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University of Southampton

Faculty of Environmental and Life Sciences

School of Health Sciences

A Mixed Methods Evaluation of Outcomes and Experiences of Older Adults Identified as Being at Risk of Frailty and Attending a Frailty-Prevention Group

by

Sarah Mercer

Thesis for the degree of Doctor of Philosophy

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University of Southampton

Abstract

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A Mixed Methods Evaluation of Outcomes and Experiences of Older Adults Identified as
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Background: Frailty is a syndrome associated with poor health outcomes and, with an ageing population, it has become a focus for research and intervention. Pre-frailty, as a distinct stage of emerging age-related changes, is less well considered in the literature. Interventions to prevent progression from pre-frailty to frailty are being introduced, but lack supporting evidence on the needs and outcomes of this group. There is a need for improved understanding of patient outcomes, including experiential accounts of the application of such outcomes to daily lives.

Methods: The research used a mixed methods realistic evaluation of the experience and outcomes of people identified as being at risk of developing frailty and engaged in a frailty-prevention course. Pre/post-test data, relating to physical and functional health outcomes generated at three time points, were analysed for 212 participants. A mixed methods exploration, using framework analysis, of experiences and perceptions of participants occurred based on nineteen semi-structured interviews with eight participants. This considered the way physical health, functional status, well-being and activity participation are understood and interact.

Results and Findings: Classification of frailty highlighted that 64.7% of the sample were living with frailty and a further 29.4% with pre-frailty. At baseline there were weak, but significant associations, between increased lower frailty classification and more favourable functional outcomes for all measures, except for the Falls Efficacy Scale. Functional and frailty measures showed improvement after the twelve-week intervention, which was maintained for functional measures only at six-month follow-up. The mixed methods analysis developed knowledge from these outcomes, highlighting that the experience of participants did not closely align with measured outcomes. Participants rejected the term frailty, yet engaged with the need to mitigate for, and adapt to, age-related deterioration that threatened independence and well-being. This was achieved through occupational adaptation to preserve function and well-being.

Conclusion: Considering frailty in terms of physical and functional status, mental well-being and occupational performance aligns with the experiences of those living with pre-frailty and frailty. The frailty-prevention intervention was highly acceptable to participants as it adopted a function and assets-based approach to health, which aligned with their conceptualisation of health and self-management. Additionally, improvement, or at least maintenance, of function, was of greatest importance to participants.

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Research Thesis: Declaration of Authorship

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| Title of thesis: | A Mixed Methods Evaluation of Outcomes and Experiences of Older Adults Identified as Being at Risk of Frailty and Attending a Frailty-Prevention Group |
|------------------|--|

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
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6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission.

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Definitions and Abbreviations

BMI – body mass index (weight in kilograms divided by height in meters squared)

BoT – burden of treatment (May *et al.*, 2014)

BP – blood pressure

CI – confidence interval

FES-I – Short Falls Efficacy Scale – International (Kempen *et al.*, 2008)

FRE – Falls Risk Estimate – produced by the QTUG™ (Kinesis Health Technologies, 2014)

FNIH – Foundation for the National Institutes of Health

GP – General Practitioner

HFRS – Hampshire Fire and Rescue Service

kg – kilogram

LOC – locus of control (Wallston, Wallston and DeVellis, 1978)

m – meter

mmHg – millimetres of mercury

NHS – National Health Service

NICE – National Institute for Health and Care Excellence

p – statistical significance value

QTUG™ – Quantitative Timed Up and Go Test (Kinesis Health Technologies, 2014)

r – Pearson’s Product-Moment Correlation

r_s – Spearman’s rank correlation coefficient

s - seconds

SD – standard deviation

SE – standard error

SLS – single-leg stance

SOP – standardised operating procedure

STEER Course - Safety Through Education and Exercise for Resilience Course

STS – sit-to-stand transfer

UK – United Kingdom

USA – United States of America

U3A – University of the Third Age

Chapter 1 Introduction

This thesis reports on a mixed methods evaluation of physical and functional measures of health, well-being and engagement in activity, within the context of the outcomes and experiences of participants in a frailty-prevention intervention. Objective outcome measurements guided the description of the physical and functional health status of participants. These measures were then used to inform and elicit discussion about subjective experiences and perceptions of activity participation and physical and mental well-being status within interviews. The evaluation approach has been adopted to identify and synthesise outcomes based on measurement with the priorities and perspectives of participants. Furthermore, this study uses principles of realistic evaluation (discussed further in Section 3.5) to determine the effectiveness of an intervention to address problems experienced by a group (Pawson and Tilley, 1997). This was deemed important as, discussed further in Section 1.10, the frailty-prevention intervention was untested.

Furthermore, the study population were not engaged in secondary or tertiary health services, and so it was assumed they were an under-researched group. This evaluation could be used to inform further studies completed under appropriate trial conditions. In order to understand the range, and impact, of changes to health and functional status experienced by a population at risk of frailty, the evaluation needed to be broader than the objective outcome measures collected during a frailty-prevention intervention. For this reason, the evaluation combined the intervention's outcome measures relating to physical health and function, with examination of broader perspectives and experiences of participants in relation to their physical health, mental well-being and participation in daily activities. This chapter continues with an introduction to the key concepts on which the study is based.

1.1 Background

This thesis focuses on the experiences and outcomes of people engaged in a frailty-prevention intervention. Frailty is a health condition associated with increasing age and experienced as a developing vulnerability to adverse health outcomes (British Geriatrics Society, 2014). Frailty has become a key concept for consideration in healthcare due to the rapidly expanding older population. Globally, the population aged 65 and older is predicted to rise by nearly 50 per cent, compared to a rise of only 34 per cent of the total population (He, Goodkind and Kowal, 2016). Within the United Kingdom this growth is likely to be experienced with greatest proportional growth in the 'oldest old' categories. It is expected that by mid-2039 the number of people over the age of 85 will have doubled (Office for National Statistics, 2015), which will have implications

for the number of people living with frailty. It is believed that between 25 and 50 percent of people over 85 years currently can be categorised as having frailty (Clegg *et al.*, 2013) and within older adults between 64 and 74 years the rate has been reported as 8.5% of women and 4.1% of men (Syddall *et al.*, 2010). A defining symptom of frailty is an increased risk of falls which has a range of medical, social and financial consequences (Tavassoli *et al.*, 2014). It is estimated that the financial implication of falls for the National Health Service (NHS) within the United Kingdom (UK) is £2.3 billion per year, which is indicative of the adverse health outcomes such as hospital admissions and ambulance-use linked to falling (National Institute for Health and Care Excellence, 2013). As frailty is a predictor of increased risk of worsening health outcomes over even a short period of time (Coelho *et al.*, 2015), it is important that interventions are developed to reduce the development of frailty and that they are evidence based and evaluated regarding their effectiveness.

1.2 Frailty Conceptualisation

Within the field of frailty there is agreement among clinicians and researchers of its importance due to established poor outcomes for those identified as having frailty (Fried *et al.*, 2004; Clegg *et al.*, 2013). There remains, however, multiple methods of both identifying and conceptualising frailty. In 2001 two key papers were published with differing, but not incompatible, conceptualisations of frailty. One outlined a frailty phenotype (Fried *et al.*, 2001) and the other conceptualised frailty as linked to, and identified by, the accumulation of deficits in a Frailty Index (Mitnitski, Mogilner and Rockwood, 2001).

The two measures have important differences in terms of their means of conceptualising and classifying frailty. Fried *et al.* (2001) focused on the clinical presentation of the physical consequences of muscle loss, whereas Mitnitski, Mogilner and Rockwood (2001) hypothesise about vulnerability to adverse outcomes due to increased burden from comorbid conditions and functional limitations. They do, however, agree that vulnerability to developing frailty is influenced by changes to biological reserves. Within the frailty phenotype the physiological changes of increased inflammation and markers of coagulation are the basis from which the clinical presentations manifest (Walston *et al.*, 2002). The Frailty Index suggests that markers of biological ageing such as inflammation contribute to the accumulated, but non-system-specific, burden of increasing deficits. As a result, increasing focus is being placed on the incorporation of biological markers of ageing to the Frailty Index (Mitnitski *et al.*, 2015).

Fried *et al.* (2001) proposed that frailty could be understood as a clinical syndrome, or frailty phenotype, identified by three of five criteria being met. The five criteria were: unintentional

weight loss, reduced grip strength, slow mobility, reduced energy and a low activity level. This work proposed an explanation of frailty derived from a cycle of depleted reserves due to sarcopenia, malnutrition and decreased activity. The phenotype model proposed structured methods of evaluating fulfilment of the five criteria: weight loss by self-report of the twelve-month period, exhaustion by response to two CES-D Depression Scale (Radloff, 1977) questions regarding energy levels, activity level using the Minnesota Leisure Time Activity questionnaire (Taylor *et al.*, 1978) regarding moderate to vigorous activity, slowness by height-adjusted walking times, and weakness by BMI-adjusted grip-strength (Fried *et al.* 2001).

Mitnitski, Mogilner and Rockwood (2001) proposed identifying frailty by counting deficits, each on a binary scale, and dividing the sum by the number of deficits assessed to create a Frailty Index. This Cumulative Deficit model asserts that the accumulation of such deficits is a means to quantify the level of physiological ageing experienced by a person and identify those at risk of poor health outcomes. Whereas the frailty phenotype emphasises limitations related to muscle loss and related disabilities, Mitnitski, Mogilner and Rockwood (2001) determined that the greater the number of deficits experienced by the person, the higher their level of frailty. The deficits listed in the full index include factors related to mobility, illness symptoms, cognition, and disability. The original Frailty Index comprised ninety-two items, but sensitivity has been shown for a twenty-item scale to predict survival when completed as part of a structured clinical assessment (Mitnitski *et al.*, 2002). Frailty is determined to be present when the frailty index is equal to or in excess of 0.25 (Song, Mitnitski and Rockwood, 2010), although its continuous scale is designed to show incremental improvements/regressions that can inform clinical interventions.

The Frailty Index-informed Clinical Frailty Scale (Rockwood *et al.*, 2005) is increasingly used in clinical settings and reports a level of frailty on a scale from 1-9. While it includes factors relating to participation in activities on daily living, it details such limitations as consequences of poor symptom control in relation to medically defined diagnoses. There is argument that this is a poor fit between the level of disability described by the Clinical Frailty Scale and frailty phenotype (Mudge and Hubbard, 2018). A person could score highly using phenotype classifications if they experienced muscle loss and its related consequences. However, if the same person had no active diseases and required no support with daily activities they would score at the lowest classification using the Clinical Frailty Scale. There has been suggestion of a broad convergence of risk identification of the two measures, however as measures intended to identify the same syndrome, they only moderately correlate ($R = 0.65$) (Rockwood, Andrew and Mitnitski, 2007). This suggests that the measures identify different presentations as being representative of the presence of frailty.

This disagreement in potential frailty classification highlights key conceptual differences between the two models. The frailty phenotype proposes that while disability, morbidity and mortality are associated with frailty, frailty is a distinct syndrome associated with poorer outcomes, which can also be present without co-morbidity (Fried *et al.*, 2004). The Frailty Index does not differentiate between the cause of functional losses being due to presence of frailty versus comorbidity (Cesari *et al.*, 2014), in opposition to current practice guidance (British Geriatrics Society, 2014).

This difference in approach lends support for the frailty phenotype to be most applicable to a population not yet experiencing disability due to chronic conditions, which are an explicit assumption of the cumulative deficit model (Cesari *et al.*, 2014). This is important for this thesis as the study population are largely 'well' and not users of secondary or tertiary health services. While frailty is a predictor of poorer health outcomes and associated with disability (Danon-Hersch *et al.*, 2012), clinical guidance advocates management of frailty as a distinct concept that can be both cause and consequence of disability or comorbidity (British Geriatrics Society, 2014). This study therefore uses Fried *et al.*'s (2001) conceptualisation of a frailty phenotype, as a syndrome encompassing risk to adverse outcomes, without assumption about co-morbidity.

In order to promote the concept that frailty is a distinct state or condition and not a state of 'being', language throughout this thesis has been used that describes people as 'living with frailty' or 'having frailty', rather than considering a person to 'be frail'. In some incidences, for example; direct quotations from other papers, or when using differing frailty states as a classification, has resulted in the terms 'frail', 'pre-frail' or 'non-frail/robust' being included. This has only occurred where the alternative results in misquotation or clumsy language.

1.3 Pre-Frailty and the Capacity to Transition between Frailty States

While much of the literature focuses on the health status and outcomes of people who have frailty, there is also consideration of the processes occurring when a person's frailty status changes from being well, or 'robust' to having frailty. The concept of pre-frailty was first defined in Fried *et al.*'s work (2001), where people assessed as possessing one to two of the frailty phenotype's criteria were identified as 'pre-frail' or 'intermediately frail' and only those meeting none of the criteria being 'robust'. Fried *et al.*'s (2001) study determined that those with pre-frailty are twice as likely to transition to frailty in a three year period compared to a population displaying none of the frailty phenotype symptoms at baseline. Within the accumulation of deficits model, a person is determined to have pre-frailty when the Frailty Index is between 0.09 and 0.24. Scores below 0.09 are considered 'non-frail' (Song, Mitnitski and Rockwood, 2010).

Studies have shown that while frailty is reversible, the most potential for transition between stages of frailty classification is for those experiencing pre-frailty to return to a 'robust' or 'non-frail' status (Woo, Leung and Morley, 2012; Trevisan *et al.*, 2017). Additionally, the opportunity to return to a 'non-frail' status once categorised as 'frail' is minimal, determined by Gill *et al.* (2006). They discovered that while transitions to increasing frailty status occurred for 43% of the sample over eighteen months, only 0-0.9% returned to a 'non-frail' status having previously been classified as having frailty. Similar results were presented by a more recent study into the frailty transitions experienced by American men. Over a longer study period (in excess of four years), 35% of the sample increased their frailty status and 15% reduced their status by one division ('frail' to 'pre-frail', or 'pre-frail' to 'robust'), only 0.5% returned to a robust status having been classified as having frailty (Pollack *et al.*, 2017).

The research above supports the implementation of frailty prevention interventions that act at the stage before a person is classified as having frailty. However, there are insufficient studies into the transitions between frailty statuses for comparable UK populations, nor the means by which improvements can be made. There is also insufficient evidence as to the responsiveness of frailty measures to capture changes in frailty status (Hoogendijk *et al.*, 2019). The characteristics, needs and experiences of those people identified as being at risk of developing frailty, at the point where there is most potential to reverse the progression of frailty as discussed above, are crucial for the development of responsive and relevant interventions. The absence of older adults' views and perspectives within the evidence base prevents clear understanding of the main issues experienced by this group and it is highly likely that such knowledge would guide more effective and acceptable interventions. These uncertainties require testing, and the complexity involved in the measures, and participants, supports exploratory study to inform future interventions (Craig *et al.*, 2008).

1.4 Frailty and Associated Physical and Functional Health Status

While the approaches of the frailty phenotype (Fried *et al.*, 2001) and Frailty Index (Mitnitski, Mogilner and Rockwood, 2001) had differing means of conceptualising frailty, they both emphasised changes to physical and functional health status. This approach is justified as the presence of frailty has been determined to have effect on physical and functional outcomes that can be used to identify frailty and as a consequent risk. Physical markers of frailty include; reduced walking speed (Kim *et al.*, 2010; Woo, Yu and Leung, 2018), reduced strength (Dodds *et al.*, 2014; Sousa-Santos *et al.*, 2018), and muscle loss (Fried *et al.*, 2001; Jung *et al.*, 2014). There is also increased mortality for people identified as having frailty (Cawthon *et al.*, 2007; Song, Mitnitski and Rockwood, 2010), as well as associations with increased co-morbidities. The

majority of research into frailty focuses on outcomes on a physical and functional level, which is understandable given the physical constructs within which it has historically been framed.

1.5 Consequences of Frailty in Relation to Activity Participation

In addition to the poorer physical health outcomes experienced by those with frailty discussed above, disability and the level to which independent activity can be completed are cited as both a measure (Mitnitski, Mogilner and Rockwood, 2001) and consequence of frailty (Fried *et al.*, 2001; Mitnitski, Mogilner and Rockwood, 2001). Consequences of pre-frailty in relation to activity participation have been described in the literature with increased difficulties in completing activities of daily living being discovered in European populations (Romero-Ortuno, O'Shea and Kenny, 2011; Danon-Hersch *et al.*, 2012; Tavassoli *et al.*, 2014). Such difficulty had implications like requiring support to complete essential tasks or increased involvement of healthcare professionals (Op Het Veld *et al.*, 2015). Even when the measure of frailty does not capture individual level of performance in relation to activity completion, the measures such as weakness and walking speed have implications for the level to which a person can independently complete a task.

1.6 Mental Health, Well-Being and Frailty

The literature identifies frailty as having a physical manifestation and consequences in functional tasks or activities of daily living, as well as poorer, primarily physical, health outcomes. However, the incidence of mental health conditions such as anxiety and depression are associated with a diagnosis of frailty, irrespective of the conceptualisation of frailty used (Lohman, Dumenci and Mezuk, 2016). There is suggestion of increased levels of emotional distress already evident for those identified as having pre-frailty (Ní Mhaoláin *et al.*, 2012). Interestingly, the frailty phenotype aimed to identify 'exhaustion' as one of its diagnostic criteria but used two questions taken from a depression screening tool to do so (Fried *et al.*, 2001), raising questions about the aetiology of low energy levels. There is certainly evidence that the physical changes associated with ageing are linked to depression and anxiety in older-adults - Fried *et al.*'s (2001) study, despite excluding those on anti-depressant medication, highlighted a higher than average incidence of depression. This raises questions about the broader consideration of psychological well-being experienced by those living with frailty.

Well-being is a term often used to describe the broader sense of psychological 'wellness' and has been described as having components of "autonomy, environmental mastery, personal growth, positive relations with others, purpose in life [and] self-acceptance" (Ryff and Keyes, 1995 pp

719). Within the field of social psychology there has been consideration of eudemonic well-being as the factor which controls the subjective well-being, or contentment, experienced with a focus on meaning of experience and goal attainment (Ryan and Deci, 2001). There is potential that a person experiencing changes in any, or all, of their physical health, functional ability, and mental health would have a changing perception of their consequent well-being, particularly if understood within these multi-contextual descriptions of well-being. There is also potential that a decrease in well-being could reduce motivation to complete enjoyable or needed activities, which could exacerbate functional limitations. By examining a range of measures, both subjective and objective, a synthesis of these aspects will inform understanding of how the changes associated with frailty can influence each other.

1.7 Activity, Well-Being and Frailty

The early conceptualisations of frailty included data about difficulties in completing activities of daily living. Fried *et al.*'s work (2001), in particular, highlighted that for those living with frailty it was common to have difficulty completing Instrumental Activities of Daily living (IADLs). IADLs include those with greater complexity such as social or pleasurable activities, rather than more fundamental activities like washing and dressing. It is therefore unsurprising that it has been suggested that for all older adults the range and variety of activity completed influences well-being (Lee *et al.*, 2016b). There has also been consideration of the effect of frailty on well-being considered within public health strategies on ageing (British Geriatrics Society, 2014; Green *et al.*, 2017). In particular, Age UK's Wellbeing Index (Green *et al.*, 2017) synthesised the effects of physical deficits with activity participation as a means of calculating well-being.

There is a case that a change in physical ability, and therefore activity tolerance, related to frailty would restrict a person's participation in social activities. This could be detrimental for overall sense of well-being, if understood by the descriptions of well-being above. Alternatively, if a person's motivation to engage in previously enjoyable activities decreased, they might spend more time at home and become less active and mobile as a result. While the theoretical prepositions of frailty focused on physical deficits and consequent disability (Fried *et al.*, 2001; Mitnitski, Mogilner and Rockwood, 2001), it is proposed in this thesis that a focus on the converse could provide insight that is not currently available. It is also proposed that the concepts of changes in physical ability, activity participation and well-being, due to frailty might be inter-linked, but that the processes by which one might influence another would benefit from greater exploration and understanding. If this is the case, current guidance for interventions that focus on improving physical strength (National Institute for Health and Care Excellence, 2013; British

Geriatrics Society, 2014) is insufficient and justification would be provided for multi-contextual approaches to reducing frailty.

1.8 Proposed Interactions of Physical Health, Well-Being, Activity and Frailty

From initial consultation of the literature discussed above it is evident that frailty has consequences for physical and functional descriptors of health, well-being and ability to complete activities of daily living. While the latter two are considered within the evidence base, much of the focus of previous research has been about biological, physiological or functional processes. For this reason it is proposed that clearer understanding is needed about the descriptions *and* interactions of physical and functional health markers, well-being and participation in activity for people experiencing the earliest stages of frailty. By expanding the focus to include outcomes relating to well-being and activity participation there is increased likelihood that all outcomes, both positive and negative, are understood. This will also inform development of interventions, and selection of outcome measures, that are important to the person. Additionally, there is potential for improvement or deterioration to occur in one area, independently of the others, which would also be crucial knowledge to gain to inform future interventions.

1.9 Origins of the Study

As frailty and its effects are increasingly recognised there is focus on prevention interventions, particularly in public health settings, however there is inadequate availability of evidence regarding effective interventions for frailty prevention and management (Dent *et al.*, 2019). Hampshire Fire and Rescue Service (HFRS) recently expanded their role to provide a community-based twelve-week frailty prevention programme. This emerged from their identification of people with poor mobility, including those for whom this was a consequence of frailty, being at risk in the event of a house fire. The 'Safety Through Education and Exercise for Resilience (STEER) Course' consisted of a weekly two-hour education and exercise group hosted in a local HFRS station. The exercise section was based on functional movements which replicate activities of daily living, making the course highly compatible for examination in relation to the concepts outlined above. The STEER Course also included a variety of physical health measures in the context of identifying and measuring vulnerability to frailty. HFRS approached the University of Southampton to offer a research partnership that would complete a service evaluation of the STEER Course. In return, the opportunity to explore wider experiences relating to participation in a frailty-prevention intervention and being a person at risk of frailty was agreed.

STEER Course participants were identified through a variety of community-based services or advertisements and were intended to have a functional ability level that would be representative of pre-frailty using the frailty phenotype (Fried *et al.*, 2001). Participation in the group aimed to reduce the risk of frailty by encouraging increased activity levels and providing guidance on how to make lifestyle changes which would reduce the risk of frailty and related adverse outcomes. The STEER Course was based on principles identified in 'Fit for Frailty' (British Geriatrics Society, 2014), and as an innovative intervention in a non-traditional setting it was untested. Evaluation of the STEER Course provided the opportunity to test the effectiveness of a preventative intervention in people at risk of frailty. The STEER Course also provided access to a population which is currently under-researched but at the stage of frailty where most change is possible (Woo, Leung and Morley, 2012; Trevisan *et al.*, 2017). As described, this offered potential for deeper understanding of the effect of physical changes related to pre-frailty, engagement in activity and mental well-being. The way in which these concepts influence each other was an area for further examination, and exploration occurs within this thesis.

The STEER Course consisted of a weekly two-hour group intervention operating over twelve weeks. The first part of the Course contained educational discussion on topics largely taken from the British Geriatrics Society's guidance on areas to address to reduce the severity of frailty symptoms (British Geriatrics Society, 2014):

Table 1 Educational topics included in STEER Course

| STEER Course Education Topics | |
|-------------------------------|-------------------------|
| 1. 'Fall proofing' your home | 9. Polypharmacy |
| 2. Cognitive impairment | 10. Continence |
| 3. Mobility issues | 11. Physical inactivity |
| 4. Obesity | 12. Osteoporosis |
| 5. Nutrition | 13. Low mood |
| 6. Hydration | 14. Vision impairment |
| 7. Smoking | 15. Loneliness |
| 8. Alcohol | |

The remaining hour of each session consisted of circuit-style functional movement. The exercises focused on improving strength and balance as recommended in public health guidance for falls prevention in community dwelling older adults (National Institute for Health and Care Excellence, 2013).

1.10 Rationale for the Study

As frailty has been conceptualised in terms which emphasise the physical deficits experienced by older people (Fried *et al.*, 2001; Mitnitski, Mogilner and Rockwood, 2001), interventions for people living with frailty have been directed towards pharmacological reviews and resistance based exercise to reduce muscle wastage (British Geriatrics Society, 2014). However, within those conceptualisations there is consideration of the influence of disability, independent activity participation and mental health on the level to which frailty is present, indicating the complex and multi-faceted nature of processes occurring. The medically focused literature has considered

frailty as a 'global burden' in terms of demand on health services (Hoogendijk *et al.*, 2019). What is not apparent in the evidence base, however, is the level to which people living with frailty experience it as a burden, or indeed *what* the true experience of living with frailty is. This is supplemented by a call for evidence-focused research which incorporates the perspectives of those living with frailty (Dent *et al.*, 2019).

While the physical and functional markers of health provide important information in understanding the characteristics of the population, and will be examined in this study, there is novel value in studying the nature of pre-frailty from a much broader perspective. This will consider the *application* of such markers of health, allowing understanding of applied strength within the context of participation in daily occupations. It will explore the implications of this participation on the experience of physical health and mental well-being.

This study developed from a commissioned service evaluation of a frailty prevention intervention. It is a mixed methods evaluation of the outcomes and experiences of people identified as being at risk of developing frailty in relation to physical and functional health status, mental well-being and participation in activity (to also include participation in the intervention). It explores the experiences of being a participant on a STEER Course, alongside a person's unique circumstances, their experience of a changing health and functional status, and application of the Course content to their daily lives. The latter point draws together the need to understand the relationship between activity, physical health and mental-well-being, so that the intervention can target relevant areas. The rationale for the methodological approach and decisions relating to data analysis are considered in Sections 3.6, 3.13.2.1, 3.14.3 and 3.15.

1.11 Study Aim

To study the experience and outcomes of people identified as being at risk of developing frailty during, and after, their engagement in a frailty-prevention course.

1.12 Objectives

1. To describe a population attending a frailty-prevention course with regard to their physical and functional health status.
2. To evaluate change in markers of physical and functional health status during and after participation in a frailty prevention course.

3. To explore the experience of activity engagement and perceptions of physical health and mental well-being status for participants in a frailty prevention intervention from personal accounts.
4. To examine interactions between physical health, mental well-being and activity participation from personal accounts.

1.13 Structure of the Thesis

The thesis continues with consideration of the literature identified in relation to grip strength measurement as this was the central outcome measure of frailty used for the quantitative aspects of the study. As this study is interested in the application of outcome measures to broader experiences of daily life, further literature was consulted. A review of activity participation for older adults living with frailty, supplemented with a more general consideration of the perspective of a non-specific older adult population is also presented. Chapter Three highlights the processes and methods used throughout the entire study. Chapter Four comprises results for all participants engaged in the quantitative measurements (n=212), it progresses to mixed methods evaluation of the STEER intervention and experience of health, well-being and activity participation for eight participants. Chapter Five is the discussion of all the results and findings in sub-sections based on the research questions highlighted in Section 3.4 and also includes study limitations and implications for the STEER intervention and wider clinical settings. Chapter Six presents the conclusions, unique contributions to the evidence base and directions for development of the research. A range of supplementary material is included in the Appendices and has been signposted at the relevant points.

Chapter 2 Literature Review

2.1 Introduction to the Literature Section

Two key areas of the existing evidence base are considered in this chapter. Initial consideration was given to the outcome measures implemented in STEER. As is discussed in more depth in Chapter 3, the STEER outcome measures used had been chosen and implemented by HFRS prior to the research partnership being established. HFRS measured grip strength, regarded as the ‘gold standard’ single measure of frailty (Syddall *et al.*, 2003; British Geriatrics Society, 2014). Less is known, however, about the application of grip strength as a classifier of pre-frailty. The extent to which grip-strength has been used to measure pre-frailty, as well as expected values, was examined to allow analysis of the measurements produced on the STEER Course.

Sections 1.4 and 1.5 detailed likely consequences of low muscle strength (as measured by grip) for function and activity participation. In order to examine what is already known, and to support the aim of this study to consider experiential accounts, evidence including a qualitative element was sought in relation to activity participation. As will be discussed below in the review on grip strength, consideration of expected, measured, values for people living with pre-frailty was limited. Therefore, the less well-examined area of activity participation was anticipated to have insufficient evidence available about pre-frailty, and all searches included the experience of those people identified as having any level of frailty. Despite this approach, two reviews relating to activity were required: one relating to people identified as having frailty, followed by a wider review of experiential accounts of all older adults.

This chapter continues with the literature relating to measured grip strength to classify pre-frailty, and is followed by exploration of the experiences of activity participation for older adults.

2.2 Literature Review 1: Grip Strength Measurement

This study is guided by the frailty phenotype established by Fried *et al.* (2001) and this rationale is discussed in Section 1.10. A key component of the phenotype criteria was the identification of weakness, represented by low grip strength (Fried *et al.*, 2001). As discussed in the introduction to this chapter (2.1), grip strength measurement was highlighted as the central quantitative outcome measure to identify frailty for this study due to the pre-existing measures chosen by HFRS (Section 3.8.1).

It was an assumption of this study that Hampshire Fire and Rescue Service, by targeting a population who were not yet requiring the use of secondary or tertiary health services, were engaging a population overlooked by research studies, which is: older adults who have pre-frailty. As it was the intention of this study to use the Fried *et al.* (2001) conceptualisation as a basis from which to develop understanding of the consequences of frailty on participation in activities, it was important to establish known parameters of the specific phenotype identifier used for a population classified as having pre-frailty. The original paper made only divisions between a person being 'robust' and 'frail' (Fried *et al.*, 2001), and so the wider evidence base was consulted for known grip strength values for people classified as having pre-frailty.

2.3 Study Population

The literature was examined for descriptive information about people specifically living with pre-frailty, or being vulnerable to frailty, as this was the intended population of the STEER Course. Several prevalence studies have included data on pre-frailty, although no explicit data were discovered for the United Kingdom. An American study, which also included residential home populations, determined that 39.5% of those over the age of sixty-five were living with pre-frailty, and that the incidence was higher amongst females (Bandeem-Roche *et al.*, 2015). A large-scale study determined that 28.1% of a Dutch population were living with pre-frailty, and that increasing age and female gender increased the incidence of pre-frailty and subsequent frailty (Op Het Veld *et al.*, 2015). Similar figures were found in a Swiss population where 26.4% met the criteria for pre-frailty and incidence among females was higher at 62.8%. A large scale analysis of prevalence rates in ten European countries (not including the UK) determined pre-frailty prevalence to be between 34.6% and 50.9% (Santos-Eggimann *et al.*, 2009). These studies are suggestive of a considerable proportion of older adults could be appropriate for an intervention which aims to reduce the incidence of frailty.

2.4 Review 1 Questions

1a. What is known about the relationship between grip strength and pre-frailty in community-dwelling older adults?

1b. Have parameters for identifying pre-frailty using grip strength been proposed and validated within the literature?

2.5 Review 1 Search Strategy

The following search strategy was generated with all variations of each concept searched within all fields and applied to academic journals. The synonyms were separated by the Boolean operator “or” and the search completed with Concept Term 1 “and” Concept 2. It was expected that alternative terms for the early stage of frailty such as ‘intermediate’ would be captured by inclusion of ‘frail*’ and so did not require additional entries.

Table 2 Literature search terms

| Concept Term 1: Target Population | | Concept 2 |
|--|-----|--|
| | AND | |
| prefrail* OR pre-frail* OR frail* | | grip strength measurement OR hand grip measurement OR dynamomet* |
| AND | | |
| community OR “living at home” OR independent | | |

This search strategy was applied on AMED, CINAHL, MEDLINE, PsycINFO and SocINDEX databases. The Cochrane Database was consulted using terms “grip strength” or “hand grip” and the resultant list reviewed for relevance, with no papers identified. Articles were screened and duplicates removed, articles not available in the English language were also excluded (as resources for translation were not available). The abstracts were reviewed to ensure relevance to the review questions. All papers published prior to 14th September 2019 were included. An updated search was completed on 20th March 2020. At this point more stringent criteria were applied. Only papers that contributed specific understanding for a population with pre-frailty status were included, as the original literature search highlighted that this was the gap in the evidence base. This produced no further studies.

Full details of the search are included in the following PRISMA diagram (Liberati *et al.*, 2009):

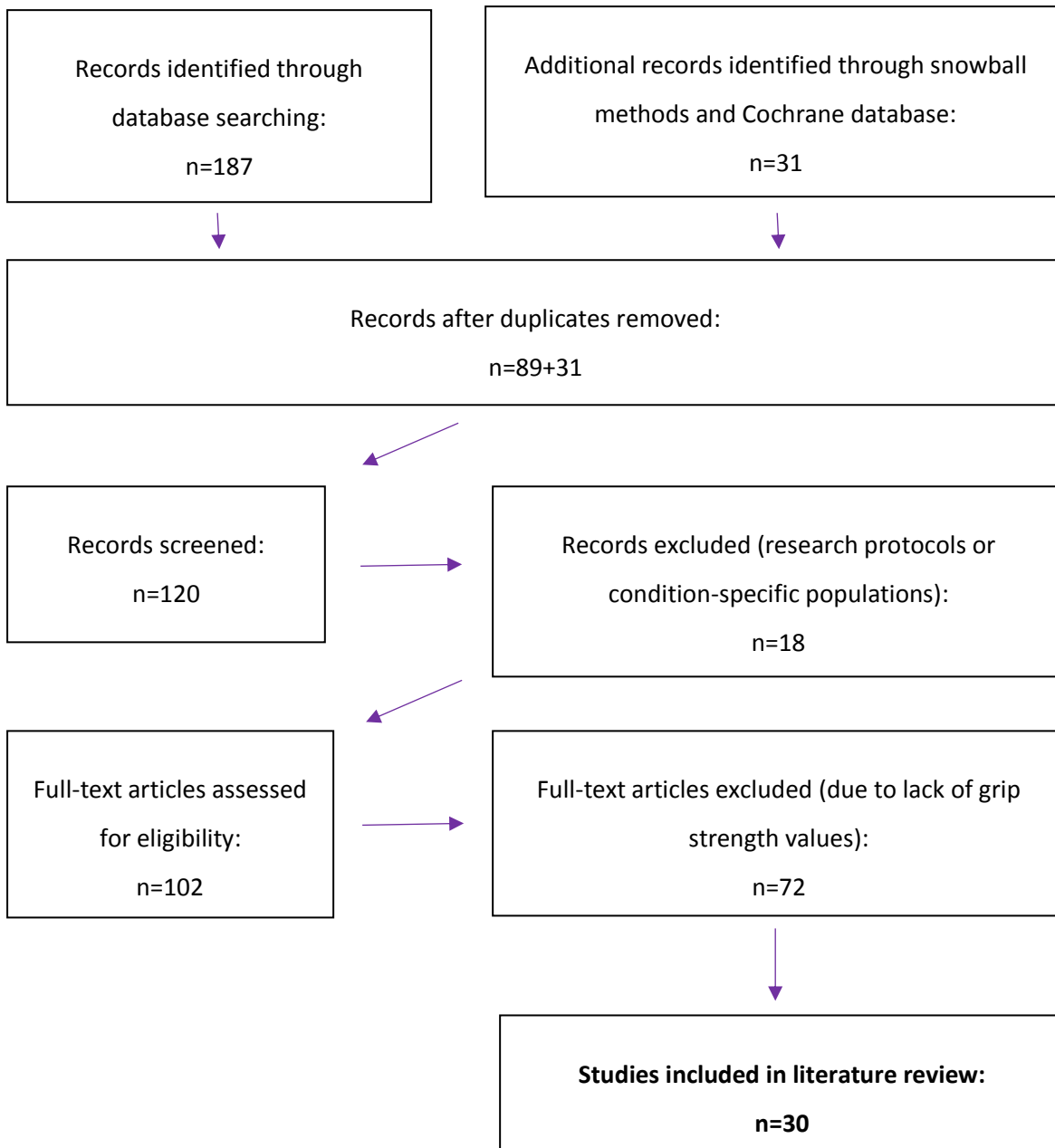


Figure 1 Review 1 inclusion process

2.6 Review 1 Relevance and Quality Summary

As highlighted in section 2.3, awareness of lack of data relating specifically to pre-frailty in UK populations meant that all studies that discussed frailty, of any level, were included. This was required to generate understanding of known relationships between grip strength and presentations/outcomes for people at any level of frailty severity, with the intention to create expectations for pre-frailty classifications between established parameters for non-frailty and frailty, if more precise information was unavailable. This section considers the relevance, and quality, of the studies identified to the participants of this study.

Eleven studies were large scale and prospective or cross-sectional in design (Sayer *et al.*, 2006; Romero-Ortuno *et al.*, 2010; Syddall *et al.*, 2010; Auyeung *et al.*, 2011; Auyeung *et al.*, 2014; Legrand *et al.*, 2014; Goldeck *et al.*, 2016; Leong *et al.*, 2016; Woo, Yu and Leung, 2018; Bahat *et al.*, 2019; Ho, Chen and Merchant, 2019). These have provided information about known associations between grip strength and other parameters and outcomes. Their design, however, limits understanding about causal factors for the relationships (McLaren, 2013).

Thirteen studies were based in populations that are known (Dodds *et al.*, 2016; Leong *et al.*, 2016) to have differing normative grip strength values due to ethnicity and location (Nakagawa *et al.*, 2008; Auyeung *et al.*, 2011; Auyeung *et al.*, 2014; Lin *et al.*, 2014; Merchant *et al.*, 2016; Masaki *et al.*, 2017; Danilovich *et al.*, 2018; De Dobbeleer *et al.*, 2018; Lera *et al.*, 2018; Woo, Yu and Leung, 2018; Alqahtani and Nasser, 2019; Bahat *et al.*, 2019; Ho, Chen and Merchant, 2019). These have been included to examine broad relationships between grip strength and frailty, but normative pre-frailty values, if available, have not been considered from these studies.

The search terms meant qualitative studies were unlikely to be sourced, and there were no mixed methods studies retrieved. One study focused on intervention outcomes using grip strength as a key outcome measure (Nakagawa *et al.*, 2008). This had 44 participants and completed in a country with lower expected grip strength values than the UK. The other study that attempted to determine how grip strength influenced activities of daily living recruited 84 participants but had no control group (Liu *et al.*, 2017).

The quality of papers was assessed using the relevant Clinical Appraisal Skills Programme (CASP) Checklist (Critical Appraisal Skills Programme, 2018). Where limitations due to quality were identified they are reported in the 'Notes' section of

Table 3. Some studies provided only values of classifying a broad category of “low grip strength” without specific data. These were not excluded during the screening of papers due to the inclusion of a reference grip strength value. However, full analysis highlighted that the absence of reported, measured, values for grip strength prevented the review question being answered. They are included in Table 3, below, but do not contribute to the discussion.

Overall, the studies that contributed to the discussion below were deemed to be of sufficient quality to contribute reliable and valid data. The direction of evidence overwhelmingly supports expectations for decreasing grip strength with increasing frailty status. The biggest limitation was that while the evidence confirms grip strength is a well-established measure of frailty, there has been insufficient consideration of expected/normative values and associations within populations who have pre-frailty, as opposed to frailty. Furthermore, studies which attempt to combine objective measures with personal perspectives of the consequences of low strength are absent from the evidence base.

2.7 Review 1 Findings

2.7.1 Paper Populations, Key Findings and Implications Summary

The table below (Table 3) highlights key findings from the review. The population studied has been identified to determine the level of comparability to this study and similarly the method of measuring grip strength has been reported to assess the likelihood of grip strength values being directly comparable.

Table 3 Paper populations, grip strength measurement methods and reference values

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | | Notes (including quality details) |
|---|---|--|---|-----------------------------------|---|
| Alqahtani and Nasser (2019) | Digital Jamar dynamometer (Sammons, Bolingbrook, IL, USA). Participants had one 'warm up' and two tested attempts, with the average score being used. | 47 community- dwelling older adults (mean (SD) years): 70(4) years, resident in Saudi Arabia. | Grip strength was reported for the whole sample without gender or BMI stratification: 18.5 (5.1) | | Little relevant data for this literature review (due to poor reporting). A convenience sample of people attending a clinic was used – there is no detail given as to the reasons for clinic attendance so difficult to determine how this might affect outcomes. |
| Auyeung <i>et al.</i> (2011) | Jamar (Sammons, Bolingbrook, IL, USA) dynamometer. Average value of both hands. | N = 2737, cognitively 'normal' Chinese men (69.5%) and women (30.5%) aged 65 and over. | Baseline Men: 32.0 (6.14) | Women: 20.7 (4.12) | Good quality sampling strategy. Some limitations in methods adopted as grip strength measurement averaged over dominant/non- dominant hands. No values reported for low grip strength. Weaker grip strength was associated with lower Mini-Mental State Exam at four-year follow-up for men and women. |
| Auyeung <i>et al.</i> (2014) | Jamar, (Sammons, Bolingbrook, IL, USA) dynamometer. Both grip strength average | N = 4000 Chinese men (50%) and women (50%). Frailty present in 5.7% men, | Lowest quintile: Men: ≤28.0kg Baseline: Men: Average: | Women: ≤18.0kg Women: Average: | No direct reporting of grip strength compared with frailty status, but recommendation made to use 28kg and 18kg for men and women respectively to screen |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | | Notes (including quality details) |
|--|---|---|--|---|---|
| | and maximums reported – measured on both hands. | 5.2% women. | 31.21 (6.45) | 20.25 (4.21) | for frailty in Chinese older adults. Frailty classification made using substitute measures for the weight loss criteria, however methods appear reliable. |
| Bahat <i>et al.</i> (2019) | Jamar (Sammons, Bolingbrook, IL, USA) hydraulic hand dynamometer in a sitting position with elbow in 90 degree flexion and wrist neutral. Maximum value recorded after three attempts with each hand. | 1138 community dwelling participants (69.4% women), FRAIL scale applied to 851 participants with prevalence of frailty: (19.5% men, 32.5% women) and pre-frailty: (42.6% men and 46.5% women) | Low grip strength classified as 32kg for men and 22kg for women. No values of grip strength by frailty status were reported. | | Detailed reporting of measurement methods, so error less likely. The focus of this study was on the association between dysphagia and frailty, and so overall frailty status was reported with grip strength only contributing to the classification. Some non-normally distributed results produced, which required use of parametric and non-parametric statistics. |
| Danilovich <i>et al.</i> (2018) | Participants completed two repetitions in each hand. No specific dynamometer or detail of | N = 139 community dwelling adults resident in Illinois and receiving | Men: Non-frail: 38 (10.21) Pre-frail: 34.45 | Women: Non-frail: 26.41 (6.30) Pre-frail: | This study produced grip strength values subdivided by gender and frailty category, however the process of measurement of values was poorly reported and |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|--|--|---|---|---|
| | calculation of grip measurement reported. | Medicaid (low income and high care need). Mean (SD) age was 74.19 (8.36) years. Frailty status: frail: 45.32%, pre-frail: 34.53%, non-frail: 20.14%. | (11.99) 24.66 Frail: (6.45) 24.94 Frail: 17.66 (9.87) (6.95) | the sample are identified as being in need of the equivalent care as received in a nursing home. Participants were also resident in one locality in the USA. Consequently, generalisation was not considered appropriate. |
| De Buyser <i>et al.</i> (2016) | Classified low grip strength as <26kg from FNIH sarcopenia criteria. Jamar (Sammons, Bolingbrook, IL, USA) dynamometer used to obtain maximum grip value from dominant hand. | N = 191 Belgian men aged 74 and over. Frailty status: Robust: 63% Pre-frail: 30% Frail: 7% | Explicit grip strength values not reported, but rather the criteria for weakness was identified with values below 26kg. | Poorly described reasons for recruiting a single-gender sample. Measurement methods were clear, however there was a lack of detail in reporting of measured values that would have enhanced the study. |
| De Dobbeleer <i>et al.</i> (2018) | Compared Jamar (Sammons, Bolingbrook, IL, USA) dynamometer with Martin Vigorimeter (KLS Martin Group, | N = 53 Greek women. Frailty status was reported using a Frailty Index derived for | Maximum grip strength: Low-frail (n=17): 27.3 (4.8) Intermediate-frail (n=18): 22.1 (6.1) | The frailty index reported here was derived for this study and not explicitly comparable with other Frailty Index ratios. The frailty divisions were of (near) equal tertiles of a |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|---|---|--|--|---|
| | Germany). Jamar (Sammons, Bolingbrook, IL, USA) values only reported here. This study examined muscle fatigue, but also captured maximum grip strength for dominant hand. | this study which divided participants into tertiles: low frail, intermediate-frail and high-frail. | High-frail (n=18): 18.2 (6.7) | very small sample and so appear arbitrary rather than representative of differing frailty classifications. |
| Goldeck et al. (2016) | Smedley dynamometer (Scandidact, Denmark) used with maximum value of three measurements recorded. | N = 1935 elderly (aged 60-85 years) and a control group (aged 22-37 years) | No specific handgrip values presented. Associations found between gender (female) and older age and lower grip strength. No significant associations found with biomarkers of serum cytokine level or cytomegalovirus and grip strength. | Reporting methods were adequate for the purposes and aim of the study, however adoption of a frailty classification and reporting of explicit values would have enhanced the study and allowed comparison to wider bodies of work. |
| Gurina, Frolova and Degryse (2011) | Carpal dynamometer (DK-50, Nizhni Tagil, Russia) used. Maximum value from three trials on each hand, with the average of left and right values | N = 611 community dwelling Russians (aged 65 and over) | Poor grip strength defined by the lowest quartile of the average score for frailty classification. Characteristics: Age 65-74 Age ≥75 | The division of 'low grip strength' by the lowest quartile of values lacks rationale. Particularly, as 21.2% were classified as having frailty, this leaves only 3.8% who had frailty but not low grip strength which is in opposition to |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|-------------------------------------|--|--|--|---|
| | recorded. 21.2% of the sample were identified as having frailty using the Fried criteria. | | Men (n=100): 25.9 (7.9) Women (n=205): 14.3 (4.9) Men (n=73): 19.7 (7.9) Women (n=233): 11.2 (4.6) | more established frailty literature. |
| Haider et al. (2016) | Jamar dynamometer (Sammons, Bolingbrook, IL, USA), maximum value of three attempts on each hand (with one-minute rest period between each measurement) was recorded. | N=83 Austrian older adults (mean age 83) classified as having pre-frailty or frailty on the SHARE-FI assessment. | Handgrip Strength: 16.8 (7.2) Handgrip of strength stratified by Overall quality of life: Low overall quality of life: 15.2 (7.6) High overall quality of life: 18.9 (6.2) p value = 0.023 | Significant association with increased handgrip strength and quality of life, however this was based on non-normally distributed data suggestive of influence of the sample size. Large range of confounders considered and suggestive that the concepts warrant further consideration. |
| Ho, Chen and Merchant (2019) | Grip strength measured using the Takei A5401, dynamometer. No details provided about measurement protocol. | N=780 community-dwelling residents in Singapore, 30.8% of whom had a visual impairment. | Handgrip strength was reported by visual impairment groupings, but not frailty status. Non visually impaired: 22.7 (7.0) Visually impaired: 20.1 (6.6) p value = 0.001 | Significant association with reduced handgrip strength and visual impairment. No reporting on handgrip values by frailty status. Recruitment was by invitation for health screening, which may have produced a selection bias skewed towards those able and willing to attend. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|------------------------------|--|---|---|---|
| Lee et al. (2017) | Jamar dynamometer (Sammons, Bolingbrook, IL, USA). Maximum value of two trials with each hand recorded. | N = 383 community dwelling adults in Canada. Frailty prevalence (defined by Fried measures): 6.5%. Mean age of participants 80.4 years. | Grip strength values not presented but the study classified low grip as a score in the lowest 20% of values for that sex. | Grip strength as a single identifier of frailty was found to have sensitivity: 100 (95% CI: 83.4-100) specificity: 90.5 (95% CI: 86.9 – 93.2). Recommendation to use grip strength in combination with gait speed for the most accurate identification of frailty. The study used retrospective screening of health data meaning measurement methods were not standardised, and in some cases the data were absent. |
| Legrand et al. (2014) | Digital Jamar dynamometer used (JAMAR Plus, Sammons, Bolingbrook, IL, USA). Maximum value was recorded and participants assigned to tertiles based on grip strength value. | N = 560. Study focused on the 'oldest old' aged 80+ years in Belgium. | Maximum value (kg) tertiles by sex: Women: ≤15.0, 15.1-20, ≥20.1 Men: ≤25.3, 25.4-33.2, ≥33.3. Single group reported by combining equivalent groups for each sex into 'low', 'medium' and 'high' categories. | The study examined the relationship between grip strength and other factors, with mortality. It was able to do so with no loss to follow up. There was a small percentage of incomplete measurements for each confounder (2.5% for grip strength). |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|-----------------------------------|--|--|---|--|
| Leong <i>et al.</i> (2016) | Jamar dynamometer (Sammons, Bolingbrook, IL, USA). Reported values as average and from dominant/non-dominant hand respectively. | N = 125 462 from European, North American, South/South-East Asia and Africa. | No comparable data as healthy populations only included. | This study provided reference values for healthy populations only. Its guidance suggested that ethnicity determined the expected values and support for values in North American and European populations being comparable. Caution is used, however, as the range of countries used was minimal and no participants included over the age of seventy. |
| Lera <i>et al.</i> (2018) | Measurements taken before 2008 used T-18 dynamometer (Country Technology, Inc., WI, USA) and a Jamar dynamometer (Sammons, Bolingbrook, IL, USA) from 2008 onwards. Maximum value on the dominant hand was recorded. | N = 6426 older adults in Chile aged 60 years and over. | Low grip strength (kg) identified by values beneath the 25 th percentile. Average: Men ≤ 27 kg, Women ≤ 15 kg | Limitations in reporting discovered as no classification of frailty made, despite using a number of measures designed to identify frailty. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|------------------------------------|---|--|--|--|
| Lin <i>et al.</i> (2014) | TTM dynamometer used (TTM, Tsutsumi, Tokyo, Japan). Average value of three attempts recorded for each hand with the higher value contributing to the study. | N = 872 older adults aged 65 and over in Taiwan. | Baseline values for grip strength (kg);by sex: Women: 20.9 (5.4) Men: 33.4 (6.1), by frailty status (combined sex): Frail: 22.0 (8.0) Non-frail: 29.7 (7.2) | Participants responded to invitation to participate, potentially causing selection bias that was not fully discussed in relation to results. |
| Liu <i>et al.</i> (2017) | Jamar hydraulic dynamometer (Sammons, Bolingbrook, IL, USA). Average of three trials on the dominant hand was recorded. | N = 84 older adults aged 60 years and over (mean age 72 years) resident in the United States of America. | Mean grip strength reported as 20.8 (9.22) lbs. | The mean value reported in this study was much lower than comparable studies. It is possible there was an error in units, as a mean value of 20.8kg would be more typical. The sample is 69% female, and 60% African American or Asian, both factors are associated with lower grip values, but still not to this level. |
| Masaki <i>et al.</i> (2017) | Digital Handgrip Meter (MACROSS, Inc. Tokyo, Japan) used. Grip strength measured by average value of | N = 123 older adults in Japan (age 65 years and over). Frailty was identified in | Grip values (kg): Women: 20.1 (3.3) Men 28.7 (5.3) | Grip strength stratified by frailty status not available. Methods of measuring grip strength were not representative of the protocol advised by Fried <i>et al.</i> (2001), |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|-------------------------------|--|--|---|--|
| | two measurements per hand. | 6% of men and 5% of women. | | this potentially reduced the values produced. |
| Merchant et al. (2016) | Dynamometer type and methods not described. | N = 90 men aged 60-80 resident in Singapore | Classified low grip strength as less than 26kg. Used Canadian Study for Healthy and Ageing Clinical Frailty Scale – minimal differences in mean (SD) grip strength (kg) “Very fit”: 28.9 (5.93) “Well controlled disease”: 29.88 (5.11) “Pre-Frail”: 29.62 (4.85) | Difficult to determine reasons for minimal grip differences due to poor quality reporting (lack of detail) of methods. |
| Mohr et al. (2007) | Uses Jamar dynamometer (Sammons, Bolingbrook, IL, USA) | N = 646 North American men aged 50-86 years. | Classified low grip strength (kg) by body mass index (kg/m ²) as stratified in the Massachusetts Male Ageing Study (MMAS): BMI: 24.9 ≤ 28kg 25.0-27.2 ≤ 30kg 27.3–30.2 ≤ 32kg >30.2 ≤ 32kg. | Level of testosterone not associated with frailty level when adjusted for confounding variables. However, testosterone level and grip strength were associated until they were age-adjusted. Suggests no benefit to examining testosterone levels but rather focusing on established identifier: weakness. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|--|---|--|--|---|
| Nakagawa <i>et al.</i> (2008) | Used grip dynamometer (YM 100kg, TTM). No details regarding method of measurement. | N = 76 older adults in Japan (15 men, 61 women) engaged in an exercise intervention. | Baseline values: 'General elderly': 25.5 (6.9) 'Frail': 18.1 (7.5) Post-test: 'General elderly': 25.2 (7.1) 'Frail': 18.2 (7.2) | Small scale intervention evaluation, reliant on non-parametric statistics. However, it detailed expected changes in grip strength during intervention/follow up period. Small detectable differences in grip strength evident. Similar improvements in both "general elderly" and "frail" groups. |
| Nakamura <i>et al.</i> (2005) | Digital grip measurement. Maximum value adopted. No other details about measurement method. | N = 143 Japanese older adults, resident at home but receiving care (86 women, 57 men). | Grip strength descriptive data at baseline: Women: 12.9 (4.2) Men: 19.8 (7.5) | This group were receiving home care, so likely to have more severe levels of disability than the STEER cohort, which is likely to explain the lower grip strength values. Mean age was also higher – 84.1 years (women) and 81.0 years (men). The study used a digital dynamometer, which has limited comparable data due to the use of manual dynamometry in most studies. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|------------------------------------|--|--|---|--|
| Roberts et al. (2014) | Maximum grip strength reported. Methods referenced to standard protocols. | N = 248 (101 hospital rehabilitation, 47 community rehabilitation, 100 nursing home residents) in England. | Grip strength value by setting: Hospital rehabilitation: Women: 13.5 (4.8) Men: 21.7 (7.5) Community rehabilitation: Women: 17.8 (7.2) Men: 29.3 (6.6) Nursing home resident: Women: 7.3 (4.2) Men: 15.5 (8.3) | No comparable populations – they were older adults in rehabilitation settings or nursing homes. Significant differences in grip strength between healthcare settings was reported even after comprehensive adjustment for age, height, weight, BMI, co-morbidities and medication. |
| Romero-Ortuno et al. (2011) | Model of dynamometer not specified. Higher score from three average readings on each hand accepted as grip strength value. | N = 442 (72% women) community dwelling older adults in Ireland. Mean age 72.1 years. Sample classified as having frailty status: 44.8% non-frail, 48.2% pre-frail, 7% frail. | Low grip for frailty classifications was accepted as being in the lowest 20 percentiles when stratified by gender and BMI. Also reports median (IQR) (kg) grip strength as an outcome: Non-frail: 25.5 (12.6) Pre-frail: 18.6 (11.4) Frail: 14.2 (6.9) | Useful data in relation to both frailty prevalence in a comparable sample and expected decrease in grip strength with increasing frailty status. The absence of gender-stratification in grip strength values made it difficult to apply to values to other data. Sound methodology. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|---|---|--|---|---|
| Romero- Ortuno et al. (2010) | Grip strength reported as a continuous variable. Value was taken as the highest recorded from two attempts on each hand. No detail regarding dynamometer model. | N = 28361 from 12 European countries, age over 50 years. Data is from first wave of Survey of Health, Ageing and Retirement in Europe (SHARE) Frailty Instrument validation. | Grip strength mean (kg) by gender for the three divisions of frailty: Non-frail: Women: 29.4 Men: 45.8 Pre-frail: Women: 23.7 Men: 36.2 Frail: Women: 17.9 Men: 26.5 | Construct and predictive validity established of the SHARE Frailty Instrument. The Instrument was not identical to the Fried method of identifying frailty, but used parallel screening measures. Younger sample than in the case of STEER (63.6 years – women, 64.1 years – men). Grip strength as a single predictor of the three-division frailty status discriminated well ($p < 0.001$). |
| Sayer et al. (2006) | Jamar dynamometer (Sammons, Bolingbrook, IL, USA) used. Three measures taken on each hand, with rest periods. Calibration of dynamometers occurred and intra- and inter-observers studies were carried out. | N = 2987 older adults (59-73 years). Community dwelling in the UK. | Grip strength (kg) Men: Women: 44.0 (7.5) 26.5 (5.8) | Significantly associated decreasing grip strength with poorer Health Related Quality of Life which was not addressed by confounders of age, size, co-morbidity or activity level. Quality of Life captured by a structured self-report measure, which combined with detailed reporting of methods provides support for the validity of results. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|---------------------------------|--|--|--|--|
| Serra-Prat et al. (2019) | A Jamar dynamometer (Sammons, Bolingbrook, IL, USA) was used, with measurements contributing to a range of measures on strength and function. No specific methods of measurement reported. | N = 324 (women = 153, men = 171). Mean age 80.1 years resident in Spain. Randomly sampled from primary care centres. | No comparable values reported as the study considered total body water and intracellular water relationships and its relationship to grip strength in a sample where those identified as having frailty were not reported as a separate group. | Provides evidence that increased intracellular water, as opposed to higher muscle mass might improve grip strength, and consequently be a protective factor for frailty. The analysis of associations between measurements was only partially reported, providing uncertainty as to the conclusions presented. |
| Syddall et al. (2010) | Jamar dynamometer (Sammons, Bolingbrook, IL, USA) used to obtain three scores per hand. No detail about average/ maximum or other procedures. | N= 638 (men = 320, women = 318) older adults (age 64-74 years). Community dwelling in the UK. | Classified 'weakness' by low grip strength as ≤ 30 kg for men, and ≤ 20 kg for women. Weakness (%) Women: 68 Men: 22. | Frailty was present in 4.1% of the male sample and 8.5% of the female sample. This study indicated that weakness was more common in women. No division for pre-frailty available which limited understanding. |
| Syddall et al. (2017) | Used a Jamar dynamometer (Sammons, Bolingbrook, IL, USA) at later stages of the study, but a Harpenden | N = 292 community dwelling older adults in the UK (120 women, 172 men). | Maximum grip strength (kg): Women: 23.7 (6.6) Men: 38.4 (8.1) Annualised rates of change of grip strength: Women: 0.08 (0.54) | Healthy survivor effect at follow-up, and variety in change in grip strength was calculated which is not evident in the small differences in mean annual rate of change. |

| Author (Year) | Grip Strength Measurement Method | Population Type | Grip Strength Values Reported (Mean (SD) kg unless otherwise stated) | Notes (including quality details) |
|---|--|--|---|---|
| | dynamometer (British Indicators Ltd. England) for data collected at the first wave. Maximum grip strength values were reported. | | kg/y Men: -0.12 (0.71) kg/y | |
| Woo, Yu and Leung (2018) | Jamar dynamometer used (Sammons Preston, Bolingbrook, IL, USA). Maximum value of trials on left and right hands used. | 4000 older men and women (n=2000 each) resident in Hong Kong (aged over 65 years). | No grip strength values reported. Low grip strength was classified as participants in the lowest quintile of grip strength measurements for the whole sample. | Little comparable data, but provided support for walking speed or grip strength to be used as a single identifier of frailty. |

2.7.1.1 Measurement Methods

Only two studies used a digital dynamometer (Nakamura *et al.*, 2005; Alqahtani and Nasser, 2019), and as these studies focused on older adults in Japan and Saudi Arabia, respectively, comparison of results to this study's population was not applicable for reasons detailed in Section 2.7.1.2. The most commonly used dynamometer was the Jamar manual hand dynamometer (Sammons, Bolingbrook, IL, USA) although a number of studies did not report the exact methods used. It has previously been established that average and maximum grip strength values do not produce significant differences (Haidar *et al.*, 2004), therefore the method used was reported to provide information about quality but not used to exclude cases. Results are now presented by themes of ethnicity, prevalence of low grip strength, consequences of low grip strength, and grip strength measurement as an identifier of frailty.

2.7.1.2 Ethnicity

The first point to note is there is good quality evidence that variation in grip strength due to ethnicity and geographic location. Normative values from a very large-scale cross-sectional study ($n = 125\,462$) suggested that grip strength values were highest in North American and European countries (Leong *et al.*, 2016). While this only provides data for healthy populations it is not unrealistic to extrapolate that decreases in grip strength due to frailty will deviate from a baseline determined by global location. While Leong *et al.* (2016) reported highest grip values in European countries, variation reflected in a 'north-south divide' was reported in relation to frailty prevalence within Europe (Santos-Eggimann *et al.*, 2009) and so caution will be applied when considering outcomes from southern European countries in relation to comparison with this sample.

2.7.1.3 Prevalence

The prevalence of pre-frailty and classifications of weakness by low grip strength was not commonly reported in the literature. The most relevant example was produced by Romero-Ortuno *et al.* (2011) and reported the following results. The percentage of people within each frailty stage, and the number of those meeting the criteria for weakness: frailty; 7% of total sample of which 51.6% met weakness criteria, pre-frailty; 48.2% of total sample of which 31.5% met weakness criteria; and non-frail; 44.8% of total sample, of which 0% met weakness criteria. This shows a significant ($p < 0.001$) decreasing grip strength as frailty status increased. Additionally, at the stage of pre-frailty, almost one third of the sample was experiencing low grip strength. Other studies provided relevant information but without comparison and division by frailty status, which limited understanding. Data pertaining to 191 Belgian men suggested that 30% of the sample had pre-frailty, but that only 3-8% had combined weakness and low muscle mass (De Buyser *et al.*, 2016). As a combined score it is not possible to determine the number of people with low grip strength only, but raises interesting questions about the relationship between grip and muscle mass. It is often assumed that measure of grip strength is a proxy for sarcopenia, which is reflected in low muscle mass, but these figures suggest that if this was the case the number meeting the criteria might be higher. The study by Roberts *et al.* (2014) was concerned with a population experiencing a higher level of care than the well older adults of the STEER Course (community rehabilitation, inpatient rehabilitation and nursing home residents). However, it demonstrated decreasing grip strength with increased level of care need and fits with the expectation that grip strength values for people with pre-frailty will fall between the levels of those who do not have frailty versus those classified as frail. Syddall *et al.* (2010) did not consider the group classified as 'pre-frail', but provided information that for a sample of 638 (men = 320)

community dwelling 'young old', low grip strength was identified in 6.9% of men and 21.5% of women. As the frailty classification was 4.1% of men and 8.5% of women it suggests that the criterion of low grip strength might more frequently be experienced by women as this occurred despite gender-stratified grip strength values being used to classify low grip. While most studies showed decreasing grip strength with increasing frailty status, the only study to use measures informed by the Frailty Index, reported no detectable differences in grip across three frailty groups (Merchant *et al.*, 2016). This study's quality was questioned due to lack of detail regarding methods and rationale for analysis.

2.7.1.4 Consequences of Low Grip Strength

As discussed in Section 1.4, it has been established that frailty has associations with worsening outcomes in terms of morbidity and mortality. Papers identified in this search have also considered the link between the specific frailty 'symptom' of weakness, identified by low grip strength, and worsening outcomes. The measure of low grip strength had predictive ability for mortality and hospitalisation (Legrand *et al.*, 2014; Goldeck *et al.*, 2016; Syddall *et al.*, 2017; Woo, Yu and Leung, 2018), however mortality figures for people identified as having grip strength representative of a level of pre-frailty were not available. The work of De Buyser *et al.* (2016) suggested that only grip strength, once considered in combination with low appendicular lean mass, was the only significant ($p = 0.006$) predictor of all-cause mortality. This study considered only one sex ($n = 191$, men only) and relied on the use of nonparametric statistics, possibly due to the sample size. However, it was a comparable Belgian population and suggests the association of muscle mass and strength must at least be considered.

Additionally to mortality, Auyeung *et al.* (2011) evaluated the associations between the phenotype criteria and predictions of cognitive decline. It determined that grip strength, in women only, was a significant ($p < 0.05$) predictor of cognitive decline over a four-year period. As established above, the prevalence of weakness was higher in women and it might be that this increased incidence of low grip strength accounted for the significance due to a larger sample. As a large scale observational study, no causal relationships were proposed, but the study adjusted for confounding variables and is suggestive that the relationship between grip strength and cognitive decline should at least be further explored. There were other associations with low grip strength and specific symptoms reported. Bahat *et al.* (2019) identified a significant ($p = 0.002$) relationship between low grip strength and dysphagia, and a small (2.6kg), but significant ($p \leq 0.001$) reduction in grip strength when visual impairment occurred was reported by Ho, Chen and Merchant (2019).

In addition to mortality and morbidity, associations between low grip strength and broader consequences have been studied. These, however, have tended to be smaller scale studies with limited application to the population of this study. In a cross-sectional analysis ($n = 83$), there was a moderate association between grip strength and overall quality of life (Haider *et al.*, 2016). While the strength of evidence in this study was limited, it was interesting that only grip strength was associated with quality of life, whereas appendicular skeletal muscle mass, while associated with grip strength, was not linked to quality of life scores. It might have been expected that increased muscle mass might facilitate movement and activity participation, and contribute to quality of life. No causal explanation for the role of increased grip strength was proposed, but it will be important to determine the practical applications, or consequences, of a person's level of grip to better understand this. The cross-sectional study ($n=2987$) by Sayer *et al.* (2006) found a significant association ($p < 0.001$) between lower grip strength and increased likelihood of reporting poor self-rated perception of health. It made no inference of reasons for this, but as a study into UK community-dwelling older adults it is an important association to recognise.

As well as self-reported measures of health and quality of life, there was consideration of grip strength and activity in the literature. A study ($n=560$), albeit with a population aged eighty and over, provided further support for the role of muscle strength (identified by grip strength) in determining outcomes in relation to activity performance (Legrand *et al.*, 2014). This study determined that muscle strength and physical performance (captured by the Short Physical Performance Battery (SPPB) (Guralnik *et al.*, 1994), were more predictive of hospitalisation and mortality than markers of muscle mass, inflammation and comorbidity. Again, causal relationships were not proposed, but it suggests that there is a link between strength and physical ability, and that these were important predictors of outcomes. If, as this suggests, *applied* strength, as opposed to raw muscle mass, is indicative of negative outcomes, it lends support to interventions that aim to improve functional strength and ability. Another study which looks at the relationship between grip strength and activity was that of Liu *et al* (2017). This study provided tentative evidence that grip strength only determines functional outcomes when strength is required, rather than being representative of overall function. The study is treated with caution as it provided grip strength values much lower than any other study which are suggestive of reporting, or measurement, error.

2.7.1.5 Grip Strength to Identify Frailty

Within the validation of the Fried phenotype (Fried *et al.*, 2001), low grip strength was proposed as a means of confirming the presence of weakness for those in the lowest 20% of values. Subsequently, several studies have endeavoured to determine if grip strength alone can

accurately identify frailty to reduce the number of tests and assessments required. The sample (n= 383) studied by Lee *et al.* (2017) was slightly older (participants were 75 years and older), however within a comparable population grip strength was found to have sensitivity: 100% (95% CI: 83.4-100) and specificity 90.5% (95% CI: 86.9-93.2) yielding classification accuracy of 91.1% (87.7-93.3). While grip strength alone had good ability to detect the presence of frailty it was recommended that the best accuracy occurred when combined with gait speed scores. The study by Auyeung *et al.* (2014) also proposed that grip strength has good sensitivity and specificity in Chinese populations, suggesting that although grip strength and frailty prevalence values vary by continent (Leong *et al.*, 2016), the means of identifying the syndrome is more uniform.

While the use of average, or maximum, grip strength to identify frailty has been thoroughly examined there was also emerging consideration of related, but alternative means. A study (n = 292) by Syddall *et al.* (2017) explored the concept of rate of grip strength loss as a predictor of mortality. In this study grip strength values did not change significantly, however the mortality data suggested those that were re-tested were likely to contribute a healthy survivor effect. When combined with original frailty status there was an association with mortality, and it suggested that further study into rates of change of grip strength could provide useful data. There was also argument that a different dynamometer, that of a Martin Vigorimeter, discriminates better between level of frailty than using a Jamar dynamometer (Sammons, Bolingbrook, IL, USA). The small (n = 53) study of Greek women showed significant difference in the ability of the Martin Vigorimeter to detect low and high-frailty compared to a Jamar dynamometer. This was a test of the speed of fatigue of muscles and so not the same measure, but indicative that different measures and equipment could give, if developed into larger studies, greater insight relating to changes attributed to different levels of frailty. However, the current position is that the majority of studies used a Jamar manual dynamometer (Sammons, Bolingbrook, IL, USA) and there is currently insufficient evidence available as to the value of measuring frailty by the method of a Vigorimeter.

Two studies (Mohr *et al.*, 2007; Lin *et al.*, 2014), examined the predictive ability of biomarkers of testosterone level in men, and polymorphisms of serum C-reactive protein (CRP), as a means of identifying people at risk of frailty, respectively. Both studies determined that measurement of grip strength had stronger predictive ability for frailty than the classification based on biomarkers. While not used to explicitly identify frailty, a study into increased inflammation and low grip strength in a large German sample (n = 1935) determined that grip strength losses occurred independently of pro-inflammatory markers (Goldeck *et al.*, 2016), which was also proposed as part of Legrand *et al.*'s (2014) work discussed in the sub-section above. Given the invasiveness of the tests required to identify these biological markers of ageing, and lack of benefit, these results

supported the use of grip strength measurement. The single study that used grip strength as an outcome measure for a strengthening intervention determined that while improvements were made in areas of balance, gait, and social and psychological attitudes, the change to grip strength was not significant ($p = 0.423$) (Nakagawa *et al.*, 2008). The studies above confirm the use of grip strength measurement by manual dynamometer testing as an accurate, sensitive and specific gauge of frailty occurrence, but perhaps not a sensitive measure of short-term change.

2.7.2 Have parameters for identifying pre-frailty using grip strength been proposed and validated within the literature?

Consideration of grip strength values for people classified as having pre-frailty was not commonly reported in the literature. Only three studies provided explicit data about handgrip strength in people meeting the criteria for pre-frailty (Romero-Ortuno *et al.*, 2010; Romero-Ortuno *et al.*, 2011; Danilovich *et al.*, 2018). The first (Romero-Ortuno *et al.*, 2011) did not provide gender-stratified results, which makes application to other populations highly limited. The combined-gender grip values were (median, IQR (kg)): non-frail: 25.5 (12.6), pre-frail: 18.6 (11.4) and frail: 14.2 (6.9). This mirrored findings above of a continuous decrease in grip strength as frailty status increased and supports the use of grip strength to identify changes that will occur even at the stage of pre-frailty. It was a study completed in Ireland, and so ethnic influences on grip strength are likely to be similar to the population of this study. As the sample was 72% female it is likely that these median scores are lower than would be expected for a sample with even gender distribution and this lack of detail about measures by gender makes it very difficult to determine expected/normative values based on this study.

As a product of the much larger Survey of Health, Ageing and Retirement in Europe, Romero-Ortuno *et al.* (2010) reported mean grip strength values (kg) for the three sub-sections of frailty status, divided by gender (non-frail: women: 29.4 men: 45.8, pre-frail: women: 23.7, men: 36.2, frail: women: 17.9, men: 26.5). This study occurred across ten European countries and the baseline values are available for 28361 people. The scale of this study provides justification for adopting the values to create a stratification. It is unfortunate that it had not been stratified further by BMI as per the original guidance produced by Fried *et al.* (2001), as grip strength had significant predictive ability ($p < 0.001$) to classify correctly into the three frailty divisions. A further study based on principles of the SHARE-FI study (Romero-Ortuno *et al.*, 2010) was completed by Danilovich *et al.* (2018). This was focused on a very specific group (139 participants in Illinois in receipt of Medicaid due to low income and high care needs) and so the results are less indicative of what might be expected in this study due to the lower disability level. The mean values (kg) measured (non-frail: women: 26.4 men: 38.0, pre-frail: women: 24.7, men: 34.5, frail: women:

17.7, men: 24.9) were all lower than in the larger study, apart from women in the pre-frailty category. This is potentially reflective of the influence of the higher level of disability experienced by participants in this study.

As Fried *et al.* (2001) propose identifying frailty using gender and BMI-adjusted grip strength values, the ideal outcome of this review would have been to find similar stratifications for a comparable population classified as having pre-frailty. As discussed above, data relating to specific parameters for a population who have pre-frailty is limited, and so the gender-stratified (but not containing variation based on BMI) values presented by Romero-Ortuno *et al.* (2010) are the best available, and comparable, parameters of pre-frailty. The mean values for grip strength for people classified as robust, pre-frail and frail were used to create the following divisions for frailty status (with the mid-point between each mean determining the boundary):

Table 4 Frailty classifications derived from Romero-Ortuno *et al.* (2010)

| Women | | Men | |
|------------------|--------------------|------------------|--------------------|
| Frailty Category | Grip Strength (kg) | Frailty Category | Grip Strength (kg) |
| Robust | ≥ 26.7 | Robust | ≥ 41.1 |
| Pre-frail | 20.8 – 26.6 | Pre-Frail | 31.0 – 41.0 |
| Frail | ≤ 20.7 | Frail | ≤ 30.9 |

These values have been determined from a large study of older adults from ten European countries. Although the means of calculating grip strength in this study was the maximum of two attempts on each side, rather than the three proposed by Fried *et al.* (2001), it has been accepted that due to the scale of study, comparable populations and stratification by gender into three stages of frailty it can be used in this thesis. No validation of this approach has been determined in other literature, but this is not unexpected given the lack of focus on grip strength values for people living with pre-frailty. This provides an opportunity for this study to contribute to the knowledge base about expected grip-strength values in people at risk of pre-frailty within the UK.

2.7.3 Properties of Handgrip Measurement

The preceding evidence has related to the use of handgrip measurement in populations living with frailty. While the literature review provided data relating to the sensitivity and specificity of the measure to identify frailty (Lee *et al.*, 2017), in order to examine the properties of handgrip measurement using a dynamometer, evidence from the wider evidence base was sought. As was noted in

Table 3 above, there were a range of methods used to achieve grip strength measurement, ranging from different brands of dynamometer to differences in measurement approaches (e.g. numbers of trials, averaging of results, rest periods). This matter was examined by Roberts *et al.* (2011) and confirmed the variation in measurement approaches. Their review confirmed findings here that the Jamar (Sammons, Bolingbrook, IL, USA) manual dynamometer was most commonly used. A standardised protocol to minimise the effect of differences, which most frequently relate to measurement protocol of number of trials, hand dominance and arm/leg posture during measurement, is proposed (Roberts *et al.*, 2011). As this study has been based on measures and values first detailed by Fried *et al.* (2001), a standardised operating procedure for grip strength measurement based on Fried *et al.*'s approach (2001) has been used.

There was evidence that dynamometer brands cannot be used inter-changeably, as significant differences in values were produced (Roberts *et al.*, 2011). A study that examined the brand of dynamometer used within this study, however, did find significant levels of agreement in values produced between three brands (Güçlüöver *et al.*, 2015).

As the measure of grip strength will be completed at three time-points for each participant, and potentially by different assessors, test re-test reliability and inter-rater reliability were important properties of the measurement. The high test re-test reliability of the Jamar dynamometer (Sammons, Bolingbrook, IL, USA) has a long-standing acceptance, based on a protocol of three-measurement per session testing (Mathiowetz *et al.*, 1984). A study of healthy older adults re-tested at an interval of twelve weeks demonstrated a slight, but not significant decrease in values during that time and analysis determined an excellent test re-test reliability (Bohannon and Schaubert, 2005). As the population and conditions of this study match those examined by Bohannon and Schaubert (2005), there can be confidence in the use of the measure. The inter-rater reliability of handheld dynamometry has been determined to be good, with no significant differences between assessors when following a standardised protocol (Bohannon and Andrews, 1987).

There are limitations of manual handgrip measurement using dynamometry proposed in the literature. Many of the studies into its properties were completed with young, healthy populations (Mathiowetz *et al.*, 1984; Ward and Adams, 2007; Güçlüöver *et al.*, 2015). There is evidence that measurement error is greatest in the lower ranges of readings (Roberts *et al.*, 2011), which has consequence for people with low grip strength and there is suggestion that alternative brands can be more appropriate (Hogrel, 2015). There was also evidence that for people with conditions that cause hand pain, maximum grip strength measurement was difficult

to achieve, and that a modified testing protocol is required that instructs a participant to stop when they feel discomfort (Kennedy, Jerosch-Herold and Hickson, 2010).

2.7.4 Review 1 Summary

This review has established that grip strength is expected to be reduced even at the stage of pre-frailty, but that specific parameters of this are not yet well established and validated. Multiple studies support the use of grip strength as an accurate single-measure to identify frailty, which supports the analytical methods planned within this thesis. Acceptable values for a three-item division of frailty classification have been discovered which will facilitate analysis of data within this study. Caution is used as they do not allow for modification of classification based on body mass index – a known influence on strength (Fried *et al.*, 2001). While the section above highlights some limitations of grip strength, it has acceptable properties, especially as it will be used within this study as one method, among several quantitative and qualitative measures, to generate relevant data. The analysis provided in this study, then, will be valuable in providing more data about the characteristics of people in this poorly defined and described population.

2.8 Literature Review 2A: Activity Participation

Literature Review 1 considered means of identification of frailty via a single measure. This measure, however, is considered to represent low muscle strength and have consequence for functional ability (Fried *et al.*, 2001; Mitnitski, Mogilner and Rockwood, 2001). Further consideration of deficits linked to frailty, such as low strength, and its effect on activity participation are important to understand. The literature review above, while providing support for grip strength measurement to classify frailty, raised suggestion that the relationship between strength, function and adverse outcomes was more complex than just capturing muscle mass or a simple measure of strength. Therefore, examining applied strength, in the form of functional ability within activity participation, could be a means of generating greater understanding of the relationship between strength and disability. There was also emerging consideration of the effect of frailty on well-being, which includes the ability to complete chosen activities (Green *et al.*, 2017). This was considered in a more tentative way, compared to the support for resistance based physical activity to improve muscle strength (British Geriatrics Society, 2014; Green *et al.*, 2017).

It is the preposition of this study that the exact means by which activity influences well-being and is limited or aided by a person's state of physical health, is not well examined. Specifically, it is proposed that in addition to activity participation, occupational engagement has a greater contributing role to both physical and well-being outcomes for older adults, than participation in

generic activities which lack personal value. This assumption is based on the definition of occupation as, “groups of activities and tasks of everyday life, named, organised and given value and meaning by individuals and a culture” (Townsend, 1997 pp.34) and emphasises a person’s volition for the type of activity in which they are engaged.

Within the field of occupational science there is long-standing discussion of the link between occupational engagement and health (Wilcock *et al.*, 1997; Wilcock, 1998; Yerxa, 1998), however the exact means by which occupation and health are linked is not well-defined and is poorly tested (Reid, 2008). As the evidence base is limited this provides opportunity to generate in-depth understanding of the motivations of, and processes occurring within, STEER Course participants in relation to their occupational engagement and activity participation alongside evaluation of the impact of the programme on markers of health.

The expected limitations in available evidence guided the first literature search to explore perceptions of people living with frailty with respect to their experience of completing daily activities. At this stage all types of activity were considered, so as to determine the range of knowledge that was available.

2.9 Literature Review 2A Approach

For the purposes of this literature review to ensure all relevant material was located, the terms ‘activity’ and ‘occupation’ were both searched. As was discussed in the introduction to this chapter (Chapter 2), and supported by findings in Section 2.7.2, it was anticipated that limiting search terms to ‘pre-frailty’ would produce insufficient evidence. For this reason, the term *frail* was searched as it would identify all stages of frailty classification and broaden the search. The aim was to find experiential accounts of living with frailty and so only mixed or qualitative articles were accepted post-search.

2.9.1 Literature Review 2A Question

What is the experience of activity participation for people living with frailty?

The following search strategy was generated with each concept searched with the title and abstract and applied to academic journals. The synonyms were separated by the Boolean operator “or” and the search completed with Concept Term 1 “and” Concept 2.

Table 5 Literature search terms

| Concept Term 1: Target Population | | Concept 2 | |
|-----------------------------------|-----|-------------------------|--|
| | | | |
| *frail* | AND | activit* OR occupation* | |

This search strategy was applied on CINAHL, MEDLINE, PsycINFO and PsycARTICLES databases. Databases that provide systematic reviews or randomised controlled trials only (for example: OTSeeker and The Cochrane Database) were not consulted due to the need to produce detailed experiential accounts. Articles were screened and duplicates removed, articles not available in the English language were also excluded as resources for translation were not available. The abstracts were reviewed to identify contents which provided experiential accounts or participant perspectives. All papers published prior to 1st February 2020 were included.

2.10 Review 2A Search Results

Full details of the search are included in the following PRISMA diagram (Liberati *et al.*, 2009):

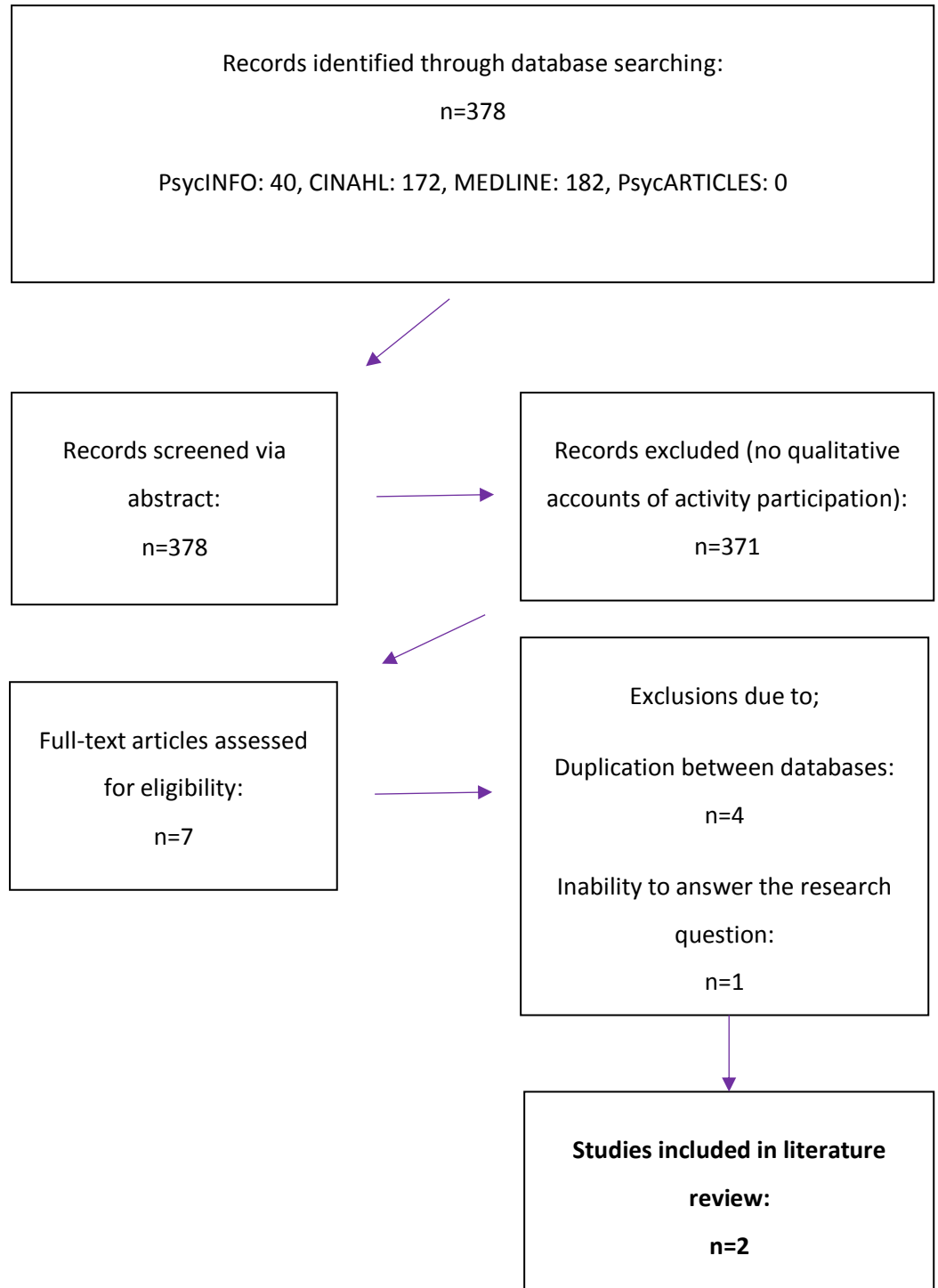


Figure 2 Review 2A inclusion process

2.10.1 Review 2A Included Studies

Table 6 Review 2A included studies

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|---|---|---|---|
| Castaneda-Gameros, Redwood and Thompson (2018) | Physical activity, sedentary time, and frailty in older migrant women from ethnically diverse backgrounds: A mixed-methods study. | 36 participants who were immigrants to the UK from a range of ethnically diverse backgrounds. Participants were classified by Fried frailty phenotype: “non-frail”, “pre-frail” and “frail” – specific statistics for the subset of participants who completed interviews was not provided. | Semi-structured interviews to explore perceived barriers to physical activity, views about activity recommendations and perceived role of physical activity for physical function. Study justified the use of mixed methods to develop explanations for the measure outcomes relating to activity type, but relied on convenience sampling. |
| Welmer, Mörrck and Dahlin-Ivanof (2012) | Physical activity in people age 80 years and older as a means of counteracting disability, balanced in relation to frailty. | 20 Swedish community dwelling people aged 80-91 years. No specific measurement on frailty, but rather it was assumed based on age. | Five focus groups explored physical activity, including value, experience and factors that encourage/discourage engagement. The focus group methodology was |

| | | | |
|--|--|--|--|
| | | | justified, but with limited consideration of the effect of the method on the findings. |
|--|--|--|--|

2.11 Review 2A Relevance and Quality Summary

While low availability of evidence had been predicted, it had been expected to retrieve more than two articles and this restricts the understanding gained from the available evidence.

Consideration was made as to whether to widen the search terms (to include activity/occupation for all older adults) at this stage, however on reflection it was deemed important to examine the current level of evidence for the specific population living with frailty. During the process of screening results, in an attempt to include the biggest range of evidence, no article was excluded if it provided any qualitative exploration of activity and no limitations regarding comparability of study population were imposed. The two articles retrieved supplied insight into the meaning and experience of physical activity only for their study populations. This approach was appropriate for the specific study's aims, but limits application to the broader consideration of activity required for this study.

Castaneda-Gameros, Redwood and Thompson (2018) considered thirty-six ethnically diverse migrants who were now living in the UK. They identified frailty using the Fried *et al.* (2001) phenotype. While the method of classifying frailty and location of research are comparable to this study, the STEER Course participants were largely native to the UK, and so it would be expected that the experience of activity participation might be different (Castaneda-Gameros, Redwood and Thompson, 2018). Gameros, Redwood and Thompson (2018) also considered solely female participants, unlike the STEER Course which has participants of both genders. Furthermore, while this paper divided participants by frailty status ("non-frail", "pre-frail" and "frail") the qualitative component of the study did not provide details of the distribution of participants in terms of their frailty status, and the findings (with the exception of direct quotations) did not report on explicit differences in response by frailty status. This has made it difficult to fully determine the experience of activity participation for people at the three different stages, however the paper provided clear account of the study design and means of analysis. Furthermore, while the study used criteria for frailty as directed by Fried *et al.* (2001), the decision in this paper to classify frailty in the lowest 20% of their sample size of sixty (in the full mixed methods study) was a questionable generalisation of the methods used by Fried *et al.* in a much larger study (2001). This study focused only on the experience of physical activity, and so, combined with the limitations

already identified, provided limited comparable evidence as to the experience of all activity participation for a population with similarities to the STEER Course participants.

The second identified study by Welmer, Mörrck and Dahlin-Ivanof (2012) was completed with twenty community dwelling adults aged eighty years and above resident in Sweden. While it aimed to explore the experience of physical activity for a population living with frailty, it did not measure or identify frailty in participants, but rather assumed its presence based on age. Although frailty is linked to increasing age, age does not necessarily mean frailty is present and is not a sufficient method by which to classify frailty (Mitnitski, Mogilner and Rockwood, 2001), which limits the quality of this study. The inclusion of participants over the age of eighty only also means that potential differences in experience of the “younger older adults” are not captured. Caution is also applied as the study investigates only physical activity and participants were resident in Sweden, so experiential and cultural differences could occur. Despite this, the research questions aimed to generate in depth discussion of the meaning and barriers to physical activity, providing valuable insight for this study.

The evidence identified in this review had quality limitations in relation to measurement/classification of frailty, but otherwise produced trustworthy findings. The biggest limitations were in the volume of evidence available regarding broad experiences of all types of activity participation for people living with frailty.

2.12 Review 2A Findings

The two studies retrieved were different in design, with one using interviews as part of a larger mixed methods study (Castaneda-Gameros, Redwood and Thompson, 2018) and the second using focus group methodology (Welmer, Mörrck and Dahlin-Ivanoff, 2012). The studies considered different populations but had similar aims: to discover experiences of physical activity to improve levels of engagement in physical activity.

Despite the cultural differences in the two study populations there were areas of commonality. They were; meaning or experience of physical activity, barriers to engagement, and motivating factors. The study of migrant women, who were identified as having lower than average levels of physical activity (Castaneda-Gameros, Redwood and Thompson, 2018), produced the greatest range of barriers to physical activity with less content in the other two categories. The study by Welmer, Mörrck and Dahlin-Ivanoff (2012), did not identify quantifiable levels of physical activity, however the findings demonstrated a more balanced influence of factors relating to engagement in physical activity.

The meaning and experience of physical activity was most clearly examined in, and a strength of, the Swedish study. For participants the clearest theme was that of physical activity being embedded within more important and valuable activities, where the ability to walk or take part in dancing was rewarded with positive consequences such as social interactions and being able to spend time outdoors. There was value held in physical activities such as walking or daily exercises that improved mood or operated as a catalyst for other activities and provided a sense of freedom (Welmer, Mörck and Dahlin-Ivanoff, 2012), providing support for the incorporation of well-being as a focus in this thesis. The study of older migrant women was focused on barriers and the value of physical activity. It identified the need for physical activity to be a good fit with a person's sense of functional ability and interests to promote engagement (Castaneda-Gameros, Redwood and Thompson, 2018).

Both studies had limitations in their means of classifying frailty, but in spite of this, useful information about *perceived* frailty was presented. The central barrier to engagement within both studies related to a perception of vulnerability due to physical or functional limitations (Welmer, Mörck and Dahlin-Ivanoff, 2012; Castaneda-Gameros, Redwood and Thompson, 2018). Within both studies there was evidence of decreasing ability and concern that strenuous physical activity could worsen existing conditions. For the older migrant women, this was not reconciled by advice from health practitioners, but rather own perceptions of ability were deemed more reliable (Castaneda-Gameros, Redwood and Thompson, 2018). For the older adults in Sweden a specific fear of falling was highlighted as a prohibitive factor to engagement in specific activities, and a dynamic between low mood, poorer physical ability and resultant passivity in relation to physical activity occurred (Welmer, Mörck and Dahlin-Ivanoff, 2012). There also appeared to be evidence of a similar process occurring in the descriptions provided by Castaneda-Gameros, Redwood and Thompson (2018). In addition to this, the study of experiences of older migrant women highlighted a range of cultural barriers that appear extremely limiting. These included familial responsibilities, expectations and care roles, lack of availability of single-sex activity options that met cultural or religious beliefs, and language barriers related to being a first generation migrant (Castaneda-Gameros, Redwood and Thompson, 2018).

The motivating factors demonstrated the most comparability across the two studies, with few cultural influences. Within each study the primary motivating factor was to maintain physical function, due to its perception of ensuring the ability to live independently. The participants in Sweden identified engagement in physical activity as a means of taking responsibility for one's health to avoid becoming a burden, and to improve quality of life rather than longevity (Welmer, Mörck and Dahlin-Ivanoff, 2012). This was mirrored with the older migrant women specifically

wishing to avoid needing other people to care for them, with the goal to avoid residential care (Castaneda-Gameros, Redwood and Thompson, 2018).

2.13 Review 2A Summary

The studies reviewed have demonstrated that the concept of participation in physical activity has multi-faceted components which provide meaning for participants. Both studies identified barriers that might limit participation or engagement, which is important knowledge for intervention design that aims to increase activity participation. The studies focused on physical activity, given known associations of low physical activity with frailty (Fried *et al.*, 2001), and recommendations regarding physical activity that informed the studies (Nelson *et al.*, 2007). There was evidence of the relationship between reduced strength and function on fear of falling and engagement in complex activities, supporting the preposition of the review that it is an important area to understand. Participation in physical activity was predominantly focused on physical limitations. However, as highlighted by Welmer, Mörrck and Dahlin-Ivanof (2012), older adults considered physical activity to occur as an integrated part of daily life and had relationship to well-being. Furthermore, both studies highlighted social and contextual factors influencing engagement, and yet qualitative exploration of the experience of daily activities is limited. The studies had limitations in their means of classifying frailty. Despite this, there was evidence that activity participation is a complex and evolving experience for older adults. This provides justification for a more comprehensive exploration of experiential accounts of activity participation for people with a more robust frailty classification.

The studies, due to their design and study populations, and total number of papers retrieved, provided minimal comparable evidence for this study. Firstly, this provides evidence that there is a gap in the evidence base for exploration of the meaning of all activity participation for those living with pre-frailty. Secondly, it has directed this study to review the evidence base regarding the experience of activity participation for a wider population of older adults (Section 2.14). This has been done with caution and does not assume a presence of frailty due to age, but rather aims to understand the factors influencing the experience for a population with increased risk of frailty (Clegg *et al.*, 2013).

2.14 Literature Review 2B

As discussed above the initial literature review highlighted a paucity of relevant evidence exploring experiential accounts of activity participation for people living with frailty, yet indicated that many factors influenced engagement in physical activity. This guided the review presented

here and resulted in a widening of criteria to explore activity participation or occupational engagement for all older adults.

2.15 Literature Review 2B Approach

Literature review 2B aimed to repeat review 2A, but with a wider population included. Therefore, the term “frailty” was replaced with “older adults” (and synonyms). Similarly to Review 2A, the terms “activity” and “occupation” were included and only qualitative data were sought, with inclusion criteria requiring participants to be community-dwelling due to a considerable focus of activity for people in residential care, who are likely to have more advanced levels of disability than the intended population for this study.

2.15.1 Literature Review 2B Questions

What is the experience of activity participation for older adults?

What barriers and facilitators influence activity participation for older adults?

The search strategy below was applied with all variations of each concept searched with the title and/or abstract and applied to academic journals. The synonyms were separated by the Boolean operator “or” and the search completed with Concept Term 1 “and” Concept 2 “and” Concept 3. Concept 3 was added following a trial search to reduce the papers to more relevant studies. The same databases were used as in search 2A due to the similar type of papers required.

Table 7 Literature search 2B terms

| Concept Term 1: Target Population | | Concept 2 | Concept 3 | |
|--|-----|----------------------------|-----------|--|
| | | | | |
| older adults OR elder* OR geriatric* OR senior* | AND | activit* OR occupation* | AND | experience* OR perception* OR attitude* OR view* OR feeling* OR qualitative |
| AND | | | | |
| community-dwelling OR “community dwelling” OR “living at home” | | | | |

2.16 Review 2B Search Results

Full details of the search are included in the following PRISMA diagram (Liberati *et al.*, 2009):

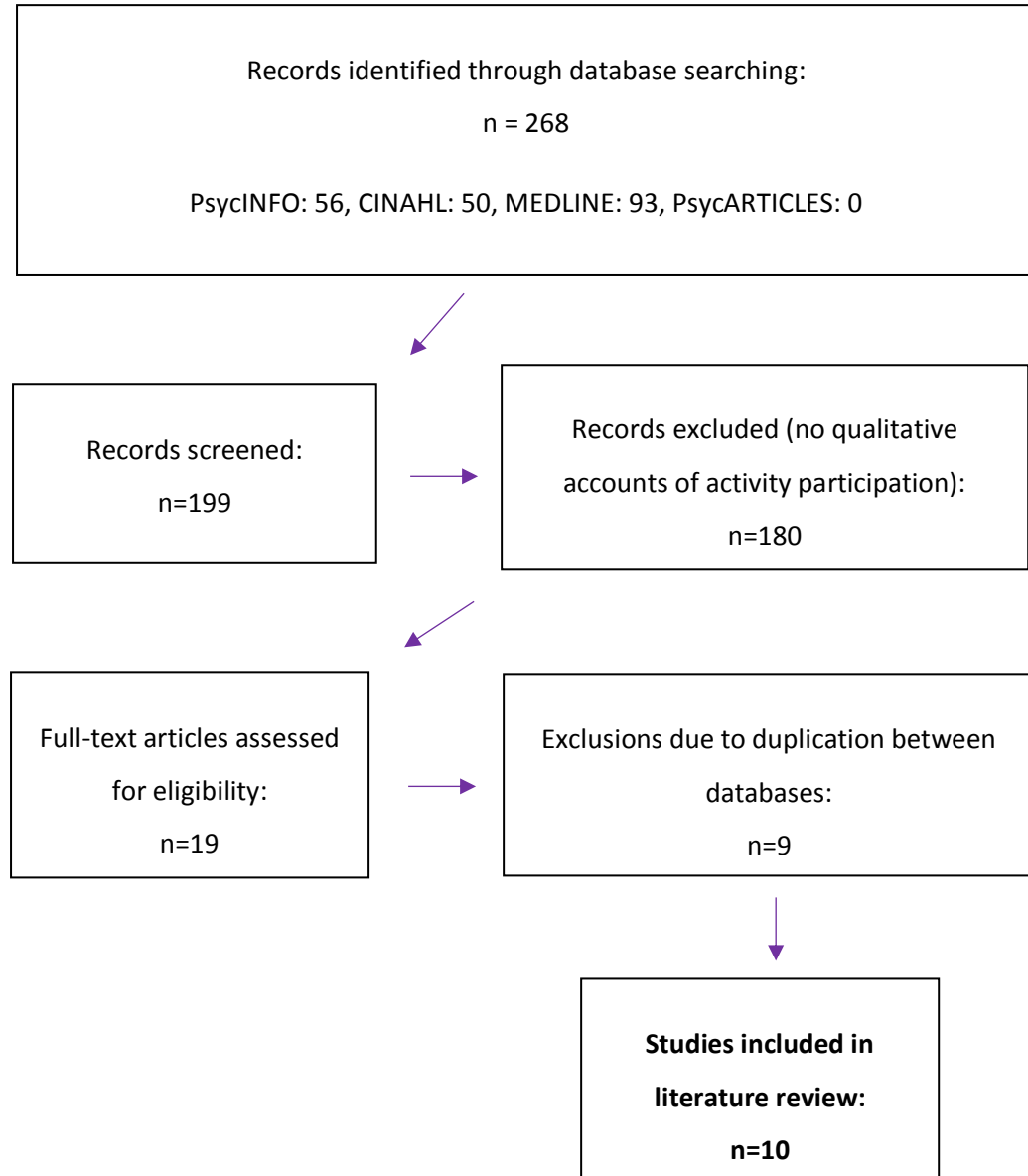


Figure 3 Review 2B inclusion process

2.16.1 Review 2B Included Studies

Table 8 Review 2B included studies

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|-------------------------------------|--|--|--|
| Dunn and Riley-Doucet (2007) | Self-care activities captured through discussion among community-dwelling older adults | 28 older adults (67-96 years) resident in Detroit and engaged in centres for senior citizens. The majority of participants were female (82%) and of non-white race. The sample was achieved purposively. | Focus groups explored areas of changes to health, how illness restricted activity participation and maintenance of spiritual health or well-being. The discussions were analysed by content analysis framed by a holistic nursing model. Data analysis commenced before all focus groups completed, without detail of how any effect of this was considered. |
| Gothé and Kendall (2016) | Barriers, motivations, and preferences for physical activity among female | 20 female African American older adults (55-75 years) resident in Detroit. | Focus groups explored the motivations and barriers to physical activity for older urban-dwelling African American women. The |

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|--------------------------------------|---|---|---|
| | African American older adults | | discussions were analysed by content analysis frame by social-cognitive theory, which was a pre-determined analytic lens – the effect of this on findings is unclear. |
| Griffith <i>et al.</i> (2007) | Defining spirituality and giving meaning to occupation: the perspective of community-dwelling older adults with autonomy loss | Eight participants (75% female) resident in Canada and receiving home care. Participants had experienced a low level of loss of autonomy in completion of daily activities. | Individual interviews were completed with the participants to examine the meaning attributed to occupation, and to define spirituality. Grounded theory, framed within social psychology theoretical constructs, was used. Methods, including targeted recruitment, and details of analytical decisions were clearly justified. |

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|---------------------------------|--|--|---|
| Janssen and Stube (2014) | Older adults' perceptions of physical activity: A qualitative study | 15 participants (65 years and over), resident in the USA. Purposive and snowball sampling occurred. Participants were engaged in a community housing complex, fitness centre and senior centre. | Two interviews and one observation were completed using a qualitative phenomenological methodology which explored perceptions and experiences of physical activity. Recruitment occurred via gatekeepers who were known to participants, the effect of this was minimally explored. |
| Lin <i>et al.</i> (2007) | Beliefs about physical activity - focus group results of Chinese community elderly in Seattle and Taipei | 24 older adults in Taipei and Seattle (n=14 and 10 respectively) were selected by purposive convenience sampling. All were aged 65 and over ("majority female, aged 75-79") and all were from the Chinese community. | Participants engaged in focus groups to explore attitudes and barriers to physical activity. The discussions were analysed by deductive content analysis – 100% interrater agreement occurred regarding code development. |

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|-------------------------------------|--|--|---|
| Marquez <i>et al.</i> (2016) | A qualitative exploration of factors associated with walking and physical activity in community-dwelling older Latino adults | 20 older Latino adults resident in Chicago were purposively sampled. All lived in the community and had a self-rated health of “fair” or better. | Participants completed exploratory focus groups regarding barriers and perceptions of physical activity. Data were analysed using an “iterative, hybrid-coding process combining a priori and emergent categories”. Limited discussion regarding the characteristics and influence of the purposive sample on findings. |
| Morgan <i>et al.</i> (2019) | A life fulfilled: positively influencing physical activity in older adults - a systematic review and meta-ethnography | 39 peer-reviewed studies were included. Participants in the original studies had to be community-dwelling and over sixty years of age. | Systematic review and meta-ethnography of qualitative studies that describe influences on physical activity for older adults. A conceptual map was created from coded extracts from the original studies- provision of quotations aided understanding of |

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|--------------------------------------|--|---|--|
| | | | the findings. While 'fatally flawed' articles were excluded, the influence of quality of included studies was not transparent. |
| Mulholland and Jackson (2018) | The experience of older adults with anxiety and depression living in the community: Ageing, occupation and mental well-being | Five participants, resident in Ireland, with diagnoses of anxiety and/or depression were purposively sampled. | Semi-structured interviews were analysed with a phenomenological theoretical standpoint to complete thematic analysis. Well-supported findings with quotations and diagrams detailing the analytical process. |
| Sanders <i>et al.</i> (2018) | Using formative research with older adults to inform a community physical activity programme: Get healthy, get active | 34 participants (28 purposively sampled, 6 further participants recruited by a convenience pragmatic sub-sample). All were aged 65-90 years and resident in the UK. | Focus groups were conducted to explore current knowledge and attitudes to physical activity. Data were analysed thematically. Unclear reporting of trustworthiness of the findings based on the data provided. |

| Author (Year) | Study Title | Population and Sample | Methods and Quality Assessment |
|-----------------------------------|--|--|--|
| Weeks <i>et al.</i> (2008) | Participation in physical activity: influences reported by seniors in the community and in long-term care facilities | 24 older adults, both community-dwelling (n = 17) and resident in long-term care. 20.8% of the sample were male and all participants were over the age of 64 and resident in Canada. | Participants engaged in semi-structured interviews to identify influences on physical activity participation and how they differ in the community versus residential care. Relied on subjective self-report of activity levels. Data were analysed by thematic analysis. |

2.17 Review 2B Relevance and Quality Summary

As discussed above, this search was completed with awareness that it would not provide specific insight into the experience of activity participation for people living with frailty, but rather potentially similar experiences of people in the same age group. In addition to the low number of articles retrieved, the main limitation of Literature Search 2A was the studies' focus on physical activity only. Search 2B produced a wider variety of literature, however the sole focus on physical activity dominated the majority of included studies (Lin *et al.*, 2007; Janssen and Stube, 2014; Gothe and Kendall, 2016; Marquez *et al.*, 2016; Sanders *et al.*, 2018; Morgan *et al.*, 2019). The remaining studies considered activity in broader terms and the search also identified literature that examined participation using occupational science or therapy theory (Griffith *et al.*, 2007; Janssen and Stube, 2014; Mulholland and Jackson, 2018). Only two studies detailed experiential accounts from those resident in similar cultural and environmental settings to the STEER participants (Mulholland and Jackson, 2018; Sanders *et al.*, 2018). A further three considered very specific ethnic groups in the USA (Lin *et al.*, 2007; Gothe and Kendall, 2016; Marquez *et al.*, 2016), whose experience is likely to be altered by cultural and environmental differences.

Perhaps unusually for a search requiring experiential accounts, a systematic review was included due to its use of direct quotations as part of a meta-ethnography design (Morgan *et al.*, 2019). The remaining studies used focus group or interviews to capture experiential data. All studies included a clear aim and largely the rationale for design, clarity of report and the decision-trail regarding interpretation of data yielded trustworthiness in findings (Guba and Lincoln, 1989). Two studies were identified as having issues with quality. The first by Marquez *et al.* (2016) detailed its findings with quotations that incorporated leading questions, which raised uncertainty regarding the way in which this could have influenced the data collected. The second (Sanders *et al.*, 2018), provided insufficient detail as to how conclusions and interpretations were achieved, based on the quotations provided, lacking the decision-making trail recommended to establish rigour (Guba and Lincoln, 1989; Koch, 1994). Despite this, the retrieved papers have provided useful, and methodologically sound, insight into the experience of activity participation for older adults.

2.18 Review 2B Findings

Literature Review 2A guided the analysis of evidence in this search to consider the findings in two sections. The first is the general experience of activity participation, which includes meaning, purpose and perspectives. The second combines the identified barriers and facilitators to engagement.

What is the experience of activity participation for older adults?

There were three common concepts regarding the experience of activity across the relevant papers. These were; identity, the meaning and purpose of activity, and the changing experience of activity due to health status.

There was evidence within the studies that a person's identity is closely connected to the activities within which they engage. This was most explicitly described by Griffith *et al.* (2007), whereby meaningful occupations and identity were proposed as mutually dependent concepts. This was a process where occupations that were meaningful were those that allowed demonstration of personal qualities, including care roles or being someone for whom activity had always been central. This paper sought to understand the experience of a loss of autonomy within daily activities, and indicates likely experiences for participants of the STEER Course. There was evidence of a faltering sense of identity based on reduced ability to complete previously meaningful roles, such as caring for a partner. This sense of loss and its impact on identity was also demonstrated by Mulholland and Jackson (2018). In this study of older adults in Ireland, the influence of activities that allowed fulfilment of roles, such as being a member of the church community or a friend, were central to the person's sense of self. There was loss, and reduction in

well-being due to inner conflict, when physical and mental health conditions meant those roles could not be completed. However, as this study considered people with diagnosed depression, it must be considered if the loss is experienced more acutely for this population either as cause, or effect, of their low mood.

The final two papers to consider activity's effect on identity provided indication of how the sense of identity influenced current engagement. Weeks *et al.* (2008) provided insight that identity in terms of activity participation across the lifespan influences current engagement. Those who identified as having been 'sporty' had experience of enjoyment in physical activity as an older adult, whereas a lack of a 'sporty' identity had the converse result. The meta-ethnography by Morgan *et al.* (2019) did not produce findings about the historic sense of identity, but rather proposed that physical activity had the ability to strengthen identity when achievement or mastery was experienced.

Closely linked to activity participation influencing a sense of identity were concepts considered as providing understanding as to the meaning and purpose of engagement. There was evidence that activity can influence behaviours such as physical activity as a catalyst for other activity (Dunn and Riley-Doucet, 2007), which mirrored findings in the earlier literature review of frailty and activity. This paper also found examples of male participants finding meaning and value in physical activity which allowed the opportunity to compete with peers (Dunn and Riley-Doucet, 2007). The meta-ethnography by Morgan *et al.* (2019) also determined that activity had many functions and purposes for participants. These included intrinsic factors such as enjoyment, pleasure, self-belief and satisfaction, as well as more practical functions such as providing routine, structure and purpose. The final area which examined the meaning of activity was to provide a conceptualisation of what constitutes physical activity for participants. The study by Lin *et al.* (2007) found differences in participants' categorisation of leisure physical activities. Those resident in Seattle included household tasks, whereas the female participants in Taipei considered that they did not engage in leisure activity, due to the need to complete household activities. It is suggestive of the potential of similar activities to hold different meanings for individuals based on cultural differences. It also highlighted the challenge of so few studies being completed on comparable populations to the STEER participants, demonstrating the need for this research, but making comparisons difficult.

The final common area considered within the literature is of how the experience of activity participation alters as a consequence of functional and practical changes associated with ageing. While the literature did not examine this in the context of frailty, as it was not their purpose, there is potential that these age-related changes being described are illustrations of frailty. The

common description was of activity being modified. This often occurred due to a necessity to care for partners or grandchildren - acting as a block to engaging in physical or leisure activities (Weeks *et al.*, 2008; Morgan *et al.*, 2019). In other studies, the modification was attributed to increased awareness of physical limitations associated with ageing (Janssen and Stube, 2014; Morgan *et al.*, 2019). For some participants there was disengagement in activities that involved heavy lifting or other tasks they felt unable to complete (Griffith *et al.*, 2007; Weeks *et al.*, 2008). The alternative was a process of adaptation of activities, using a reduction in intensity, duration or substitution of activity type to match current abilities (Weeks *et al.*, 2008; Janssen and Stube, 2014; Morgan *et al.*, 2019). The level of success of modification was variable, with consequences for social engagements and psychological well-being (Griffith *et al.*, 2007).

The literature highlighted how complex the experience of engaging in activity was for older adults, with physical, social, environmental and psychological influences. There was evidence that specific meaning and purpose of activity is modified by the characteristic of increasing age, and that a changed experience, or process of transition regarding engagement, were common. There was emerging discussion of the factors that facilitate and prevent engagement in activity above and more specific examples are now considered.

What barriers and facilitators influence activity participation for older adults?

The barriers have been grouped into categories of; health and functional status, environmental limitations, and other personal factors. The facilitators to engagement were discrete concepts and while there was some relationship between barriers and facilitators, they were not simply the converse. The facilitators were; awareness of activity to improve health or function, and outcomes of social engagements or enjoyment and/or pleasure.

The most common barrier was related to physical limitations. The need to adapt to a changing physical capacity has been discussed above. There was also the additional barrier of fear related to worsening health symptoms for participants. This was frequently described as the concern that physical activity has the ability to cause injury or make existing pain worse and so people avoided such activities (Lin *et al.*, 2007; Gothe and Kendall, 2016; Morgan *et al.*, 2019), and supports the frailty-specific findings in Review 2A. There was differing understandings of perceived control in relation to this. Participants in Taipei felt powerless to prevent it, whereas those in Seattle believed in adapting or modifying activity to manage pain (Lin *et al.*, 2007). The lack of control to prevent worsening physical symptoms was also reflected in the African American female participants in Detroit (Gothel and Kendall, 2016). Avoidance of activity due to fear of symptoms was not limited to the physical domain. Participants with a history of panic attacks occurring within activities also avoided such activities (Mulholland and Jackson, 2018).

There were several incidences of personal factors that prevented desired, or assumed as beneficial, activity participation. A common barrier that featured in relation to physical activity was a lack of availability of time, due to roles such as caring or household maintenance, that needed to be prioritised (Lin *et al.*, 2007; Gothe and Kendall, 2016; Morgan *et al.*, 2019). A lack of awareness of opportunities for physical activity was also cited. This was a single example within a study which lacked transparency regarding the conclusions it drew, and also detailed the need for intrinsic motivation for physical activity (Sanders *et al.*, 2018).

The local environment was frequently cited as a barrier for participation, with awareness that improvements could encourage participation in activity. In some urban areas with high crime rates this was perceived as making the risk level for engaging in the local community too high and either preventing engagement or limiting it to daytime hours and walking in groups (Gothé and Kendall, 2016; Marquez *et al.*, 2016). In addition to environmental limitations due to crime there were also concerns about safety due to features like poorly maintained pavements (Marquez *et al.*, 2016). Seasonality and associated weather (both high temperatures and occurrence of ice or snow) were frequently reported as limiting engagement (Gothé and Kendall, 2016; Sanders *et al.*, 2018; Morgan *et al.*, 2019). There is value in the duplication of findings in relation to the environment, as the two studies with limitations in their reporting (Marquez *et al.*, 2016; Sanders *et al.*, 2018) received support from the studies with higher quality evidence.

As mentioned above, the factors that promote engagement in activity are not just the absence of barriers, but rather discrete concepts. The facilitators closely link to the earlier discussed purpose and meaning of activity, however they have been collated within this section where a specific outcome was identified as the reason for completing activity. The most common aspect was an awareness and acceptance of activity, especially physical activity, to improve or maintain function and health. Several studies highlighted the tendency of participants to consider physical health and function as the same outcome, which could be maintained by physical activity (Marquez *et al.*, 2016; Sanders *et al.*, 2018). There was a desire to remain independent and avoid the perceived limitations associated with ageing (Gothé and Kendall, 2016; Morgan *et al.*, 2019). Within these descriptions there was understanding that physical activity could have benefits for sleep as well as emotional and cognitive health (Lin *et al.*, 2007; Morgan *et al.*, 2019). There were also benefits cited for mental health by being outside (Mulholland and Jackson, 2018), and physical health by engaging in medically orientated activities (such as appointments or medication management) and cooking nutritious meals (Dunn and Riley-Doucet, 2007).

In addition to those outcomes that are presented relating to improved health there were also reports pertaining to awareness that activity would enable social interactions and provide a sense

of enjoyment. Activities such as dancing were described as giving a sense of pleasure, and 'feeling good' in one's body (Dunn and Riley-Doucet, 2007) and similarly there was description of physical exercise being chosen for pure enjoyment and fun (Gothe and Kendall, 2016). This experience was likely influenced by reports of increased ability to play, and enjoy time, with grandchildren (Gothe and Kendall, 2016). The meta-ethnography by Morgan *et al.* (2019) determined physical activity had the ability to increase a sense of vitality, and improve overall energy levels which encouraged participation. The study also highlighted the role of physical activity as the basis for social interactions, which were desired.

2.19 Review 2B Summary

This review has expanded insight gained within Review 2A, where activity is framed as a complex experience with many motivators, detractors and containing multi-contextual factors that alter the experience. While this review did not demand a specific incidence of frailty, there were many similarities of experiences reports compared with the participants in Review 2A. The predominant focus of most literature is of the experience of physical activity, with an appreciation of participants that this can improve or maintain physical health, mental well-being and function. There is frequent consideration of the influence of a deteriorating health status and the way in which this can limit engagement in chosen activities.

As discussed above, the findings from the two reviews highlight a focus on physical activity participation within the evidence base. However, within those findings there is indication that physical activity occurs as an embedded occupation either within other activities (such as homecare) or within social engagements. This, combined with the influence of a changing health status and desire to remain independent in all aspects of life, support exploration of *all* daily activities for people at risk of frailty. It is proposed that this should be completed in such a way that considers the perceptions of older adults within a multi-faceted context that incorporates all domains applicable to the person.

2.20 Conclusion

This literature review has focused on two key areas to this study. The review of grip strength data also shows limited comparable evidence to this specific population, although more comprehensive data is available for people living with frailty, as opposed to pre-frailty. There was

sufficient availability of evidence to establish parameters for pre-frailty to be used within this study, but also offers the opportunity to contribute to an under-researched area.

Objective measurement of grip strength in pre-frailty was confirmed as possible, but poorly evidenced. A minimally studied area of the grip strength evidence base was of a complex relationship between raw strength applied to function. This could have consequences for activity participation. Conversely, study of activity participation could increase understanding of the application of low grip strength to functional abilities. Therefore, the evidence base was consulted regarding broader experiences of activity participation. It was established that participation in activity is influenced by multiple factors for both older adults living with frailty, and those for whom a frailty status was not established.

The notable features were a focus of existing evidence on physical activity, but with findings that physical activity is individually defined. The level of engagement was determined by interacting factors. They include, but are not limited to, the level of physical and mental health disability experienced, environmental modifiers of activity, and desire for perceived outcomes (health benefits, social interactions and an ability to maintain independence). While the experience of people living with frailty had similarities to that of the wider population, there is insufficient evidence available to accept that conclusion. Additionally, the studies that considered wider populations did not seek to identify frailty and might have been influenced by an unclassified, but present, frailty status.

The literature reviewed suggest that pre-frailty is likely to influence both functional measures and the experience of applied functional ability through activity. The lack of high-quality, relevant, evidence retrieved supports the need for this study, which aims to examine the experiences and outcomes of an under-researched population. The methods used to generate this knowledge now follows in Chapter 3.

Chapter 3 Methodology

3.1 Introduction to the Mixed Methods Study

The study was conducted using a quasi-experimental pre-test post-test and semi-structured interview design to complete a mixed methods evaluation. This mixed methods approach was chosen to best reflect the multi-factorial dimensions involved in both the STEER Course outcomes and participants' experiences, for which a solely qualitative or quantitative approach would have been inadequate (Creswell and Plano Clark, 2007). The STEER Course was a new intervention with under-explored components, which could have contributed to its outcomes. These included; the use of functional exercise, a combined education/exercise programme, the social setting within an operational fire station, and targeting of population at risk of frailty whose needs are less well identified. As such, it warranted an approach which could both evaluate the objective measures occurring for participants, and have the scope to explore the subjective experiences occurring in all areas of participants' lives.

Overall, the study design was chosen to evaluate, within broad contexts, the experiences and outcomes of being a person at risk of frailty, who chose to participate in the STEER Course. This was achieved using qualitative methods to complement the quantitative measures and produced a level of insight not achievable with those quantitative measures alone (Pope and Mays, 1995). The quantitative elements of the study design captured changes occurring for all participants of the STEER Course and was used to inform qualitative interviews with a smaller subset of participants. The interviews developed understanding of individual experiences of both the intervention and its outcomes, and the multi-factorial influences on health, well-being and engagement in daily activities. This approach provided a more complete exploration of the developing concept of a multi-contextual consideration of pre-frailty than could have been achieved with inclusion of a single paradigm approach (Teddlie and Tashakkori, 2009). This depth of understanding could be valuable for further intervention design, as well as refining, and more thorough evaluation of, the existing intervention.

3.2 Aim

To study the experience and outcomes of people identified as being at risk of developing frailty during, and after, their engagement in a frailty-prevention course.

3.3 Objectives

1. To describe a population attending a frailty-prevention course with regard to their physical and functional health status.
2. To evaluate change in markers of physical and functional health status during and after participation in a frailty prevention course.
3. To explore the experience of activity engagement and perceptions of physical health and mental well-being status for participants in a frailty prevention intervention from personal accounts.
4. To examine interactions between physical health, mental well-being and activity participation from personal accounts.

3.4 Research Questions

1. What is the nature and type of deficit measured in people attending a frailty prevention course with respect to:
 - a. frailty and falls risk scores,
 - b. markers of physical and functional health status?
2. What changes are recorded during/after participation in a frailty prevention intervention in relation to:
 - a. frailty and falls risk scores,
 - b. markers of physical and functional health status?
3. What is the experience of attending a frailty-prevention programme consisting of education and exercise within a fire service setting?
4. What is the experience of older adults engaged in a frailty prevention intervention in relation to:
 - a. activity participation and engagement,
 - b. physical health and mental well-being,
 - c. interactions between activity, physical health and mental well-being?

3.5 Research Philosophy

This study required consideration of multiple layers of complexity. It evaluated a real-world intervention that has been designed and implemented by a local fire service, and while the STEER Course was informed by public health guidance and related evidence, it was not created with a rigorous clinical trial as its objective. It also engaged a participant group not extensively involved with other health and social care providers and about whose physical/functional health status and engagement in daily activities, little is known. Furthermore, the STEER Course was delivered in multiple locations, by different staff members and had been evolving for a period before the research study commenced. The study also required methods that were sensitive to capturing experiences and interacting concepts that have biological, functional, psychological and social constructs.

The philosophical approach to the study was influenced by reflection on the existing intervention and the potential to develop knowledge and understanding. The Fire Service was already collecting discrete data about baseline presentation and changes in physical and functional status of its participants, but there were many unanswered questions about the implications of those measures on the lives of the participants and any perceived causal factors for the changes. Simple examination of the objective data would have only allowed for a description of the characteristics of participants and any potential change they experienced. The interaction of social and environmental influences on the experience of attending the Course, and any effect on daily routines and activities, could be better understood with a method that examined the subjective experience. For this reason, the philosophical stance of mixed methods research was adopted, using both qualitative and quantitative data to better inform the results, as outlined in Section 3.1. Creswell and Plano Clark (2007) described the importance of merging or embedding the two types of data collected so that one element can support the understanding gained from the other.

The construct of mixed methods research, which has also been defined as methodological triangulation (Morse, 1991), is not a new concept in healthcare research. It has developed since Morse's prepositions that the method must align more closely with either the qualitative *or* quantitative paradigm. The research questions for this study focused on descriptions of characteristics and measurements of change, and questions about meaning and experience. This did not solely align with either philosophy associated with the quantitative or qualitative paradigms of empirical truths versus constructed realities. The rejection of binary paradigms was proposed by Hammersley (1992), with the suggestion that mixed methods is the mechanism by which breadth, depth and other complexities can be captured when an acceptance of existence of multiple paradigms is present.

Pragmatism is an approach that is not limited to aligning itself with competing approaches of objective versus subjective knowledge, but rather finds the middle-ground with focus on the reality of the experience and influence of social and cultural factors (Burke Johnson and Onwuegbuzie, 2004). Pragmatism is less focused on the philosophy, but rather the “practical empiricism as the path to determine what works” (Burke Johnson and Onwuegbuzie, 2004 pp. 18). This approach was highly suited to examination of the STEER Course as it allowed for the use of mixed methods to expose the complexities of processes occurring. These included participants’ individual circumstances, group dynamics and variations in the Course, while utilising the empirical data collected. Pragmatism, while less focused on philosophy, is still compatible with the theory of mixed methods research as described by Creswell and Plano Clark (2007), which relies on a practical approach and synthesis of inductive and deductive analysis.

3.6 Designing a Research Study Using an Existing Intervention

The STEER Course had been in operation for several months when the invitation to complete a research study was extended by HFRS. This created a challenge with respect to designing a research study that best elicited the knowledge and understanding in relation to the gaps in the current evidence base, while maximising the quantitative data that HFRS had been collecting since the Course commenced.

Within the field of research using multiple strategies there is conflict over naming the precise design. Some researchers suggest that caution is required as defining the exact strategy can limit the use of the data which emerges (Bryman, 2006). This study is based on the principles of realistic evaluation. The overall aim was to develop knowledge in a pragmatic, or realistic, manner; that was applied to, and will allow development of, a specific intervention (Pawson and Tilley, 1997). Fundamentally, it seeks to understand outcomes, behaviours and experiences within a real-world health intervention and the outcomes will be applied within the context of said, or similar, interventions.

The approach of realistic evaluation also fits well with principles included in the Medical Research Council’s (MRC) Framework: ‘Developing and Evaluating Complex Interventions’ (Craig *et al.*, 2008). The intervention was designed by HFRS and as a result the full process has not been adopted, but the components of the feasibility and piloting stages were central to this study. This iterative cycle of the MRC Framework allowed questions relating to the population and measures to be answered in the context of a complex intervention, which could inform a more robust evaluation and development of the intervention based on this data (Craig *et al.*, 2008).

While this study was not confined to strict philosophical standpoints, nor driven by well-defined scientific theory, it was influenced by established conceptualisations. Section 1.2 addressed the differing conceptualisations of frailty proposed by Fried *et al.* (2001) and Mitnitski, Mogilner and Rockwood, (2001). On establishing the research partnership with HFRS it was determined that they had already implemented outcome measures (See Section 3.8.1) that used Fried *et al.*'s (2001) phenotype classification of frailty. While other theoretical constructs were not excluded during the analysis of the results, it meant that evidence based on the same theoretical underpinnings was more widely adopted to provide comparisons and explanations for the data produced in this study. This provided realistic and useful evaluation applied to the focus of the study (Pawson and Tilley, 1997).

While there was scope for the approach of Mitnitski, Mogilner and Rockwood (2001) to include more multi-contextual factors related to frailty than the frailty phenotype (Fried *et al.* 2001), it was designed to be implemented following a Comprehensive Geriatric Assessment completed by a geriatrician and multi-disciplinary team (Rockwood *et al.*, 2005; British Geriatrics Society, 2014). This had implications for this study as the outcome measures which produce frailty classification were completed by non-medical staff from HFRS and the study required an approach to identifying frailty which is not reliant on multiple-item assessments or clinical judgment. As discussed in Section 1.2, despite including routine daily activities, the commonly used nine-item frailty index-informed Frailty Scale (Rockwood *et al.*, 2005) depicts an older adult who is either well and has no limitations, or is someone increasingly restricted in their abilities, and indeed becoming house- or bed-bound, due to disease pathology (Mudge and Hubbard, 2018). Examination of such a scale emphasised a poor fit with an older adult engaged in a frailty-prevention intervention. This provided justification for the use of the phenotype conceptualisation (Fried *et al.*, 2001) to inform the study. This conceptualisation was used to provide physiological underpinnings for the changes related to frailty. Additionally, it provided a basis from which to develop and explain, in a novel manner, the processes occurring in relation to physical and functional health status, well-being and activity participation from a non-medical perspective which is not currently addressed by the model.

As highlighted in the literature review on grip strength (Section 2.2) and supported by the lack of experiential research into a population living with frailty or pre-frailty (Section 2.8), there was an opportunity for smaller scale mixed methods research to provide a level of understanding, and depth of insight, not possible in large cross-sectional studies that are most common for this group. As the population group were not expected to be frequent users of health services there was an opportunity to evaluate their needs and outcomes when engaged in an intervention that would not ordinarily be available.

Had the research been designed in a way that allowed for full control of the outcome measures used, and procedures followed, it is likely that different decisions would have been made about the precise tools and protocols adopted. These specific decisions, and potential effect on the results obtained, are discussed throughout the thesis. Despite this, the literature review (Section 2.2) provides support for the use of grip strength as a sole identifier of frailty and the fundamental premise of the study would still have sought to understand the outcomes and perspectives of the same population group, within the same multi-faceted context. The evaluation approach, not limited to quantitative or qualitative paradigms, would likely have remained the chosen approach in a situation of full autonomy over outcome measurement.

3.7 Research Design

Based on a philosophical stance that aimed to capture complex processes occurring for STEER Course participants within biological, behavioural and social contexts, a mixed methods evaluation study was created. This allowed the qualitative interviews to contribute contextual understanding as to what works, for whom, and in what circumstances to produce the realistic evaluation (Pawson and Tilley, 1997).

Realistic evaluation (Pawson and Tilley, 1997) has been developed into a defined methodology for use in health and social work evaluation (Kazi, 2003). Within this, Kazi (2003) outlined the value of this methodology for situations where a synthesis between internal service evaluation and external academic study is required. There is also support for realism to be applied to explain an event, after its occurrence, rather than predicting outcomes (Robson and McCartan, 2016). As this study occurred as part of a clinical academic studentship, the approach also supported rigorous study applied to a real-world intervention. Furthermore, it allowed expansion to evaluate the open-system of participants' lives (Robson and McCartan, 2016), incorporating experiences of physical health, mental well-being and activity participation. Realistic evaluation allowed for the potentially modifying influences of environment and other contextual factors to be embraced, rather than attempting to isolate the systems from factors that influence outcomes (Kazi, 2003). This guided synthesis of measured outcomes with participants' experiences and perceptions of causal relationships.

The Realist Effectiveness Cycle (Pawson and Tilley, 1997) was the basis for the research design. The rationale for a focus on physical and functional health, mental well-being and participation in activities for people living with pre-frailty was described in Section 1.8. The reality of participants' lives, including but not limited to participation in the STEER Course, was proposed as containing the contextual factors that influence the outcomes for individuals. This was explored within a

multi-methods data collection that combined measured outcomes with experiential accounts. The analysis was then completed under a lens that allowed for explanations to be made within multi-contextual scenarios. This produced a synthesis of experiences and outcomes that could answer the research questions outlined in Section 3.4.

The design afforded a range of outcomes to be examined and participants were offered two levels of participation:

Part A – Inclusion of anonymised quantitative measures as detailed below and collected at weeks one and twelve of the Course, and six-months after completing the Course, for all new participants commencing a STEER Course within the data collection period. Permission was also sought to include the data collected at weeks one and twelve of the Course, and six-months after completing the Course, from all past-participants as participants were informed that their anonymous data were being contributed to a research study and evaluation of the Course (Appendix A).

Part B – Participation in semi-structured interviews exploring both the experience of participating in a STEER Course and enabling understanding of the effect of changes in participants' physical and functional markers of health on their daily lives. The interviews occurred with the researcher on HFRS property and the semi-structured interview schedule is attached (Appendix B). The interviews occurred on three occasions, by mutual agreement with participant, HFRS and the researcher, and held at the HFRS location which hosted the participant's STEER Course.

3.8 Data Collection Methods

3.8.1 Quantitative Outcome Measurements

The following measurements were collected routinely by HFRS as part of a standard STEER Course (all equipment owned, operated and maintained by HFRS – Standardised Operating Procedures (SOPs) are attached in Appendix C.

Table 9 Measures - Part A

| Measurement | Unit | Equipment Used - Name (Model, Manufacturer) |
|--|-------------------|---|
| Height | m | Portable stadiometer (213, SECA™) |
| Weight | kg | Segmental Body Composition Monitor (InnerScan™ BC 568, Tanita™) |
| Body mass index (BMI) | kg/m ² | Calculated from height (m) and weight (kg) measurements. |
| Resting heart rate | bpm | Automatic Blood Pressure Monitor – (M2 – HEM-7120, Omron™) |
| Body fat | % | Segmental Body Composition Monitor (InnerScan™ BC 568, Tanita™) |
| Grip strength | kg | Physical Fitness Test Grip Manual Dynamometer- A (T.K.K. 5001, Takei™) |
| Blood pressure | mmHg | Automatic Blood Pressure Monitor – (M2 – HEM-7120, Omron™) |
| Single leg stance (duration) | S | Stopwatch (W073, Seiko™) |
| Sit to stand repetitions in thirty seconds | Repetitions | Stopwatch (W073, Seiko™) |
| Frailty score | % | Quantitative Timed Up and Go Test (QTUG™ (Kinesis Health Technologies, 2014)) |
| Falls risk score | % | Quantitative Timed Up and Go Test (QTUG™ (Kinesis Health Technologies, 2014)) |

| | | |
|---------------------|---|--|
| Depression severity | Score from 0-27 (Depression Severity: 0-4 none, 5-9 mild, 10-14 moderate, 15-19 moderately severe, 20-27 severe) | PHQ-9 (Kroenke, Spitzer and Williams, 2001) |
| Fear of falling | Score from 7-28 (7 is lowest possible concern, 28 highest concern) | Falls Efficacy Scale – International (FES-I) (Kempen <i>et al.</i> , 2008) |

3.8.2 Qualitative Interviews

Part B

Participants engaged in three semi structured interviews (Appendix B) at the following time points:

- First interview
- Interview within two-weeks of final measurements being taken (which occurred during the final session of the STEER Course at week twelve).
- Final interview six-months after completing the STEER Course, during the follow-up measurement session completed by HFRS staff.

They were held in a confidential meeting room at the HFRS station which hosted the STEER Course and the interviews were recorded on MP3 audio recorder.

3.9 Participants

3.9.1 Part A

Participants were group members of the STEER Course hosted by HFRS. By virtue of being a STEER Course group member participants were aged 60 or over and had a risk of falls or frailty as HFRS require group members to:

Be at risk of becoming frail due to one of the following:

- mild cognitive impairment,
- mobility issue but able to participate in exercise,
- obesity / poor nutrition / dehydration,
- taking four or more different types of medication,
- physically inactive,
- vision impairment,
- low mood, loneliness or isolation (wording as decided by HFRS, see Appendix F).

A screening process was conducted with participants on application to join a STEER Course by HFRS administrative staff. The following questions and assessments are completed with participants to confirm their suitability:

- **Can the participant attend the whole twelve weeks (the individual is able to miss one session but must be available for week one and twelve when measurements are taken)?**
- **Can the participant get themselves to the venue?**
- **Is the participant over the age of 65 (discretion is used for participants aged 60-64 if all other criteria are met)?**
- **Can the participant take part on moderate exercise including squatting, lifting and walking movements?**
- **Can the participant walk 20m unaided? (The use of one stick is acceptable.)**
- **Has the doctor ever said the participant cannot take part in exercise? If answered, “Yes”, the individual might not be suitable for course.**
- **Does the participant have a medical condition that they think might exclude them from taking part in exercise? If answered, “Yes”, the individual might not be suitable for course.**
- **HFRS conduct a physical screening assessment of each participant including blood pressure, resting heart rate and body mass index.**

- **HFRS utilise an electronic measuring device to determine a participant's likelihood of a fall – scoring in excess of 75% is deemed a high risk and would, in normal circumstances, be excluded from the STEER course.**
- **If there is any doubt about a participant's capability to participate in exercise HFRS refer them to their GP for guidance before the course commences.**
(Hampshire Fire and Rescue Service, 2017)

STEER group members joined the STEER Course primarily through self-referral (with awareness of the Course achieved via word-of-mouth from past participants, poster and leaflet advertising at health and community locations, and HFRS promotional events at local community settings). A small number of participants were signposted to the STEER Course through health professionals or when engaged in a 'Safe and Well' home visit conducted by HFRS. The physical and cognitive demand level of STEER Course participation matches that of participation in the research, and as such it was deemed that any person accepted onto the STEER Course would be suitable for participating in either Part A or B of the research. The criteria are also consistent with expected functional levels for people living with pre-frailty as described in Section 1.4. Further discussion about the capacity to consent is considered in the 'Ethics' section below (Section 3.10).

3.9.2 **Part B**

Participants for Part B were new participants to STEER Courses run by HFRS during the data collection period of this study, which operated between August 2017 and August 2018. By virtue of their STEER Course membership, they met the same inclusion criteria as participants in Part A above (Section 3.9.1). Following acceptance onto the Course by HFRS, potential participants were made aware that a research programme was operating alongside the STEER Course by means of letter included with routine pre-Course information (Appendix A). On week 1 of the STEER Course the researcher attended the introductory session and outlined the nature of the research by means of a short PowerPoint presentation (Appendix G) and informal discussion. Participants were able to ask questions in person at the first session, and at any other time by email and telephone. As HFRS operate STEER Courses at a variety of geographical locations throughout Hampshire it was intended to recruit two to four participants at each site to try and capture potential differing experiences at different locations. Only two sites commenced Courses during the period that allowed for the full data collection to occur within the twelve month timeframe. HFRS had expected other sites to commence Courses in the autumn, however they were delayed by staff availability and waiting for each Course to reach the maximum number of participants to

make them most economical. This resulted in recruitment of eight participants (n=8), four from each of two sites.

While it was expected that most interviews would be completed on a one-to-one basis, a participant was able to request to have a partner, spouse or friend join their interview. It was explained that if the person chose to have a second person present, that person would be considered part of the research and their contributions will be included in the information analysed from their interview. While there were procedures in place to ensure that the second person also received the Participant Information Sheet and consent forms, the only participants who opted for joint interviews were all members of the STEER Course in their own right. This meant they had the same information about the research and each signed a modified consent form (Appendix E) that specified that they agreed to being interviewed with the named person. Four participants in total opted to be interviewed in a pair. To ensure anonymity, detail cannot be provided about relationships between pairings.

3.10 Ethics

3.10.1 Consent

Consent for Part A and Part B was determined with differing consent processes (Appendix A and Appendix E).

Part A

HFRS have routinely sought consent for the anonymised outcome measures to be contributed to an academic research study analysing the STEER Course and participants' outcomes since it commenced (Appendix A). This was the only research study that HFRS had given permission to and as the research aim and objectives include a comprehensive analysis of outcomes of STEER Course participants' permission was sought via the University of Southampton, Faculty of Health Sciences Ethics Committee to use the data for that purpose. The anonymised data set only contributed to the research questions pertaining to physical markers of health and functional outcomes, guiding evaluation of the STEER Course. The use of the full, anonymised, dataset allowed recruitment to exceed that required to satisfy the sample size calculation.

Part B

Participants in Part B consented to participate in three interviews and have their outcome measures from Part A de-anonymised and given to the researcher to inform the interview

discussion (see Appendix B for an example of this). To ensure the anonymity of participants in Part A Only research, it was arranged so that the participants in Part B interviews are selected from a range of sites to leave a sufficient quantity of anonymised data which ensures that 'Part A Only' participants' data does not become identifiable when the identity is attributed to the data of Part B participants. Four participants were each recruited from two different sites, which left eight participants at the sites whose data were used for Part A only.

The capacity of participants to provide valid consent to the research was primarily assured by their ability to meet the inclusion criteria defined by HFRS for STEER group membership, which requires the person to have capacity to participate in an interactive group-based education and exercise Course. The STEER Course operates in a non-clinical community-based setting with a healthy population who are identified only as 'at risk' of developing frailty, as such even a person with 'mild cognitive impairment' would be able to give valid consent. This approach to capacity is in accordance with the *Mental Capacity Act (2005)* which assumes capacity until a lack of capacity is established and would be guided by the researcher's clinical assessment skills as a registered occupational therapist as an ongoing means of assurance as to the safe inclusion of a person in the study.

The facility for a second person to be present during interviews was identified as a potential choice for a minority of participants. The second person was not present to act as a proxy and both participants had to have capacity to consent, however the recruitment resulted in only STEER Course members participating in interviews and so their capacity was determined as outlined above. If a participant's capacity appeared to change during the research period (perhaps due to illness) they would have been excluded from the study and directed to the appropriate means of support (such as general practitioner or Accident and Emergency Department). This process was not required during the study.

Research participants received participant information sheets prior to the research commencing. The researcher attended the first session of the STEER Course to answer any questions participants had. Dates for Part B first interviews were scheduled no sooner than one week from the first session and consent forms were given to participants to review, however the signed form was not completed until the start of the interview to allow time for participants to consider their involvement. Participants were offered the opportunity to ask questions in person and by telephone and email. Participants who completed interviews at the start of the STEER Course were approached at the end of the Course and during their six-month follow-up – their ongoing consent was checked verbally, with the assurance that they could stop or pause interviews at any

stage. The interview participants were self-selecting, and no coercion or incentive was used to recruit.

3.10.2 Risk to Participants

Part A

The risk to participants in Part A of the research was minimal as it does not alter the participant's usual experience of membership of a STEER group, which is protected by risk assessment conducted by HFRS (Appendix I). Additional risk mitigation was ensured by use of Standardised Operating Procedures (Appendix C). The security of participants' data were assured and discussed in more depth in the next section.

Part B

Participation in the interview component (Part B) of the research involved a possible risk of emotional distress to participants as it involved discussing their own experience of a changing health status. To reduce the risk of harm, participants were assured that they could decline to answer any questions they wish and pause or stop the interviews at any time. The researcher had experience of conducting thorough clinical assessments on sensitive topics and utilised clinical skills to minimise distress caused. No participants became distressed during the interviews or declined to answer specific questions.

Participants were assured that at all stages that the research is occurred separately to the STEER Course and should they have declined to participate, or withdrawn at any time, it would not have affected their participation in the STEER Course. No financial or other type of recompense was being offered for this study, therefore risks of coercion were minimal.

3.10.3 Role of the Researcher

Participants were made aware that the researcher's role was as a clinical doctoral research fellow with affiliations to the University of Southampton and Southern Health NHS Foundation Trust, but independent of HFRS, and that the study was incorporated in fulfilment of a research degree. The semi-structured interview schedule was adopted to ensure a uniform approach to the interviews and a reflective diary (See Appendix L for examples of this) was kept on interview days to explore emerging thoughts and how they could influence interview discussion. While full analysis of both quantitative and qualitative data did not occur prior to completing all interviews so as not to influence the discussion, the nature of follow-up interviews meant the researcher needed to be

aware of the physical and function outcomes achieved by participants. This, combined with the developing thoughts and ideas captured in the reflective log (Appendix L), meant some informal analysis occurred prior the more formal processes captured in Section 3.13.

3.10.4 Hampshire Fire and Rescue Service's Involvement

The STEER Course was designed and implemented by Hampshire Fire and Rescue Service. They provided access to the courses and enabled the research by obtaining consent and providing anonymous data where appropriate. They did not have influence on the methods of data analysis or the content which was reported, in order to remove potential bias from the findings and results.

3.11 Ethical Approval

Ethical approval for the study was sought and granted by the University of Southampton, Faculty of Health Sciences Ethics Committee on 30/06/2017, submission number: 22859.

3.12 Information Governance

3.12.1 Data Protection and Anonymity - Data Handling and Storage

Part A

Data were routinely collected by HFRS as detailed above and managed in line with Hampshire Fire and Rescue Service's Data Protection Statement which confirms their compliance with the *Data Protection Act 1998*, as the data collection period concluded prior to the implementation of the *Data Protection Act 2018* (Hampshire Fire and Rescue Service, n.d.). The data given to the researcher for inclusion in the study (all routine data collected during the study dates where consent had not been withheld) was prepared by HFRS staff. They applied an anonymous code to the data to ensure it could be removed if a participant retrospectively withdrew consent and it was then given to the researcher on a password-protected memory stick of standard FIPS 140-2. The researcher uploaded the data to the University of Southampton Research Filestore as per the University's research storage procedure. The memory stick's data were destroyed following upload to the Filestore. During the data collection and analysis phases of the research the anonymised data were accessed via the researcher's password-secured University of Southampton account from the University of Southampton Research Filestore.

Part B

Following receipt of the identified outcome measures previously included in Part A the researcher applied a code that allowed for these measures to be coupled with the relevant interview recording. The interview recording was uploaded from MP3 recorder onto the University of Southampton's secure network as above and saved with a matching code to the data. The recording was transcribed, at which point identifiable data were removed from the transcript. The transcript could then be shared with supervisors and relevant quotations were included in the findings. The original recording was deleted from MP3 recorder to ensure the only copy is stored in a secure password-protected location. During transport from research site the recorder was kept in the possession of the researcher until was uploaded as above. All consent forms were scanned and uploaded to the researcher's University of Southampton Network location. The originals were securely destroyed using a cross-cut shredder.

3.12.2 Data Retention

In line with the University of Southampton's data retention policy all data will be stored for ten years following the last access.

3.12.3 Data Availability

The dataset for Part A of the study was supplied to the researcher by HFRS staff in an anonymised format and stored as detailed above. Despite being an anonymous dataset, it was provided to the researcher with participant consent to be used as detailed in the research method. Consequently, it would not be ethical for it to be released to other parties without returning to the participants to seek updated consent.

The dataset for Part B of the study was anonymised as detailed above. As with the Part A data, it would not be ethical to release the data to other parties as consent was only obtained for use of the data within this study and its dissemination.

3.13 Data Analysis Methods

3.13.1 Part A – Quantitative Outcomes

Quantitative data were produced from the measures shown in 'Measures – Part A'. Sample size calculations were completed using the frailty and falls risk scores produced by the QTUG™ (Kinesis Health Technologies, 2014) as this is a multifactorial assessment synthesising several physical and psychosocial markers of frailty. At the research design stage, it was anticipated that

the QTUG™ (Kinesis Health Technologies, 2014) would be the central measure used, which guided the decision to base calculations on its outcome. As is discussed in more depth in Sections 5.2-5.3 the QTUG™ (Kinesis Health Technologies, 2014) was replaced as the central measure by grip strength, supported by the content of the second literature review. However, at this point power calculations, recruitment and outcome measurement had already occurred. Using anonymous feasibility data from HFRS as to the pre and post-test changes detected in QTUG™ (Kinesis Health Technologies, 2014) falls scores for the first twenty STEER participants, a standard deviation of difference in falls score was calculated as 14.77. Using a power of 0.9 and significance level of 0.05 (Jones, Carley and Harrison, 2003), the sample size calculation was determined to be 92 participants. With a standardised effect size of 0.5 the minimum detectable difference of the QTUG™ (Kinesis Health Technologies, 2014) data is 7.39%. The use of pilot data to complete power calculations in exploratory research is supported (Jones, Carley and Harrison, 2003), even though the power and detectable difference calculations are likely to be overly cautious due to a standard deviation calculated from a small sample from pilot STEER Courses. These results might have experienced greater numbers of outlying results due to lack of standardised operating procedures in place at the time of measurement. However, as quantitative data were obtained for 212 participants, the minimum sample size was exceeded.

Data were analysed using IBM® SPSS® Version 24. Initial analysis of the distribution of outcome measures demonstrated variability in the spread of data (See Appendix K). There is debate within the literature as to best procedure for non-normally distributed data, with concern raised about the use of parametric tests when their associated assumptions are not met (Anderson, 1961). For this reason procedures recommended for normally distributed (mean and standard deviation), and non-normally distributed (median and interquartile range) were applied to most comprehensively describe the data and allow for any differences between results due to parametric versus nonparametric tests to be fully transparent (Mackridge and Rowe, 2018). The use of both parametric and nonparametric statistics continued with correlations between frailty classifications and functional health markers being calculated to produce both Spearman's Rank and Pearson's correlation coefficients. For similar reasons the change in outcome measures over time (measures were repeated twelve-weeks from baseline at Course completion, and six-months after finishing the Course at six-month follow-up) were analysed using the Wilcoxon signed rank and paired-t tests.

3.13.1.1 Frailty Classifications

The intention was to produce classifications of frailty using the categories produced by the QTUG™ (Kinesis Health Technologies, 2014), however due to difficulty determining the algorithms

used to produce this classification from a trademarked product it was subsequently modified to create a frailty classification based on grip-strength alone. The review of literature suggested that grip strength as a single marker of frailty was accurate and specific (Lee *et al.*, 2017), therefore allowing comparisons of outcomes achieved in this study with other available evidence. The evidence base has not yet established both sex- and body-mass index -adjusted reference values for pre-frailty, in the same manner that was proposed for identifying frailty by Fried *et al.* (2001). The most comparable values to the STEER population were the sex stratified-mean scores for maximum grip strength reported in the Survey of Health, Ageing and Retirement in Europe – Frailty Instrument (SHARE-FI) (Romero-Ortuno *et al.*, 2010) as this provided mean values for people classified as robust, pre-frail and frail. The mid-point between the mean value for robust, pre-frail and frail groups was used to create the following frailty classifications for this study:

Table 10 Frailty classifications by grip strength and gender, derived from Romero-Ortuno *et al.* (2010).

| Women | | Men | |
|------------------|--------------------|------------------|--------------------|
| Frailty Category | Grip Strength (kg) | Frailty Category | Grip Strength (kg) |
| Robust | ≥ 26.7 | Robust | ≥ 41.1 |
| Pre-frail | 20.8 – 26.6 | Pre-Frail | 31.0 – 41.0 |
| Frail | ≤ 20.7 | Frail | ≤ 30.9 |

Once divided into frailty groups (Table 10), participants' measures were evaluated by frailty status at three time-points.

3.13.2 Part B – Mixed Methods Analysis of Interview Data and Quantitative Outcomes

The interview transcripts were transcribed verbatim and analysed using framework analysis as a means of thematic analysis as described by Ritchie and Lewis (2003). This type of analysis is suggested as a way of answering specific qualitative research questions using a structured analytical tool. Gale *et al.* (2013) proposed that this type of framework analysis does not limit findings to inductive or deductive processes, provided that the research questions are appropriate for analysis by this means. Framework analysis was developed as a means of understanding qualitative data in social policy research (NatCen Social Research, n.d.), to systematically evaluate intervention outcomes. This was appropriate for this study as the commissioned service evaluation was able to be specified as a domain, as well as the areas highlighted in Sections 1.4-

1.8 relating to physical and functional status, mental well-being and activity participation, and interactions between concepts. The study aimed to evaluate the outcomes and experiences for individuals both within the STEER evaluation, and within broader contexts of their lives. The framework structure allowed for the contextual influences to be isolated, with the analysis synthesising those relationships as part of a realistic evaluation (Pawson and Tilley, 1997).

Within this study the analytical framework was pre-determined before analysis. This was informed by the preposition that contextual factors can explain individual outcomes for specific people (Kazi, 2003). Likely contextual influences were informed in developing the rationale for the research (Section 1.8) and research questions (Section 3.4). Column headings marked content relating to 'activity', 'physical health and mental well-being' and 'evaluation of the STEER Course' were derived from the semi-structured interview content. It was intended that although the framework categories were pre-determined, the themes generated within the confines of the research question-led domains had no *a priori* assumptions. There was also an 'other' column in case data had been generated that did not fit any of the categories, but it contained no content after labelling of themes and was deleted. This is likely to have occurred as the semi-structured interview guided discussion on the topics of the three domains, and they were sufficiently broad to incorporate all content within one of the domains.

Verbatim transcription, using NVivo™ 12 software, allowed immersion in the interview data and familiarisation with the content (Gale *et al.*, 2013; Spencer *et al.*, 2014). Initial codes that created subthemes were added to the transcript, an example is included in Appendix M. As discussed above, the initial framework matrix included the pre-determined domains of activity, intervention experience, and physical health and mental well-being. The matrix had columns for the different time points – allowing analysis of any changes in perspective, or experience, throughout the duration of the study. The framework matrix allowed the data to be managed and displayed initially on a case (participant) by case basis (Table 11), within which subthemes (created from the initial codes applied following transcription) were entered as rows for each participant and an excerpt is included in Appendix O. This full matrix was printed to allow for visual examination of the entire case-by-case framework (partial photograph included in Appendix N). Following this, the sub-themes were listed, and index themes were generated from analysis between cases, allowing for commonalities and differences to be highlighted. This was brought together as a

summary matrix of themes occurring within the domains and an example is included in Appendix P and presented in the final matrix (

Table 12) (Spencer *et al.*, 2014). The matrices were created using Microsoft Excel™ 2013 software.

Table 11 Initial framework matrix

| Domain | Experience of Intervention | Activity | | Physical Health and Mental Well-Being | | Quantitative Outcomes | Participant Summary |
|---------------|----------------------------|----------|-----------------------|---------------------------------------|-----------------------|-----------------------|---------------------|
| | Twelve-Week/Six-Month | Baseline | Twelve-Week/Six-Month | Baseline | Twelve-Week/Six-Month | | |
| Participant 1 | | | | | | | |
| Participant 2 | | | | | | | |
| Participant 3 | | | | | | | |
| Participant 4 | | | | | | | |
| Participant 5 | | | | | | | |
| Participant 6 | | | | | | | |
| Participant 7 | | | | | | | |
| Participant 8 | | | | | | | |

Table 12 Skeleton structure of index framework (between-case analysis)

| Index Theme: <u>Domain</u> | Duty of Self-Care | Managing Vulnerability | Understanding of Health and Well-Being | Meaning of Activity | Social Engagement |
|--------------------------------|-------------------|------------------------|--|---------------------|-------------------|
| Experience of the Intervention | | | | | |
| Activity | | | | | |
| Health and Well-Being | | | | | |

The stages of analysis are discussed further in the context of the findings (Section 4.11.4). At the stage of entering the labelled data into an initial framework containing the three domains of “experience of the intervention”, “activity” and “health and well-being”, the evaluation of the STEER Course was completed by analysis of the labels and quotations generated, alongside the quantitative outcome measures for each participant, which were included as a column (Table 11). The quantitative results were also used to provide further details in relation to the participants’ perceptions of their own health and functional status in combination with the qualitative data provided. The findings are considered in Chapter 4.

3.13.2.1 Rationale for Analysis by the Framework Method

As discussed in the previous section, framework analysis was highly suited to this study due to its inclusion of a commissioned evaluation of an intervention. Furthermore, the multifactorial components of health, well-being and activity participation were identified for evaluation, fitting well the proposition of framework analysis being suited to multidisciplinary health research (Gale *et al.*, 2013). While the framework was highly structured, the open research questions were intended to allow for inductive reasoning to occur alongside deductive processes (Gale *et al.*, 2013). The adoption of realistic evaluation principles supported this approach (Pawson and Tilley, 1997); allowing for experiences, perceptions and new knowledge to be developed, but ensured the focus was on the priority areas that had been selected for study. The framework also allowed

the quantitative data to be considered within the matrix, producing true triangulation and integration of the mixed methods, therefore strengthening the findings (Creswell and Plano Clark, 2007). The creation of index themes required a level of deep analysis, akin to that of the detailed description and interpretation completed within traditional thematic analysis (Braun and Clarke, 2006), and the generation of codes, searching for, refining and checking themes occurred in the same manner as detailed by Braun and Clarke (2006). It is suggested here that the framework ensured focus on the areas identified for consideration in the research questions but did not limit the depth of analysis compared to completing a pure thematic analysis.

3.14 Rigour of Results and Findings

As this study is composed of quantitative and qualitative methods, which incorporate a number of measures, there were a range of issues relating to assessing rigour of results and findings produced (Tobin and Begley, 2004). These are discussed in the sub-sections that follow.

3.14.1 Inter-rater and Intra-rater Reliability

To evaluate the reliability of measurements and minimise error, when completing the quantitative outcomes over a period of time, intra-rater reliability was tested (Bialocerkowski and Bragge, 2008). The HFRS STEER Course facilitators completing the measurements taken for Part A of the research were familiar with the means of testing and followed the Standard Operating Procedures (SOPs) as a means to mitigate error (Bialocerkowski and Bragge, 2008) and as documented in Appendix C. Reliability testing occurred by measurement of all outcome measures listed in Quantitative Outcome Measurements above, by the HFRS Course facilitator with the researcher acting as a STEER Course member as a control measure. This was repeated one week later. Observations occurred to determine if SOPs were followed, and measurements were all found to have agreement within 5%. It had been intended to capture inter-rater reliability by comparison of these scores between Course facilitators, however during the period of data collection only one member of HFRS staff completed the measurement sessions, meaning no inter-rater reliability was possible, but therefore not required for this study. While HFRS have multiple members of staff delivering STEER Courses the measurement sessions have historically been completed by a small number of staff members, this means they are familiar with the SOPs and apply a consistent measurement standard to a large proportion of the data that has been collected.

3.14.2 Validity and Reliability of Outcome Measurements

All outcome measurements were conducted using Standardised Operating Procedures (SOPs) to ensure a uniform method was adopted to complete the measurement. Except for the PHQ-9 (Kroenke, Spitzer and Williams, 2001) all measures were chosen by HFRS when the STEER Course was first designed. There is no information available as to the justification for each measure from HFRS, however information about their established validity and reliability was checked prior to commencing the study and is now presented. It has been assumed that the measures of height, weight, body mass index and the timed measures of single leg balance and sit-to-stand transfers, if obtained using SOPs, provided accurate data.

3.14.2.1 Blood Pressure and Resting Heart Rate Readings

Measurements were taken with an automatic blood pressure cuff which produced brachial blood pressure readings and a resting heart rate. The Omron M2-HEM-7120 has been validated and found to adhere to the International Protocol of the European Society of Hypertension (Asmar *et al.*, 2010).

3.14.2.2 Grip Strength

The properties of handgrip measurement have been examined in more detail as part of the literature review (Section 2.7.3). The specific dynamometer used in this study, to measure maximum grip strength, was manual in style. The review of literature (Section 2.2) determined that the most common type of dynamometer used within the field of frailty is the Jamar handheld manual dynamometer (Sammons, Bolingbrook, IL, USA) and was used in studies that provide reference values for this population (Fried *et al.*, 2001; Roberts *et al.*, 2014). The Jamar was also considered the 'gold-standard' for handgrip measurement (Roberts *et al.*, 2011). However, the type of dynamometer used is not specified in the study which provided reference values for people with pre-frailty (Romero-Ortuno *et al.*, 2010). There is limited evidence available that different shaped manual dynamometers can produce different outcomes (Amaral, Mancini and Novo Júnior, 2012), however this study was completed with a young, healthy population and there is insufficient evidence to determine if comparison across different dynamometers is reliable. Roberts *et al.* (2011) proposed that variations in measurement tool and technique can produce differing results. For this reason, a standardised approach, based on the technique detailed in the original literature on grip strength and frailty (Fried *et al.*, 2001), was adopted to minimise measurement error (Bialocerkowski and Bragge, 2008) as the brand of dynamometer had been chosen and implemented prior to the research partnership commencing (Appendix C).

The use of grip strength as a single measure to identify frailty is, however, better examined. Lee *et al.* (2017) determined grip, albeit with a Jamar manual dynamometer (Sammons, Bolingbrook, USA), to have sensitivity of 1.0 (95% CI: 0.83-1.0) and specificity: 0.91 (95% CI: 0.87 – 0.93). The study proposed that for best accuracy the grip strength outcome is combined with gait speed. Unfortunately gait data were not available from the pre-determined outcome measures. While there is uncertainty about the use of different brands of dynamometer, a further study using another brand (Harpenden (British Indicators Ltd. England)), established that grip strength is a better marker of the level of ageing experienced than chronological age alone (Syddall *et al.*, 2003) which has supported the use of grip strength measurement in this study.

3.14.2.3 Depression Severity

The Patient Health Questionnaire (Kroenke, Spitzer and Williams, 2001) was the only measure selected after the research partnership commenced. It was considered that formal assessment of rates of depression would have contributed breadth to the data already produced, as the majority of measures focused on physical or functional health. It was chosen as a measure with sensitivity and specificity of 88% in primary care settings (Kroenke, Spitzer and Williams, 2001). It was agreed to be implemented by HFRS but unfortunately this did not occur (See Field Notes – Appendix H). Part of the reason for including the PHQ-9 was its validity despite being a relatively short assessment (Kroenke, Spitzer and Williams, 2001). For development of understanding of rates of depression in the STEER Course population it might be appropriate to consider an even shorter assessment, such as the two-item screening proposed by the National Institute Health and Care Excellence (Whooley *et al.*, 1997; National Institute for Health and Care Excellence, 2009). The STEER Course has an intensive measurement session at the beginning, end and follow-up points so it is important to minimise the demand of extra assessments on HFRS Course facilitators and participants.

3.14.2.4 Fear of Falling

Participants' fear of falling was assessed by the Short Falls Efficacy Scale – International (Kempen *et al.*, 2008). The shortened form of the full Falls Efficacy Scale correlated to the level of 0.97 (Kempen *et al.*, 2008). This meant it saved time in a busy measurement session while still providing nearly the same level of information. Kempen *et al.*'s (2008) validation study does, however, suggest that the full FES-I discriminates better amongst a wider variety of activities that have a linked falls risk, and so there could have been value in implementing the longer assessment. It has been established that fear of falling is most commonly captured by the FES-I (Kempen *et al.*, 2008), however there are a range of validated falls measures in use and a lack of clarity as to the most appropriate measure (Ruggieri *et al.*, 2019). As is discussed in the results

(Section 4.8.7), there was evidence of difficulties with implementation of the FES-I (Kempen *et al.*, 2008) in this study.

3.14.2.5 Falls Risk Score and Frailty Estimate

This was completed using inertial sensors connected to the software of the Quantitative Timed Up and Go Test QTUG™ (Kinesis Health Technologies, 2014). The sensors analyse a six metre walk and combine this with answers to a falls risk assessment to produce falls risk scores and a frailty estimate (Kinesis Health Technologies, 2014). The QTUG™ (Kinesis Health Technologies, 2014) has been evaluated on its ability to correctly identify frailty compared to the Timed Up and Go (Podsiadlo and Richardson, 1991) test alone. It proposes a small but significant ($p \leq 0.05$) increase in accuracy compared to Timed Up and Go (Podsiadlo and Richardson, 1991) test, but was less accurate than using grip strength alone (Greene *et al.*, 2014b). As the software licence had been purchased by HFRS it was considered important to include the measures and determine if the expenditure contributed understanding not provided by grip strength outcomes. The evidence above relating to the properties of the QTUG™ (Kinesis Health Technologies, 2014) was produced by the developers of the instrument, and no further independent evidence was available.

3.14.3 Semi-Structured Interview Rationale

The interviews were all conducted by the researcher and guided by the semi-structured interview schedule (Appendix B). It was designed to provide a consistent approach that allowed the interviews to have comparable content, but also to have scope for in-depth discussion about the most relevant aspects for each participant. Interviews were chosen as a means to discover historic and current experiences for each participant (Marshall and Rossman, 2006). The use of three interviews over a period of time, which included repeated questions, was supported as the ideal means to examine emerging thoughts and perceptions (Seidman, 2006). As is discussed more in Section 4.11, most unique content was generated in the baseline interview, however the confirmation of those views over time was a valuable finding. Subsequent interviews that occurred at the points of STEER Course completion and six-month follow up included questions that prompted reflection on, and insight into understanding of, the quantitative outcome measures achieved and experience of the Course and its application to daily life. This integration of quantitative results with qualitative findings has been highlighted as a supportive strategy to clearly highlight the results of mixed methods research (Östlund *et al.*, 2011).

The content of the interview schedule was based on the pre-determined framework used for analysis which is discussed in Section 3.13.2. This required content to be generated based on the three main topics of interest highlighted in the research questions (Section 3.4, Questions 3 and

4). These related to experiences and perceptions of; the intervention, own health and well-being status, and participation in daily activities. Discussion was prompted on current experiences relating to those areas, and on understanding of any changes that had occurred. This was in relation to health, well-being and activity participation as guided by conceptualisations of frailty as a dynamic presentation, with need for understanding of people's subjective experiences of potential frailty within their unique context (Markle-Reid and Browne, 2003).

In order to check that the questions were understandable and appropriate to likely participants, the interview schedule was discussed with two participants of a previous STEER Course who volunteered their time. They were shown the questions and, while not asked for their response to the questions, they were asked if they would have felt comfortable in principle to respond, as well as feedback as to any other areas to be included. These participants confirmed the suitability of the interview schedule without amendment. The implemented schedule also concluded with an opportunity for participants to discuss anything they deemed important that had not already been discussed to ensure pertinent issues were captured.

3.14.4 Trustworthiness of Interview Findings

A range of measures were implemented to enhance the trustworthiness of the research, these were based on constructs of credibility, transferability, confirmability and dependability (Lincoln and Guba, 1985).

Both the rationale and the steps taken to create the semi-structured interview discussed above (Section 3.14.3) are intended to support the credibility of the findings. As was discussed in Section 3.13.2, the mixed methods analysis used the quantitative outcomes to strengthen and provide detail and context when analysing the qualitative interview data for the eight participants. The interview schedule also incorporated prompts to check meaning of content raised by participants. Data analysis was discussed with supervisors to consider and challenge any interpretations of the data. Furthermore, reflexivity was adopted as a method of ensuring subjectivity was responsively used to enhance the findings produced (Finlay, 2003) (Appendix L), also allowing the credibility of the research to be assessed (Koch, 1994).

The ability for qualitative findings to be transferred, or generalised, beyond the specific study population is a contentious issue (Lewis *et al.*, 2014). The qualitative arm of this study was small and completed with a very specific population, so the views and experiences might not be representative of all older adults at risk of developing frailty. However, to allow readers to determine the level to which results could be generalised to broader samples, rich descriptions and analysis are provided and compared to existing evidence (Lincoln and Guba, 1985).

Confirmability has been supported with the use of direct quotations from participant interviews and supplemented with analysis and discussions that illustrate how conclusions were drawn. This included the presentation of findings initially in sub-sections of the three domains (Section 4.12 - 4.14) before consideration of the more developed Index Themes (Section 4.15). Four participants were interviewed in groups of two. To ensure any influence of the other person is transparent, their contributions are reported alongside the quotations from the participant being considered. Reflection on the joint interviews considered if there had been a dominant voice that may have influenced the contributions from either participant. These reflections supported this style of interview as generating meaningful content that was enhanced by the second person. There were frequent occurrences where the discussion produced differing opinions from the two participants, suggesting they felt able to share, without influence, their own perspectives.

The detail regarding methods adopted, and the rationale for those methods, provided throughout this chapter was intended to support dependability (Tobin and Begley, 2004). This has been supplemented with inclusion of appendices which provide full transparency as to the procedures and measures used (Appendix A - Appendix E, Appendix H, and Appendix K - Appendix M). Review of coding and theme development occurred with the supervisory team, as well as supplementary review of the initial mixed methods analysis with an additional Faculty staff member.

3.15 Alternative Design and Methods

As has been discussed throughout this chapter, the use of mixed methods research was highly supportive of the aim and objectives of this study to evaluate both outcomes and experiences of participants in a frailty-prevention intervention. While the quantitative measures discussed above (Section 3.8.1) were largely implemented prior to the research partnership being created, and as was discussed in that section, the use of existing measures was a compromise that afforded a larger sample size. The inclusion of additional quantitative measures is discussed in Section 3.8.1, and developed as part of the discussion (Sections 5.8.2 and 5.9).

The data collection method that was most able to be influenced was the means of capturing qualitative and mixed data. As was mentioned in Section 3.6, there were challenges in creating a study around an existing intervention. The use of realistic evaluation principles (Pawson and Tilley, 1997; Kazi, 2003) allowed this situation to be embraced. The pre-determined outcome measures were used as a basis for the study, and then additional data collection measures were identified to add detail to their results. Instead of tightly controlling the intervention conditions, qualitative data added to understanding of reasons for outcomes in individual scenarios. This included factors specifically linked to the intervention such as the environment, other Course

members and staff. It also expanded on the contextual understanding of broad health and well-being outcomes with perspectives on what might influence such outcomes.

The justification for the semi-structured interview as a means of identifying contextual influences on outcomes is proposed above (Section 3.14.3) and alternatives now considered. These ranged from focus groups with multiple participants, to including the perspective of HFRS staff in additional semi-structured interviews. The latter could have enhanced the perspective of processes occurring within the STEER Course for participants, however it was decided at this stage to focus on the experience of those for whom the Course was designed. Focus groups could have provided rich data and participants' contributions could have prompted reflection on the experience of others and allowed for greater insight into the group dynamics and evaluation of the processes occurring in the intervention (Finch, Lewis and Turley, 2014). Focus groups were considered but not included due to the desire to capture sensitive data about experiences of health and well-being that were unique to each person and might not have been offered in as much detail, or at all, in the group setting (Kaplowitz, 2000). Although there were two interviews where two participants were interviewed together, the relationship between participants appeared to prevent any reticence to share personal information and, indeed, allowed some of the benefits of perspective sharing and reflection that are attributed to focus groups discussed above. Had the evaluation have been solely about the experience of the STEER Course, a focus group might have been appropriate.

The content above focused on design choices and outcome measures based on the reality of this evaluation occurring where data were already being captured. Had this not been the case, and due to the lack of evidence available, a full Exploratory Design could have been implemented which consisted of two phases of research; an initial qualitative study to create understanding as to the phenomenon occurring, followed quantitative phase validating the findings (Creswell and Plano Clark, 2007). This could have been a valuable way to test interactions between physical health, mental well-being and occupational engagement but as much quantitative data already was being captured it seemed prudent to fully use this and explore more fully with the realistic evaluation (Pawson and Tilley, 1997). As is discussed in Section 6.3, this is an area for development of further research.

3.16 Methodology Summary

This section has described the multiple methods of evaluation used within the study. The research design, methods, protocol and ethical considerations have been detailed for study, which included pre and post-test measurements of physical, functional health and falls and frailty

measures for all participants in HFRS operated STEER Courses. The differing consent procedures for participants in the semi-structured interviews are described. The study used multiple methods of analysis including descriptive statistics and analysis of change for the 212 participants engaged in the quantitative element of the study. The data of participants who engaged in interviews was analysed using framework analysis of mixed qualitative and quantitative data to answer specific research questions. The research design was guided by principles of realistic evaluation (Pawson and Tilley, 1997) to understand what works, for which individuals and how context influences this (Kazi, 2003). This supported the over-arching aim of the study to understand the experiences of outcomes of participants engaged in a frailty-prevention intervention.

Chapter 4 Results and Findings

4.1 Introduction

This section is presented in sub-sections divided by the method of data analysis. The first section considers the results of quantitative data analysed to provide data relating to research questions one and two. The quantitative data firstly considers the participants' measures at baseline to build a description of those attending the STEER Course and is then supplemented with results of pre-post intervention outcomes. The results are followed by a findings section which was completed using mixed quantitative and qualitative data to address research questions 3 and 4. Section 4.11 presents findings from a framework analysis divided into domains of the intervention, activity, and health and well-being. A deeper analysis of index themes spanning the three domains follows, allowing for exploration of interactions between health and well-being, and activity. The chapter concludes with a summary of key results and findings for further consideration in relation to the evidence base.

4.2 Quantitative Results

The results are presented in two categories. The first being physical descriptors at baseline including; age, gender, body mass index (BMI), systolic blood pressure and resting heart rate. The second is functional and frailty status descriptors at baseline, Course completion and six-month follow-up. These included; duration of single leg stance (SLS), sit-to-stand (STS) repetitions, Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)) measures of falls risk, and grip strength – which has been stratified by known reference values to produce a classification of the presence of frailty.

From the implementation of the first STEER Courses in 2016 to the end of data collection in May 2018, thirty STEER Courses have been completed at eight different HFRS stations. The average number of participants is just over nine per Course, with a maximum of twelve participants. Of the thirty STEER Courses that had reached the six-month follow-up time period at the point when data analysis was completed, the retention rate between first week and Course completion was 78.8%. Attendance figures per session were collected in the later stages of STEER Courses only, and so are not analysed here. It is possible that a person who attended a majority of STEER sessions but was not able to attend the final week was lost to follow-up and this figure is presented as a conservative rate of engagement with the Course.

The six-month follow up was arranged via the HFRS 'Fire as a Health Asset' administration team by telephone contact. This yielded a retention rate of 58% of those who contributed baseline measurements, but 73.7% of those who completed the STEER Course. Some flexibility was used to invite participants to alternative testing dates or locations if the date selected was not convenient.

Functional outcome measures were checked for normality and while the female sample produced a normal distribution for grip strength, falls and frailty scores at one to two of the three time-points, the male sample and the remaining measures for the female sample did not achieve tests of normality (Appendix K). As discussed in Section 3.13.1, parametric and nonparametric statistics were both applied to determine the consistency of, and transparently display, the outcomes produced. Where there was doubt about the spread of data the more conservative option was used. As can be seen in Table 13 on page 94, at baseline there are fewer differences between mean and median values. The distribution of data at baseline was a better fit with normality curves, with variability in spread occurring at follow-up testing. Table 14 (page 100), however, shows greater differences in value as this is considering functional performance measures rather than physiological data.

4.3 Baseline Physical Descriptors

Data were analysed for 212 participants at baseline, these participants were selected as their STEER Course had completed its six-month follow-up at the point that data collection ceased. In the early stages of the STEER Course, data were collected under conditions determined by HFRS operational procedures and pre-dated the agreed standardised operating procedures and rater-testing which was implemented once the research partnership was formed. The STEER Course was also a developing intervention and some of the early Courses did not complete outcome measures such as the Quantitative Timed Up and Go Test™, or Falls Efficacy Scale – International (Kempen *et al.*, 2008). This was reported informally as being due to logistical reasons such as unavailability of equipment at multiple sites, or lack of time to complete all measures. All partial data has been included as the reasons for omission were operational. It would have been unlikely to generate a specific bias regarding a population characteristic as a whole STEER Course cohort at a specific site were subject to the same missing data. There were also some measures that individual participants declined to complete due to individual physical limitations, such as hand osteoarthritis preventing completion of a grip strength test. This is discussed in more detail when the specific measures are presented below, however specific information for each participant and their reason for not participating was not captured by HFRS.

Table 13 Baseline physical descriptors by gender

| Physical descriptors at baseline: | | | | | | |
|--|--------|--------------------------------|--------------|------|--------------------------------|-----------------|
| | Female | | | Male | | |
| | N | Mean (SD), Mean 95% CI | Median (IQR) | N | Mean (SD), Mean 95% CI | Median (IQR) |
| Age - years | 136 | 76.3 (6.0), 75.2 -77.4 | 76.0 (8.0) | 76 | 78.2 (6.1), 76.7 – 79.7 | 79.0 (10.0) |
| Body Mass Index - kg/m² | 136 | 26.2 (4.8), 25.4 – 27.0 | 25.1 (5.9) | 76 | 27.2 (4.4), 26.2 – 28.2 | 26.1 (4.3) |
| Systolic Blood Pressure – mmHg | 136 | 143.7 (18.7), 140.5 – 147.0 | 142 (24) | 76 | 142.2 (18.7), 137.9 – 146.0 | 143 (25) |
| Resting Heart Rate - beats per minute | 136 | 73.6 (11.9), 71.5 – 75.6 | 72.5 (15) | 76 | 71.2 (12.7), 68.3 – 74.1 | 70.5 (19) |

4.3.1 Gender

Table 13 highlights baseline characteristics by gender, of which the initial 212 participants 64.2% (n=136) identified as female and the remaining 35.8% (n=76) as male. Specific data were not captured regarding biological sex versus gender identification. For the purposes of analysing characteristics related to known differences between men and women (for example regarding grip strength), a person's gender has been assumed to be the same as their sex. There were fifty

fewer men than women who participated in STEER Courses during the data collection period, making the male sample more prone to the effects of extreme values.

4.3.2 Age

The STEER Course routinely accepts participants aged sixty-five and over. However, with support from a general practitioner it will accept younger participants who meet the remaining inclusion criteria discussed in Section 3.9. Initial inspection of the data revealed one participant fifteen years younger than the minimum age. Due to the limitations this posed in terms of capturing Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)) outcomes for this participant (lowest age accepted by the software is sixty years), and the likely different pathology of the health and functional problems experienced, this person's data were excluded and has not been counted in the sample size. However, the data belonging to three participants aged between sixty-three and sixty-four remains included as these participants met all other inclusion criteria and were able to be assessed using the outcome measures as intended. Table 13 highlights that female participants were, on average, almost two years younger than male participants, with a marginally higher distribution from the mean for men. The youngest participants were sixty-three, and oldest ninety-five, years old.

4.3.3 Body Mass Index

Examination of the percentile distribution of participants' BMI scores indicates that in almost 60% of participants can be categorised as 'overweight' and at least 20% of these would further be classified as 'obese'. The minimum recorded BMI of 18.4kg/m² identifies a single participant was marginally underweight (NHS Choices, 2016b). Both women and men had a mean BMI in the 'overweight' category at 26.20kg/m² and 27.19kg/m² respectively (Table 13).

4.3.4 Systolic Blood Pressure

Due to limitations of the analytical software it was not possible to analyse blood pressure in the typical form of systolic blood pressure/diastolic blood pressure. Each individual blood pressure reading was reviewed for its fit with NHS blood pressure guidance (NHS Choices, 2016a) to ensure that by entering the systolic blood pressure reading only the person's blood pressure could be categorised correctly as low (less than 90/60mmHg), normal (90/60mmHg – 120/80mmHg), 'at risk of high blood pressure' or pre-hypertension (greater than 120/80mmHg and less than 140/90mmHg), and high (greater than or equal to 140/90mmHg). Blood pressure readings are taken as a screening measure on the STEER Course and are not used as an outcome measure.

Participants with low or high blood pressure were advised to contact their General Practitioner (GP) for review and guidance on whether participation in a moderate exercise programme was appropriate.

Table 13 highlights the mean systolic blood pressure for women was 143.7mmHg and slightly lower for men at 142.10mmHg. No participant's blood pressure was classified as 'low', however only 9.3% of participants had a systolic blood pressure in the normal range of 90-120mmHg. 36.3% were classified as 'at risk' of high blood pressure, or pre-hypertensive.

4.3.5 Resting Heart Rate (RHR)

Participants on the STEER Course also have a resting heart rate taken at baseline as a screening measure. The mean value was 73.56bpm (female) and 71.17bpm (male) (Table 13). The range was from 46 bpm to 110 bpm (with those recording values outside of the agreed range of 60-100 bpm were directed for medical review to ensure fitness to participate in the STEER Course).

4.3.6 Body Fat Percentage

Body fat percentage was an intended measure at baseline. However, the final results show only completed values for approximately 50% of the sample. It was reported that for some participants the difficulty, or inconvenience, of removing socks and footwear to use bioelectrical impedance analysis on the measuring scales was a barrier. It was also not used at Course completion or six-month follow-up and so had no ability to be used as an outcome measure. It was, therefore, removed as a descriptive measure and has not been reported.

4.4 Baseline Functional Status Descriptors

Table 14 Functional outcome measures at baseline

| Functional outcome measures at baseline. | | | | | | |
|---|--------|----------------------------|-----------------|------|---------------------------|-----------------|
| | Female | | | Male | | |
| | N | Mean (SD), Mean 95% CI | Median (IQR) | N | Mean (SD), Mean 95% CI | Median (IQR) |
| Single Leg Stance - s | 132 | 8.1 (7.0), 6.9 – 9.3 | 5.0 (12.0) | 73 | 7.7 (7.0), 6.2 – 9.3 | 5.0 (12.0) |
| Sit to Stand Transfers - repetitions/30s | 131 | 10.8 (2.9), 10.3 – 11.3 | 10.0 (4.0) | 73 | 10.7 (3.6), 9.8 – 11.5 | 11.0 (4.0) |

4.4.1 Single Leg Stance

Single leg stance was measured as a means of assessing balance. It was completed on both left and right legs, timed for the duration the bodyweight was supported on one leg with the average score contributing to the results. The results demonstrated equivalent balance ability on left and right legs, supporting the decision to include the average score. It was intended that the test would be capped at twenty seconds, with those able to continue balancing asked to stop at this point. On receipt of the data it was evident that this did not occur at all sites. As it is not possible to determine if those people scoring twenty seconds had been asked to stop or lost balance at this point, all scores in excess of twenty seconds were normalised to the intended maximum. Five participants were unable to balance on one leg but attempted to complete the assessment and therefore recorded a 'zero' score, which is different to a missing score. The effect is tendency towards lower values, illustrated in Figure 4. Figure 4 also displays the equal median values by gender at 5 seconds, with mean scores being 3.1 (women) and 2.7 (men) seconds higher. The nonparametric values are considered more appropriate for this outcome.

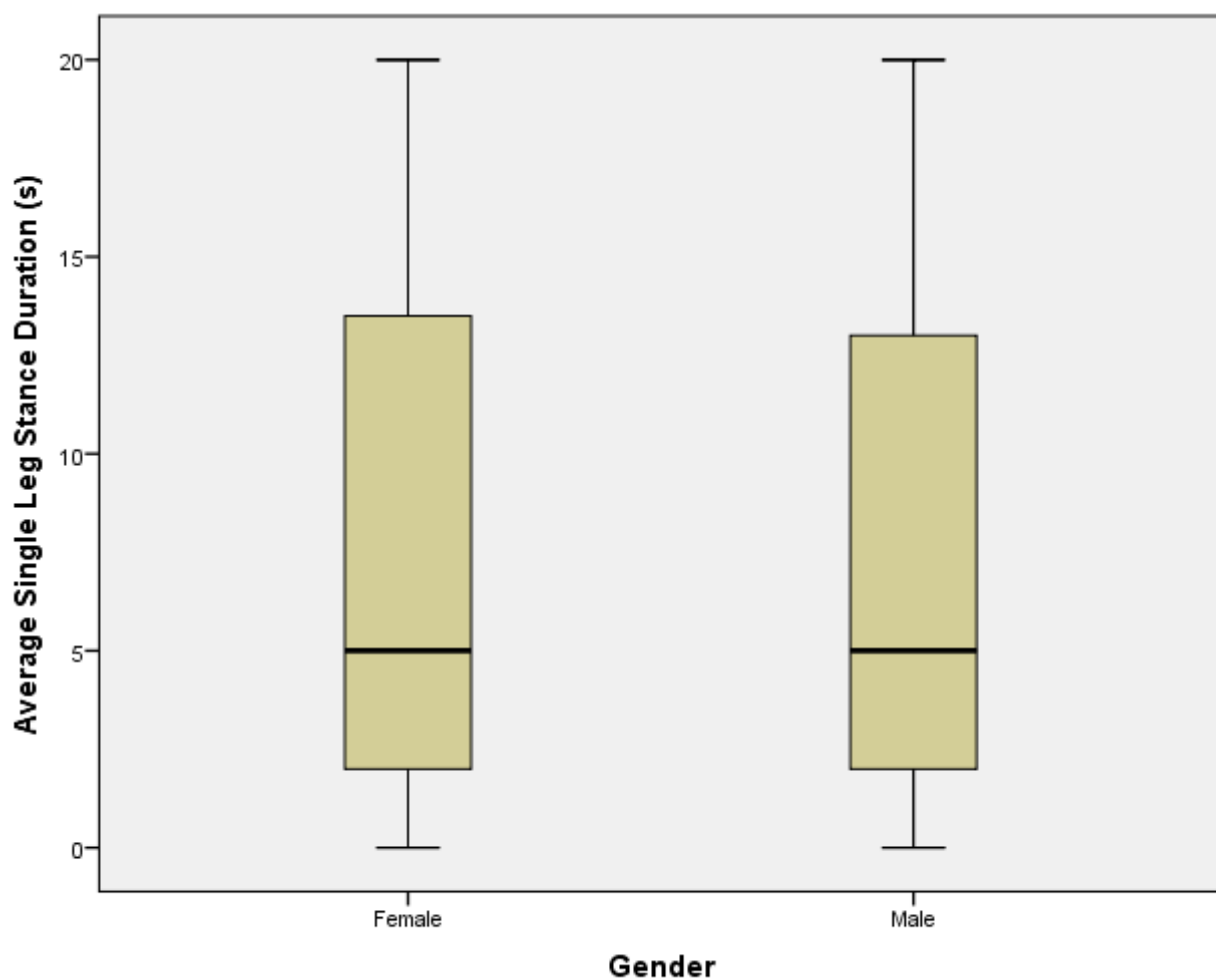


Figure 4 Box plot: Average single leg stance (s) by gender

At baseline there is similarity in the ability to balance for both genders of participants, illustrated in the box plot (Figure 4).

4.4.2 Sit to Stand Repetitions

Sit to stand measurements were taken as an indicator of lower leg power. The number of sit to stand repetitions completed in thirty seconds from a standard armchair was measured. The minimum number of repetitions completed was 3 and maximum 24.

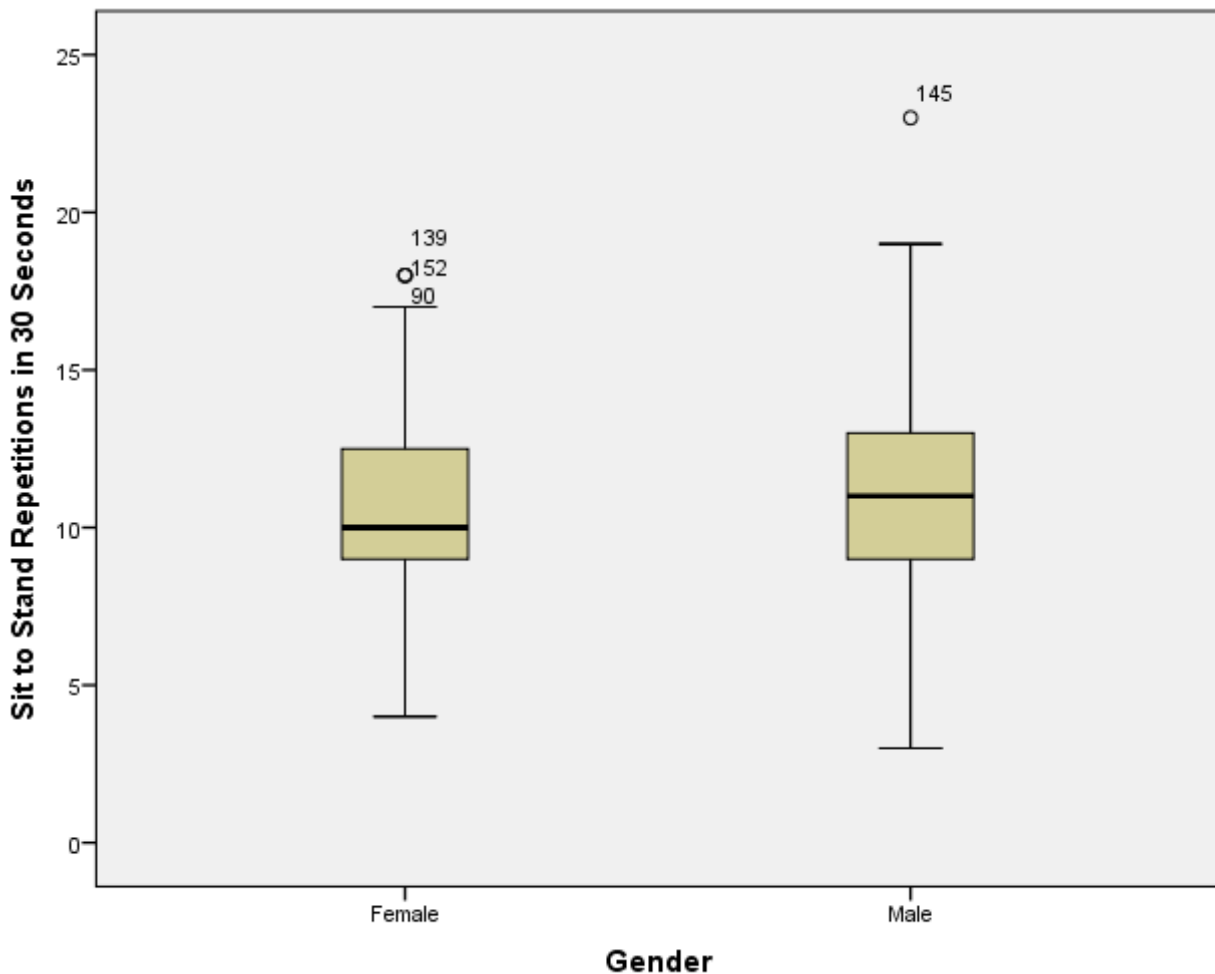


Figure 5 Box plot: Sit to stand repetitions by gender

The mean score for female participants was 10.8 repetitions, and marginally lower for male participants at 10.7 repetitions. There was a slightly larger range for the male participants with both minimum and maximum scores exceeding those of the female participants and is illustrated in Figure 5. This figure also highlights that the higher values recorded by female participants were considered outliers.

4.5 Baseline Frailty and Falls Measures

Two falls scores, and a single frailty score, respectively, are calculated for all participants. STEER Course participants engage in assessment using the Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)) to produce composite falls and frailty scores. The Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)) is a single assessment which produces risk scores for falls and a frailty estimate as a percentage score. The QTUG™ (Kinesis Health Technologies, 2014) uses inertial sensors combined with a questionnaire about falls to predict the likelihood of a fall (Kinesis Health Technologies, 2014). The mechanism by which the frailty classification was made was unclear from the literature provided by Kinesis

Health Technologies as its documentation specified it was only a, “*statistical estimate of a patient’s risk of having a fall. Statistics are based on a large reference population of community dwelling older adults*” (Kinesis Health Technologies, 2014, pp.11). Clarification was sought from the manufacturers who redirected back to the same guidance document. For this reason, the QTUG™ (Kinesis Health Technologies, 2014) frailty score was excluded from analysis with frailty classification occurring via the better established and evaluated grip strength classification (Lee *et al.*, 2017). The final measure used was the Falls Efficacy Scale – International (FES-I (Kempen *et al.*, 2008)) is a seven item questionnaire intended to capture the person’s level of concern about falling when completing several routine daily activities.

Table 15 Frailty and falls scores by gender

| Frailty and Falls Scores at baseline. | | | | | | |
|--|--------|---------------------------|-----------------|------|---------------------------|-----------------|
| | Female | | | Male | | |
| | N | Mean (SD), Mean 95% CI | Median (IQR) | N | Mean (SD), Mean 95% CI | Median (IQR) |
| Maximum Grip Strength - kg | 131 | 18.8 (5.2), 17.9-19.7 | 18.0 (7.0) | 73 | 28.7 (7.7), 26.9-30.5 | 28.0 (14.0) |
| Falls Risk Estimate - % | 132 | 51.5 (16.1), 48.8-54.3 | 50.0 (21) | 73 | 47.9 (18.7), 43.5-52.2 | 42.0 (27.0) |
| Falls Efficacy Scale– International (Possible Scores 7-28) (Kempen <i>et al.</i>, 2008) | 91 | 9.3 (2.8), 8.7- 9.9 | 8.0 (4.0) | 45 | 10.7 (4.3), 9.4 -12.0 | 10.0 (5.0) |

4.5.1 Maximum Grip Strength

The descriptive values for maximum grip strength demonstrate higher strength levels for male participants in all categories. The mean score of 18.8kg for women was lower than for men at 28.68kg. The scale of the range for both genders is similar at 28kg for women and 32kg for men. However, the minimum score of 3kg for female participants is much lower than the minimum score of 15kg for men. At baseline there were minimal differences between mean and median for

both genders (Table 15). Measurement of grip strength resulted in some missing data with 3.8% of the sample not recording a score. No specific information was gathered about the reason for non-measurement. Anecdotal evidence from the groups suggests that people with arthritis in their hands were reluctant to complete a grip strength test.

As described in more detail in section 3.13.1.1, a gender-stratified grip-strength classification (Table 16) was derived from the work of Romero-Ortuno *et al.* (2010) as Fried *et al.*'s work (2001) only provides divisions of 'frail' and 'robust':

Table 16 Frailty status by gender-stratified grip strength values developed from Romero-Ortuno *et al.* (2010).

| Women | | Men | |
|------------------|--------------------|------------------|--------------------|
| Frailty Category | Grip Strength (kg) | Frailty Category | Grip Strength (kg) |
| Robust | ≥ 26.7 | Robust | ≥ 41.1 |
| Pre-frailty | 20.8 – 26.6 | Pre-Frailty | 31.0 – 41.0 |
| Frailty | ≤ 20.7 | Frailty | ≤ 30.9 |

As HFRS do not capture information about hand dominance the maximum score was accepted as representative of grip strength for the participant (Sipers *et al.*, 2016).

Table 17. Frequency and percentages of robust, pre-frail and frail STEER Course participants by grip strength at baseline.

| | Frailty Category | N | Percentage (%) |
|---------------|--------------------|-----|----------------|
| | Robust | 12 | 5.8 |
| | Pre-frailty | 60 | 29.4 |
| | Frailty | 132 | 64.7 |
| | Total (N) | 204 | |
| Missing data: | | 8 | |

Table 17 demonstrates that 64.7% of those recruited were already living with frailty and were not the expected intended population for a frailty prevention group. There is also argument that the 5.8% of participants who were 'robust' do not meet the criteria of being vulnerable to frailty.

4.5.2 Falls Risk Estimate

The QTUG™'s (Kinesis Health Technologies, 2014) body worn sensors produce a falls risk percentage by combining the sensor data with a clinical score based on answers to questions about falls risk factors. It has been created with scores standardised to a reference population of community dwelling adults (Greene *et al.*, 2014a). The QTUG™ (Kinesis Health Technologies, 2014) also produces data about the specific mobility features and how they compare to the reference population, however these were not reported by HFRS.

Table 18. QTUG™ Falls Risk Estimate adapted from Kinesis Health Technologies (2014)

| QTUG™ Falls Risk Estimate (Kinesis Health Technologies, 2014) | Likelihood of Fall |
|---|--------------------|
| Less than or equal to 50% | Low |
| 51-70% | Medium |
| 71-90% | High |
| Greater than 90% | Very High |

The STEER Course aims to target those at risk of developing frailty, and therefore it would be expected that some risk of falls is present in the sample at baseline. As STEER is intended as a preventative intervention, those with a medium risk would be the ideal population to participate in the Course.

Table 19. QTUG™ Falls Risk Estimate (Kinesis Health Technologies, 2014)

| QTUG™ Falls Risk Estimate Category (Kinesis Health Technologies, 2014) | N | Valid Percentage (%) |
|--|-----|-------------------------|
| Low | 137 | 51.7 |
| Medium | 91 | 34.3 |
| High | 33 | 12.5 |
| Very High | 4 | 1.5 |
| Missing Data | 8 | - |
| Total | 273 | - |

Analysis of the sample highlighted that the mean and median falls risk was 50.7% and 49% respectively, which is the border between low and medium falls risk. When analysed by category 34.3% of the sample were medium risk, the ideal population for receipt of a falls-prevention intervention. There were 4 participants with very high risk scores. This outcome, combined with other measures taken at baseline, would have been reviewed by HFRS for the person's suitability to participate in the STEER Course (See Section 3.9.1).

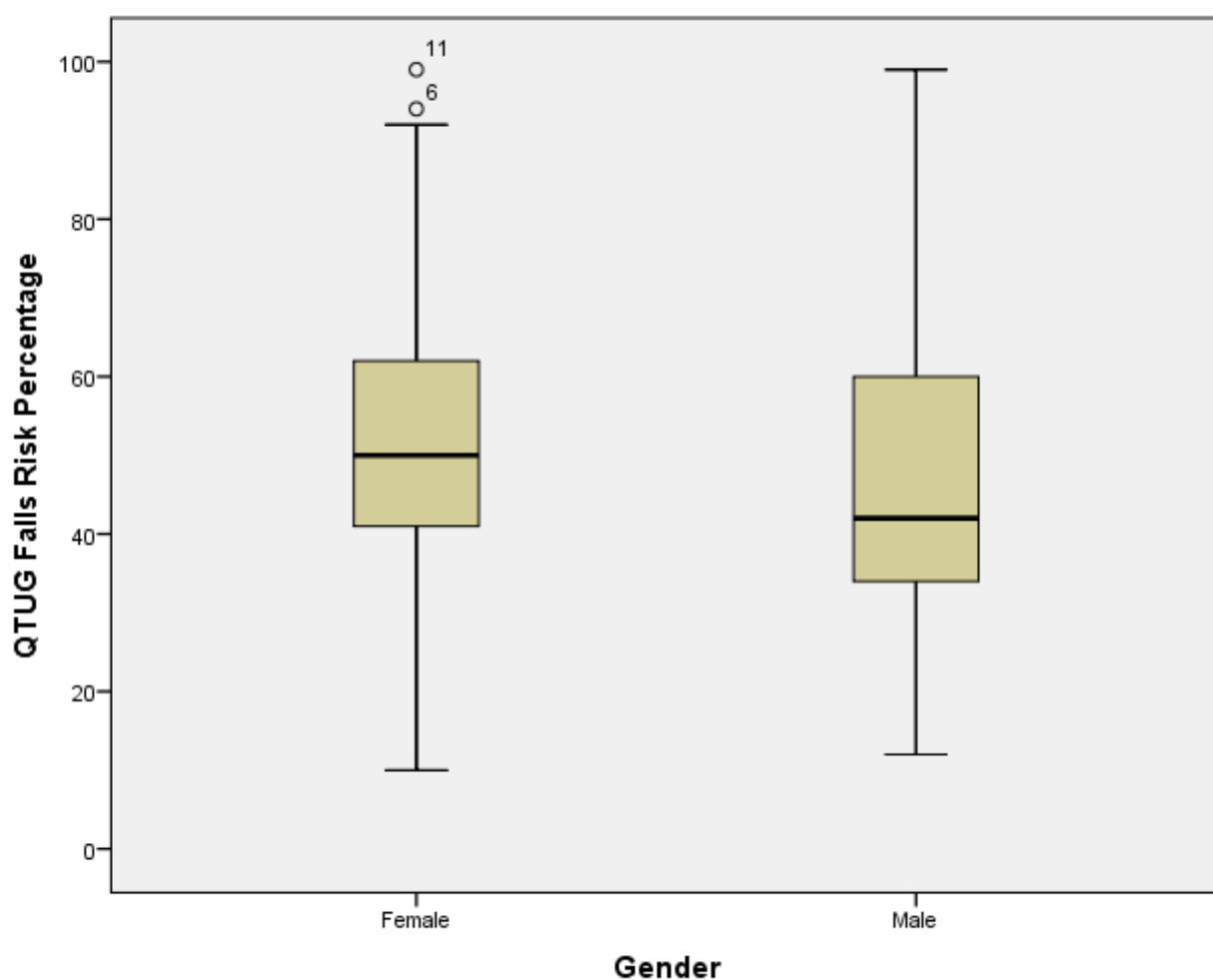


Figure 6 Falls Risk Estimate (QTUG™ (Kinesis Health Technologies, 2014)) by gender

While the FREs when subdivided by gender are not identical, they show some broad similarities. The mean score for a female participant is 51.5% which is at the lower margin of the 'moderate risk' category (Kinesis Health Technologies, 2014). The large standard deviation and range of scores from 10% to 99% show a spectrum of risk results from low to very high risk of falls. Similarly, the male participants have a mean score of 47.9% which places the average risk at the upper end of 'low risk' and the range is from 12% and 99% as with female participants. The median score of 42% and interquartile range demonstrated on the box plot (Figure 6) for men illustrates that more male participants fall into the 'low risk' category than female, however the box plot reflects that the female participants who score in the very high risk category are potential outliers, which is not the case for the male participants.

4.5.3 Short Falls Efficacy Scale – International (FES-I) (Kempen *et al.*, 2008)

The Short FES-I (Kempen *et al.*, 2008) comprises seven questions about a person's concern about falling while completing routine daily activities such as using stairs and going out of their home. It uses a four-point scale from 1 = 'not at all concerned' to 4 = 'very concerned'. It categorises the total concern about falling as follows:

Table 20 Short FES-I fear of falling outcomes (Kempen *et al.*, 2008)

| Short FES-I Score (Kempen <i>et al.</i> , 2008) | Fear of Falling |
|---|------------------|
| 7-8 | Low Concern |
| 9-13 | Moderate Concern |
| 14-28 | High Concern |

The FES-I (Kempen *et al.* 2008) was used to capture the level to which a person had concern about falling while completing routine daily activities. At baseline 61 fewer participants completed a FES-I (Kempen *et al.*, 2008) compared to the QTUG™ (Kinesis Health Technologies, 2014) tests. There is no recorded reason for this, but in general the FES-I (Kempen *et al.*, 2008) was sent to participants prior to starting the STEER Course and they brought the completed form to the session, whereas the QTUG™ (Kinesis Health Technologies, 2014) was administered by HFRS staff during the first session. It is not possible to know if all cohorts received a FES-I (Kempen *et al.*, 2008) prior to attending, but is suggestive that there is a limitation either with the means of distribution, or the acceptability of the test to participants. This was discussed with HFRS with aim to troubleshoot the problem, however assurance was received that the earlier difficulties had since been resolved (see Appendix H).

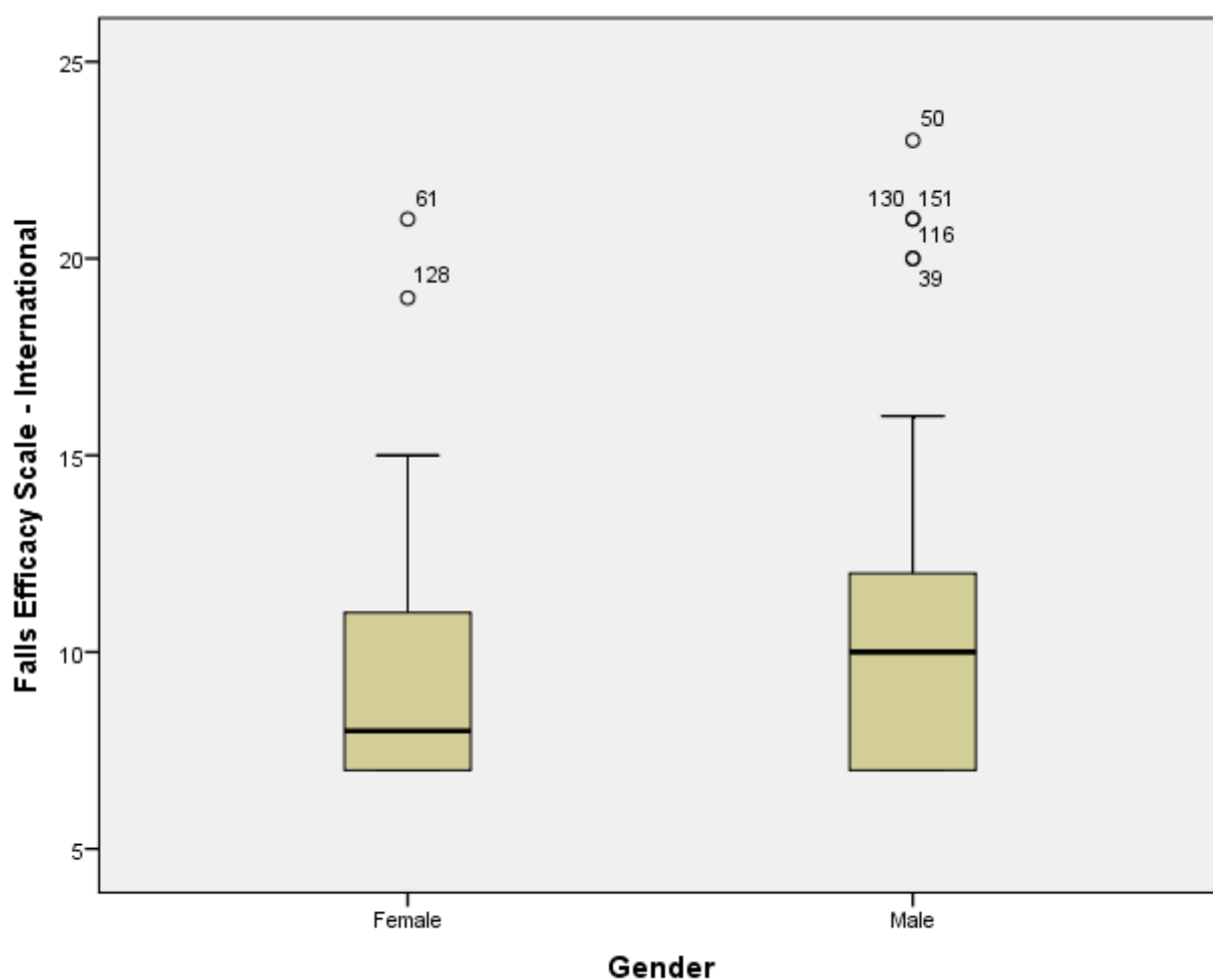


Figure 7 Box plot: FES-I (Kempen *et al.*, 2008) outcomes by gender

The scoring system for the FES-I (Kempen *et al.*, 2008) produces a skewed dataset with many participants scoring the minimum possible value. It is not possible to score lower than 7 on the Short FES-I (Kempen *et al.*, 2008) as the 7 item test scores a '1' for 'not at all concerned [about falling]'. There is potential that the questions in the FES-I (Kempen *et al.*, 2008) are producing a ceiling effect (as results are clustered towards the most positive result (Everitt and Skrondal, 2010), despite this being a lower value). The mean score is lower for the female participants at 9.3, compared to 10.7 for the male group. The skewness is evident in Figure 7. It illustrates that the median for women is 8, only one point above the lowest (most desirable) score of 7 out of 28. These scores are categorised into the 'moderate concern' about falling, however the spread of results shown in the differing box plots indicate that more women are scoring in the 'low concern' category compared to men. The male group also contained a higher maximum score of 23, compared to 21 for females.

4.6 Baseline Descriptive Data Subdivided by Frailty Status

As this study is interested in the description of the characteristics of people living with pre-frailty, analysis is included with sub-divisions using the three classifications of frailty status defined by Fried *et al*, 2001 and using division as outlined in Section 4.5.1. As identified earlier, the majority of the functional outcome measures did not produce a normal distribution. Consequently, Spearman's Rank correlation coefficient (r_s) was calculated to determine any association between raw grip strength score and the other characteristics. Additionally, Pearson's Product-Moment correlation (r) was also calculated to compare the effect of using a parametric statistic as detailed below:

Table 21 Correlation coefficient classifications (Dancey and Reidy, 2007)

| Strength of correlation coefficient | Value of r_s or r |
|-------------------------------------|-----------------------|
| Perfect | +/- 1 |
| Strong | +/- 0.7-0.9 |
| Moderate | +/- 0.4-0.6 |
| Weak | +/- 0.1-0.3 |
| Zero | 0 |

The division of the sample into frailty categories produced the following frequencies and percentages when divided by gender (data were missing for 5 women and 3 men):

Table 22 Frailty classification by gender

| | Robust | Pre-frailty | Frailty |
|------------------|---------|-------------|-----------|
| | N (%) | N (%) | N (%) |
| Female (n = 131) | 8 (6.1) | 35 (26.7) | 88 (67.2) |
| Male (n = 73) | 4 (5.4) | 25 (34.2) | 44 (60.3) |

4.6.1 Maximum Grip Strength

Grip strength was used to derive the frailty classification and so is not presented.

4.6.2 Average Single Leg Balance Duration

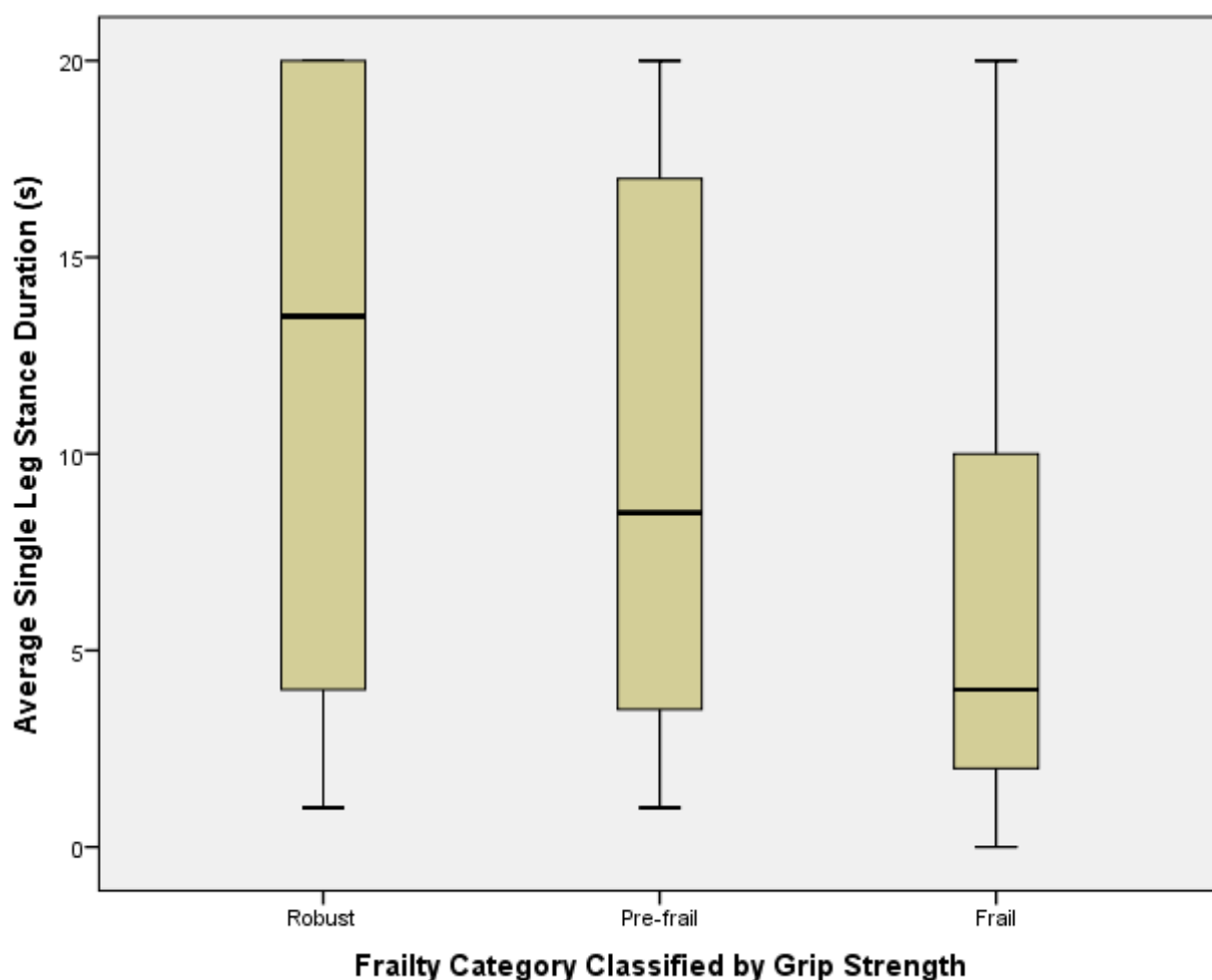


Figure 8 Box plot: Average single leg stance (s) by frailty category

Figure 8 highlights that the mean (median) durations for average single leg balance decrease with increasing level of frailty. A mean score of 12.1s (13.5s) for the robust group, 10.8s (8.5s) for the pre-frail group, and 6.6s (4.0s) for the frail group was achieved. There is a weak but significant correlation between increasing single leg stance duration and higher maximum grip strength (and so decreased lower frailty classification) using both methods: ($r_s = 0.274$, $n = 204$, $p \leq .001$ and $r = 0.268$, $n = 204$, $p \leq .001$). Within each category there are participants achieving scores at the twenty second cap, however only the 'frail' group had participants who attempted, but could not complete, any single leg balance.

4.6.3 Sit to Stand Repetitions

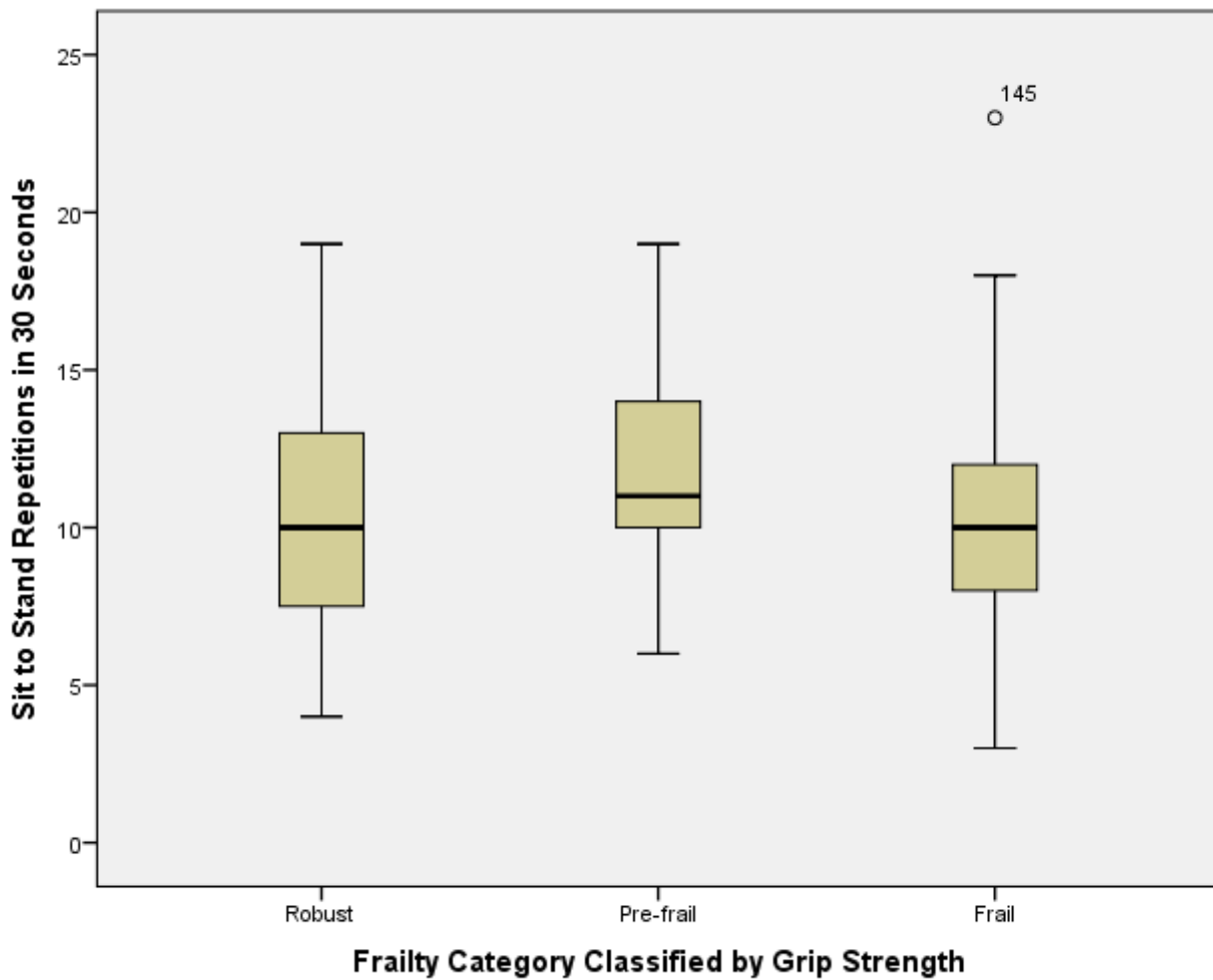


Figure 9 Box plot: Sit to stand repetitions in thirty seconds by frailty category

The number of sit to stand transfers completed in thirty seconds does not follow the same pattern as single leg stance and is perhaps influenced by the small number of participants ($n=12$) contributing scores to the 'robust' group. The mean (median) scores are within 0.9 repetitions of each other within each group: robust: 10.3 (10.0), pre-frail: 11.9 (11.0) and frail: 10.3 (10.0) and with the exception of the 'pre-frail' group a more symmetrical plot is presented in Figure 9. There is very little difference in the range or mean scores when considered by frailty grouping, suggesting it is not a good measure for identifying frailty. The relationship between increased sit-to-stand repetitions and higher maximum grip strength (and so decreased lower frailty classification) is weakly correlated: ($r_s = 0.202$, $n = 203$, $p \leq .004$ and $r = 0.182$, $n = 203$, $p \leq .009$).

4.6.4 Falls Risk Estimate (FRE)

The Falls Risk Estimate (FRE) is a percentage score produced by the Quantitative Timed Up and Go Test (QTUG™ (Kinesis Health Technologies, 2014)). The QTUG™ (Kinesis Health Technologies,

2014) comprises sensors that transmit to a linked tablet. The QTUG™ (Kinesis Health Technologies, 2014) produces a FRE that categorises a person's risk of falls as below:

Table 23 QTUG™ Falls Risk Estimate categories adapted from Kinesis Health Technologies (2014)

| QTUG™ Falls Risk Estimate (Kinesis Health Technologies, 2014) | Likelihood of Fall |
|---|--------------------|
| Less than or equal to 50% | Low |
| 51-70% | Medium |
| 71-90% | High |
| Greater than 90% | Very High |

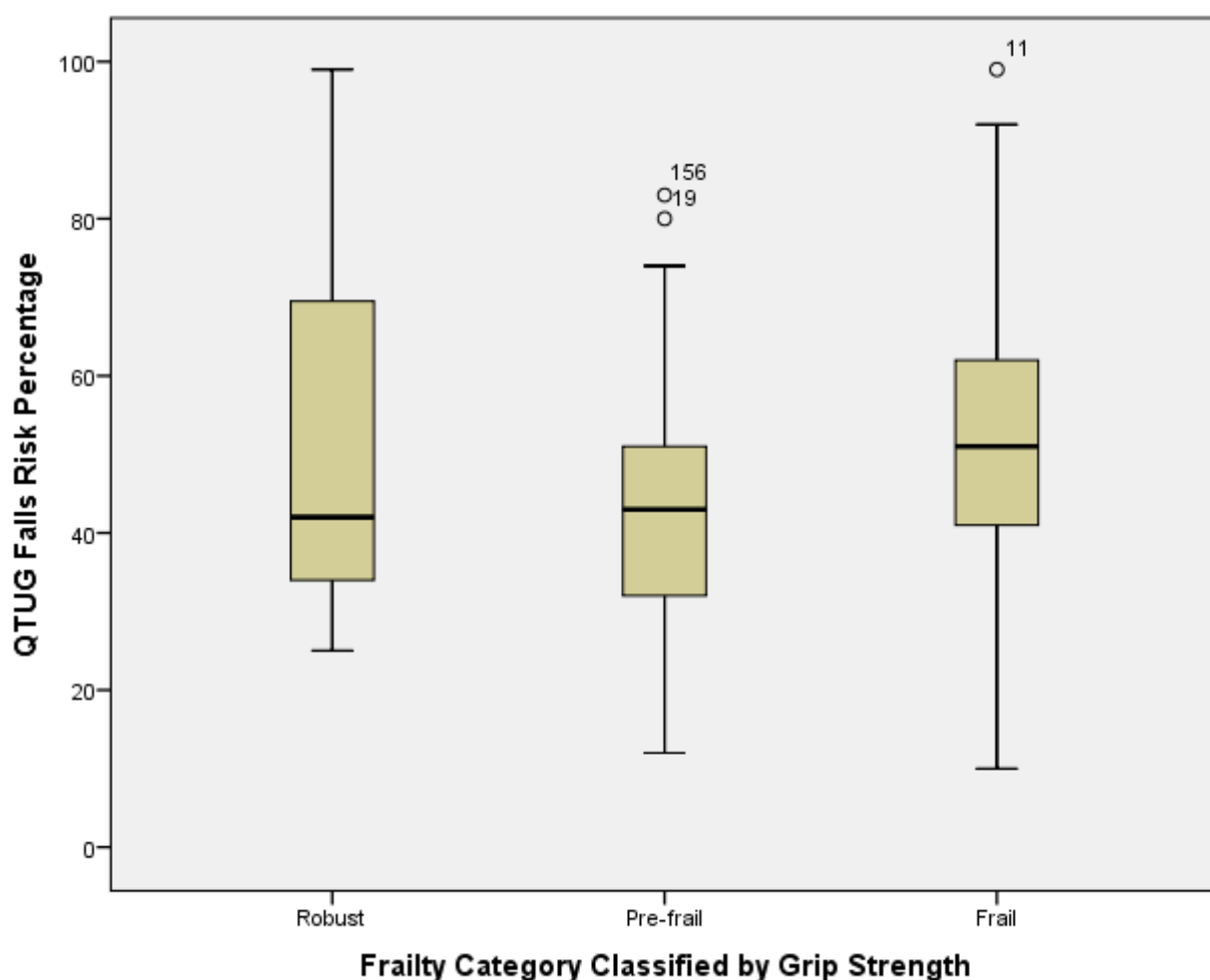


Figure 10 Box plot: Falls Risk Estimate (FRE) (Kinesis Health Technologies, 2014) by frailty category

The FRE when examined by frailty categories produces interesting results. Figure 10 shows ascending median scores (therefore increased falls risk) by increasing level of frailty, however the mean scores (robust: 53.3, pre-frail: 43.3, frail: 52.6) are not following the expected pattern. Figure 7 suggests that the higher scores recorded in the pre-frail and frail groups were potential outliers, which was not the case for the robust group and explains the higher than expected mean. It must be remembered that this group only contained 12 participants and so is prone to skewed results. Similarly, it is also unexpected that the values for lowest risk of falls were achieved by participants classified as 'pre-frail' and 'frail'. The relationship between lower falls risk score and higher maximum grip strength is also weakly correlated on both measures: ($r_s = -0.317$, $n = 202$, $p \leq .001$ and $r = -0.266$, $n = 203$, $p \leq .009$).

4.6.5 Short Falls Efficacy Scale – International (Kempen *et al.*, 2008)

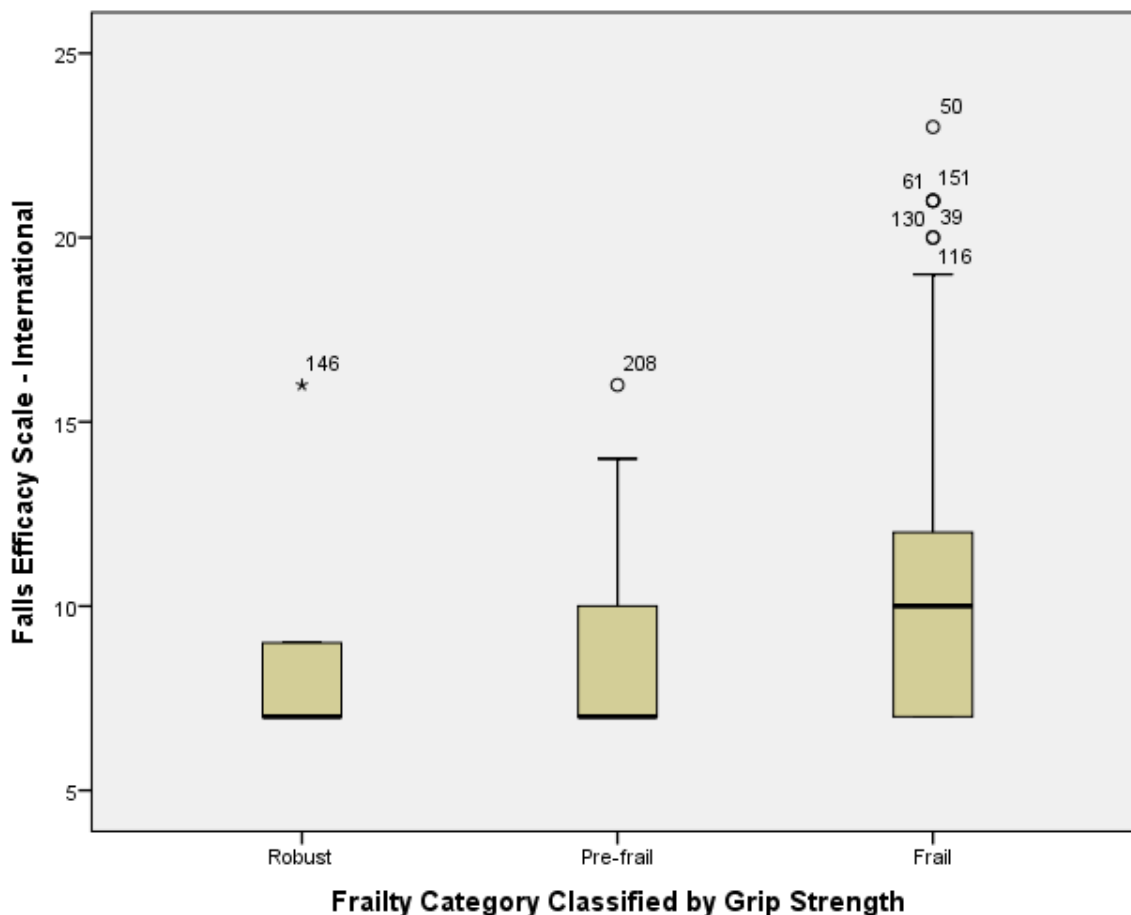


Figure 11 Box plot: Short Falls Efficacy Scale – International (Kempen *et al.*, 2008) by frailty category

The Short FES-I (Kempen *et al.*, 2008) demonstrates a pattern of increasing (and so less favourable) outcomes by frailty category (Figure 11), however the median score for both 'robust'

and 'pre-frail' group is the lowest achievable score of 7. The mean scores are 9.2 and 8.6 for 'robust' and 'pre-frail' groups respectively and it is only in the frail group that the mean value is elevated at 10.4. The more favourable FES-I (Kempen *et al.*, 2008) scores (expressing lower concern) and higher maximum grip strength (and so decreased lower frailty classification) follow the patterns of the above measures with weak correlation, however possibly due to the smaller sample size produces lower levels of significance: ($r_s = -0.219$, $n = 132$, $p \leq .012$ and $r = -0.142$, $n = 132$, $p \leq .104$). All three frailty categories have participants scoring the minimum possible value of 7. Only the 'pre-frail' and 'frail' categories have participants with a high concern about falling that are not outliers (Figure 11), and in these categories the increasing standard deviation illustrates the greater range of responses.

4.7 Baseline Description of Participants

The physiological and functional measures of health presented above describe the average STEER Course participant as female, aged in their late seventies and having a BMI that can be classified as overweight and a systolic blood pressure indicative of hypertension. It was not a homogenous group, however, and a range of measures was recorded for the full sample. Baseline functional measures were also examined in gender-stratified groupings. This produced similar outcomes for measures reliant on lower body strength but lower scores for women when upper body strength was tested. Despite using gender-adjusted grip strength values, levels of frailty were higher amongst women than men. There were weak, but significant, associations between increased grip strength and more favourable functional outcomes for all measures using both parametric and nonparametric statistics, except for the FES-I (Kempen *et al.*, 2008) when tested using Pearson's correlation coefficient.

4.8 Pre/Post-Test Changes

4.8.1 Physical Descriptors – Pre/Post Test

The physical descriptors were used as a screening tool and not repeated at STEER Course completion or six-month follow up, therefore no analysis of change is possible.

4.8.2 Functional and Frailty Status Descriptors

The descriptive statistics related to the changes in the outcome measures used to present the functional abilities and frailty status of participants are presented below at three time points (Table 24). Measurements were taken on the first week of the STEER Course (baseline), on the

final session of the STEER Course (Course completion) and six-months after completing the Course (six-month follow-up).

All measures, except for the Falls Efficacy Scale – International (Kempen *et al.*, 2008), followed a similar pattern with respect to retention and completion of the measures. At baseline, data were held for at least one measure for 130-132 women and 68-73 men, at Course completion this dropped to 103-105 women and 53-61 men, and at six-month follow-up the values were 73-74 women and 46-48 men. The Falls Efficacy Scale (Kempen *et al.*, 2008) had difficulties with implementation at some sites (discussed earlier). This resulted in 91 women and 45 men contributing baseline scores, this dropped to 60 women and 28 men at Course completion but rose to 69 women and 42 men at six-month follow-up. Parametric (Paired T-Test) and nonparametric (Wilcoxon signed rank) tests were applied to change in the mean and median scores compared to baseline values, respectively. The functional status outcomes in Table 24 are discussed in Sections 4.8.3-4.8.4.

Table 24 Functional status outcomes at three time points

| Course Completion and Six-Month Follow Up Functional Outcome Measures | | | | | | | | |
|---|---------------------|----------------------|--------|-----------------|---------------|--------------------------------|-----------|------------------------------------|
| | Time Point | Wilcoxon Signed Rank | | | Paired T-Test | | | |
| | | N | Median | Z, <i>p</i> | N | Mean Change from Baseline (SD) | 95% CI | <i>t</i> value |
| Average Single Leg Stance - s | Course Completion | 165 | 13 | -8.8, ≤ .001 | 161 | 4.0 (4.7) | 3.3 – 4.8 | $t_{160} = 10.8,$ $p \leq .001$ |
| | Six-Month Follow Up | 120 | 13 | -6.4, ≤ .001 | 115 | 3.5 (5.1) | 2.6 – 4.4 | $t_{114} = 7.4,$ $p \leq .001$ |
| Sit to Stand Transfer - reps/30s | Course Completion | 165 | 13 | -9.3, ≤ .001 | 161 | 2.1 (2.0) | 1.8 – 2.4 | $t_{160} = 13.1,$ $p \leq .001$ |
| | Six-Month Follow Up | 120 | 13 | -6.0, ≤ .001 | 115 | 2.0 (3.2) | 1.4 – 2.6 | $t_{114} = 6.6,$ $p \leq .001$ |

4.8.3 Average Single Leg Stance

Both female and male STEER participants demonstrated an increased ability to balance on one leg by the end of the Course. As discussed elsewhere, this test has a potential ceiling effect as a number of participants achieved the maximum score of twenty seconds at all three time points. Table 24 presents the change values in single leg stance for the whole sample. The paired-t test demonstrated a mean improvement of 4 seconds at Course completion, which only reduced by 0.5 seconds at six-month follow-up. The increased median score of 13 seconds for the combined sample, using the Wilcoxon signed rank, was maintained at six-month follow up. When considered as a combined sample the change in mean and median scores compared to baseline are all considered statistically significant ($p \leq .001$ in both parametric and nonparametric tests - Table 24).

4.8.4 Sit to Stand Transfers

The number of sit to stand repetitions completed by participants followed a similar pattern to single-leg balance, detailed in Table 24. At baseline the scores for women were marginally higher and both genders showed improvement by the end of the Course – on average 2.1 repetitions more for women and men. Similarly to the single leg stance, changes in mean and median scores (Table 24) were considered significant ($p \leq .001$) in the paired-t test and Wilcoxon signed rank tests, respectively. The values at Course completion and six-month follow up are almost identical (Table 24), but with a reduced confidence interval (CI 1.4-2.6).

Table 25 Frailty and falls measures at Course completion/six-month follow-up

| Course Completion and Six-Month Follow Up Falls and Frailty Measures | | | | | | | | |
|--|---------------------|----------------------|--------|---------------------|---------------|------------------|-------------|----------------------------------|
| | Time Point | Wilcoxon Signed Rank | | | Paired T-Test | | | |
| | | N | Median | Z, p | N | Mean Change (SD) | 95% CI | t value |
| Max. Grip Strength - kg | Course Completion | 160 | 24 | -7.8, $p \leq .001$ | 160 | 2.2 (3.1) | 1.7 – 2.7 | $t_{159} = 8.8$, $p \leq .001$ |
| | Six-Month Follow Up | 117 | 24 | -5.6, $p \leq .001$ | 117 | 2.1 (4.1) | 2.6 – 4.4 | $t_{116} = 5.6$, $p \leq .001$ |
| | | | | | | | | |
| Falls Risk Estimate - % | Course Completion | 163 | 41 | -5.3, $p \leq .001$ | 158 | -5.2(12.0) | -7.1 – -3.3 | $t_{157} = -5.5$, $p \leq .001$ |
| | Six-Month Follow Up | 122 | 53 | -3.4, $p = .001$ | 116 | 3.9 (14.3) | 1.3 – 6.5 | $t_{115} = 2.9$, $p = .004$ |
| | | | | | | | | |
| Falls Efficacy Scale (Score possible: 7 (low concern) – 28 (high concern)) (Kempen <i>et al.</i>, 2008) | Course Completion | 111 | 8 | -1.8, $p = .077$ | 55 | -0.4 (2.4) | -1.0 – 0.3 | $t_{54} = -1.1$, $p = .264$ |
| | Six-Month Follow Up | 88 | 8 | -1.0, $p = .334$ | 76 | -0.2 (3.5) | -1.0 – 0.6 | $t_{75} = -0.5$, $p = .651$ |

4.8.5 Maximum Grip Strength

As discussed in the analysis of baseline characteristics, the difference in mean grip strength scores between men and women was not unexpected. The scores at Course completion and six-month follow up produced similar patterns of increase and near maintenance as the single leg stance and sit to stand transfers. The combined sample had an improvement in mean score of 2.2kg, with men having a greater deviation in scores from the mean (Table 25). The decrease between Course completion and six-month follow up was very slight at 0.1kg. When examining the median, it is maintained at 24kg for the combined sample and both repeat tests. The values for the range of scores show an increase in both minimum and maximum values at Course completion, which is maintained at six-month follow up. At both time-points the change is considered significant and agreement is achieved using nonparametric and parametric analyses (Course completion: $Z = -7.8$, $p \leq .001$, $t_{159} = 8.8$, $p \leq .001$, Six-Month follow up: -5.6 , $p \leq .001$, $t_{116} = 5.6$, $p \leq .001$).

4.8.6 Falls Risk Estimate (FRE)

The FRE requires a decrease in score to represent improvement. At baseline the mean score for women represents a 'moderate' risk of falling and at the upper limit of 'low' risk for men (Kinesis Health Technologies, 2014) with a large range of results from 10% to 99% (Table 15). At Course completion the mean scores for both sexes are within the range for low risk of falls with no participants being rated over 89% risk (which, however, remains in the 'very high risk' category). At six-month follow up, however, there is an increase in FRE. For women the mean score now exceeds the baseline risk at 58.0%, compared to 51.5% and for men it has returned to 0.4% lower risk than the baseline value (Table 25). This is the first variable to produce a worsening outcome at six-month follow-up than at baseline. Analysis of the change in outcomes produced agreement using parametric and nonparametric measures at Course completion ($t_{157} = -5.5$, $p \leq .001$, $Z = -5.3$, $p \leq .001$), with the negative values demonstrating a reduction in FRE as a positive outcome, and significance is maintained in the outcomes at six-month follow-up (Table 25).

The QTUG™ (Kinesis Health Technologies, 2014), which produces the FRE, uses algorithms which are not publicly available but that use age as part of its calculation (Kinesis Health Technologies, 2014) – it is possible that within a nine month period between baseline and six-month follow a participant will have had a birthday and so the increased age might be contributing to the increased risk score.

4.8.7 Falls Efficacy Scale – International (Kempen *et al.*, 2008)

As discussed elsewhere the minimum possible score for the Short FES-I (Kempen *et al.*, 2008) is 7 and represents ‘low concern’ about falling up to and including scores of 8. All data is highly skewed towards the low scores and suggests a ceiling effect of this assessment. There is a very marginal decrease in mean scores at Course completion, with slight increase at the point of six-month follow-up. These changes are too small to infer any change linked to the STEER Course and the results are not significant (Table 25). Fear of falling has been addressed in the qualitative part of this study, and the lack of information provided by this measure will make the interview findings even more valuable to the study.

4.9 Change Data Summary

The measures of grip strength, sit to stand transfers and single leg balance all show improvement at Course completion, which is largely maintained at six-month follow up. There is, however, a large loss to follow up between Course completion and six-month follow up and it raises questions about the relative abilities of participants who return to engage in the follow-up testing, this is discussed further in the next section (4.10). The falls measure using the QTUG™ (Kinesio Health Technologies, 2014) showed improvement in the period of the STEER Course which is not maintained, returning close to baseline values at six-month follow-up. As discussed above, this could be due to the algorithms used to calculate values being largely based on age, but it is difficult to determine this as the exact algorithm is not available. The outcomes using the Short FES-I (Kempen *et al.*, 2008) suggest it is not best suited to capturing the views of STEER participants and it is worth identifying more acceptable measures for this group.

4.10 Loss to Follow Up Analysis

The characteristics of participants who were lost to follow up were analysed for differences at their baseline functional measures. Participants were divided into three groups based on data availability at baseline, Course completion and six-month follow-up (Table 26).

Table 26 Loss to follow up characteristics

| Loss to Follow Up Group Characteristics | | | | | | | |
|---|---------------------|------------------------|------|--------|--|----------|----------|
| | Data Availability | Descriptive Statistics | | | Difference in Groups – Kruskal Wallis H Test | | |
| | | N | Mean | Median | Mean Rank | <i>H</i> | <i>p</i> |
| Max. Grip Strength - kg | Baseline | 33 | 19.6 | 19.0 | 80.4 | 6.44 | 0.040 |
| | Course Completion | 54 | 21.9 | 20.0 | 100.5 | | |
| | Six-Month Follow Up | 117 | 23.6 | 22.0 | 109.7 | | |
| | | | | | | | |
| Average Single Leg Balance - s | Baseline | 33 | 3.7 | 2.0 | 67.7 | 14.18 | 0.001 |
| | Course Completion | 55 | 9.3 | 7.0 | 111.7 | | |
| | Six-Month Follow Up | 117 | 8.6 | 7.0 | 108.9 | | |
| | | | | | | | |
| Sit to Stand - reps | Baseline | 32 | 9.4 | 9.5 | 75.9 | 8.79 | 0.012 |
| | Course Completion | 55 | 11.3 | 11.0 | 114.0 | | |
| | Six-Month Follow Up | 117 | 10.9 | 11.0 | 104.4 | | |
| | | | | | | | |
| Falls Risk Estimate - % | Baseline | 34 | 55.7 | 55.5 | 122.6 | 8.90 | 0.012 |
| | Course Completion | 55 | 45.6 | 44 | 85.2 | | |
| | Six-Month Follow Up | 115 | 50.9 | 49 | 105.7 | | |

| | | | | | | | |
|---|---------------------|----|------|-----|------|------|-------|
| | | | | | | | |
| Falls Efficacy Scale (Possible scores 7-28) (Kempen <i>et al.</i>, 2008) | Baseline | 21 | 9.7 | 9.0 | 75.6 | 0.90 | 0.636 |
| | Course Completion | 39 | 9.4 | 9.0 | 66.2 | | |
| | Six-Month Follow Up | 76 | 10.0 | 9.0 | 67.7 | | |

The Kruskal-Wallis H test was used as a nonparametric analysis of variance between the groups based on their status regarding course completion (Mackridge and Rowe, 2018). By grouping participants this way there are significant differences between the three groups (Table 26), with the exception of the Falls Efficacy Scale (Kempen *et al.*, 2008), which has previously been discussed regarding its poor completion rate. It should be noted that while the participants who did not complete the Course had the poorest measures at baseline, the most favourable ones were attributed to those who completed the Course but did not return for follow up testing for all measures except maximum grip strength.

4.11 Mixed Methods Analysis of the Experience of Being a Participant on the STEER Course

4.11.1 Introduction

This section presents the findings from the mixed methods analysis which was adopted to address the following research questions:

3. What is the experience of attending a frailty-prevention programme consisting of education and exercise within a fire service setting?

4. What is the experience of older adults engaged in a frailty prevention intervention in relation to:

a. activity participation and engagement,

b. physical health and mental well-being,

c. interactions between activity, physical health and mental well-being?

As is discussed in Section 4.11.2, the entire population in the mixed methods sample were living with pre-frailty or frailty. This has allowed the analysis to expand beyond the intended consideration of people engaged in a frailty prevention intervention, to those already experiencing pre-frailty and frailty.

The mixing of methods occurred in two ways; during data collection, and data analysis. Participants engaged in semi-structured interviews, within which there were questions that explored their reaction to, and understanding of, their own quantitative outcome measures. Secondly, while compiling the analytic framework, each participant's interview data were considered alongside the baseline and outcome data held for the person.

The study design used principles of realistic evaluation (Pawson and Tilley, 1997). The 'what works?' element of this relied on the quantitative outcomes, whereas the 'for whom, and in what circumstances?' was understood by synthesis with the qualitative data.

4.11.2 Summary of Part B Participants

Eight participants (seven female, one male) participated in the interview component, contributing nineteen interviews. All participants completed interviews at baseline and STEER Course Completion (reported as: twelve-week), and three returned for follow-up testing and contributed

a final interview (reported as: six-month). Participants 4 and 5, and 6 and 7, completed their interviews together but their contributions were separated and considered as discrete pieces of data (as discussed in Section 3.14.4). The evaluation of the STEER Course primarily occurred during the interview at Course completion and so all eight provided perspectives on the experience of attending the intervention. Regarding frailty status at baseline, four participants had pre-frailty as classified by both grip strength and QTUG™ (Kinesis Health Technologies, 2014) and one participant met the criteria for frailty on both measures. The literature review (Section 2.2) demonstrated that grip strength as a single measure could identify frailty. Based on this, three participants had frailty and the remaining five had pre-frailty at baseline, when the majority of experiential data were captured (see Section 4.11.4). This has allowed the analysis to go beyond the anticipated consideration of the experiences of people engaged in a frailty-prevention intervention, and provide insight into people living with pre-frailty or frailty. Each participant's 'case' was summarised to ensure the key features of their experience contributed to the analysis, as well as examining their specific quantitative outcome measures. Their key characteristics are presented, however due to the small number of participants and the potential for identification of cases details such as age and gender are not included:

Table 27 Participant key outcomes

| Participant | Interviews Completed | | | Frailty Status (Grip) | | | Frailty Status (QTUG™ (Kinesis Health Technologies, 2014)) | | |
|-------------|----------------------|-----------------|---------------|-----------------------|-----------------|---------------|---|-----------------|---------------|
| | Baseline | Twelve -Week | Six- Month | Baseline | Twelve -Week | Six- Month | Baseline | Twelve -Week | Six- Month |
| P1 | X | X | X | | | | | | |
| P2 | X | X | X | | | | | | |
| P3 | X | X | | | | N/A | | | N/A |
| P4 | X | X | | | | N/A | | | N/A |
| P5 | X | X | | | | N/A | | | N/A |
| P6 | X | X | | | | N/A | | | N/A |
| P7 | X | X | | | | N/A | | | N/A |
| P8 | X | X | X | | | | | | |

Key

| | |
|--|---------------|
| | 'Frailty' |
| | 'Pre-Frailty' |
| | 'Robust' |

4.11.3 Theoretical Approach to Analysis

A more detailed consideration of the approach to the research design and how it informed the data analysis plans was provided in Section 3.13. To ensure relevant content was examined, the analysis deliberately sought content relating to the research questions, however these were broad in scope which allowed for a range of experiences to be captured. In the initial phases an 'Other' category was created, to ensure that potentially important findings were not excluded due to poor fit with the pre-determined areas of interest. However, this proved an unwarranted concern and all data were assigned to categories as originally anticipated. More detail regarding this process follows in Section 4.11.4.

The analysis was largely completed without consultation of the evidence base. This occurred subsequently, to complete the discussion chapter, and allowed a deeper level of interpretation. However, due to awareness of literature relating to frailty, occupation, health and well-being, as well as professional identity as an occupational therapist, there is potential influence of this knowledge on the concepts that were deemed important. As an attempt to minimise any researcher bias and establish credibility, a reflective log was kept throughout data collection and analysis (Koch, 1994). Furthermore, coding and theme development was checked with the supervisory team. The impact of bias is discussed further in Section 5.8.4 and extracts of the reflective log can be found in Appendix L. An example of this was when the first two interviews contained experiences relating to bereavement, which appeared important. In order to ensure subsequent interviews were not led, the reflective log identified bereavement as a potentially interesting topic but ensured awareness of the need to not direct discussion onto that topic.

4.11.4 Stages of Analysis

The theoretical and practical considerations relating to transcription and analysis were described in Section 3.13.2. This section considers more detail about the stages of applying the framework

1. The initial framework divided codes into domains of 'activity', 'physical health and mental well-being' and 'evaluation of the STEER Course'. These were pre-determined areas of interest based on the research questions, and relevant content was ensured within the semi-structured interview schedule (Appendix B) (Rationale discussion in 3.13.2). The coded data from transcripts was assigned to the domains.
 - The first section (4.12) of analysis was to consider content which provided evaluation of the experience of the STEER Course as an intervention, including wider consideration of changes experienced during the period of participation in the Course.
 - The second section included experiences related to activity (Section 4.13).
 - The third section explored experiences of physical health and mental well-being (Section 4.14). This stage included the quantitative outcomes for each participant and summarised the experience for that participant based on all available data.
2. Coded data were grouped together (between cases) and themes then created. A review of themes for their fit with the coded data and full dataset was completed. Comparisons were also made between the 'activity' and 'physical health and mental well-being' datasets to confirm extracts had been placed in the set most representative of their content.

- Presented in a descriptive format to illustrate how they contributed to later stages of analysis.
3. Deeper analysis of these themes produced the index themes. The stages of this analysis are considered in Section 4.15.1.
 - Presented with explanatory and interpretative content.

Some modifications to the planned analysis occurred. On review of the transcripts and codes generated the data demonstrated that most content relating to activity participation, physical health and mental well-being occurred during baseline interviews. At twelve-week and six-month interviews there was either repetition of discussion (confirming accuracy of what was captured at baseline), or omission of this information. Reflection on the interactions with participants supported the view that participants remembered their initial discussions, particularly on topics such as the processes of bereavement or caring for others, and so did not repeat them. The interview schedules (Appendix B), had been designed with a greater number of questions at follow-up that focused on changes in experience, and evaluation of the intervention, and so latter interviews focused on these areas. Where there was overlap of the coded data, such as a person discussing how their health affected an activity, the data were assigned to the dataset in which they best represented (for example a discussion that focused on the experience of an activity, with secondary mention of a physical limitation, would be placed within the 'activity' dataset).

The table below outlines the first part of analysis which allowed the division of coded data into domains and the over-arching themes:

Table 28 Case-by-case framework

| Domain: | 1. Intervention | | 2. Activity | | | | 3. Health and Well-Being | | | Participant Summary | Participant Outcome Measures |
|---------------------|--------------------------------|--------------------------|----------------------------------|---------------------------|-----------------------------------|----------------------|---|------------------------------|----------------------|---------------------|------------------------------|
| Over-arching Theme: | Experience of the Intervention | Perspectives on Outcomes | Current Occupational Experiences | Barriers to Participation | A Changed Occupational Experience | Adaptation to Change | Current Perception of Health and Well-Being | Perceptions of Deterioration | Management of Health | | |
| Participant 1 | | | | | | | | | | | |
| Participant 2 | | | | | | | | | | | |
| Participant 3 | | | | | | | | | | | |
| Participant 4 | | | | | | | | | | | |
| Participant 5 | | | | | | | | | | | |
| Participant 6 | | | | | | | | | | | |
| Participant 7 | | | | | | | | | | | |
| Participant 8 | | | | | | | | | | | |

4.12 Framework Analysis of the Intervention Domain

The 'Intervention' domain collated coded data that would address the research question 3, "What is the experience of attending a frailty-prevention programme consisting of education and exercise within a fire service setting?" Content assigned to this domain was grouped and two over-arching themes generated with codes relating to; experience of the STEER intervention, and perspectives on outcomes. Data were also compared case-wise by row, to summarise the experience for each participant and provide the context of their experience with the inclusion of quantitative outcome measures.

4.12.1 Experience of the Intervention

Within the over-arching theme of 'experience of the intervention', responses were coded, and two sub-themes created. These were; experiences due to the format of the intervention, and those related to the setting.

4.12.1.1 Format of STEER Intervention

There were many positive experiences detailed about Course participation and all participants described a favourable experience of attending the STEER Course. The most commonly reported appreciated aspect of the Course was that of it being a group intervention. The benefit of a group intervention was complex, with its success being attributed to multiple functions of the group such as companionship and a sense of being part of a team, with resulting increased motivation:

P3: That's been great because it's the companionship and working with others, gives you the impetus to do it. [...] It kept being said, "I find this difficult on my own" (12-week)

A feature of the group dynamic was that of an appreciation of the perspective of the other participants. As will be discussed in the following sections (4.13-4.16), participants were responding to, and mitigating, a functional decline they observed. The shared experience of peers provided a sense of reassurance about the situation, and was a trusted source of expertise:

P4: You realised and you realised you weren't the only one who was doing...suffering. (Twelve-week)

While the group dynamic was valued by all, caveats were raised. For one participant there was acknowledgement that the group interactions were so important that it was anticipated that a less successful dynamic would have been problematic:

P7: It's been very friendly, but you can always get a person, that's, sort of, a stick in the mud compared with everyone else but we haven't got anyone like that! (Twelve-week)

Comparison with other group members was also a facet of the group experience. It had both motivational and disheartening elements and was suggestive of the success of the group dynamic being reliant on participants having similar, perceived, abilities:

P8: It's great to be in company of other people in my age group. Um, some of whom are very mobile [...] but it's easy to get disheartened with somebody like that around! (Six-month)

The experience of completing the intervention in the group setting might encourage comparisons that have a basis in perceived abilities as opposed to objective measures; in the example above there were minimal differences in quantitative outcomes.

The education component was frequently highlighted as a positive experience, which also linked to the group dynamics. It appears the informal delivery style supported this:

P8: The talks, were excellent, because they got us thinking, and talking. The fact that we were in a group was great, because people would, you know, pipe up with their own experiences and recommendations, things like that. (Twelve-week)

A feature of the education component was that often the content was not new knowledge, yet the reminder and opportunity to discuss was still valued:

P2: No, I think it's, it's I think the talks are very good, a lot of it, as you're being told you think, "Yeah, I know that", "I know that", but as I say, it's quite important to have it refreshed, the important things." (Twelve-week)

P1: Uh, well, the lectures gave you food for thought with all the things they talked about - various ones, and some you knew, some you didn't." (Twelve-week)

The education component was often reflected upon first and appeared to be described as the more valuable of the two aspects of the STEER Course. However, the exercise component also received positive feedback. Again, the group dynamic featured and was identified as providing motivation:

P2: I enjoyed the exercise because we weren't competitive, but we, it was quite nice to see how we "eked" on each other. (Twelve-week)

Participants' experiences were largely very positive and only a few issues were raised. The only common area for improvement was related to the pre-course information. Several participants felt unaware of what would be involved in the Course:

P6: [Unprompted] It's [STEER] been entirely different to what I expected! [...] I never knew-- realised that we'd have all of these talks, at the beginning on diet, and danger around the home and all that sort of thing. I imagined there would lots of exercises for balance. (Twelve-week)

P2: I had no idea, really. I didn't know how difficult it would be. (Twelve-week)

P8: Um, just that I think I wish I'd known more about how the Course was run, before I started. (Twelve-week)

It is noted that although no participant felt they had a good understanding of what to expect from the Course, it was not a barrier to recruitment. It is worth HFRS considering whether this is a potential block to wider recruitment from the community, as this study can only capture the views of those who overcame any such barriers.

All other areas for improvement of the intervention were based on individual preferences. These included a lower level Course with its goal to be ready to complete the STEER Course, and tailoring of exercises to address specific limitations:

P4: Just one thing, um, when you come here and write down all your - you answer all the questions - I've got a sore shoulder and sore foot, and I thought that, just one thought, was that you was going to have exercises that were 'specially for you. (Twelve-week)

This concern, however, is countered with feedback from another participant who reflected on the Course facilitators' ability to support participants with variable ability levels:

P1: I was watching the way they treated other people who could not do some of the exercises and, uh, they were very patient in guiding them through and to help to give them confidence. (Twelve-week)

The areas for improvement are presented with caution as Participant 4's repetition and qualification of statements suggests it might have been difficult to raise negative feedback, and it is possible that this was a barrier for others. The large volume of positive feedback, however, is supportive of a highly acceptable, valuable and enjoyable experience.

4.12.1.2 Setting

It was an *a priori* assumption of this study that the unusual setting of the intervention in the appliance bay of an active fire station, facilitated by current fire service staff, might have had influence on the experience of the STEER Course, compared to similar interventions often located in community spaces and delivered by staff associated only to health promotion work. A range of responses were noted.

The only participant who found the setting more challenging had openly discussed finding the level of the Course demanding at the start, potentially influencing their perception. The only other area of concern noted by a participant demonstrated the awareness participants had for the primary purpose of the fire station. They were unaware that the staff delivering the Course were not on active duty at the time:

P5: If they were called out, would they just have to leave us and go? (Twelve-week)

The remaining discussions about the setting were very positive and involved perceptions of the fire service as a whole, and qualities of respect and professionalism associated with fire service. There was support that the setting allowed delivery of a trusted, yet empowering, intervention with qualities that transferred to participants:

P3: Um, and I think actually turning up in the fire station, um, it think it sharpens you a little mentally, um, not that that's the purpose of fire stations but it, it means, 'we mean this'. (Twelve-week)

As part of consideration of the effect of the setting, many participants highlighted a positive experience of the STEER Course facilitators. The fire service was, perhaps, not as routinely engaged with people in non-emergency situations and yet their reputation and perceived skills made participants highly receptive to their input:

P2: I have the utmost respect for the firemen, and you put your trust in their abilities to teach you, and that's all that, to me, is important. (Twelve-week)

P8: No, it was really good and it was wonderful to have contact, on tap, with firefighters - they are a wonderful breed of people! (Twelve-week)

The influence of the fire service setting was not identified by all, but for those who did describe influences, they were largely linked to the perceptions of the role and meaning of the fire service and its staff. The limited negative feedback must be considered in the context of potential

reluctance to speak honestly within an interview occurring on fire service property, but overwhelmingly the staff were described as professional and highly skilled.

4.12.2 Perspectives on Outcomes

The quantitative data were used within the interviews to elicit perspectives on the outcomes achieved during STEER Course participation. The first sub-theme was coded as 'Experience of Outcome Measurement' and includes the acceptability of the measures used. The second sub-theme captured broader subjective outcomes that were identified during the period of participation.

4.12.2.1 Experience of Outcome Measurement

All interview participants had experienced outcome measurements at baseline, twelve-week and six-month follow-up (if attended). This is the first consideration of a discrepancy between perceived frailty status and more objective classifiers of frailty. This manifests in a variety of ways throughout the findings, and in this section relates to measured values that are in opposition to perceived abilities. The measure most frequently commented upon was the Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)). This provoked a sense of uncertainty both about the meaning of results and also the accuracy of what it was capturing. For Participant 1 there was a discrepancy between the QTUG™ (Kinesis Health Technologies, 2014) frailty score worsening when all other measures improved. This was exacerbated by a self-assessment of improved performance in the QTUG™ (Kinesis Health Technologies, 2014) test:

P1: Oh! Why's my frailty score gone up? I just wondered, really, when everything else has sort of improved, why that had gone up, not down? I mean, I got up straight away that time [referring to QTUG™ (Kinesis Health Technologies, 2014) test procedure] (Twelve-week)

Other participants also prioritised subjective assessment of their own walking ability and balance, in comparison to others, to question the measure. Participant 6 and 7 were interviewed together and both had QTUG™ (Kinesis Health Technologies, 2014) scores that placed them in the 'robust' category at twelve-week follow-up. They both expressed disbelief in the scores. Self-assessed function, evidenced through daily activity completion, was taken as more representative than any measure:

P6: Yeah, and, uh, various things, but the frailty thing, and that, [exhales], comparing [P7's name] to mine - I don't think it's working right!

P7: Because I'm more frail than you! I almost topple over, I don't fall over but I think...
[laughs].

The discussion above highlighted that Participants 6 and 7 had perceptions of their own relative frailty status, which was not reflected in the measure. This was discussed by another participant in relation to her QTUG™ (Kinesis Health Technologies, 2014) classification. There was uncertainty over how to interpret the QTUG™ (Kinesis Health Technologies, 2014) score, which is important for the fire service to address. However, even when the classification was explained, there remained a discordance between the perception of someone who has frailty and their own status:

P5: What about these - the frailty score - I was quite surprised that it's - it's 88% - is that quite high? So I'm frail - how is that judged, that I'm frail? It's just I was shocked when I saw it. It's just I've not thought of myself as being frail. (Twelve-week)

Participant 5 was classified as having frailty on both grip strength and QTUG™ (Kinesis Health Technologies, 2014) measures at all time points. Despite the measures, having frailty was not something Participant 5 had considered, and their perception of frailty was of someone with a greater limit in walking speed and physical function. This aligns with the experience above, where experiential assessment of function is deemed more trustworthy than objective measures. The language used in this example highlights the measurement process created an awareness of a frailty status, which was interpreted as 'being frail'. The potential consequences of perceiving oneself 'as frail' are discussed further in Section 4.14.

There was very limited discussion about benefits of outcome measurement. Combined with the limitations in specific outcome measures highlighted in the analysis of quantitative outcomes, the measures used and their acceptability and utility to participants are worth reviewing by HFRS. Additionally, participants value their own assessment of ability over measured values and consider this more accurate. This suggests that not only are the measures used in this study not capturing the full experience of living as a person at risk of frailty, but that acceptable measures for participants would need to incorporate self-assessment.

4.12.2.2 Personal Outcomes

The most common code within subjective outcomes was that of reactions to the Course concluding. This was not a direct question within the interview schedule and yet all participants expressed thoughts and feelings about it. For some the intervention had become a meaningful activity in its own right and several people expressed sadness or loss at the prospect of not being able to return the following week:

P2: This [the STEER Course] was quite important! This was quite important, and I will miss it! (Twelve-week)

P3: We--we feel very much, as if we're now at a loss. (Twelve-week)

Some participants had arranged replacement activities to maintain either, or both, the physical and social aspects of the Course. One participant was pleased to have the freedom to choose how to spend her time, having felt an obligation to attend:

P8: We can do something else on Tuesday mornings! [Laughs] I'm the sort of person, if I start doing something regularly, after a while I get itchy: "Ooh, I'd like to do something else." (Twelve-week)

A range of subjective outcomes from the Course were reported. Several participants explained how they had directly applied better lifting techniques to daily life. Application of improved outcome measures to daily life was not always immediately apparent:

P1: As I said, balance is probably better than it was, um, it's not the sort of thing you do at home - stand on one leg often! (Twelve-week)

This became easier to value when there was an understood transfer to real-life situations:

P7: One thing - it hasn't been so bad lately, if you go to a theatre and you've got a crowd of people going down stairs - you haven't got anything to hold onto, I was quite conscious at one time - it's not so bad now, and you just wait for it, imagining you're going to topple like a stack of cards! (Twelve-week)

Several participants referenced the value of the education session on hydration, including specific report of reduced medication-use due to an increase in fluid intake:

P2: The biggest improvement, really, was taking more fluids, certainly helped my bathroom problems, and I am now off medication for that, so that's --I'm really grateful for that. (Six-month)

This specific example occurred in the six-month interview. As only three participants completed interviews at the final time-point there was a missed opportunity to determine if any other outcomes, linked to longer-term behaviour change, occurred for other participants. This is discussed in more detail in Section 5.8.3. This outcome is important as it demonstrates something that is highly acceptable to the participant, as well as having known benefits to reducing risk of adverse events.

4.12.3 Summary of the Intervention Domain

The intervention domain contained participant experiences that related to the format of the intervention, the experience due to the setting, and perspectives on both the formal outcome measures and personal outcomes noted. The intervention received very favourable feedback with value held in the group intervention and the interactions that afforded. The education component was also frequently mentioned as informative and appreciated, with an interesting feature being that information was frequently reported as not new knowledge, yet still valued. Participants had a less positive experience of outcome measurements. Some participants expressed uncertainty over ability of the outcome measurements to accurately classify their frailty status. Furthermore, the process of completing the measurements prompted insight into a potential discrepancy between the measures used to identify frailty in this study and the personal conceptualisation of the deficits and abilities attributed by participants to an imagined person living with frailty. Participants' conceptualisations of their own frailty status is discussed further in the following sections (4.13-4.16).

4.13 Framework Analysis of the Activity Participation Domain

The activity participation domain includes content that will be used to discuss and answer research question 4A, “what is the experience of older adults engaged in a frailty prevention intervention in relation to activity participation and engagement?” At the point of subdividing the framework into domains the term ‘activity’ was chosen to represent all discussion about ‘doing’ described by participants. ‘Activity’ had been used throughout the interviews due to an assumption that ‘occupation’ might be misinterpreted as relating to employment history as opposed to the broader construct detailed below. Following the subdivision, coded data were reviewed to determine if people were discussing general activities available to the population, or rather their experience of a, “personally constructed, non-repeatable experience... [and] a subjective event in perceived temporal, spatial and socio-cultural conditions” (Pierce, 2001 p. 139). The latter was more representative and aligned with Pierce’s definition of occupation (2001). More theoretical consideration of the experience of occupation is included in the following Discussion chapter (Section 5.5).

The codes within the domain of ‘Activity’ were grouped together into four themes that reflected the experience of engagement in occupation when living with pre-frailty or frailty, due to the measured frailty status of the sample. The first, ‘Current Occupational Experiences’ described the occupations with which participants engaged. The second theme ‘Barriers to Participation’ combined all factors that were acting on each participant’s experience of participation. There was frequent discussion of occupation as having a developing or changing experience as a consequence of these barriers, which was grouped as the ‘Changed Experience of Occupation’. The final theme ‘Adaptation to Change’ examines the methods employed by participants to mitigate those changes.

4.13.1 Current Occupational Experiences

The interviews used questions about daily routines and perceived value, enjoyment or importance of activities, as a starting point regarding the occupations engaged with by each participant. The question about daily routines was used to ensure that participants considered more routine activities, as well as those anticipated to be listed as most important or enjoyable. Participants tended to focus on complex activities completed away from home, often combining social contacts with physical activities. There was a routine and rhythm for most participants, blending needed self-care and home-care occupations, with social and physical activities away from home. There was description of rich and full occupational lives, irrespective of any differences in frailty

status and other functional measures, where complex activities away from home were usually discussed first, within which space needed to be made for the more routine occupations:

P6: Um, and then, um, some days, we belong to two or three clubs and they meet up with us and go for lunch. Or we might go skittling, I don't go ten pin bowling anymore because I've got the back problem, um, what else do we do?

Most participants focused their discussion on the activities completed away from home. In this example the tempo was influenced by both a weekly structure of formal activities, and it being controlled by the availability of activities that only occurred during school term times. Irrespective of any differences in functional and frailty measures, a range of complex occupations such as line-dancing, tai chi, aerobics, voluntary work, card groups and other social activities were engaged with. This suggests a need to consider function, as represented through activity participation, distinctly from objective measures.

Participants also identified the purpose of those occupational choices being for reasons such as “your brain”, for “friends” and physical activity being for leg strength. The function of occupation for maintaining health was identified by several participants and reflected in personal beliefs held by participants. It was most commonly detailed in beliefs about the desire to remain independent. This independence was imagined in the context of the ability to complete chosen occupations:

P1: Um, I do all my own housework, all my own gardening, I walk the dogs. Um, I do most things myself where I can. Um, and I'd like to carry on doing it that way.

P2: I'd be, ah, yeah, I'd be quite sad not to do my garden. [...] No, I, I, want to be independent. I want to be, be able to do things for myself - in my own time, I'm not saying I want to be Flash Harry, you know, um, but I know my independence is probably the most important.

Further evidence of personal beliefs influencing participants' choice of occupation was in relation to a perspective that sedentary activities are less admissible or acceptable. For some participants this was reflected in an avoidance of sedentary activity. For others there was a sense that time spent in solitary or sedentary occupations at home *was* enjoyable and desired, yet evoked feelings of guilt leading to a conflict between chosen occupations and personal judgments about time-use:

P2: I shouldn't really say that because it's too much time on the sofa, isn't it?!

P8 I spend a lot of time at home and it's bad, but I'm just quite happy and content to do that.

These comments were made at baseline, and while Participant 2 expressed guilt about sedentary activities they also described many other fulfilling physical, social and productive occupations in their week. Participant 8, however, described a greater challenge in finding motivation for those types of activity and no further change in attitude at follow-up interviews. This suggests that increasing engagement in physical or social activity does not occur, solely, in response to awareness of negative effects of inactivity. Rather, the processes occurring are much more complex, instilling guilt or conflict, but not necessarily a change in behaviour.

All participants were able to detail complex occupational lives, despite living with pre-frailty or frailty, with some variability in the level of satisfaction experienced. Within this theme the main challenges for engagement related to an internal conflict between desired occupations and those adopted. The conflicts surrounded; a lack of time to include all chosen activities, perceived functional levels, and the need to adopt 'health-promoting' activities. There were further influences, which have been grouped together within 'Barriers to Participation'.

4.13.2 **Barriers to Participation**

This theme was generated to group together discrete experiences which appear to act on, or modify, the person's sense of being their 'desired' occupational being. The most common of these was the experience of physical symptoms, representative of frailty-related deteriorations, influencing the experience of occupational engagement. Most participants reported awareness of physical health symptoms influencing the way in which they completed chosen occupations, with a focus on increased concern either about the effect on their health, or on the ability to maintain engagement. As is discussed more precisely in the following section (4.14), this is another occurrence of an unnamed manifestation of frailty; where functional deterioration was expected. A specific fear was that emerging symptoms could become prohibitive of the ability to drive, with driving considered essential for freedom and enabling participation in further occupations:

P8: Just getting in a car and being able to go where you want to is a great freedom, and it's, even if it's just locally, it's a great feeling of independence. I'd better watch that.

P1: My one biggest fear is that they [feet] will go really numb and I won't be able to drive. [...] I mean, I'd be lost if I can't drive any more, um, that's your freedom, to do that.

As well as concerns about progressive symptoms having limitations on future participation, there was also awareness of current symptoms causing a fear of falling:

P6: I've got this arthritis and osteoporosis and I get very concerned, now I don't mind walking up steep hills, that doesn't bother me, but going down steep ones I'm always worried - it's on grass and the grass is a bit wet – “I'm going to slip”.

Discussions highlighted that fear of falling was present for participants in a number of activities – namely complex physical and social tasks completed away from home, which, as discussed in the previous section, were central to participants' lives. The perceived falls risk supports the measured frailty classifications of participants. This also supports the proposition considered earlier (Section 4.6.4) that the FES-I (Kempen *et al.*, 2008) was not an appropriate measure when compared to the abilities of the group. As it only asks about basic tasks it is missing the fear of falling present within higher demand tasks like walking on uneven ground or climbing stairs while carrying washing. As mentioned in the 'Intervention' domain (Section 4.12.2.1), there was discrepancy with measured outcomes suggesting poorer function than participants' perceived, and described, level of ability. In the case of fear of falling, however, the chosen measure is not capturing a functional limitation that *was* recognised within participants' experiences.

While changes in health and function due to frailty often directly influenced a person's ability to engage in chosen activities, the health of a spouse, close family member and consequential adoption of care roles by participants also affected occupational engagement. In this situation the need to adopt care roles became an external influence on the type of occupations engaged with. There is a sense of necessity of the role, with consequence for the availability of time for chosen occupations. Care roles also prompted a period of transition when the role ceased due to bereavement:

P2: I'm, you know having to really find my feet and go out and find the big world again.
[...] Big adjustment, big adjustment, yes.

As part of this transition was the change in experience of previously valued occupations, which now are perceived as unavailable as a solo occupation:

P1: I suppose you don't go out for meals and things like you used to, because it's, uh, finding someone to go with.

Finally, there were experiences where external barriers, located within the person's own environment, prevented fulfilment of potential to engage in chosen occupations. For several participants there was an influence of the perspective of family members, usually adult children, of the type of activity that were safe for the participant to complete:

P1: Oh yes, yes! Yes, yes, yes. Whereas my—they [offspring] have banned me from going up steps now, because they said "if you fall off, we've got to look after you" and, uh, because otherwise I would probably quite happily.

With the exception of bereavement and care roles, all of the barriers to participation are linked to the presence of frailty, and its effect on function, for the participant. The consequent experience is discussed in Section 4.13.3

4.13.3 A Changed Occupational Experience

The third theme details the consequences of the barriers detailed above. Universally participants reported awareness of recent change in their experience of occupational engagement. A repeated code was the attribution of ageing, as a more acceptable explanation than frailty, to a reduced endurance to complete occupations at a level previously achieved:

P1: I must admit I suddenly ran out of energy, [...] Oh, I felt my age that day!

P6: Um, but some of that might be age-related. Um, and that's why, up until two years ago I was doing all day walks.

For others there was an awareness of changes in physical capacity in the context of occupation. It is described as a more gradual process, noticed specifically with changes to physical attributes of balance, with consequences for confidence or the overall demand level:

P8: Just ordinary, everyday, things, which I used to absolutely take for granted [...] it's meant ordinary things just become a difficulty.

P2: To improve my balance, basically, and my confidence because, I have started dropping that, as I say particularly when, I said I went up in the loft.

All the descriptions include the application of markers of frailty, such as reduced energy/endurance, strength, mobility and balance (Fried *et al.*, 2001), to daily occupations. Within the theme of 'Barriers' there had been discussion of the effect of care roles on occupational engagement. There was further evidence of a transition occurring within such roles. For one participant while caring for grandchildren there was evidence of an altering means of completing that role, with a shift to more sedentary occupations:

P5: I can't do a lot outside with them, because I can't walk very far - but I used to!

Throughout this section there remains an unnamed, but active, awareness of functional deterioration. The reluctance to consider, or lack of alignment with, the concept of frailty despite

its overt effect on daily life is important to understand. When discussing the 'Changed Experience of Occupation', there was often report of an active response to such changes. These responses have been grouped into the following theme.

4.13.4 **Adaptation to Change**

As discussed above participants generally sought to maintain engagement in chosen occupations when they began to notice an altered experience of occupational performance, due to increasing frailty. The awareness of deterioration in function was a threat to independence. As this has been highlighted as an important goal (Section 4.13.1), an adaptive response was implemented. The most common method was to modify the existing occupation, driven by a belief that continued engagement is the means to maintain independence.

P4: I try to do everything - you find ways of doing things. When you say shopping, I now have two bags, instead of one heavy one.

As well as modifying the method of completing a task, the demand of valued occupations was often reduced to maintain engagement. This was either by shorter duration of engagement or use of different equipment:

P7: I did buy an electric bike, which is a great help, and, uh, so now my ordinary cycle is sitting in the garage.

Similarly, some participants had experienced the need to adapt their means of washing, due to being unable to get out of the bath. This had varying levels of acceptance:

P4: As I said, it's showers now, for me, not baths, uh, because, I couldn't push down on my arms, because of my shoulder, and I was stuck in the bath!

P5: Do you miss having a bath?

P4: Yes!

P5: You see, I don't miss having a bath.

A challenge of finding the right demand level, when adapting occupational engagement, was evident. For some participants there was concern that a high physical demand might make physical symptoms worse. This challenged participants' conviction in their ability to implement adaptive strategies, in some cases prompting complete disengagement:

P4: It's going to get worse, I think, see, I worry about it, you think to yourself, "Am I doing the right thing by exercising?"

While the above processes were largely about limiting losses by adapting existing occupations, there was also one proactive approach identified. In response to an awareness of decreasing function there was a tendency to seek out occupations with understood functional benefits. An example was choosing line dancing and tai chi as occupations with purpose - to improve physical function. Seeking activities that generated social contacts was a common experience, although the level to which a person felt comfortable and desired social interactions varied. There was understanding that social contacts and interactions could be both an obligation and a benefit:

P8: I mean, going to the Women's Institute, I suppose, is something that's, it's only once a month, is important to me, because I'm forced to be sociable.

The adaptations demonstrated were self-initiated attempts to maintain function. This occurred based on perceived functional limitations and a desire to maintain independence and limit losses. Despite these active processes, and high levels of self-awareness regarding changing function, there was no discussion of the term frailty as the driver of the change. Rather, a positive approach to maintain independence in activity was the goal.

4.13.5 Summary of the Activity Domain

The activity domain was determined to include content that detailed participants' experience of completing valued and meaningful activities. The activities were understood during analysis as occupations due to their fit with theoretical definitions of occupation. Largely the focus was on those occupations completed away from home, with the physical activity or social elements appearing most valued and there was an emerging conflict between reporting occupations that were considered health promoting, versus those perceived more negatively due to being sedentary in nature. Participants noticed changes in their patterns of occupational engagement due to barriers such as caring for others, or a reduced physical, and functional, capacity representative of frailty. However, despite this it was usual to maintain participation in personally meaningful occupations, albeit with self-directed and initiated modifications or adaptation to the means of completing the activity and to ultimately maintain independence.

4.14 Framework Analysis of Physical Health and Mental Well-Being Domain

The physical health and mental well-being domain includes all analysis that will inform discussion of the research question 4B, "what is the experience of older adults engaged in a frailty-prevention intervention in relation to physical health and mental well-being?" Initially, the

intention was to consider physical health and mental well-being as separate constructs. However, after the initial coding of data it was identified that physical health and mental well-being were considered as components of an overall health status, centred on the experience of living with an increasing frailty status. For this reason, the analysis is presented with an understanding of an overall health status being the product of levels of physical health and mental well-being.

Analysis of the coded data produced three themes. They were, 'Current Perception of Health and Well-Being', 'Perceptions of Deterioration' and 'Management of Health'.

4.14.1 Current Perception of Health and Well-Being

This theme contained discussions about each participant's understanding of their own health and well-being status, including health beliefs, which influence their perception of health. There was a division in responses. Some participants framed health primarily in terms of health symptoms (although not without mention of the effect on activity), while others conceptualised it in terms of fitness, function, and the ability to complete chosen activities. It was noted that when asked about health status in general, when described in terms of symptoms, *physical* symptoms only were listed. Content about mental well-being, or linked concepts like life satisfaction, were readily engaged with if asked directly. Irrespective of these differences in describing health and well-being, there was a common disconnection between perceptions of health and frailty status. Frailty was not a concept that was accepted, and yet the descriptions of deteriorating function and vulnerability to negative health events match what is known about frailty in the literature.

For those that framed health in terms of fitness, while linking function closely to health, they were perceived as independent constructs:

P6: I would say I'm fit, not healthy. If you understand what I mean?

Interviewer: Can you tell me a bit more about what you mean by that?

P6: Well, I walk, and I, uh, I don't go out on all-day walks any more the most I do now is nine miles, which is like a half-a-day walk. I swim every week. And go to aerobics. Every week. But! I have high blood pressure, uh, I've got osteoporosis, severe arthritis in my lumbar area. Yeah, so, I feel I'm fit but I've got all these other things wrong with me.

As mentioned above, even when the definition of health focused on physical symptoms, the consequence for activity was also included:

P7: I had a heart attack over thirty years ago. And, uh, I had a heart by-pass, and, uh, since then I've been mostly okay, apart from had a hip replacement and I used to go walking with the walking group - can't do it now. This hip's playing up.

The difference in perspective is not explained by functional outcomes as Participants 6 and 7 both demonstrated similarity in both the value, and improvement, of functional measures. What appears more representative is that Participant 6 reported, and perceived, fewer functional limitations in daily life, but more physical health problems and had higher (more severe) frailty classification than P7.

These findings presented above, irrespective of a focus on fitness versus symptoms, illustrate poor alignment between activity levels, perceived health status, and measured functional abilities. This supports the findings already discussed in Section 4.12.2 that STEER is not capturing what is important to participants. It also goes further, suggesting that for people at risk of frailty, measurement of function is not fully representative of the level of health problems experienced, nor the ability to complete chosen activities.

Mental well-being was a concept that was, either offered as a secondary consideration to physical health (including fitness), or only discussed when asked directly. Yet the analysis of the eventual discussions showed a close link between mental well-being and an overall health status. The initial disconnect was not reflected in the supporting discussions. Participants closely linked mental well-being having either causes rooted in, or consequences for, functional ability and physical health. This included a period of poor physical health causing isolation and withdrawal from daily activities. The process of reclaiming or returning to previous activities away from home was identified as requiring effort, but being the catalyst for improving well-being:

P5: Because I know when I was poorly, I was indoors, you begin to give up on things. You've got to make that effort, and say "no, I'm going back to do this", and then you start improving.

Within the discussion about well-being, other external influences on well-being largely were identified and related to bereavement. Bereavement, complicated by other issues, had a detrimental effect on well-being. For participants who did not report current feelings of mental ill-being, the level to which life satisfaction was experienced, was a concept more readily engaged with. The continuation of a close relationship between life satisfaction and functional ability was demonstrated. Participants often confirmed positive life satisfaction, but were quick to reflect on how changes to functional ability, linked to frailty, limited activity participation, and appeared as a controlling factor to the extent of satisfaction achieved:

P6: I wish that I could, that we could go walking. We used to do a lot of walking ourselves. And I, that's one wish. If he gets his hip done we'll be able to do that again.

Participants often considered the constructs of physical symptoms, fitness or functional ability, and mental well-being separately. However, their examples showed the, often consequential, way in which each construct influenced the other. This was further expanded with content illustrating participants' beliefs about the factors that control health. Within the discussion above there was reference to age (as a more acceptable explanation than frailty) being a limiting factor to achieving health, as well as physical fitness and function being both a marker, and means, of achieving health and well-being. There was also discussion that demonstrated an externally derived belief about the need to engage in physical activity to support health:

P6: Well, because they say, "exercise is good for your health", and I assume they're right. But, um, yes, I think you need to keep moving.

P7: Um, we've got a friend [...] and he has to exercise more [and] we couldn't believe the difference it's made to him!

The sources of this awareness were two-fold. 'They' as described by Participant 6 referred to more general public health promoting material and was accepted with little question; however peer experience was provided as evidence of the accuracy of the message by Participant 7. There was also evidence of participants synthesising personal experience with guidance they have read in Participant 8's account of the importance of social interactions:

P8: Well, I certainly feel brighter when I've been in company, my spir--my mood lifts and, uh, because I can get terribly introverted if I'm not talking to anybody, because I've read in places that older people should be in contact, they should talk - it keeps them alive.

Understandably, the concepts of beliefs about health and the conceptualisation of a person's own health and well-being status were closely linked. These views also influenced participants' assessment of changes in their health status, which are considered in the following section.

4.14.2 Perceptions of Deterioration

Subsequent to discussions about a participant's perception of their current health status, there was detail provided about awareness of recent changes to health. These were often symptoms that were considered to have developed gradually. Additionally, they described changes that can be attributed to frailty, such as weakness and low energy (Fried *et al.*, 2001):

P2: I've certainly noticed my muscles getting - getting, uh, weaker.

P8: Physical health... um, [pauses], well I suppose, I haven't got any diseases or, um, things, [...] don't have an awful lot of energy.

As was discussed at the start of this thesis (Section 1.2), low energy and weakness are markers of frailty, yet discussed here as an afterthought of an overall health status. This highlighted a disconnection between perceptions of deterioration with awareness of such changes being linked to frailty. This illustrates how the early stages of frailty appear to be experienced; without the need for a name, or explanation, for the cause.

There was a common belief that ageing involved inevitable decline in health, and that such a deterioration was a threat to physical fitness. This provides further support for health, and now frailty, conceptualised in terms of function:

P5: Yeah, I'd like to be fitter.

I: Is that's what's behind the "sort of"?

P5: Yes, it is, and ageing, really, I don't want to get old, I don't wanna.

Participants identified acute changes to musculoskeletal function as reducing performance in the outcome measurement and medication-use for infection increasing feelings of ill-being. All were discussed in the context of the symptoms being temporary and a state of health that would improve. In the above illustrations there appears to be acceptance of a deteriorating health status that aligns with theoretical descriptions of frailty. Despite this, no explicit connection of that experience with having frailty (or pre-frailty) is made. In fact, the discussion was framed in terms of anticipated deterioration being something that would be expected in older, 'frail', people.

It was also noticed that despite a general assertion that these changes are not permanent or serious, this did not prevent future planning to account for further deterioration. This was also identified at the end of the discussion above about adaptation to reduced occupational performance due to frailty (Section 4.13.4):

P1: You could have fallen, you could be dead [...] I just like to be one step ahead so that I don't wait until it actually happens and it's all too late. I mean, I love my house I've got at the moment - I can cope in there really at this stage, no problem.

Participants who met pre-frailty criteria were among those engaged in planning for further deterioration. This indicates that while participants did not accept the term frailty, they were aware of a likely reduction in functional ability.

Where changes in health status were identified they were often considered temporary and understood to be unrelated to either Course participation or a changing frailty status. It is beyond

the scope of this study to confirm whether changes were directly linked to progression of frailty, but the descriptions are reflective of known markers of frailty (Fried *et al.*, 2001). The important finding is that for many participants there is little overt awareness, or perhaps acceptance, of a permanent deteriorating health status. Despite this, the examples above suggest that while participants do not attribute changes to frailty, or fully accept that continued deterioration will occur, there is still a willingness to make plans to maintain autonomy and control of future decisions. In addition to some of these initial responses to changes in health described, there were further explicit examples of the mechanisms by which participants managed changes to their health. These are reported below.

4.14.3 Management of Health

Similarly to the 'Adaptation to Change' theme in the 'Activity' domain described earlier, participants had adopted a variety of ways to mitigate losses related to, or improve, their frailty and health status. Within this theme the predominant approach was to use a variety of self-management strategies that aligned with a person's own beliefs and experiences. There was also reflection on interactions with health professionals, and the burden of symptoms and/or their management. Correspondingly to the divide in responses regarding conceptualisation of health and well-being status, there was a tendency for those who conceptualised health in terms of physical symptoms to describe management in terms of blended input from health professionals, with self-management and use of activity. Those who described health in terms of fitness adopted methods of self-management.

The most common approach to self-management, especially for those who defined health by functional ability or fitness, was to deliberately seek physical activity. This is not surprising result in a group of people who sought participation in a physical activity group but provides insight as to participants' rationale for using activity in this way. The benefit of exercise to reduce specific physical health symptoms was often reported:

P1: I try and exercise, um, stretching and um, um, various exercises, every day, at home.
Um, as I said, I find if I don't, I stiffen up.

P5: That's why I push myself to do these exercises, because I think, "they are helping with your breathing".

Conflicting methods of health management occurred, even with awareness of a differing opinion:

I: What are the most important things that you do for your health and your well-being?

P6: Exercise!

P7: Like I say, take all the tablets the doctor prescribes!

P6: No, I feel, um, you know, swimming, aerobics, walking, that's what I feel.

As well as using physical activity to address physical symptoms, exercise in group or social settings was identified as a means to improve mental well-being. This was not without challenge as the process of engagement required either motivation or challenged a person's intrinsic tendency to avoid social situations. While these components were experienced through STEER, participants adopted engagement in this type of activity in other settings prior to commencing STEER:

P8: And doing exercise, normally, makes you feel better, doesn't it? Yes. I went home yesterday feeling--after the STEER class - feeling much happier than I did coming in.

Conversely to the approach of self-management of physical symptoms solely with physical activity, there was value in physical, social *and* solitary activities to manage mental well-being:

P2: I, no, sometimes I am, um, mentally flat, and lonely, um, but I usually go, yeah, go out [laughs] and try and work it off in some way or do my jigsaws.

It appeared as though the ability to independently manage health was the desired approach for most participants and contacts with health professionals was often considered something to be avoided; occurring only when self-management approaches failed. Medical treatment was sought when the severity, or duration, of the symptom meant it was unavoidable:

P4: Well, I've had twinges in my left hip, and I wanted it to go away, but it hasn't, so I've made an appointment for the doctor, which I didn't want to do.

While the above scenarios involved seeking medical support at the point where self-management was insufficient, there is further evidence of the challenge, and problem, of incorporating the outcome of such external support into daily routines. An example was of finding space for prescribed exercises within an already busy schedule:

P6: I do them, twice a day, and then 'cause I have to fit in these things [STEER exercises] too! [...] And I went to the physio again this week, and she gave me six others to do [...] But, I don't know how I'm going to fit it all in.

In the above examples there appears to be better acceptability of self-management approaches that are directed by the person and involve complex activities with secondary functional benefits. The latter example shows how both physiotherapy and STEER exercises are 'prescribed' and become something that is an obligation.

4.14.4 Summary of the Health and Well-Being Domain

While findings in the other domains demonstrated unique experiences, there was homogeneity in the beliefs and broad concepts being discussed. The health and well-being domain, however, exposed a divide in participants' conceptualisation of health. The majority of participants synthesised concepts of health and well-being with fitness to participate in daily activities, whereas a small number focused on assessment of the level, or absence, of disease symptoms. These differences in conceptualisation would have implication for services for people living with frailty.

This domain provided evidence for the need to understand physical health and mental well-being as separate, but linked, constructs to functional ability. Similarly to the findings presented earlier, perceived function is the primary concern for participants, in order to maintain independence. In this domain perceived function, or fitness, takes precedence over self-assessed health, adding to the understanding provided earlier regarding measured, versus perceived, functional abilities. Furthermore, perceived function, such as reduced energy and strength, aligned with measured frailty status. 'Frailty' as a term was not recognised by participants as defining their experiences of deterioration. Those experiences, however, aligned well with theoretical descriptions of pre-frailty and frailty. Throughout there was understanding of age-related deteriorations in health and, particularly, function. There were active attempts to limit such losses, but with fear that deterioration was inevitable.

The role of occupational engagement as a marker of health warrants further exploration. Its role appears to vary. Occupation is used to improve physical health and mental well-being and reduce the effects of frailty. Additionally, when physical health and frailty restrict occupational engagement, this is identified as a limitation on mental well-being. Further exploration of this relationship has been completed through the examination of index themes below and summarised in Section 4.16.

4.15 Framework Analysis of Index Themes

4.15.1 Process of Creating Index Themes

Following the framework analysis of domains presented above, deeper analysis occurred in stages:

1. Over-arching conceptual issues were highlighted by further analysis within the framework.
 - This was shaped by all participants in this sample having pre-frailty or frailty.
2. Five index themes were generated (Sections 4.15.2-4.15.6) to:
 - Encapsulate the concepts contained within, with specific application to, each of the three domains,
 - Provide insight into common concepts, and interactions, between domains,
 - Enable analysis of inter-relationships between physical health, mental well-being and activity participation for people living with pre-frailty and frailty.

The index themes provided the evidence for research question 4C, “What is the experience of older adults engaged in a frailty prevention intervention in relation to interactions between activity, physical health and mental well-being?” to be answered. To avoid repetition, minimal quotations are included in this section as the index themes were produced from higher level analysis of the content of Sections 4.12-4.14. The presentation below draws out evidence from the three domains to provide a detailed summary of each index theme. The full summary of interactions between domains follows in Section 4.16.

A map of index themes applied to the domains is presented:

Table 29 Map of index themes applied to framework domains

| Index Theme: | Duty of Self-Care | Managing Vulnerability | Understanding of Health and Well-Being | Meaning of Activity | Social Engagement |
|---------------------------------------|--|---|--|--|--|
| Experience of the Intervention | Desire to reduce strain on health services. | Reduction in fear of falling. | Personal conceptualisation of frailty in context of outcome measurement. | The meaning of the fire service applied to the intervention. The intervention becoming a meaningful activity. | Shared understanding. Increased motivation. |
| Activity | Activity as means to, and marker of, independence. Tension between desired/enjoyed activities and those perceived as health-promoting. Adaptation to maintain independence. Activity chosen to improve physical function. | Fear of loss of valued activities and consequent independence and freedom. Fear of falling. Fear of worsening symptoms. Externally driven reduction of risk. | Age-related health changes enforcing a reduced capacity for participation. | Personal resources: demands on engagement due to care roles, internal barriers. | Activity as the basis for friendship and/or social interactions. |

| | | | | | |
|------------------------------|--|--|--|---|---|
| Health and Well-Being | <p>Duty due to externally derived beliefs about activity to support health and well-being.</p> <p>A desire to avoid formal health interventions.</p> <p>Burden of self-management of health.</p> | <p>Planning for deterioration in health - maintaining control.</p> | <p>Functional perspective of health vs symptomatic perspective.</p> <p>Level of activity participation as cause and effect of changes in health and well-being.</p> <p>Decreased well-being as a response to adverse events.</p> <p>Ageing equalling deteriorating health.</p> | <p>Using activities to improve physical health and mental well-being.</p> | <p>Using social interactions to improve well-being.</p> |
|------------------------------|--|--|--|---|---|

4.15.2 Duty of Self-Care

A duty, or desire, to care for the self was evident across all three domains. This theme was developed by analysis of the motivations, or drivers, behind many of the topics discussed by participants. Within this theme there was a responsibility for participants to manage their own health and well-being, to avoid further deterioration due to frailty, with the goal of independence through maintenance of function.

The intrinsic motivation to manage one's health was evident in several areas of discussion. In the context of the STEER intervention itself, engagement with the intervention was understood to be a proactive means of self-directed care:

P4: And if it helps the NHS - I'm all for helping myself, having to look after and care for myself.

There was a belief that self-care was the means to reduce the strain on health services, and this was combined with adoption of activity with functional benefit. This concept appeared again within discussions about management of health and desire to avoid formal health services in the 'Health and Well-Being' domain. In these instances, there was intention that GP consultation was considered only when other approaches had failed, or when the severity of symptom exceeded what could be self-managed.

The findings relating to conceptualisations of health indicated the prioritisation of approaches that maximised health and well-being, in light of an increasing frailty status, without reliance on other people. The analysis sought to examine the perceived outcome of achieving good health, and the concept of independence in valued activities was consistently raised within the 'Activity' domain. The processes by which this was self-assessed as having been achieved demonstrated a relationship whereby activity was used as both the marker of independence, and the means by which independence could be maintained. The use of activity to enable independence was further analysed, and participants understood differing activities to be supportive of specific functional outcomes that combined to achieve the goal of independence. There was a cyclical relationship where good health was a personal responsibility with a goal of independence in activity, and could be achieved by choosing supportive activities that maintained independence - enabling good health.

An awareness of the need to engage in physical activities to support the self-management of health appears to have been increased through the STEER Course, with participants adopting approaches to implement additional types of physical activity following Course completion. This occurred despite most participants commencing the Course with a history, and awareness, of

engagement in physical activity to increase function. There was evidence of the desire to achieve self-care being ingrained in internal beliefs, motivations and long-standing patterns of occupational engagement. Increased awareness of the benefits of physical activity was also generated through external sources, including public health strategies such as the STEER Course. This knowledge contributes to generation of the Duty of Self-Care. The STEER Course was not the first experience of a health promotion activity class for many participants, and modification of activity, and attitudes, based on messages from this type of intervention might already have occurred.

The duty to self-care was a concept that was not without challenges. There were a range of adaptation responses that people adopted to support the goal of independence. Variability occurred in the level to which the adaptations were deemed acceptable, particularly regarding routine daily activities such as bathing. Within these examples there appears to be an internal conflict between maintaining independence and the acceptability, or enjoyment, of replacement or modified activities that are required due to a reduction in function linked to frailty. In other examples, the satisfaction of completing tasks independently outweighs any dissatisfaction with the modified activity.

There was further evidence of conflict in the choice of activities people engage with. For some, physical and social activities were the desired means of spending time, however for others the reason for engagement appears to be driven by perceived benefits and an obligation to engage. This was highlighted with a description of being 'forced' to be sociable, with awareness that it would produce positive benefits for well-being despite not being a desired activity. For those who discussed obligation in their activity choice there was also ingrained judgment that more solitary or sedentary use of time is 'bad', irrespective of the level of enjoyment that is achieved through engagement. This suggests that the duty to self-care is given higher precedence than innate desires and choices. There was also consideration of the challenge in finding time for activities that supported self-care, in opposition to those deemed more enjoyable. The tension between importance of activity for health and enjoyment of activity was experienced as a burden of finding time to complete physiotherapy and STEER Course exercises.

Despite the conflict and burden, the Duty of Self-Care was accepted as a necessary part of life. As well as the externally derived awareness of using activity to maintain function, discussed above, the biggest driver of this duty was the desire to maintain independence. As has been detailed earlier in the analysis there was a frequent discussion of the need to mitigate against age-related changes to health and function. This unnamed understanding of frailty's threat to function

manifested in this case as the driver to maintain independence. This was understood as both self-sufficient management of health, and the ability to complete activities without assistance.

Within this index theme there is commonality in a shared goal and a sense of duty to achieve self-care in terms of health and well-being status. The variability appears to occur in relation to the level to which people naturally enjoy the activities they feel are supportive of the goal. For some participants the sense of duty appears more internally driven by a sense of concordance with goals and choices. For others, the duty appears generated, yet not entirely internalised and embraced, due to conflict between the sense of obligation and desired patterns of engagement. Irrespective of the means of generation, the duty is driven by a desire to avoid age-related deterioration in function associated with frailty.

4.15.3 Managing Vulnerability

The index theme of 'Managing Vulnerability' was generated from observations that participants frequently discussed awareness of a vulnerability to adverse events across all domains of experience. Closely aligned to this awareness was the need to take either preventative action to reduce the perceived risk, or to make accommodations that maintained autonomy, or control, in anticipation of an expected deterioration in health status or functional ability. As has been discussed throughout, participants rejected the term frailty, and yet were acutely aware of a vulnerability to adverse events, which is a central definition of frailty (Fried *et al.*, 2001). This theme is closely linked to the preceding 'Duty of Self-Care' theme but differs in that the self-care theme is driven by a desire for independence and positive outcome, compared to this which is based on desire to avoid a negative event.

The mechanism by which the awareness of vulnerability was created appeared to be two-fold. The first is an externally generated awareness of risk, the second is an internal reflection on changes in health or functional ability. As has become common throughout the analysis, the vulnerability was never named as frailty, yet the participants appear to be responding to a distinct process of deterioration that aligns well with frailty as a construct.

There were instances where there was a clear, external, generation of a need to reduce risk in the theme of 'Experience of the Intervention'. This was applied learning from the STEER Course to reduce environmental hazards within home environments. Additionally, there were other sources of externally driven awareness of vulnerability in the 'Activity' domain. Often, family members suggested a need to reduce risks of falls and injury when completing routine daily activities at home. In these scenarios there was better acceptance of a need to allow for an increasing vulnerability when the awareness was generated through peers or professionals, as opposed to

family members. The differences are, perhaps, related to the relationship between the 'information-provider' and participant. STEER Course facilitators have sufficient professional distance to be deemed more trustworthy and reliable. Additionally, within the examples cited, the awareness created through STEER included practical and proactive means of reducing risk. This was contrary to the approach suggested by family, which usually resulted in removal of a means of completing activities, without a viable alternative.

Examination of content relating to an internally generated awareness of increasing vulnerability provided further insight into the processes occurring for participants. The first is a fear of deteriorating health and function that reduces independence. This fear stems from observing gradual changes in ability to complete usual activity. These observations are based on perceived levels of function. As discussed throughout the analysis it highlights the importance of such perceptions to participants, as it initiates a serious concern about a threat to independent activity participation. Driving was an occupation that, if lost, evoked a sense of increased vulnerability. This was due to loss of independence and freedom to participate in other activities that were dependent on driving as the means of access. Changes in functional ability in the context of walking created awareness of a vulnerability to, and fear of, falls. Fear of falling was illustrated as a fear of injury and associated loss of independence.

The second internal process is the willingness of participants to mitigate vulnerability by planning for, and attempting to maintain a sense of control or autonomy over, any future decline. For some participants this was about a need to have advanced directives in place about management of financial or care decisions. This planning was prompted, again, by perceived levels of deterioration in function. Alongside adaptation responses to maintain independence that were discussed in the 'Duty of Self-Care' theme, there appears to be a higher level response and need to plan for the vulnerability that would be created by changes to cognitive health.

Developing from the concept of reducing vulnerability by future planning, was uncertainty about how to limit deteriorating physical health symptoms. The challenge identified within this process was a fear of physical exercise exacerbating existing symptoms. This was the first instance where a sense of vulnerability was not able to be resolved with a proactive response, as had been common in all other situations. It also contradicted the certainty of beliefs about using purposeful activity to maintain health, discussed in the previous section (4.15.2). It is likely that this contradiction prevents a self-directed response. The usual approach would have been to use physical activity to improve function, but if this causes pain or does not appear to work, it leaves the person without an effective strategy.

Within this index theme there is acceptance of the increasing vulnerability, based on perceptions of deterioration, or *potential* for deterioration. What was striking was the vulnerability was not named as frailty by participants, despite appearing to drive such an active response. This was also discussed in the domain of Health and Well-being (Section 4.14.2), where awareness of deterioration in function did not prompt consideration of frailty as the cause. The content of this theme suggests that, irrespective of whether this vulnerability is understood as frailty, what is important to participants is the ability to limit losses and maintain independence. This is discussed further in relation to known evidence on the topic (Section 5.6), and also within the following index theme (4.15.4).

4.15.4 Understanding of Health and Well-Being

The index theme 'Understanding of Health and Well-Being' includes participants' experiences of physical health and mental well-being, as well as their conceptualisation of the influences and controlling factors of their level of health. While the majority of themes occurred within the 'Health and Well-Being' domain there were further examples within both 'Activity' and 'Experience of the Intervention' domains, suggesting a close relationship between the concepts. Throughout the analysis there is evidence that the key feature of health and well-being is the presence of frailty, and its threat to function and independence. Specific analysis of the role of function, versus physical health or symptoms, was important to understand how participants understood their health when living with frailty.

The most striking observation was a divide in participants' responses in terms of framing their health in terms of functional capacity versus symptomatic descriptions. Those who framed their health in terms of fitness did not experience an absence of physical or mental-health symptoms. Instead, they emphasised the level to which they could complete daily activities as evidence of health. Those who used symptomatic descriptions of health prioritised symptoms as the marker of health, and a reason for limitations in activity participation. When comparing these statements to the functional performance outcomes of the STEER Course, there was no alignment, suggesting that awareness of functional level was created from self-assessment of abilities in much broader contexts than STEER outcomes. Participants used their evaluation of ability level in chosen activities to assess their level of fitness, functional performance, and ultimately, define their health status. As was discussed throughout the analysis of domains (Sections 4.12-4.14), there was a poor fit between objective measures of function and self-rated perceptions of health and functional status. There was no uniformity in the direction of this misalignment (the objective measures were both better and worse than perceived abilities). What was universal, however,

was that greater importance was placed on self-perceptions, as they were rooted in tangible, lived, experiences.

Well-being was considered separately, or subsequently, by participants. For those that experienced an acceptable sense of well-being, there was a link in which activity was both the means and controlling factor for positive well-being:

P4: I do something every day. It gets you out of the house, you meet different people, different, you know, friends, which keeps you, uh, happy, keeps you happy!

Where a poorer sense of well-being was experienced there was a divide. Some understood low mood as an unmodifiable personality trait, with unjustified cause:

P8: But, uh, really, I've got nothing to complain about, so....

Whereas other participants identified significant challenging events, such as family stress or bereavement, which prompted an emotional and psychological response in the form of depression, low mood and tearfulness. A related topic was noticing reduced energy levels and motivation. Several participants reported recent experiences of this, usually linking it to reduced energy to complete valued activities. As was discussed in the introduction (Section 1.6), low energy is a marker for frailty, but also identified by Fried *et al.* (2001) using assessment measures for depression. There is potential that this component of depression is better recognised by participants as the more straightforward concept of low energy. As was discussed earlier, it had been intended to capture a more robust, quantitative, measure of depression which would have allowed greater clarity on this topic (Section 3.14.2.3).

Well-being was also frequently discussed as contingent on level of performance in meaningful activities. Satisfaction and enjoyment were limited by difficulties participating in activities to the chosen extent, duration, or level of performance. Physical symptoms were often identified as a controlling factor for life satisfaction, due to their influence on meaningful engagement in activity. This extended to the point where acute physical illness was linked as a cause of low mood, because it prevented the ability to attend social activities. As well as the sudden disengagement in activity caused by acute illness, there was also support that gradual reduction in activity (framed as 'laziness') was a trigger for worsening well-being.

Participants largely understood changes to their physical health status as being beyond their control. Ageing was the factor, listed by others, which was accepted as being associated with a worsening health status. It also evoked a sense of powerlessness to prevent it impacting health. While never explicitly named, there was an insinuation that 'old' must equate to poor health.

Linked to conceptualisations of ageing's assumed negative effect on health were participants' explicit understanding of frailty. This was examined initially through the intervention outcome measurements. There was an understanding of frailty largely as being associated with people at risk of falls, and who had poor mobility. Despite not considering themselves to have frailty, participants frequently described reduced energy levels, concerns about walking ability or falling, reduced strength and susceptibility to acute illnesses. All of these are established markers of frailty (Fried *et al.*, 2001; British Geriatrics Society, 2014). This was also evident in the earlier discussion on 'Management of Vulnerability' (Section 4.15.3), where there was an acceptance of increased vulnerability to adverse events but failure to see this as a manifestation of frailty. The descriptions of ageing and 'getting old' as undesirable was due to a belief that ageing meant unavoidable negative changes to health. This appeared reflective of an understanding of frailty. Despite participants' experience of progressive deterioration of their health and functional status, there was no conscious awareness that this could be the experience of the earlier stages of a deteriorating frailty trajectory.

Throughout this analysis there have been unnamed conceptualisation of a changing health status that fits well with the theoretical conceptualisations of frailty. This dissonance in perceptions of frailty by those living with, or at the early stages of, frailty compared to the literature and professional priorities is an important area for further discussion. Within both this index theme and the 'Duty of Self-Care' considered earlier, there is an active process to influence, and need to engage with, the 'work' of looking after, physical health and mental well-being. This concept is considered further within the following index theme.

4.15.5 **Meaning of Activity**

The index theme of 'Meaning of Activity' included a range of participants' occupational experiences. It highlighted how for some people the shared activity of the STEER intervention had become a valued occupation in its own right. There is also discussion of the reasons and motivations for other occupational choices, as well as the challenges and barriers faced by individuals with respect to the value of daily activities.

It was common for participants at the twelve-week interviews to express sadness or loss at the Course concluding. There was also evidence that the Course had become a valuable occupation in its own right, rather than just an activity that had been engaged with for a short time.

Companionship had influenced the sense of value of the intervention. There was also suggestion that the fire service setting, and the associated attributes, contributed to the importance of engagement with the intervention. The influence of the fire service setting must be considered for

its ability to shape the meaning of the intervention as a serious, and proactive, means of managing one's health. The fire service setting, if interpreted in this way, also demonstrates how the meaning derived through the activity of STEER supports participants' goals and intentions to proactively engage in self-care, as detailed in Section 4.15.2. A question that was not explicitly answered was how the STEER Course, as a frailty-prevention intervention, fitted with participants' lack of acceptance that they were experiencing pre-frailty or frailty. The meaning assigned to the Course, by participants, was of a means of ensuring independence. Given that participants had an acute awareness of the need to mitigate age-related deterioration, the need to understand that as frailty was not required to allow participation in the intervention.

There was evidence of increased effort in the context of previously valued activities, which appeared to modify their meaning into a source of increased demand and challenge, and enjoyment of long walking activities was reduced. Additionally, there was detail provided about the need for an activity to align with a person's capabilities. Activities became unsatisfactory and were disengaged with at the point where the experience was understood to be either causing too much, or too little demand, combined with an unsatisfactory outcome.

A closely aligned concept within the 'Meaning of Activity' was understanding participants' reasons for completing specific activities. Frequently, this was reported as seeking specific activities based on prioritisation of functional benefits, as opposed to intrinsic enjoyment. The benefits were reduction in, or management of, physical symptoms, or improved mental well-being, linking back to the 'Duty of Self-Care' index theme. When the aim was maintenance of physical function, the activities sought had direct link to the intended outcome. For example, activities such as Tai Chi were implemented as participants reported improved balance, when improved balance was the desired outcome. Mental well-being, however, was addressed in a less direct, and more variable, manner. Several participants outlined the value of physical activity to improve mental well-being, whereas others valued the social components of activities to improve low mood. There was also reference to the value of sedentary activities, which kept the mind busy, even though these were considered less supportive to physical health.

The 'Meaning of Activity' and its relationship to mental well-being was a more complex one than physical activity to address physical symptoms. As outlined above, the type of activity that could be beneficial varied, influenced by personal preference and what was needed in that moment. There also appears to be a difference between adopting activities that continually support good levels of well-being, and a more active process in seeking activity to address feelings of ill-being. This provides further support for the process of needing to work at management of well-being, as was found when implementing physical activities for functional benefit (Sections 4.14.3 and

4.15.2). There is overlap between the 'Meaning of Activity', and a 'Duty of Self-care'. The experiences were separated to consider the specific functions of activity in this section, compared to the motivations and drivers in the previous section. While there was variation in meaning, the central feature is the experience of living with pre-frailty and frailty and attempting to maintain function through activity in light of this. The following chapter discusses the proposed processes behind the work of maintaining health and well-being, often with the use of valued occupations (Sections 5.5-5.7).

Within this theme there is influence of social interactions that occur in the context of engagement in activity, and these contribute to the meaning and experience for participants. As social engagements were a recurring theme throughout all domains they have been separated and are considered in the following section.

4.15.6 Social Engagement

The importance and value of social engagement to manage the experience of living with pre-frailty and frailty was a recurring feature of most participants' discussions. There was application to the STEER Course, supplemented with discussion about social engagement within participants' daily lives.

The shared experience and understanding of peers that was enabled through the STEER Course was a success. There appears to be a level of trust and importance given to the contributions of peers, due to the perception that they truly understand the experience of deterioration and isolation. There is suggestion that this can only be achieved within a similar age group, and further highlights the impact of living with age-related changes representative of frailty:

P2: You don't talk about it, you know, to young--to--everyone has things that they cover up. (Twelve-week)

There was specific application of the insights and knowledge of other participants within the education component of the intervention, in addition to the general appreciation. The connection with other participants, in addition to the shared experience, had a function of increasing motivation levels. The earlier description of relating to, and trusting, the other participants due to a shared understanding contributed to a sense of teamwork, described by one participant as reflecting the 'Army buddy system'. There appeared to be relief in finding other people were also experiencing change due to frailty, and the social engagement might be a mechanism which encourages the attempts to mitigate frailty-related losses.

In these examples the intervention is not considered as something a participant completes in isolation, but rather that all participants work together to achieve:

P3: Umm, not just the companionship with any group, but it was this, this, motivation - there's always that motivation, and it kept being said, "I find this difficult on my own" (Twelve-week)

Outside of the intervention, participants frequently engaged with activities as a means of maintaining, or creating, friendships. There was experience of joining the Women's Institute (WI) when relocating to a new area as a guaranteed mechanism for meeting new people. Another participant had experience of achieving social interactions through engagement with the WI, for the purpose of improving well-being, but with less certainty about the pleasure experienced. Linking back to the Index Theme 'Managing Vulnerability' (4.15.3), where activities were sought that improved function, those that combined social elements were valued as a way to make purposeful occupations fully meaningful and enjoyable.

The focus of the interviews on daily activities and their function has perhaps skewed findings toward social engagements that occur within meaningful activities, however the occurrence of participants deliberately seeking activities that involve social interaction must not be ignored. The findings about the value of social interactions with peers, within the STEER Course, is crucial. There appeared to be an unexpected realisation for participants of the need to share the experience of ageing, and a changing health status representative of frailty, and receive validation and input from people who could relate due to lived experience.

4.15.7 **Summary of Index Themes**

Five index themes of 'A Duty of Self-Care', 'Managing Vulnerability', 'Understanding of Health and Well-Being', 'Meaning of Activity' and 'Social Engagements' transcended the three framework domains of experiences related to; the Intervention, Health and Well-being, and Activity.

There was a common feature running through the index themes of a deteriorating health and functional status, which required management to maintain function and well-being, which would retain independence. There was an unwillingness to engage with the term 'frailty' as this was not understood as reflective of participants' experiences. However, there was acceptance of an unnamed, age-related, process of deterioration. This conceptualisation aligned with theoretical descriptions of frailty, and was central to participants' experiences of activity participation, health and well-being.

The participants emphasised a responsibility to look after oneself and mitigate any changes in health to maintain independence. This 'Duty of Self-Care' was evident, and discussion about growing awareness of vulnerability to deterioration (the unnamed manifestation of frailty) is likely to contribute to the desire to manage one's health in this way. This concept was further supported with examination of participants' understanding of their health and well-being. There was assertion that while changes to health were largely beyond the control of participants, means of self-management, through activities understood to have functional benefits, were something participants could control. This led to consideration of the 'Meaning of Activity'. While functional benefits of activity for both physical health and mental well-being still featured, there was also consideration of the challenges faced in self-managing frailty through activity in terms of external demands on time, changing abilities and personal resources. The final index theme explored the role of 'Social Engagement'. Much like the use of activity to manage health and well-being, social interactions were considered both a means to, and marker of, satisfactory well-being. Furthermore, having the ability to share the experience of living with frailty with peers was highly appreciated and identified as improving motivation to complete the work of limiting losses in function.

Although specific examples varied, all participants discussed largely compatible experiences of a changing health and functional status. There was implicit discussion of frailty in terms of deterioration of those aspects, despite lack of self-identification with the term. This prompted a desire to remain as autonomous, well and able as possible, and a personal responsibility to act in a way that would achieve this goal. Where differences occurred, these often related to perceptions of one's functional ability level or conceptualisation of health status. This did not correspond to the variations in quantitative outcome measures or frailty status recorded by this group. This suggests that the measures did not capture changes to health and performance in the areas of most concern to participants, or that the process of self-assessment of health status and ability level is one that is more complex. The latter was influenced by the level to which people were experienced life satisfaction. This was contingent on; acceptability of adaptations made to occupational engagement, the effect of changes to occupational performance or physical health on mental well-being, and the level to which people felt a sense of autonomy over the choices and changes occurring in their life. These concepts will be illustrated further in the following section (4.16).

4.16 Interactions Between Physical Health and Well-Being, and Activity

In order to address the research question 4C, “What is the experience of older adults engaged in a frailty prevention intervention in relation to interactions between activity, physical health and mental well-being?” interactions between physical health and well-being, and activity are now considered. This has been achieved by summarising findings from the index themes above which addressed the concepts, and centres on a changing relationship with physical health, well-being and activity participation when living with pre-frailty or frailty. Rather than creating an index theme which solely considered this concept, it was decided to extract the findings from the themes in which they occurred. This allowed understanding of the circumstances which exposed any interaction of concepts. Throughout the illustration of index themes above there were multiple links between themes, suggesting that while creation of distinct index themes was possible, there are still very complex and closely linked processes occurring within themes.

Within the interviews there was an overwhelming objective that participants wanted to lead healthy and independent lives, free of reliance on health services, which would produce well-being and satisfaction with life. This was prompted by awareness of an increasing vulnerability to frailty, despite not naming it as such, and its impact on health and function. Through exploration of this concept there is preposition that the conceptualisation of a ‘healthy and well’ life is one in which chosen activities can be completed independently. Furthermore, there was shared understanding that as well as activity being a marker of a healthy life, it was how it could be achieved and maintained. It is proposed that this belief is the basis for many of the occupational choices made by participants. It is also important to understand the mechanism by which this occurred, as this exposes more fully the perceived relationship between activity, health and well-being for participants living with pre-frailty or frailty.

Evidence for an acceptance of interactions between activity, health and well-being appeared to be generated by multiple sources. Within the index theme ‘Duty of Self-Care’ there was an externally derived belief that both physical activity and social interactions are important for health and well-being in older adults. There was also suggestion, however, that this contributed to a sense of obligation to complete ‘compatible’ activities in order to look after oneself, potentially at opposition of activities that would have been chosen ordinarily. There was a better sense of ownership of choices to engage in occupations that were understood to have benefits either for maintaining physical function or improving a well-being, where awareness of the benefits had been achieved through personal experience. This concordance was derived from making choices that were supportive of goals to live independently and had tangible experiences such as the reduction in stiffness or ‘feeling better’ after a group activity.

Perhaps similarly to externally derived awareness of functional/health benefits to activity, there was an uneasiness where the motivation to complete an occupation, such as driving, was directed by fear. Where occupations were listed as being 'at risk' of loss due to frailty, there was concern that not only could the occupation be taken away, but that a further loss of autonomy would occur. This was imagined in two ways. Firstly, some occupations were dependent on another – for example driving allowing the choice to engage in chosen occupations of visiting of friends or attendance at social groups. Secondly, the dependence manifested as a fear that loss of ability to walk would have direct consequence on the ability to manage independently. This would mean a lack of autonomy in more basic occupations completed at home, with belief that this would negatively affect well-being.

This influence of autonomy was crucial in understanding the interactions between broader concepts considered. Changes in physical health were often considered beyond the person's control, and an inevitable part of ageing. Frequently, reduced performance capacity in chosen occupations was attributed to changes to physical health 'due to age', and belief that it could not have been prevented, nor could it be reversed. Yet, despite this, there was still a willingness and motivation to try and prevent loss of occupations through continued participation. This was enabled by experience that maintenance of engagement in chosen activities could be achieved by perseverance, modification and adaptation, despite deteriorating health. Despite participants not naming their experiences of deterioration as 'frailty', the awareness and acceptance of changes meant participants made attempts to limit losses. What is important to consider is if awareness of the deterioration being due to frailty would enhance, or limit, these self-directed endeavours.

The inevitability, however, did not apply to well-being. Participants described a more active process in responding to a sense of decreasing well-being with use of specific activities that were known to instil positive feelings. The activities varied by participant. They ranged from solitary time-fillers, to those more active and involving social interaction. There was reflection on the need to find the initial motivation to work in opposition to negative feelings, but never a sense that reduced well-being was not within the person's control to improve. There was, however, suggestion that if low mood were to become pervasive, there would have been blame for not working sufficiently hard enough to prevent it. This belief was linked to participants having awareness and experience of physical and social activities to improve mood, and a sense of responsibility to implement such activities.

When reduced well-being was explained as a response to physical symptoms that limited participation in meaningful occupations, participants focused on the reasons why they were unable to participate. This was either lack of control to prevent physical decline, or a need to

adapt occupational engagement. This was a different experience of ill-being to that described above and did not involve the same mechanism of seeking alternate activities that would improve well-being.

As has been discussed earlier in this section there was little, explicit, consideration from participants of identifying that they were living with frailty, or even the earlier stage of pre-frailty. This was in opposition to quantitative outcomes. This meant there was no explicit consideration of the effect of having frailty on physical health, mental well-being and occupational performance. However, many of the topics discussed featured a gradual decline in health; susceptibility to negative changes in physical health; and reduced energy and performance in the context of activities of daily living. All of which fit with conceptualisations of frailty discussed in Section 1.2. Furthermore, participants discussed their increased vulnerability to adverse events, leading them to make plans for a deterioration in health status and to adopt preventative measures to reduce the risk of such adversity. In this situation a reduction in well-being (expressed as despondency at age-related changes) presented as a product of awareness of a deterioration in physical health or functional abilities within the context of occupation. These outcomes of dependence and vulnerability are representative of outcomes associated with frailty, and their occurrence has consequences for well-being (discussed further in Section 5.7). Awareness of vulnerability to deterioration in physical health and functional ability prompted the adaptive response. Avoiding the adverse outcomes associated with frailty, however understood, was the driver behind most choices related to health, well-being and occupation. The choices prioritised maintenance of engagement in valued activities either as a means of ensuring continued independence, or because of the value of those occupations for mental well-being and life satisfaction.

It is suggested that these findings highlight a close relationship between health and well-being, and activity for participants living with frailty and pre-frailty. Activity was understood as the means of improving and maintaining health and well-being, in the face of deterioration due to frailty. Participants also used activity to evaluate the extent to which avoidance of deterioration was achieved. In all of the examples given, a change to any one of the constructs of physical health, mental well-being, or occupational engagement appears to have consequence for the remaining two, and an inter-dependence of all three areas is proposed. While a cyclical relationship was apparent, the most common example was that changes to physical health, due to developing frailty, reduced occupational engagement, and the resulting product was reduced well-being. There were common processes influencing these constructs. Most often this was the varying levels of autonomy experienced, and the assertion of needing to work at maintaining the cycle of good physical health, full occupational engagement, and mental well-being. Autonomy was recognised as the desired outcome within activity.

Finally, the experience of needing to work at achieving 'a good life' appears contingent on the level to which the work feels successful. Where limitations in areas of physical health, mental well-being or occupational performance are still experienced it is understood as a burden of work, whereas if deemed successful the workload is embraced as a positive duty, supportive of goals. Frequently, this work is implemented by adapting valued occupations. The adaptation is a means of limiting the losses which are threatened due to developing frailty. It enables maintenance of function, independence within occupational engagement, and contributes to well-being. Autonomy, adaptation and the workload of managing health are discussed in more depth throughout the discussion (Sections 5.5-5.7).

4.17 Chapter Summary and Key Findings

The key findings, linked to research questions, are presented here. They will be considered in relation to the evidence base in the following chapter. This chapter has provided analysis of baseline and change data contributed by 212 participants of the STEER Course over three time-points of baseline, Course completion and at six-month follow up. It then considered findings from eight participants who took part in nineteen semi-structured interviews at three time-points. Based on the objective outcome measures (See Section 4.11.2), participants in the interview component were all classified as having pre-frailty or frailty. This has allowed the realistic evaluation to answer research questions 3, 4A, 4B, and 4C in terms of 'what works, for whom' being people already living with pre-frailty or frailty.

1. What is the nature and type of deficit measured in people attending a frailty prevention course with respect to frailty and falls risk scores and markers of physical and functional health status?

The baseline descriptive data highlighted gender stratified differences for measures of upper body strength, with women having lower strength levels, but less divergence when lower body strength was considered. The level of frailty was recorded by two measures and was higher than anticipated for a group intended for people only at risk of frailty.

2. What changes are recorded during/after participation in a frailty prevention intervention in relation to frailty and falls risk scores and markers of physical and functional health?

The measures of grip strength, sit to stand transfers and single leg balance all show improvement at Course completion, which is largely maintained at six-month follow up. There were questions raised about the sensitivity and specificity of two outcome measures used (the FES-I (Kempen *et*

al., 2008) and QTUG™ (Kinesis Health Technologies, 2014)), which was supported with supplementary information from the mixed methods study.

3. What is the experience of attending a frailty-prevention programme consisting of education and exercise within a fire service setting?

Attendance of the frailty-prevention intervention was highly enjoyable and valued by most. There was appreciation of the group element for shared expertise, and experience, provided by peers. The focus of the intervention on building resilience to functional decline aligned with participants' experiences. They did not like, or recognise, the term 'frailty' as representative of their experiences and so the interventions' avoidance of the term appears to enhance acceptability.

4. What is the experience of older adults engaged in a frailty prevention intervention in relation to activity participation and engagement, physical health and mental well-being, and interactions between activity, physical health and mental well-being?

This question will be considered in the Discussion in its original component parts within the discussion (4A, 4B and 4C). The key findings transcend the questions but will be discussed with specific application to the question topic. They include:

Frailty Conceptualisation

The experience of living with health and function-related changes was a shared experience. There was detailed description of an age-related deterioration that was compatible with theoretical descriptions of frailty. This perceived deterioration was the catalyst for many occupational choices that were understood to preserve function and independence. The interview data supported the objective measures that participants were living with either pre-frailty or frailty. Despite this, there was no alignment of these reported experiences with participants' perceptions of what it would mean to be experiencing frailty. All of which has consequences for frailty-related research and clinical services.

Assessment of Health and Functional Status

A range of objective measures were incorporated into this study and there were demonstrations of improvement during participation in the STEER Course. A number of challenges with the measures were identified in the quantitative analysis, which was further confirmed with the interview data. Participants gave precedence to their own assessment of functional status, often in the context of ability to complete real-life, valued, activities. Participants considered objective measures less reliable, and often less meaningful, as the measured value appeared arbitrary. This

also linked to data which illustrated participants' conceptualisation of frailty, as mentioned above. Objective frailty measures did not align with participants' image of "being frail", and subjective self-assessment of function was used as the counterargument to measured frailty level.

Disability (or Functional Ability) Versus Co-Morbidity and Frailty

Participants prioritised function over all other components of health. Health was largely defined in terms of function, specifically as the ability to complete chosen activities, and to remain independent in those activities. Functional ability was also identified as the means to prevent age-related declines in health. When unpreventable, declining function was identified as the catalyst for such age-related deterioration, understood through the analysis as frailty. Co-morbid conditions influenced function but were less strongly used as the marker of overall health. Disability, frailty and co-morbidity were independent, but related, constructs.

Adaptation

The process of adaptation had many manifestations within participants' experiences and occurred across the areas highlighted above. The driver for adaptation was the need, and desire, to mitigate losses in function caused by the unnamed experience of frailty. This adaptation increased the workload of management of health and had consequences for mental well-being. However, such adaptation was accepted, and readily embraced, as a means of maintaining function which would allow independence in daily life. Similarly, to the self-assessment of function, adaptation was initiated based on perceived deterioration in occupational performance and functional health domains. It occurred in a largely autonomous and self-directed manner.

The results and findings are now discussed in the context of available evidence and guided by the research questions and areas for further exploration identified in this chapter.

Chapter 5 Discussion

5.1 Introduction

This chapter discusses the results and findings presented previously, sub-divided by their ability to address the research questions. Each question will begin with a summary answer, followed by the full discussion of the components that contributed to the answer. The chapter concludes with limitations of the study and implications for the development of the STEER Course, as well as clinical practice.

5.2 Research Question 1 (RQ1): What is the nature and type of deficit measured in people attending a frailty prevention course with respect to frailty and falls risk scores, and markers of physical and functional health status?

5.2.1 RQ1 Summary Answer

This question used baseline data to provide detail of participants' objective measures of frailty and function, prior to engagement with the intervention. More women were recruited to the Course than men, and the greatest proportion of participants were overweight, but not obese, and had hypertension.

There were limitations in considering the results against comparable populations due to a lack of evidence. From the evidence that was available, participants had a greater level of deficit in relation to balance and strength (lower and upper body), than would have been expected for a targeted population who had pre-frailty. This might be explained by analysis of the frailty measures, which demonstrated that the greatest proportion of people already had frailty, as opposed to pre-frailty.

Within the sample there were differences in functional measures between genders. Women had a higher level of frailty, even when using gender-adjusted classifiers based on grip strength. A more favourable frailty status was associated with preferential outcomes on all functional measures, regardless of gender.

As well as the challenges of lack of evidence to compare the measured results, there were limitations highlighted in measures relating to falls risk. This has meant RQ1 is answered

cautiously, with respect to those limitations. However, the results suggest the population are experiencing deficits in relation to function and frailty that are more advanced than expected and warrant more conclusive evaluation.

5.2.2 RQ1 Discussion

As it was the intention of HFRS that people who are vulnerable to, but not yet experiencing, frailty were recruited to its STEER Course. The results obtained are discussed in relation to known descriptors of a population who live with pre-frailty as well as wider evidence, where appropriate.

The STEER Course recruitment criteria includes those aged sixty-five and over. This sample demonstrates a range from sixty-three to ninety-five. Exceptions were made for those slightly younger than the intended minimum age as they met all other inclusion criteria. The Course recruited a higher number of women than men. As frailty is more common among women (Syddall *et al.*, 2010), this is not an unexpected finding, however there is potential that women find the nature of the Course more appealing.

Body Mass Index was calculated from weight measurements taken on the Course. The STEER Course is not intended as a weight-loss intervention and so measurements are used for information and guidance only. Sixty per cent of participants have a BMI in the overweight category or higher. Several studies highlighted a correlation between higher BMI and frailty (Ramsay *et al.*, 2014; Pollack *et al.*, 2017). Previously, sarcopenia, or the loss of muscle mass which results in poor strength, has been associated with lower body mass (Cruz-Jentoft *et al.*, 2014). There is increasing understanding of the consequence of sarcopenic obesity to contribute to the muscle weakness or low strength associated with frailty (Lee *et al.*, 2016a). The STEER Course already addresses obesity in its education component and uses resistance training as an approach to reduce weakness. This result is supportive of the dual approach included within the intervention.

Over half of participants had a systolic blood pressure in excess of 140mmHg, which is indicative of hypertension. This result closely matches known figures for the general population over the age of sixty-five years (National Institute for Health and Care Excellence, 2011; Lacey *et al.*, 2017). Blood pressure is used by HFRS as a screening tool for fitness to participate in the STEER Course and is not re-tested at the end of the Course. The remaining 55.4% had high blood pressure. Permission had not been sought to gather data regarding participants' medications, in retrospect this would have been important to compare these figures with level of prescription of anti-hypertensive medication.

Sit to stand transfers are representative of lower body power, and appropriate for use with people who experience pre-frailty (Zech *et al.*, 2011). The single-leg-stance was included as a measure of balance. Anecdotally, participants reported more unfamiliarity of the movement involved in a single-leg balance compared to a sit to stand transfer which is, presumably, completed regularly as part of activities of daily living. As a non-standardised assessment comparison with other studies is presented cautiously. Reference data for older adults over the age of sixty (but with no classification regarding frailty) suggests mean (SD) scores of 12.7 (4.0) repetitions/30s for women and 14.2 (4.6) repetitions/30s for men (Bohannon, 2002). The scores are in excess of 2 and 4 repetitions higher than achieved on the STEER Course for women and men, respectively, suggesting some influence of a presence of reduced strength within the STEER group. The single-leg-stance has some reference data for a comparable group at baseline prior to engaging in an exercise intervention (Takano *et al.*, 2017). The mean period for one leg balance for the group with pre-frailty was in excess of forty seconds which is suggestive of a much lower level of balance exhibited by STEER Course participants.

It had been anticipated that sit-to stand transfers, as a measure of power, would mirror the upper body strength tested by the maximum grip strength (discussed below). However, the parity between genders suggest this is not the case. The reference values (Bohannon, 2002) also suggested that the minimal difference between women and men on the STEER Course was not an expected finding when compared to a broad sample of older adults (without any classification of frailty status). There are several potential explanations within this population; it is possible that lower and upper body strength is not directly comparable or equal, or that the dynamometer testing is less favourable to female participants, or that the sit-to-stand transfer is also a test of fitness, flexibility and functional movement rather than just strength.

Frailty divisions by gender-stratified grip strength highlighted a higher incidence of frailty among female participants. The difference in strength by gender is not unexpected given that gender-specific classifications for the presence of frailty have always been proposed (Fried *et al.*, 2001). This is further supported with known prevalence rates of frailty (Syddall *et al.*, 2010). The values recorded for this group were, however, lower than of known comparable populations (Romero-Ortuno *et al.*, 2010). There is argument that as the grip strength literature has focused on either healthy populations (Leong *et al.*, 2016) or those with frailty, that there is insufficient evidence as to the expected reference values for a population classified by three divisions of frailty (to incorporate a stage of 'pre-frailty'). As the values proposed by Romero-Ortuno *et al.* (2010) were the only such study to do this, and these values do not include a BMI-based modification, it is an area that warrants further examination.

It is known that established measures of identifying frailty do not have sufficient specificity to prevent false positives (Clegg, Rogers and Young, 2015), and it is possible that grip strength creates false positives when identifying people living with frailty. If, however, the indicators are accurate this suggests that the STEER Course is not recruiting its intended population of people at the stage solely of 'pre-frailty', but rather a majority who are already living with frailty, as well as a smaller group at the anticipated 'pre-frailty' stage. The use of grip strength is an established means of identifying weakness that would indicate frailty (Danon-Hersch *et al.*, 2012; Sousa-Santos *et al.*, 2018). This approach identified that 64.7% of participants in this study as living with frailty. There is also support for this finding with the functional outcomes (single leg stance and sit to stand repetitions) above, where the STEER Course values suggested more functional limitation than comparable populations who were known to have pre-frailty, as opposed to frailty. This has implications for the operation of the STEER Course and is discussed in Section 5.9.

While there is potential for the outcome measures used to be 'over-classifying' frailty among STEER Course participants, it could be that HFRS was unintentionally recruiting people living with a higher level of frailty than intended. Discussion has previously occurred about how people who live with frailty do not see themselves "as frail", despite meeting established criteria for frailty (Age UK, 2015; Warmoth *et al.*, 2016), often due to the negative associations with the term (Nicholson, Gordon and Tinker, 2017). It is not difficult to imagine, then, that those who are already experiencing frailty would only recognise themselves as *vulnerable* to frailty – enabling self-identification of suitability for the Course. This is discussed further in Section 5.4.

As discussed within the analysis, the use of the QTUG™ (Kinesis Health Technologies, 2014) had challenges related to the lack of transparency of its calculations due to being a trademarked commercial device with minimal independent validation (Greene *et al.*, 2014a; Greene *et al.*, 2014b). This resulted in the frailty score being rejected as an outcome measure as no evidence could be found that it was classifying frailty based on anything other than falls risk factors. The second measure it produced, the Falls Risk Estimate, was also presented with caution. The falls questionnaire it incorporated provided reassurance that it was assessing falls risk, but it has the same limitations as the frailty score. It would be appropriate to assume that a medium falls risk score would be likely for a participant on the STEER Course, and it was found that 34.3% of people met this criteria. The Falls Risk Estimate, however, classified over half of participants (51.7%) of being at low risk of falls. It could be that this terminology means that the risk is present, but at a low level, but equally it might be determining that the person does not have any risk of falls, which would be suggestive of an absence of need to engage in a STEER Course. Further doubt is cast on the utility of this measure as the sample recorded low grip strength values compared to

known populations (Romero-Ortuno *et al.*, 2010), suggesting a high incidence of frailty, which has well established increased likelihood of falls (Sternberg *et al.*, 2011; Cheng and Chang, 2017).

The FES-I (Kempen *et al.*, 2008) produced unexpected results as women have a higher risk of falling according to QTUG™ (Kinesis Health Technologies, 2014) data, yet this self-report measure identified lower levels of concern about such risk. It is suggestive of the need to understand more about perspective of people who might be at risk of falls with respect to the effect on both psychological concepts such as confidence as well as how that translates to the activities they complete, when they involve a risk of falling during participation. Overall, the FES-I scores were suggestive of very low concern about falling (Kempen *et al.*, 2008). Evidence from a pilot randomised controlled trial determined that while occupational therapy-led environmental assessment could significantly reduce falls in participants, when captured by the FES-I (Kempen *et al.*, 2008), there was no parallel reduction in participants' fear of falling (Pighills *et al.*, 2011). This supports the results in this study that fear of falling, and risk of falls, are not dependent constructs. There is potential that the questions used in the FES-I (Kempen *et al.*, 2008) are more suited for a population who have a greater level of difficulty with activities of daily living than this sample group. Conversely, the questions posed regarding difficulty with routine activities might elicit a fear to respond honestly, which would identify vulnerabilities to the ability to manage independently. In order to understand the effect of fear of falling, and better identify why this measure does not capture useful data, it has been explored in more depth in the qualitative interviews within the context of daily activities in Section 5.5.

Except for the FES-I (Kempen *et al.*, 2008), there was a significant association (Dancey and Reidy, 2007) between lower frailty status and more favourable physical and functional markers of health. This supports much of what is known in the literature about frailty's effect on health but contributes knowledge in relation to these specific outcomes. With the exception of grip strength, there is no detailed evidence available about the outcomes expected for this group. It had been intended that this analysis would provide a better description of the physical and functional health status of people living with pre-frailty. The analysis highlighted that only 29.4% of the sample were classified as having pre-frailty. There is potential that analysis of the measures related to this group in isolation would be valuable, however it was decided to consider the full group to fully detail the attributes of all participants engaged within the frailty-prevention Course. This was based on an interest in how traditional measures to classify frailty compared to the broader, and richer, experiential accounts of people who had self-identified as being at risk of frailty by seeking out participation in the STEER Course. These findings are discussed in Sections 5.5-5.7.

5.3 Research Question 2 (RQ2): What changes are recorded during/after participation in a frailty prevention intervention in relation to frailty and falls risk scores, and markers of physical and functional health?

5.3.1 RQ2 Summary Answer

It had been expected that the physical health markers (blood pressure, weight and resting heart rate) would have been included in the follow-up testing, but as discussed below this did not occur. The prevented comparison of this change data with functional, falls and frailty measures.

The functional measures, and falls and frailty measures, showed differing patterns of change. The measures of specific elements of function (single-leg-stance, sit-to-stand transfers and grip strength) all demonstrated a significant improvement at the completion of the Course. While there was a slight regression towards baseline values, the improvement was maintained in excess of such values when participants returned for testing at six-month follow-up. The falls and frailty measures also demonstrated improvement at the end of intervention, however at six-month follow up had regressed to near, or slightly below, baseline values.

There is potential for the change data to be influenced by participants lost to follow-up. By considering the outcomes for those who did not complete the Course, or completed the Course but did not attend six-month testing, differences were highlighted. Participants with the poorest scores at baseline were least likely to complete the Course. Those with highest scores were likely to complete the Course but not attend six-month testing. Further evaluation would seek to understand the outcomes experienced by those with differing baseline values.

5.3.2 RQ2 Discussion

This decision was made by those who designed the STEER Course to not repeat the physical observations completed at baseline. This was because they felt it was not an intervention designed to promote weight loss or improve physiological measures such as blood pressure, but rather improve the functional outcome measures relating to falls risk and frailty level.

Anecdotally, the STEER Course facilitators reported little change in pilot data when these measures were repeated, influencing the decision not to include the measures at Course completion or six-month follow-up. This was due to a lack of awareness that a 'no change'

outcome could have been positive. Their removal allowed for sessions to be shorter in duration (See Field Notes – Appendix H), and was an example of the realistic evaluation needing to allow for measurements occurring within a real-world intervention, as opposed to trial conditions. It would, however, have been valuable to analyse such data, especially if, as reported, there was little change compared to the functional measures. This was a missed opportunity in relation to capturing the Course's ability to effect weight-change, as mitigation of muscle loss over the nine-month duration would be a positive outcome in relation to preventing shrinking, as described by Fried *et al.* (2001).

Follow-up testing occurred when participants had had no engagement with HFRS or the STEER Course for six months and many people cited new commitments or a change in availability as reasons for non-attendance. The reasons were not captured formally, and it is not possible to determine circumstantial reasons why participants lost to follow-up might have better or worse measurements. The baseline data of those lost to follow up was compared in three categories; those with data at six-month follow up and those lost to follow up who had baseline data only, and those with data at baseline and Course completion. Participants differed significantly between groups for all functional measures (all significance levels in this section based on Dancey and Reidy's classification (2007)), with the exception for the Falls Efficacy Scale (Kempen *et al.*, 2008) - as discussed previously, the limitations of this measure are also likely to apply to this analysis. Participants who did not complete the STEER Course had the poorest measures at baseline. Perhaps surprisingly, the participants who had highest functional measures at baseline were most likely to complete the Course but not return for follow-up testing. The reasons for this are not immediately apparent, and unfortunately the loss to six-month follow up means it was not explored in any of the qualitative final interviews. Speculatively, with anecdotal support, there is potential that those who started the Course from the highest functional level were engaged in plentiful, alternative, social/physical activities and when the Course completed, they filled the STEER Course time with other occupations.

Some of the measures demonstrated improvement which was sustained after six months without engagement in the STEER Course. A considerable aspect of the education component of the Course is the message that the exercises can be completed independently, but no data were captured by HFRS as to the extent to which this was implemented by participants. It was, however, explored within the follow-up interviews and provided an area of focus for the qualitative aspects of this research discussed in Section 5.4-5.5.

The first example of such a measure is that single leg stance showed significant improvement and maintenance of change. Exercises that specifically targeted the ability to balance on one leg were

included in the STEER Course circuits, which is potentially an explanation for the improvement by Course completion, however at six-month follow-up when the circuit had not been completed for six months, scores remained well in excess of the baseline measure. Similarly, to the single leg stance, sit to stand repetitions from a chair were included in the STEER circuit and followed the same pattern of significant change and only marginal decrease at six-month follow-up. No comparable change data has, to date, been discovered within the evidence base, making it difficult to determine if these outcomes are unique to the STEER Course, however, to maintain change six months after intervention is a favourable outcome. The improvement, and maintenance of improvement, in grip strength was, perhaps, a less predictable outcome as the use of the dynamometer was not part of the circuit, unlike the above measures. Meta-analysis into the effects of exercise interventions for frailty indicated positive outcomes in reducing frailty classifications (MacDonald *et al.*, 2020). This meta-analysis was able to evidence improvements in grip strength following resistance-based exercise versus control, but with a high variability in outcomes contributing to the analysis (MacDonald *et al.*, 2020). Other studies, however, have not measured improvement in grip strength when used as an outcome measure for a comparable intervention (Nakagawa *et al.*, 2008). There is still potential that increased familiarity with use of the dynamometer could produce the improvements in this study, but the suggestion that overall strength has improved during the STEER Course cannot be discounted.

The effectiveness of comparable interventions to the STEER Course has not yet been fully established within the literature (Apóstolo *et al.*, 2018). The STEER Course uses functional exercise that incorporates balance and resistance training. Recent evidence suggests, with moderate certainty, that this format can reduce the rate of falls by 34% (Sherrington *et al.*, 2019) and is the most effective type of exercise in falls prevention. A simple measure capturing rate, and incidence, of falls would be a useful addition to the STEER Course. The pattern of regression of measures (especially those classifying frailty status) back to baseline values at the six-month follow up raised suggestion of the Course's ability to prevent continued deterioration of frailty status. Evidence from elsewhere of education and exercise groups showed no difference in frailty classifications at the point of 3.5 year follow-up compared to a control group (Kehler and Theou, 2019). This would be an important area to test for the STEER Course in further research, as maintenance of baseline value compared to deterioration in a control group, would be a positive outcome.

The quantitative data in this study provides support that change is experienced during participation in a STEER Course but the means by which this happens, and perhaps more interestingly, is maintained after the Course is completed warrants further study. The qualitative

arm of the study includes some exploration of participants' explanations for change, along with participant-led focus on specific measures. This is discussed in the following section.

5.4 Research Question 3 (RQ3): What is the experience of attending a frailty-prevention programme consisting of education and exercise within a fire service setting?

5.4.1 RQ3 Summary Answer

Participants both enjoyed and valued the intervention. There were a number of contributory reasons for this. The predominant feature was of the intervention being a proactive, and trusted, means of maintaining health and independence. The intervention, aided by perceptions of the fire service as professional and knowledgeable facilitators, aligned with views and values of the participants to maximise health through function. This is also discussed within research questions 4A-C.

A highly acceptable feature of the intervention was the group dynamic. This was experienced as improving motivation and contributing to learning, due to the value of lived experience. This lived experience was also understood, and valued, more generally regarding the experience of ageing. Participants rejected the term frailty and imagined it as applicable to people with greater functional deficits. As was discussed in RQ1 and RQ2, there was evidence that the objective measures of frailty were accurate and the group who participated in interviews met the criteria for pre-frailty or frailty. Therefore, the experience of participants who were living with pre-frailty and frailty is that while they felt the need to mitigate losses, and prevent functional decline, they did not conceptualise this as the beginnings, or presence, of frailty.

There was further evidence of a misalignment between measured outcomes and experiential accounts. Self-assessment of function, in the context of complex daily activities as opposed to measured, component skills, was given greater precedence by participants. Specific measures were often questioned as they did not reflect personal experiences of progress or ability. Despite this, and the lack of alignment with the term frailty, the intervention was readily engaged with. The Course's completion was understood as a loss, particularly relating to the social interactions and support with physical activity it offered.

5.4.2 RQ3 Discussion

Participants largely reported a very positive experience of the STEER Course, with enjoyment of the intervention as a whole. The most prominent experience of participants was linked to the intervention being conducted in a group. Participants frequently reported value in the shared experience, either for improving motivation in the exercise section, or for providing a sense of shared understanding and perspectives within the education component. Participants reflected on how important the group dynamic was and had awareness that it could be the determining factor as to the success, or potential failure (although not actually experienced), of the intervention. The Course was not designed to be peer-led; however an unintended outcome was that the social environment of the education section, encouraged sharing of lived experiences and knowledge. Evidence exists of the ability of peer-led physical activity programmes to improve self-efficacy (Watkins, Burton and Hill, 2019) and value in a sense of empathy between peer-instructor and participants (Jin, Lee and Baumgartner, 2019). As well as in physical activity, there is evidence that motivation to engage with, and adopt strategies of, an education based falls prevention intervention was improved with peer facilitation (Khong *et al.*, 2017). Peer-facilitated learning is a feature that could be more formally adopted in future development of the Course. Understanding of the value of the group intervention suggests a complex dynamic, ranging from enjoyment and pleasure, to a sense of belonging, increased motivation, and empowerment resulting from peer-to-peer knowledge sharing, with support for these processes occurring in examinations of other interventions for older adults (Nilsson and Lundgren, 2018). Participants had a paradoxical rejection of frailty (discussed further below), in opposition to active engagement to maintain function that was threatened by frailty. This, perhaps, explains why the value of peer perspectives was so important – due to the shared, but unnamed, experience of living with frailty.

As discussed above, the intervention was highly valued by participants and the only area of uncertainty surrounded the process of outcome measurement, which was largely prohibitive of using the measures to inform discussion about changes in performance as the discussion centred on the meaning and interpretation of the outcome measures more generally. The outcome measure most frequently questioned by STEER participants was that of the QTUG™ (Kinesis Health Technologies, 2014). This included some participants finding the closed-system nature of the test did not instil confidence. This supported the analysis completed in this thesis regarding the difficulty assessing the means by which frailty scores were calculated on a trademarked system with limited validity and reliability data (Greene *et al.*, 2014a; Greene *et al.*, 2014b). For other participants the production of an explicit ‘frailty score’ was the part that prompted discussion. This is discussed below.

The analysis of interview discussion allowed the theme 'Managing Deterioration' to be created due to conscious awareness of a changing health and functional ability status. However, there was no self-identification of participants with the term 'frailty' as being applicable, even when faced with their own measured frailty status, or describing deterioration of health. This mirrors findings elsewhere, where people living with frailty interpreted the term as pejorative (Age UK, 2015; Nicholson, Gordon and Tinker, 2017). In particular, the Frailty Identity Theory proposed by Warmoth *et al.* (2016) included a process of actively resisting an externally generated label of frailty by multiple means. Strategies to prevent adoption of a frailty identity are detailed in the Theory (Warmoth *et al.*, 2016), and many were evident in the data collected here. These included; social comparison (description of own abilities against those of peers to reject results of the frailty measure), containment of functional limitations to specific body parts (e.g. awaiting an operation on a body part or limitation attributed to a specific condition) and use of activity (to 'keep doing things'). Perhaps helpfully, the STEER Course does not use the term 'frailty' in its name, but rather focuses on the ability to build resilience, which reflects the approach of participants. Section 5.6 expands on this topic, with evidence that while participants do not acknowledge the presence of frailty, they experience a number of functional changes that align with the frailty conceptualisations discussed throughout. Section 5.2 provided support that while classification of pre-frailty and frailty had challenges, there was mounting evidence, based on functional measures, that the high incidence of frailty in this study was accurate.

The outcome measures implemented by HFRS and discussed in Sections 5.2 and 5.3 are focused on markers of physical health, and those which capture functional measures do so at a fundamental level, measuring specific task skills such as a single leg balance. What became evident through interview discussions was that while participants noted changes in their health or functional ability (e.g. reduced energy within tasks) they were often able to complete activities in the same manner, or with minor modification. The features that were reported to change were satisfaction or enjoyment of the task rather than a focus on specific physical abilities, and greater weight was given to self-assessed changes in function, as opposed to measured outcomes. There is potential, then, that reductionist assessment of components of activity completion (such as a sit-to-stand transfer) does not capture the full experience of changes occurring during STEER Course participation. Measures such as grip strength, sit to stand repetitions and FES-I (Kempen *et al.*, 2008) also appeared difficult for participants to interpret as discrete values with no comparable data.

While not specifically focusing on frailty but rather successful ageing, which could be proposed as the purpose of the STEER Course, the Well Elderly (Clark *et al.*, 1997) and the UK-based Lifestyle Matters (Sprange *et al.*, 2013) randomised controlled trials included a broad range of topics

similar to STEER (e.g. home safety, falls prevention and physical well-being). Additionally, they explored the adoption of meaningful activities through occupational therapy intervention and included outcome measures that assessed social and physical function, as well as a greater focus on mental well-being (Clark *et al.*, 1997; Sprange *et al.*, 2013). Given the findings relating to the importance of social contacts and group dynamics achieved through STEER participation, and the reports discussed in subsequent sections (Section 5.5) about the value of socially-focused activity and retaining physical functional abilities, these studies could provide a blueprint for a more encompassing evaluation of STEER outcomes that better reflect the priorities and experiences of participants. In addition to the challenges in objective outcome measurement detailed above, there were processes occurring in relation to self-assessed outcomes. This included under-estimation of ability, influenced by comparison to others. The perceived ability level was not reflected in the outcome measurement, occurring in opposition to known results of self-assessments of health and function with objective measurements (Vagetti *et al.*, 2014).

The exploration of the meaning of activities that participants complete was analysed to answer research question 4A, below. This highlighted that for a number of participants the STEER Course had become a meaningful occupation, rather than a generic education/physical activity intervention. This can be understood due to the way in which participants experienced STEER. As discussed at the start of this section, value was held in the ability to have shared experience with peers, as well as fulfilling social interactions with both facilitators and participants. The meaning of the intervention identified above closely aligned with findings achieved elsewhere (Nilsson and Lundgren, 2018), but there was also indication that the fire service setting contributed to the meaning for some participants. There was support for the professionalism and identified values of the fire service (as an organisation who rescue and help) contributing to a sense of empowerment and ability to contribute to one's own management of health. Current research into fire service led health interventions focused only on home visitation (Lowton *et al.*, 2010; Laybourne *et al.*, 2011). There are no experiential accounts of perceptions, and indeed influence of this perception, of the fire service as a profession within the context of a health intervention available. This is a new finding which warrants further exploration.

The STEER Course became a valued occupation in its own right, providing a sense of belonging and supporting participants' intrinsic desire to complete activities that support their health. The ability to derive meaning through occupation has a long-standing proposition as a determinant of successful ageing (Clark *et al.*, 1991; Jackson, 1996). The valued components of the interventions were enjoyment, social interactions and the range of factors that supported a desire to manage self-care, including the perceptions of the fire services' role. Consequently, it is understandable that the intervention imbued a meaning that resulted in a sense of loss when the Course

concluded. There is further consideration of the meaning of activity, and broader experience of valued occupations, in all areas of participants' lives in the following section.

5.5 Research Question 4A (RQ4A): What is the experience of older adults engaged in a frailty prevention intervention in relation to activity participation and engagement?

5.5.1 RQ4A Summary Answer

Participants were living with pre-frailty and frailty and yet were able to detail varied, and full, accounts of activity participation and engagement in valued activity. This was irrespective of frailty status and functional measures, so additionally to the preference of participants to value self-assessment of function and health (discussed in RQ3), disability cannot be assumed based on the markers in this study. The activities with greatest value were those with physical and social elements. This was due to factors like enjoyment, and also their fit with a desire to maintain function and, ultimately, independence.

The desire for independence was created in response to an awareness of deterioration in function, which could have consequences for activity. Conversely, activity was understood as preserving function, and independence. This threat to independence was never named, and yet fit with conceptualisations of frailty. Participants were able to maintain participation and engagement in valued activities with self-initiated adaptation of original activities. The maintenance of function by adaptation of activity was something that participants' experienced autonomously, and additionally was implemented to preserve future autonomy.

5.5.2 RQ4A Discussion

As was discussed in the Findings (Section 4.13), the analysis of the 'Activity' domain in the framework allowed consideration of the activities discussed *as* occupations. This was because although the term 'activity' was used in the interview schedule, it was partnered with questions about meaning and value of those activities which aligned with occupational science's conceptualisation of occupations as activities that comprise personal and cultural relevance and meaning (Clark *et al.*, 1991). This allowed consideration of the findings alongside occupational science literature. It also supported the approach of this study which aimed to understand experiences, which are influenced by meaning, values, and social and physical environments, within the context of the daily activities. Furthermore, this multi-contextual consideration supported the realistic evaluation that enveloped the whole study (Pawson and Tilley, 1997).

Participants were able to detail rich, and largely fulfilling, occupational lives that contained a mixture of activity types. Although there was some effect of an increasing frailty status on the way in which occupations were completed, or at least a changed experience of those occupations, there was, predominantly, a sense of ability and autonomy to complete them as desired.

When considered alongside conceptualisations of the type of deficit experienced by people living with frailty, there was expectation of limitations in activities of daily living (ADLs) (Fried *et al.*, 2001). Furthermore, dependence within ADLs was used as an identifier, even at the stage of mild frailty, in the Frailty Index (Rockwood *et al.*, 2005). This raises questions, then, about the classification of frailty and the level of disability expected. For the participants in this study, frailty measures identified all participants to be living with pre-frailty or frailty using grip strength, and similarly for all but two to have pre-frailty or frailty using the QTUG™ (Kinesis Health Technologies, 2014). Despite this classification, all were able to report independent engagement in physically and socially demanding occupations away from home. There was some evidence of seeking support, or adapting, occupations at home but not in a manner sufficient to be described as being dependent. There is recent evidence that frailty measures, including the phenotype (Fried *et al.*, 2001) and Frailty Index (Mitnitski, Mogilner and Rockwood, 2001), poorly predicted levels of disability in activities of daily living (Op het Veld *et al.*, 2019). This is in opposition to established literature which proposed a causal relationship between disability and frailty (Fried *et al.*, 2004). There is potential that as this literature does not consider subjective measures of function, there is a disparity between objective and subjective measures, which results in an incomplete understanding of the relationship between frailty and disability. The findings relating to personal definitions of function, health and frailty are discussed further in the following sections (Section 5.6 and 5.7).

While the evidence in this study is from a small sample, and no longitudinal study is included to determine if disabilities develop, it is suggestive that the focus of traditional deficits-based models of frailty (Fried *et al.*, 2001; Mitnitski, Mogilner and Rockwood, 2001), do not accurately capture the experiences of participants. Consequently, the experiences of completing occupations which follow are now discussed in an assets-focused manner. This has been driven by the way in which participants understood their experiences.

Pierce's definition of occupation proposed,

“An occupation has a shape, a pace, a beginning and an ending, a shared or solitary aspect, a cultural meaning to the person, and an infinite number of other perceived contextual qualities.” (Pierce, 2001 pp. 139)

Within this study there was frequent description of occupational lives where the pace was determined by routine and frequent engagement in occupations that incorporated physical and social activities, away from home. These were listed as the most value and the meaning attributed to qualities like enjoyment, social interactions or perceived health benefits. This fits with Clark's (1997) explanation of occupational meaning being influenced by an individual sense of tempo and temporality, perceived current level of function and desire to act to maintain this. The occupational accounts were of busy lives, with rhythm provided by scheduled activities that were valued both for providing a pleasurable experience, but also a sense of satisfaction that the activity met needs for social interactions, management of health and well-being and avoiding further deteriorations due to frailty. This is explored further later in this section.

Perhaps surprisingly those occupations with a solitary aspect (Pierce, 2001), were often not considered to have the same level of meaning and were not used to create a routine, but rather fill otherwise empty time. There was also suggestion that these type of occupations; reading, watching television, and spending time on a computer, contained a level of guilt. This derived from accepted, and unquestioned, views. Evidence suggests that sedentary (although not all of the occupations included were sedentary *and* solitary) occupations can have benefits for multi-dimensional function and provide meaningful activity (O'Neill and Dogra, 2016; McEwan, Tam-Seto and Dogra, 2017), and yet there was a perception of negative associations with the term (McEwan, Tam-Seto and Dogra, 2017). It is highly likely that within the setting of the STEER Course, which is focused on increasing physical activity, that participants found the value and qualities of sedentary occupations to be less admissible. There is evidence of sedentary activities being linked to increased mortality for those with frailty, although the benefit of physical activity in reducing frailty status and associated poor outcomes is the better researched aspect in relation to activity (Kehler and Theou, 2019). There is a parallel with Morris and Cox's preposition of occupational engagement (2017), within which it is suggested that choice in occupational engagement has consequences (in this case the potential choice of sedentary occupations is coupled with an awareness of understood negative consequences of such occupations). The way in which participants discussed sedentary activities as being less admissible, or not what they *should* be doing, suggests a level of conflict: where the occupation is enjoyed and valued, but understood to be unsupportive of either personally, educationally, or culturally-derived, judgments of how to spend time.

This study determined that participants were experiencing changes to their experience of engagement in valued occupations. These were often aspects such as a reduced energy level, increased experience of pain or other physical limitation (and concern about increasing pain/injury through activity completion). These findings are supported elsewhere (Lin *et al.*, 2007;

Gothe and Kendall, 2016; Morgan *et al.*, 2019), and identified in the literature review. Within the review, uncertainty about comparability of findings due to population differences was suggested. Therefore, while cultural specifics are likely to still occur, there is a commonality of shared experience of older adults in relation to barriers to physical activity completion. A specific feature for this study was the fear of losing the ability to drive and the consequences it would have in terms of maintaining control and independence of chosen occupations. Evidence suggests that a decision to stop driving can be a personal choice, with functional decline a predictive factor (Pozzi *et al.*, 2018). However, an alternative view is that concerns about the driving of other people was the limiting factor (Allen, Beck and Zanjani, 2019). It would appear that the former study is more representative of the sample considered here.

A final area of challenging occupational experience was that of the effect of care roles, subsequent bereavement, and the transition to engagement in new occupations following that period of caring. While each person's experience was unique, there was a common effect of the need to adopt care roles (most frequently for a spouse) meaning that 'care occupations' became the priority. Previously valued occupations, often completed with the spouse, were no longer feasible. The influence of care roles or family obligations is documented elsewhere (Morgan *et al.*, 2019) and previous research has focused on the determinants of burdens experienced by caregivers (Mello *et al.*, 2017). However, the pertinent issue for this research was the way in which participants adapted following bereavement. For some there were practical barriers caused by the bereavement (e.g. new reliance on public transport), which reduced occupational choices. For others there was a need to adjust to occupations that previously had social elements and were completed with a spouse. These were now solitary occupations or ruled out as unsafe to complete alone. Conversely, there was also evidence of pleasure and appreciation of the opportunity to complete occupations that were self-directed and self-satisfying, following a long period of needing to support others' needs. Similar differing experiences of freedom to engage in new occupations, versus loss or change in meaning in old occupations, has been reported elsewhere (Batista *et al.*, 2019).

As proposed earlier, there was a report of assets, adaptations and, occasionally accommodations, not deficits and limitations, in participants' experiences. Although the section above has detailed barriers and changes to the way occupations were engaged with or experienced, this largely did not result in disengagement. The following content explores the responses of participants to these challenges. The concept of occupational adaptation has been used to frame the processes occurring. This was defined as an internal process, and response to an encounter with an occupational challenge, driven by desire to achieve mastery over one's environment (Schultz, 1997). This definition was chosen due to its reflection on the process used by participants. In

opposition to the practical 'adaptation of occupations' that occurs within an occupational therapy intervention, participants adapted their occupations instinctively and without support.

Within Schultz's (1997) definition there was an assumption that mastery over the environment was the purpose of adaptation. Within this study there was a strong desire to continue to maintain mastery of previously valued occupations. There was additional awareness of a need to find ways to facilitate that engagement in the face of a changing occupational experience. The use of occupational adaptation as a concept has not been applied to people at the pre-frailty stage, although its use to understand a changing occupational experience is widespread (Johansson *et al.*, 2018). The most common adaptation made was the need to reduce duration of engagement of physical activities like group walks. This allowed continued participation with minimal difference in the experience. This usually occurred following a negative experience of trying to complete the occupation as intended, creating awareness of reduced energy levels and a need to reduce the demand of the activity. Other strategies involved self-directed environmental modifications such as choosing the shower rather than bathing, to accommodate difficulties getting out of the bath, and increasing the number of trips taken when carrying shopping to reduce the demand and risk of falls. Again, the trigger for adaptation is the awareness of reducing functional abilities, and motivation occurs with the desire to maintain independent completion of the task. There was only minimal dissatisfaction with adapted occupations, perhaps due to the sense of mastery afforded by maintaining independent participation in valued occupations. Described elsewhere is the process of adaptation as a subtle, continuous adjustment to loss for older adults (Jackson, 1996), and while the experiences detailed in this study appeared more responsive to individual triggers, there was evidence of a gradual nature of the need to respond and adapt.

There appears to be good alignment with a theory of self-initiated occupational adaptation, and other well-evidenced processes and constructs. The suggestion that achieving mastery over valued occupations in the face of a changing functional ability could be understood by theory surrounding the locus of control (LOC), and in particular the multi-dimensional health locus of control determined by Wallston, Wallston and DeVellis (1978). This measure was based on theory that people's locus of control can broadly be internal (the belief in ability to affect health being contained in one's self) or external (that health professionals and their decisions control outcomes, or that outcomes are down to chance and unmodifiable). In this study there was influence over beliefs relating to a very broad conceptualisation of health which focused on unnamed frailty and preservation of function (discussed further in Section 5.6). There was assumption and experience of the benefit of physical and social activities for reducing deterioration due to frailty. There was also a sense of choosing those occupations based on a

duty, and ability, to affect improved outcomes and ensure independence, which were threatened by frailty. This was apparent in discussions that were categorised under a 'Duty of Self-Care'. While there was a sense of obligation, there was also a desire driven by a belief that autonomy to maintain independence in important daily activities could be determined by the person's own actions, reflective of an internal locus of control (Wallston, Wallston and DeVellis, 1978) present in this sample. Other research has suggested that older adults' internal locus of control is challenged by awareness of negative events affecting peers (Goldsteen, Counte and Goldsteen, 1995). Within this study the converse was true, where awareness of peers having reduced function did not trigger a sense of inevitability of a similar outcome for themselves, but rather increased determination to maintain control of their own destiny, with increased engagement in physical activity.

Current health policy has focused on supported self-management of long-term conditions to improve outcomes (Coulter, Roberts and Dixon, 2013; NHS, 2019). Within this study there is evidence that unsupported, self-initiated, self-management of functional ability, and avoidance of frailty, occurs through occupation. For the participants there is evidence that they are highly motivated and aware of mechanisms that they determined would reduce their risk of adverse events. This view is represented in theoretical considerations of active ageing that emphasises the ability of older adults to direct and implement strategies that improve their health (Wilcock, 2007). This appears reflective of the concept of having knowledge, confidence and skills to manage one's health, which is defined as patient activation, and is linked to improved outcomes (Greene and Hibbard, 2012; Barker *et al.*, 2018). As well as the use of occupation to manage function, its use to manage wider ranges of symptoms, largely representative of frailty, in physical health and mental well-being domains occurred and is discussed in Sections 5.6 and 5.7 below.

5.6 Research Question 4B (RQ4B): What is the experience of older adults engaged in a frailty prevention intervention in relation to physical health and mental well-being?

5.6.1 RQ4B Summary Answer

The experience of physical health and mental well-being was the only research question to highlight a division in participants' perspectives. The central feature was that participants were living with both measured and experienced levels of pre-frailty and frailty. However, subtle differences in understanding their health, well-being and frailty status were present. The first was conceptualising health as function and fitness, as opposed to physical symptoms. While all participants recognised the effect of physical symptoms on function, those defining health using function, believed in the ability to have good health in spite of physical limitations. Linked to this conceptualisation were the differences in beliefs that health could be modified or controlled. Those people who understood health in terms of fitness and function had an approach that attempted to modify symptoms and prevent further deterioration. Those who adopted a symptoms-based description were more passive and relied on healthcare professional advice for management of symptoms.

Despite differences in conceptualisation of health there was commonality in an age-related deterioration of health and well-being. Similarly, to the experiences in RQ3 and 4A this aligned with, but was not named as, frailty. Frailty was experienced as a gradual decline in function and a susceptibility to adverse health events. Even for those who demonstrated a belief in the ability to modify health status, there was an inevitability of ageing and associated deterioration. However, the inevitability could not have been fully accepted, as there were frequent attempts to continue to adapt to health-related changes and mitigate against further decline.

Well-being was a concept considered as a component of an overall health status. It was often listed in a secondary manner and described as contingent on frailty or physical health status or as a consequence of adverse events. Due to its close association with both physical health and participation in activities, it is also explored in RQ4C.

5.6.2 RQ4B Discussion

Similarly to the experience of activity in the preceding section (5.5), there was evidence of deterioration, this time relating to health, for all participants detected by both quantitative measures and interview data. This was frequently reported as decreased energy, which is

supported in traditional conceptualisations of frailty (Fried *et al.*, 2001). Within discussions about health there were generally two types of experience that shaped the person's view of their health and frailty status; that of a gradual decline in health with increasing awareness of susceptibility to poorer physical and mental health, or awareness of an increasing frequency of adverse health events, such as acute illnesses or injuries which were understood to be temporary and transient. However, even those in the latter category appeared to engage with acceptance of an increasing vulnerability to those events and despite not the term 'frailty' not resonating with participants, it appears that the description of frailty involving an increasing vulnerability to adverse outcomes from minor stressors (British Geriatrics Society, 2014), was experienced in this population.

The conceptualisation of health status for participants highlighted they experienced important distinctions between frailty, co-morbidity and function, in line with traditional prepositions (Fried *et al.*, 2004). These concepts were closely related, but not the same. The discussions above illustrate frailty (despite the term not being representative of their experience) as a vulnerability to increases in co-morbidity *and* deteriorating function. However, there was some misalignment where overall health status could be discussed positively despite such changes occurring. A study with older adults with more advanced functional limitations, due to being housebound, found a similar incongruence, where 50% classified their health status as 'good' or better (McGregor *et al.*, 2017). As was discussed in Section 5.4, there was a difference between measured outcomes (usually less favourable) and perceived abilities. It appears that self-assessment of health is influenced by perceived function more greatly than awareness of diagnosed conditions.

Recent papers continued to highlight the 'burden' of frailty on people and the healthcare resources required to support them (Dent *et al.*, 2019; Hoogendijk *et al.*, 2019), and emphasised the risks for people who have frailty in relation to mortality and other serious illnesses (Rockwood and Howlett, 2019). While not trivialising these perspectives, and remaining mindful that the people considered in this study were not all at the level of established or advanced frailty, the findings in this research suggest that the actual experience of those living with frailty is much more complex, and often less pessimistic, than much of the literature. The previous paragraph highlights that participants were experiencing health-related deteriorations, including an awareness of vulnerability, yet there was only some concern about impending, serious, health conditions. Furthermore, the literature often described deficits as rapidly accumulating (Rockwood and Howlett, 2019), in an almost non-modifiable manner. The experiences reported here are of being able to respond to frailty, and mitigate against changes in functional ability, physical health and mental well-being. This was often with the use of purposeful activity, which creates a workload of health management. The processes driving health management are now discussed in relation to existing, related, theories.

The latter part of the discussion in Section 5.5 proposed an internal locus of control (Wallston, Wallston and DeVellis, 1978), as having application to the use of occupation to maintain function for participants in this study. Using a more traditional application of locus of control (LOC) theory to health beliefs and behaviours (Jacobs-Lawson, Waddell and Webb, 2011), there was extensive evidence of the multidimensional health locus of control in the context of discussions about health status and experiences (Wallston, Wallston and DeVellis, 1978). Unlike the application of locus of control to maintenance of function through activity above, in the context of health and frailty status the participants reported divided experiences that could be attributed to a predominating internal LOC, versus an external LOC. The division was most apparent in responses to questions about current health status. For some there was a conceptualisation of health measured in terms of 'fitness' to complete daily activities, whereas for others there was a focus on symptoms, especially physical symptoms, and interactions with healthcare professionals. Those who focused on physical symptoms reported powerlessness over the progression of those symptoms. The means of response was to trust in the guidance of a doctor and the medication prescribed, demonstrating the external LOC (Wallston, Wallston and DeVellis, 1978).

Another component of external LOC is acceptance of health outcomes being due to chance (Wallston, Wallston and DeVellis, 1978), and there were several suggestions that ageing meant an inevitable decline in health status, reflective of this construct. Although participants' responses could broadly be divided into an internal versus external LOC, there was evidence of a blended LOC. A person could have largely understood their health status to be as a result of chance, and to 'do as the doctor tells you', yet there was still evidence of an internal belief to maintain a healthy and active lifestyle. The most pertinent example of this blended LOC was of an apparent acceptance of increasing vulnerability to events like falls or deteriorating frailty status, but with evident belief in the ability to manage that vulnerability and reduce the risk independently. This is pertinent to the understanding of people living with frailty and pre-frailty. The sample in this study applied an internal LOC to reduce of frailty's effect on function, yet there was some externalisation of that LOC when considering the longer-term trajectory. Participants were working to mitigate frailty, yet imagined a tipping point, or loss of autonomy, that would be beyond their power to prevent.

LOC also appeared relevant to participants' understanding of mental ill-being. The topic of mental well-being also was influenced by LOC. Again, the blended feature appeared with participants understanding external events or an unmodifiable personality type to be the cause of low mood, but combined with a sense that well-being could be improved by action; either seeking social

interactions or other activities that prevented rumination. The influence of LOC over health, well-being and activity decisions was not anticipated to feature so pertinently, and it is proposed that future studies could evaluate LOC more thoroughly in comparison to outcomes. Other evidence suggests that female, white, older adults are more likely to have an internal LOC which supported improved outcomes (Zhang and Jang, 2017). This mirrors the sample who contributed the data to the qualitative study but adds specific insight that people living with pre-frailty and frailty can apply their internal LOC to management and mitigation of deterioration. It would be important to understand variations in LOC for the wider population.

Closely linked to the concept of LOC is that of self-efficacy. Self-efficacy in health management stems from psychological behavioural change theory. Bandura's (1977) theory proposed that the level to which someone perceives they can influence a successful outcome will determine the instigation, and degree of persistence, of a coping behaviour or activity. There is only recent investigation of measures of self-efficacy for people with frailty. A cross-sectional study found associations with poorer self-efficacy and worsening frailty status (Hladek *et al.*, 2019). While self-efficacy was not formally captured in this study, the findings show a sample of people who appear to have positive self-efficacy. This was in relation to their ability to influence their functional abilities by making health-promoting behaviour choices. Such behaviour occurred irrespective of frailty severity and challenges the results from other studies. While the STEER Course was not an intervention designed to increase self-efficacy, its approach might suit, and attract, people who already have positive levels of self-efficacy, explaining the findings.

As became apparent in the discussion of activity above (Section 5.5), the participants were highly skilled at adapting their occupational engagement in response to a changing health status and did this in a self-directed manner. Largely, the process of self-management was also self-initiated and unsupported, but where contacts with health professionals occurred there appeared to be less satisfaction. Participants in this study had only routine encounters with health professionals such as general practitioners and physiotherapists, and these were usually engaged when deemed unavoidable. As discussed earlier, there was a belief that health problems were temporary, and evidence suggests this can be a barrier to seeking treatment (Taber, Leyva and Persoskie, 2015). There is, perhaps, learning from engagement with the STEER Course. As discussed in Section 5.4, its assets, and function, focused approach allowed participation due to alignment with participants' priorities. Participants might not have been so willing to engage had the Course been focused on ill-health, as is commonplace in many health services. The location of the intervention, away from traditional health services, could have encouraged participation from people who value a positive approach to health management.

Once treatments, such as physiotherapy or medication prescription, had been sought there was a challenge in engaging with such treatment. Things like side effects from medication were unpleasant, and exercise prescription from physiotherapists while understood to be beneficial, created challenges in incorporating into busy routines. There was also evidence of the obligation to engage in health-promoting and frailty-avoiding activities such as the STEER Course and social groups. The image created was of a workload of managing one's health. These experiences are reflected in the Burden of Treatment (BoT) theory which is described as the workload of caring for one's health, and in particular the proactive and self-managed aspects of living with long-term health needs (May *et al.*, 2014). The features of BoT reported in this study, and detailed elsewhere (Demain *et al.*, 2015), were disruption of meaningful activities due to a need to engage in 'prescribed' activities and a non-adherence of medication-use due to the intolerable side-effects experienced. There was also specific application of BoT to the maintenance of mental well-being, where participants felt that increased ill-being was a consequence of failure to work sufficiently hard at implementing activities and engagements that they understood would improve their mood.

Existing BoT evidence has explored the experience of people living with complex or chronic conditions (Eton *et al.*, 2012; Demain *et al.*, 2015) and so the important finding here is the presence of a notable burden with an emerging impact on well-being, even at a stage when participants consider themselves to be living well with the unnamed frailty. This finding has been previously demonstrated on older adults (aged over 85) with established frailty, by an increased workload to mitigate a deteriorating health status (Nicholson *et al.*, 2013). There is potential that if participants had generated an internal health locus of control as described earlier, that this self-initiated response contributes to the sense of workload and ownership of the need to manage their health conditions. There was also evidence of a variable sense of satisfaction with this workload of frailty management. There is potential that while all participants were engaged to some degree in the workload of avoiding frailty-related deterioration, those who experienced greater self-efficacy relating to that work, had a lower treatment burden. There were examples where multiple participants experienced similar health deteriorations, and adopted a similar management strategies, but yet the resultant satisfaction, or well-being, differed. It would be valuable to measure the effect of self-efficacy in relation to the self-management of frailty to determine if it explains the type of differences noted.

These experiences align much more closely with emerging discussion in Intrinsic Capacity in frailty, which emphasises the ability of people to draw on physical and mental resources to maintain function and achieve healthy ageing (Cesari *et al.*, 2018; Belloni and Cesari, 2019). Furthermore, the Cumulative Complexity Model (Shippee *et al.*, 2012) demonstrates the potential

for complexity, and challenges, to occur when imbalances develop between a person's capacity (aligning with Intrinsic Capacity) and the workload (aligning with Burden of Treatment, discussed above) of managing health. Participants in this study were balancing a great deal of complexity; they had high levels of internal resources and were successfully applying them to the management of a changing frailty status. The image of the fine balance between workload and capacity might explain the level of fear experienced. Participants *were* living well with frailty, but were conscious that any insult to their capacity could result in a sudden tipping point, and loss of the function and independence they desired and needed.

This section has considered the experiences of physical health and, in part, mental well-being. Frailty was evident within participants' experiences of a deteriorating health and functional status. However, influence of self-assessment of function as representative of health, ensured a largely positive description of the overall health status. Well-being and life satisfaction were both concepts of relevance to participants, notably a decreasing sense of well-being in response to a changing physical health status. This had impact on activity participation and consequently is discussed in the following section.

5.7 Research Question 4C (RQ4C): What is the experience of older adults engaged in a frailty prevention intervention in relation to interactions between activity, physical health and mental well-being?

5.7.1 RQ4C Summary Answer

The experience was of participants living with pre-frailty or frailty and whose physical health, mental well-being and engagement in activity were changing, as a result. The constructs of physical health, mental well-being and activity were inter-dependent, or cyclical. This was experienced where change to any one, in either positive or negative manner, would have consequence for the remaining two. For example, where physical health limited activity engagement, reduced well-being was experienced. However, deliberate engagement in valued and purposeful activities had the power to improve physical or functional symptoms, and well-being.

Participants had awareness of the ability to influence their physical health or mental well-being with engagement in targeted activity. For some people this was readily used and provided a sense of autonomy, which further increased well-being. However, there were incidences where the need to adopt purposeful activity was experienced as a burden, and either detrimental to, or creating a conflicted sense of, well-being.

The driver for targeted adoption of activity was experiential evidence of its utility. As was discussed in RQ 3, participants valued their experiences over objective measures of function. It appears that this was generated through long-standing experience of recognising deterioration due to frailty, specifically in elements of their physical health, function or well-being. Participants were able to improve each area with activity. Similarly, to discussions in RQ 4A, activity is being used to adapt to changes related to frailty. This occurs in two ways; either adaptation of the activity itself, or adaptation to health-related deterioration by the mechanism of activity.

5.7.2 RQ4C Discussion

Throughout the Findings and Discussion chapters it has been difficult to consider the experience of living with frailty and changing relationships with occupation and activity, and physical health and mental-well-being in isolation, such was the interlinked manner in which they were experienced by participants. This section, then, will synthesise that discussion. Within the fields of occupational science and occupational therapy there is a fundamental assumption that there is

a (positive) relationship between occupation, health and well-being (Wilcock, 1998). There has been identification of a lack of empirical studies into this relationship, especially for those experiencing challenges to their health or well-being due to frailty (Law, Steinwender and Leclair, 1998; Stewart *et al.*, 2016). This supported the endeavours of this study to examine the interaction based on the evidence from experiential accounts, with specific application to a sample experiencing pre-frailty or frailty. As was established earlier, discussions about ‘activity’ were determined to be accounts of occupational engagement, and so that term is used throughout this section.

The theoretical preposition of a link between occupation, health and well-being is of humans having occupational needs that are driven by a desire to maintain, or overcome, physical, social or emotional limitations (Wilcock, 1998). While proposing this theory Wilcock (1998) encouraged a need to substantiate this claim. Within this study the clearest interaction between occupation and physical health or mental well-being was the deliberate choice to engage in occupations that had understood benefits for the physical health and mental well-being of participants. This was driven by the threat of frailty to independence, and used occupational engagement to mitigate losses and maintain function. As was discussed in Section 5.6, findings in this thesis challenge the deficits-focused frailty literature. Very recently a call has emerged to include sociology and humanity-informed perspectives to inform a more positive view of frailty (Pickard *et al.*, 2019), and this thesis suggests an occupational perspective would align with this approach. This thesis provides support for assets-focused, and experiential, perspectives based on a sample of people successfully living with frailty. This section continues with specific examination of the role of occupation in the experience of physical health and mental well-being when living with pre-frailty or frailty.

Participants frequently reported their reasons for choosing specific types of activity (usually physical activity completed in groups, away from home, or social activities) because of experiential awareness of them having benefit for physical symptoms or function, or a sense of well-being. Combined with this was experience that when not completing those activities, either through choice or circumstance, there was deterioration in health and well-being. As well as the internally-derived and experiential belief in the benefit of these activities, there was suggestion that public health campaigns for older people had generated awareness of those occupations being supportive of good health. The occupations most valued by participants frequently could be categorised as leisure activities (e.g. walking groups, Women’s Institute sessions or card games). Although the functional benefits listed were often things like leg strength, brain function, and social interactions, there was value and enjoyment of the activity as a whole occupation.

There is evidence supporting similar activities as improving older adults' sense of optimism which has known links to lower depression levels (Heo *et al.*, 2017), and links between higher demand leisure activity engagement and increased life satisfaction (Nilsson *et al.*, 2007). There is potential in this study, which relies on experiential account rather than measured life satisfaction or mental well-being, that the more overt and tangible benefits to older adults are physical or cognitive improvements, whereas improvement in mental health might more simply be identified as enjoyment and value. The Lifestyle Matters intervention (Mountain *et al.*, 2017) had some similarities to the STEER Course, although had a broader approach as not focused on frailty but rather improving mental well-being. It was unable to demonstrate improvement in mental well-being during intervention, due to participants having a high level at baseline (Mountain *et al.*, 2017). There is potential that measured well-being values, if implemented for STEER, would have followed a similar pattern. The qualitative arm of this study provides some understanding as to why this occurs. Participants largely experienced good mental well-being, and when physical health threatened occupational engagement that could detract from well-being, they were skilled at adapting engagement to maintain participation.

There appeared to be a dynamic between concepts of physical health (including function), mental well-being and occupation. The most frequent illustration of this was when physical symptoms limited occupational engagement. For some participants this reduced the activities they completed, and this was identified as a limiting factor of the mental well-being they experienced. Related literature has identified links between physical functional measures of balance and grip strength with reduced quality of life markers (Haider *et al.*, 2016). Within this study there was discussion about the impact of improved balance resulting in increased confidence in the occupation of attending the theatre, identifying ways in which physical function can influence quality of life. There was also supposition that due to the physical constraints already experienced, there was prediction of a reduced engagement in activity and related sadness or loss - maintaining a cycle of increased physical symptoms, reduced participation and reduced mental well-being. The association between physical activity and improved psychosocial outcomes is documented elsewhere (Calderon, 2001; Delle Fave *et al.*, 2018), and it is suggested here that there is a mediating effect of occupational engagement, which is the mechanism to influence physical health and mental well-being.

Discussions about participants' understanding of health also identified a link between occupation, health and well-being. Although not a universal approach, the majority of participants had a conceptualisation of their overall health status defined by constructs like fitness and their level of independence in important daily activities. Importantly, there was a level of achievement or satisfaction achieved by being able to choose how to spend time and remaining independent in

daily activities. A focus on physical health symptoms, and to an even lesser extent, the level of mental well-being, were secondary concerns. Participants acknowledged a good sense of health and well-being, determined and measured by their ability to independently complete activities with a sense of autonomy and control. This was comparable to an important finding by Jessen-Winge, Petersen and Morville (2018), wherein older adults' well-being was determined by the extent to which mastery over daily routines was experienced. While not conducted in the field of frailty, there are parallel findings in research into people living with multi-morbidity (Leijten *et al.*, 2018). Leijten *et al.* (2018) provided evidence of people's definition of 'good health' being the ability to choose and complete valued, but 'normal', daily activities. The experiential accounts highlighted the need to consider functional health separately to 'symptomatic' health, to align with participants' conceptualisation. In this study, frailty was understood to threaten independence in chosen occupations due to reduction in functional ability, and avoidance of dependence was a key reason for the choice of occupation. These findings were replicated in the literature review, where health was defined by function and could be improved with physical activity (Marquez *et al.*, 2016; Sanders *et al.*, 2018). This is important knowledge for health service design as it highlights that people's priority is to remain independent in completing chosen occupations, rather than an expectation to live free of disease.

The discussions in Section 5.6 proposed the use of Intrinsic Capacity (Cesari *et al.*, 2018) to frame the level to which participants had the physical and mental resources to experience healthy ageing, in the face of frailty. This was pertinent to the conceptualisation of frailty suggested here as an active process involving work to maintain function and mitigate health-related losses, through the use of purposeful activity. Intrinsic Capacity was based on a model that includes participation and activity to maintain function, and a number of interacting factors that contribute to health status, including contextual factors (environmental and personal) (World Health Organisation, 2001; Cesari *et al.*, 2018). This is highly reflective of discussions in this thesis, within which all of those factors interacted. However, what is also proposed here is that *occupation* (understood as purposeful, valued and meaningful activity by the way participants described their experiences) contributes an additional level of understanding of the factors that contribute to overall health status described in that model. Where participants were able to engage in occupations that both supported their goal of mitigating the effects of frailty, and provided genuine enjoyment and satisfaction, there was less obligation, or burden, of the work of managing their health. The experience of Burden of Treatment (May *et al.*, 2014) was discussed in RQ4B (Section 5.6). Learning from this study suggests that the burden is less apparent when 'treatment' can be contained within complex occupations that synthesise enjoyable or satisfying components with the aspects that address functional limitations.

Developing from considering successful approaches to mitigating frailty was understanding of the experience of living with frailty when a burden of health management was felt. Within discussions that contributed to the understanding of the meaning of activity and a duty to engage in occupations that enhanced self-care, there was a differing sense of life-satisfaction and well-being. For some participants the desire to maintain independence and good health through the use of valued occupations was supportive of their goals and wishes. For others, however, there was a sense of obligation to complete those occupations, with an externally generated belief that it was the right course of action. In the latter situations there appeared to be less satisfaction, or well-being, generated by the engagement. This finding is supported by research completed with the 'oldest old' who described a level of considerable effort in sustaining their level of function, and a need to respond and adapt creatively to change in function (Nicholson *et al.*, 2013).

These experiences align with Burden of Treatment (May *et al.*, 2014) and provide new understanding as to its relationship to occupational engagement. There is also understanding gained from the concept of occupational integrity, wherein well-being is determined by the extent to which a person can control their occupational choices, to congruently align with their own values and personally-derived meaning (Pentland and McColl, 2008). There is further similarity to the earlier discussed concept of health locus of control (Wallston, Wallston and DeVellis, 1978). Those participants who demonstrated experiences reflective of a well-developed internal health locus of control appeared to have greater satisfaction and higher levels of meaning in their occupational engagement, whereas those with a more blended or externally driven health locus of control appear not to experience occupational integrity as described above. There is potential that those people who complete, for example, an exercise class because they are aware it is important to be physically active, but would not routinely choose the activity are not experiencing an *occupation*, but rather, somewhat ambivalently, adopting health-promoting *behaviour*. While there is little evidence in the field of frailty, discussion elsewhere considered how routine occupations become 'illness infused' and linked to a broader experience of ill health (Elliot, 2012; Stewart *et al.*, 2016). There is potential that participants who were not historically engaged in physical activity only associate it with avoidance of a declining health, rather than a more positive connotation. It is suggested here that those people who find true meaning, and enjoyment, in occupations that incorporate health-promoting activities would have a greater sense of mental well-being. The effect of this on health and well-being outcomes over time, in relation to a potential progression (or otherwise) of frailty is an important area for further study.

Occupation, as the form of personally meaningful activity participation, was closely connected to the health and well-being of older adults living with pre-frailty or frailty. A cyclical, or inter-dependent, relationship between the three factors was observed, where changes in one had

effect on the other, which maintained motion of the cycle. For most, occupational engagement was fulfilling and supportive of physical health and well-being, and the means to limit the effect of frailty. There was emergent suggestion that for some a sense of duty to complete the 'right' occupations to support health and well-being detracted from a sense of the occupations being those that would organically be embraced. These features linked to the Burden of Treatment (May *et al.*, 2014), where true occupational engagement could reduce the burden of mitigating frailty. While a cyclical relationship is suggested, it should be noted that most commonly it was changes to physical health, functional ability or mental well-being that prompted negative changes in occupational engagement, which could have further consequences for those same components. Conversely, increased engagement in occupation was identified as the mechanism to either improve, or maintain, physical health, functional status and mental well-being.

5.8 Limitations

This section considers the limitations of the study and potential influence on results and findings. It is divided into sub-sections based on the study design and sample, outcome measurements, loss to follow-up and influence of bias.

5.8.1 Study Design, Population Characteristics and Sampling

The study design included methods of pre/post-testing of a single group receiving the intervention, which prevents identification of the reason for change. Additionally, the lack of empirical evidence as to expected outcomes for people living with pre-frailty and frailty in a non-intervention setting over the same time period means the scale of such improvements cannot be identified. A central aspect of this study was that health, well-being, and activity participation were complex concepts occurring within multi-faceted contexts. This complexity meant that even a simple measure, such as sit to stand transfers, were influenced by many things and so definitive explanations for change were not possible. As well as contextual influences, there was an inability to tightly control the conditions of measurement (discussed further in the next section). However, as interventions such as STEER will never operate under trial conditions in the real world, this study blended procedures that minimised bias and error with the opportunity to study an 'organic' intervention. Follow-up testing occurred six months after completing the Course, this relatively short period of time prevents understanding of the longevity of any changes to outcomes.

At the point of designing the study it was not anticipated that the group recruited to STEER Courses would have such a high incidence of measured frailty, as opposed to pre-frailty. The research was interested in the health status of those engaged in a frailty-prevention intervention, and so analysed the results of the whole population. This allowed consideration of people who identified as being at risk of a deteriorating health status, representative of, although not named as, frailty (by virtue of signing up for the intervention). Based on this, this thesis has not focused solely on pre-frailty, as intended. At the point of analysing baseline data it was considered if outcomes and experiences of people categorised as having 'pre-frailty' only should be considered. This was rejected as the discrepancy between measured frailty, function and conceptualisations of frailty was evident at an early stage, which appeared important to understand.

The sampling for the qualitative arm of the study was achieved using a convenience sample of those already engaged in the Course, with participants for the qualitative arm of the study self-selecting. The influence of this is considered below (Section 5.8.4). It had been intended to recruit sixteen participants for the interview component of the study, with inclusion of four participants

at four different STEER locations. However, during the twelve month data collection window, only two STEER Courses commenced. At the point of recruiting the eight participants it was not known that no further Courses would commence, preventing additional recruitment at those sites. Even if it had been known, the ethical considerations regarding maintaining anonymity of participants in the quantitative study only would have prevented the target recruitment being met (See Section 3.9 for full details). There were fewer men than women on the STEER Course as a whole, but two-three male participants would have made the sample more representative, based on the full cohort.

5.8.2 Outcome Measurement and Measurement Error

The study was based on a range of quantitative outcome measures. The properties of which were discussed in more detail earlier (Section 3.8.1). As was discussed in this section, the measures were implemented prior to the research being designed. As little alteration of outcome measures or procedures could be implemented, it was decided to keep such procedures as uniform as possible so that all data from the Courses could be included in analysis. This compromise increased the sample size by approximately 50% but was at the expense of having full control over the measurements used or full supervision of the implementation of standardised operating procedures. However, the examination of the measures provided support for them being appropriate for the study population (Section 3.8.1). Despite this, a key finding from participants who completed interviews was that the value of outcome measurement was poorly understood, with several participants questioning the outcomes achieved in comparison to their own experiences. This was an important finding, and suggests that while there might be other measures that are more suited and acceptable to the group. Outcome measurement as a whole does not provide much value for participants compared to experiential outcomes and achievements rooted in their daily lives.

This study had intended to have more data relating to mental health and well-being outcomes, but this was not achieved (see Section 3.8.1). Development of the research would benefit from greater examination of large-scale data relating to mental health of participants. An area which would need to be addressed in further studies would be the inclusion of outcome measures based on examination of the most appropriate measures for the client group with appropriate levels of sensitivity and specificity, and in particular participant acceptability. This has been discussed above and studies such as the Well Elderly (Clark *et al.*, 1997) and Lifestyle Matters (Sprange *et al.*, 2013) provided examples of a more comprehensive measurement of physical, social and mental health functional measures. This three-stage approach to measuring function was also supported in current practice guidance (British Geriatrics Society, 2014) and reflected the

qualitative outcomes produced in this study. As mentioned in the preceding paragraph, there was indication that outcome measurement was of less concern and relevance to participants. It will be important to determine if this is still the case with measures that are well-understood and easily interpreted by participants, while capturing priority areas (from a participant point of view). Potentially, outcome measurement is of low interest and would need to be mindfully incorporated into development of the Course to allow stakeholders to receive evaluative information, without creating an unwanted focus on objective measurement for Course members.

The Standardised Operating Procedures (Appendix C) were adopted to reduce measurement error. The potential for measurement error or inconsistencies was intended to be mediated with inter-rater testing, however a single tester completed all measurements which made this redundant (see Section 3.14).

5.8.3 Loss to Follow-up

Analysis of characteristics of those lost to follow up suggests that results might be biased to better outcomes as a person with the poorest outcomes was most likely to not complete the Course. The highest outcomes, however, were attributed to those who completed the Course but did not attend six-month follow-up testing for all measures except grip strength, suggesting that where improvement has been maintained at the six-month point it has not been influenced by over-representation of participants who started the Course with higher functional abilities.

Within the mixed methods section there was full retention between baseline a Course completion, but only three participants returned for testing and completed a six-month interview. At this time point content about the ways in which participants had experienced and adopted changes to behaviour was expected and so findings in relation to this are limited. However, information about health, well-being and activity participation was primarily found within the baseline interviews and it is not expected to have been detrimental to the research questions surrounding experiences of health, well-being and activity.

5.8.4 Bias

There were a range of measures implemented to reduce bias with the study and these are considered in Section 3.14. An area not fully accounted for prior to the research commencing was that within the interviews there was suggestion that it could have been difficult for participants to report less positive experiences or outcomes. This appeared to be driven by a desire to be polite, having experienced a largely positive and enjoyable experience of the STEER Course, and which

generated gratitude for the time and expertise of STEER Course facilitators. This could have been exacerbated by the Course being free to participants. While the positive aspects reported by participants are likely to be accurate, there could be omissions due to an expectation, or desire, to be supportive of the fire service. If follow-up studies are completed the use of an impartial space for any interview or focus group data collection could help emphasise the impartiality of the researcher, although there is potential that a level of caution would always exist as participants would be aware their feedback would eventually be received by HFRS.

Participants were aware that the researcher was an occupational therapist. Furthermore, content of the STEER Course promoted an active and healthy lifestyle. There is potential that, despite interview questions encouraging discussion of all aspects of activity-participation, participants felt obliged to report mostly health-promoting activities and proactive approaches to health management.

The final area of bias that could not be mitigated was that STEER Course members were attending a health-promotion intervention largely by means of self-referral. It is expected that this would attract people with a pro-active approach to managing frailty-related deteriorations. Due to this, the perspective of those with a differing approach has not been captured. Furthermore, those who participated in the interview component were aware the purpose was to explore health, well-being and activity participation. Those people with less positive experience of those domains might have been less willing to volunteer.

5.9 Implications for the STEER Course

The STEER Course was a well-received intervention with some promising outcomes for participants. No major changes are recommended to the Course content or format of the intervention, and the recommended improvements are discussed below. The only clear area for improvement was providing more detailed pre-Course information about the format and structure of the Course as all participants expressed being uncertain of what to expect before attending their first session.

On initial consideration of the findings, the most crucial result in terms of implications for HFRS is the number of people attending the course who were identified as already living with frailty. Analysis of frailty status by grip strength determined that only 29.4% of those recruited to a STEER Course met the intended criteria of having pre-frailty. The first implication of this is that the STEER Course already had positive outcomes using a sample with a higher frailty status than intended, therefore outcomes for a sample classified solely with pre-frailty, could be even more successful.

As the STEER Course is intended as a preventative intervention for those at risk of frailty it highlights a discrepancy between those recruited and the target population of the course. However, the, albeit small, qualitative arm of the study indicates a much more complicated process occurring whereby the frailty classifications do not translate to self-perceptions of ability, or perhaps more pertinently, disability. The only participant to express concern that they might not have been sufficiently able to complete the STEER Course met the criteria for pre-frailty on both measures, whereas others with a higher frailty status reported very positive experience of participating in STEER. HFRS have two options based on this. The first is to consider re-branding the intervention as one aiming to prevent further deterioration in function due to pre-frailty and frailty, as long as participants have the functional ability to participate. The second would be to screen for frailty prior to participation using grip-strength measurement and only accept those meeting the criteria for pre-frailty. This decision would be down to HFRS and their priorities based on their service planning and strategy. However, based purely on the intervention outcomes, the first option is recommended.

As the STEER Course used Fried *et al.*'s (2001) definition of pre-frailty it would be worthwhile to alter some of the outcome measures to allow a more robust identification of frailty level - especially as phenotypical pre-frailty has recently been proposed as a non-homogenous syndrome of two sub-types (Romero-Ortuno *et al.*, 2019). No data is captured about reported weight loss in the previous year, and this would allow determination of participants experiencing "shrinking" (Fried *et al.*, 2001). Alternatively, simply adding in a weight measurement at Course completion and six-month follow-up would allow for objective measure of weight change. While being underweight was not a concern for the vast majority of this sample, sudden weight loss could indicate problematic muscle loss and would provide warning of such a change. The raw Timed Up and Go (Podsiadlo and Richardson, 1991) collected as part of the QTUG™ (Kinesis Health Technologies, 2014) would provide the data to identify those in the "slow walking speed" category, identified by Fried *et al.* (2001) and would improve accuracy when identifying frailty (Lee *et al.*, 2017). The remaining Fried criteria of exhaustion and low physical activity were captured using short reported assessments (Fried *et al.*, 2001). These could be implemented without extending the duration of the measurement sessions.

The Geriatric Depression Scale (GDS) (Brink *et al.*, 1982) would provide a useful outcome measure about rates of depression in the group if adopted in its full form. The GDS (Brink *et al.*, 1982) is a brief measure that captures both depression and positive affect with acceptable sensitivity and specificity for depression (0.814 and 0.754, respectively) within community-dwelling older adults who have some functional limitations (Friedman, Heisel and Delavan, 2005). Given many of the STEER population reported positive affect, in addition to those who had low mood, it could be a

highly suitable measure and more suited to the population than the PHQ-9 measure which had been selected for use (Kroenke, Spitzer and Williams, 2001). The STEER Course participants' data also demonstrated that the majority of participants are overweight. As obesity and nutrition are already educational topics for the STEER Course it is unlikely that this requires modification, but provides information for HFRS as to the typical needs of its participants and support for its inclusion in the Course. Falls are closely linked to frailty, and recent evidence suggests functional exercise could be the most effective means of reducing the rate of falls in older adults (Sherrington *et al.*, 2019). Capturing data of number of falls pre/during/post intervention would provide a useful measure of the effectiveness of the STEER Course.

The qualitative aspect of this study indicated that the process of outcome measurement is not especially relevant to participants, and that there are issues with acceptability of some measures. As the FES-I (Kempen *et al.*, 2008) was not contributing useful data for this population group, removal of this assessment and implementation of a measure of psychological health, such as the Geriatric Depression Scale as discussed above, is recommended. The QTUG™ (Kinesis Health Technologies, 2014) was highlighted as a measure with an element of uncertainty over the interpretation of the results both based on the data produced in the quantitative arm of the study, and from self-report from participants. It is unclear if it is producing any valuable data and the lack of acceptability to participants suggests it is not appropriate for this setting. There is evidence available of studies that provided a more encompassing assessment of multi-dimensional function (Clark *et al.*, 1997), and this could be used to guide modification of outcome measurement. The qualitative arm of this study was small, and yet provided varied perspectives about potential changes and outcomes for participants. It is suggested that measures that capture individual perceptions of health and functional outcomes in a validated manner, such as Patient Reported Outcome Measures (Devlin and Appleby, 2010), would be a beneficial addition to the evaluation of the Course. A well-received feature of the Course was the ability of participants to share information at a peer-peer level. HFRS might wish to exploit this further with alterations to the design that incorporate more formal peer-led sessions.

5.10 Clinical Implications

The results and findings of this study provide greater insight into the needs and experiences of people at the stage when they are not accessing complex health services, however they represent a group that might become in need of complex healthcare.

Based on the findings of this study, clinicians would need to recognise that at the stage people seek support with their health, they would have experienced a long period of adjustment and self-

managed adaptation to a changing frailty and functional status. At the time they seek help they would have exhausted the strategies within their own power to adopt. There is also likely to be reluctance to seek medical help and professionals need to be aware that people come to them when symptoms or limitations are extreme.

Developing from this is the need to provide preventative health interventions in an acceptable manner to those at risk of frailty. Strategies are required that reach people at risk of frailty at an early stage, rather than waiting to the stage that people seek support. HFRS were successful in creating an intervention which attracted people keen to maximise their functional health and did so without the need to identify as having frailty. This is an important finding for other services. The majority of the sample were already living with frailty and were aware of an age-related deterioration in health but did not accept the term 'frailty'. The implications of this are two-fold. This study provides further support that the term frailty is contentious. Furthermore, despite designing the intervention to target those at the earliest stages of frailty, there appeared to be opportunity to intervene and improve outcomes even at this more established stage.

The value of peer-facilitated learning and the related social interactions is an important implication. Greater emphasis on a peer-led intervention could be trialled. As well as this, considering ways to adopt this approach for people at a greater level of clinical need where interventions are typically healthcare professional-led, could be valuable.

The findings about participants' conceptualisations of health detailed their prioritisation of maintenance of function and independent activity completion. This was in opposition to concern about specific physical health or mental health symptoms, and driven by their awareness of the value of using occupation to improve health and well-being. It will be important for clinicians to consider the use of meaningful occupations as both the mechanism and goal of successful interventions.

Furthermore, the need to consider implications of changes to outcomes has important clinical relevance. Understanding of the application of, for example, reduced strength to a reduced ability to complete valued activities has consequences for not only physical health, but also mental well-being. This research encourages the consideration of the needs of people living with frailty in a more comprehensive manner.

As is discussed further in Section 6.3, there were a range of constructs identified that shaped participants' approaches to health-management. For those findings to have utility clinically they require further study, but in doing so it would allow better informed services that understand, and embrace the realities, strengths, and limitations experienced by those living with frailty.

5.11 Summary of the Realistic Evaluation

This section has considered the results and findings of Chapter 4 and provided a further level of interpretation against known theory and empirical evidence. This study was completed using principles of realism (Pawson and Tilley, 1997; Kazi, 2003). This was applied to the open-system of participants' lives, to evaluate the role of experiences and perceptions of the multi-contextual factors. These factors occurred within domains of; the intervention, activity-participation and physical health and well-being. The discussion presented in this chapter highlights that identifying what works, and for whom (via objective measures), is a process influenced by a number of factors (more clearly understood with the synthesised mixed methods data). With respect to the mixed methods study, all participants had pre-frailty or frailty, which allowed specific examination of the findings framed within this context.

Research Questions 1 and 2 considered quantitative data for all STEER participants and highlighted the challenge of capturing pre-frailty and frailty status using single outcome measures. The change data provided support for improvement during the STEER Course, and some evidence that maintenance of that change was possible during the follow-up period. Research Question 3 used qualitative data to inform the evaluation of the STEER Course, finding value in the inclusion of peer support and interactions throughout both education and exercise components of the intervention. Participants highlighted an uncertainty about the outcomes produced by selected measures and discussion emphasised a greater focus on social aspects of the Course.

Research Question 4 was divided into three parts, to consider experiential accounts of activity, health and well-being, and potential interactions between those areas. Regarding the evaluation of physical health, mental well-being and activity participation experiences and outcomes, the relationship was of a synergistic link between all three domains. The key findings were that frailty, while rejected as a term, was a central feature to participants' experiences. Awareness of frailty-related changes to health and function were best understood by participants' self-assessment of ability and awareness of deterioration, in the context of physical function applied to valued occupations. This awareness, and fear of loss of independence, prompted adaptation responses to maintain function. Participants prioritised functional independence in daily activities over the absence of symptomatic health limitations. Irrespective of measured functional levels, participants shared understanding, and experience, of the ability to affect their perceived functional, and well-being, levels through targeted occupational engagement.

Chapter 6 Conclusion

6.1 Introduction

This chapter concludes the thesis with a summary of the key findings and implications of this research. It commences with a statement of contributions to the evidence base, followed by key priorities for development of the research topic.

6.2 Contributions of the Study to the Evidence Base

New understanding was generated based on the experiences and outcomes of participants in the frailty-prevention intervention. Participants who contributed quantitative data were mostly living with frailty or pre-frailty. For this group improvement of function occurred during the intervention, and some maintenance of change was possible. Participants of the mixed methods arm of the study were all living with pre-frailty or frailty. This allowed specific understanding to be generated of this experience. This surrounded participants' conceptualisation of frailty, and adaptation to frailty in the context of physical health and mental well-being through participation in occupation. Both of these areas were influenced by perceived functional outcomes to a greater extent than measured outcomes.

6.2.1 Conceptualisation of Frailty

This study's focus was on people living with pre-frailty, which the literature reviews identified as an under-researched group both in terms of physical outcome measures and experiential accounts of activity or occupational engagement and their related outcomes. The objective measures suggested that the sample mostly comprised those living with frailty, and a smaller group with pre-frailty. Participants in the qualitative section rejected the term frailty as representative of their experiences, but despite this, their perceptions were of changes to health, that were due to the presence of frailty or pre-frailty. This suggests that theoretical conceptualisations poorly align with the experience of living with an increasing frailty status.

Conceptualisations of frailty have derived from a largely medical model (Fried *et al.*, 2001; Mitnitski, Mogilner and Rockwood, 2001), and yet the evidence produced in this study highlights the experience of participants occurs within a multi-faceted environment, within which social, physical and physiological, emotional, and occupational influences all interact. The value and importance of daily activities and occupational engagement, with related life satisfaction, was seen as a marker of ageing well and mitigating frailty, as opposed to concerns about physical

health symptoms. Furthermore, constructs of health were understood as function *and* symptom, which were not always dependent features. Functional health was the controlling factor for occupational performance, which had a greater influence on mental well-being than symptomatic assessments of health. The approach of the frailty-prevention intervention, to prioritise function and build resilience without the need to accept the presence of frailty, aligned with participants' views. This is important learning for similar clinical services.

6.2.2 **Adaptation to Frailty**

It remains a focus within frailty literature of the 'challenge' and 'burden' of the needs of people living with frailty, particularly for health services (Dent *et al.*, 2019; Hoogendijk *et al.*, 2019). It is suggested here, that while people experience aspects of the management of their health as a burden, the experiential account focuses on the ability to overcome, mitigate or embrace a changing health status. The deficit-focused frailty literature negates the contributions of those living with pre-frailty and frailty to improve and manage their own outcomes with self-initiated self-management, using purposeful occupation. Furthermore, the dissonance of participants' conceptualisations of frailty as being an inevitable, non-modifiable and negative part of ageing, compared to their own perceptions of their health and functional status (which matched with theoretical descriptions of frailty), is potentially fuelled by the pessimistic tone within much of the literature.

The specific experience of occupational engagement was another unique contribution of this study. The exploration of participants' experience of daily activities demonstrated an interlinked cycle of occupation to manage health and well-being, and occupation as a marker of health and well-being. Research into occupational therapy interventions in frailty has lacked empirical classification of frailty (Fritz *et al.*, 2019). This study has combined frailty classification and other outcomes, with insight into the experience of living with frailty. As this approach has been missing within the evidence base it could allow better-informed interventions to be designed.

The mechanisms that operated within each person's experience of occupational engagement were similar. Participants placed importance in maintaining autonomy and control, and this was driven by a fear of frailty jeopardising such independence. This study has highlighted the links between occupational engagement and theory from broader fields of health and psychology, including Intrinsic Capacity (Cesari *et al.*, 2018), Burden of Treatment (May *et al.*, 2014) and Locus of Control (Wallston, Wallston and DeVellis, 1978). The group were highly motivated in initiating adaptation strategies, centred on occupational engagement, to limitations they faced in areas of

function or well-being. While a largely acceptable strategy, this also exposed areas of conflict between congruent occupational engagement versus an obligation to reduce burden on others.

6.3 Development of the Research

In order to disseminate the results and findings a publication plan has been created and writing will commence post-submission (Appendix P). The above contributions of the research to the evidence base show the value produced within this thesis, including the indicative value of a frailty intervention. Perhaps more crucially, the importance of considering broader experiences and outcomes in terms of internal motivations, drivers and barriers, and the complexity of older adults' strategies for managing frailty and maintaining independence have been proposed. This fits with a call for frailty research to focus more on intervention-level studies and include the perspective of those living with frailty (Dent *et al.*, 2019). While this study has embarked on evidence-generation that supports this approach, it was done so in a manner that always intended to provide better-informed guidance for further study. These specific areas for development were detailed in Sections 5.8-5.10.

Suggested developmental research questions and methods of study are now considered.

1. Do outcomes of a standardised frailty-prevention intervention vary based on the setting of delivery?

This could be captured by a randomised controlled trial of a standardised STEER intervention delivered 'as usual' in a fire service setting, versus one delivered by non-fire-service staff in a generic setting. Both outcomes and experiences could be studied.

2. What is the effectiveness of the STEER Course for populations stratified by frailty status?

This assumes HFRS adopt the earlier recommendation to, intentionally, widen participation to people of all frailty statuses.

3. What is the rate, and direction, of changes in outcomes over time for participants who complete a STEER Course versus those in a non-intervention control group?

Questions 1, 2 and 3 could be completed as part of the same trial. The setting had likely influence on the characteristics of the sample population. There is potential that these results are reflective of a population who are more inclined to engage in a pro-active intervention, and future work must consider how to capture outcomes and experiences of those people who are not as engaged in community initiatives or physical activity.

Further qualitative study is also required to develop the multi-contextual conceptualisation of the relationship between activity, health and well-being:

4. How is engagement in meaningful activity, for people living with pre-frailty and frailty, influenced by;
 - a. Locus of Control (Wallston, Wallston and DeVellis, 1978),
 - b. Burden of Treatment (May *et al.*, 2014),
 - c. occupational adaptation (Schultz, 1997),
 - d. and occupational integrity (Pentland and McColl, 2008)?

This could be incorporated into the above trial to capture experiential accounts of those with a range of experiences of managing frailty-related health changes.

Throughout this thesis the focus of research on (largely physiological) deficits has been emphasised, yet the experience is of a positive and readily embraced relationship with a changing health status. This is not to negate the difficulties experienced but does rather challenge traditional views of living with frailty as a negative, and somewhat passive, process. If a more robust confirmation of this experience can be provided it would be highly beneficial to development of interventions and services based on the reality of living with frailty, from the individual's perspective.

6.4 Concluding Statement

The aim of this study was to study the experience and outcomes of people identified as being at risk of developing frailty during, and after, their engagement in a frailty-prevention course. This thesis has outlined a level of complexity in capturing meaningful outcomes for the population, who had a higher than anticipated frailty status. This demonstrated the need for experiential accounts to improve understanding of developing frailty, as well as additional understanding as to the expected outcomes for people who are “living well” with frailty. Additionally, it emphasised the need to find ways of measuring frailty's effect on function, physical health and well-being that are of value to all stakeholders.

This thesis has outlined the importance of understanding the outcomes and experiences of people largely living with frailty or pre-frailty. The outcomes of the intervention demonstrated that improvement in functional outcomes was achieved during the STEER Course, and that some maintenance of this improvement was possible. Further evaluation highlighted successes of the Course were attributed to the opportunity to share experiences and understanding of a changing health status with peers, due to the common, challenging, experience of living with frailty, yet not

recognising the term as reflective of the changes occurring. Throughout the evaluation there was increasing evidence of a poor fit between objective outcome measures of function, and frailty, with self-assessed markers of functional performance and health. Participants' experiences prioritised experiential performance capacity, over both measured outcomes and symptomatic descriptions of health.

Within the evaluation of experiences of activity participation, physical health and mental well-being, a complex relationship between occupation, health, and well-being was outlined. It has been proposed that while individual experiences were unique, the processes occurring were influenced by a person's relationship with constructs like the ability to adapt, internal priorities and the meaning of activity participation. There was also variability in perceived autonomy over occupational choices and progression of health symptoms. This also provided support for the constructs of occupation, health and well-being being inter-dependent, particularly in their ability to be influenced by age-related changes to functional status associated with frailty.

A feature of this research was the insight gained into the conceptualisations of participants as to the experience of living with a deteriorating health status. This was framed within theoretical descriptions of 'pre' and 'full' frailty, yet was not recognised as such by the person. What was more readily accepted was a gradual change in functional, physical or well-being status that was met with a desire and willingness to mitigate losses by adapting and often 'working' at maintaining health, function and engagement in valued occupations. This challenges traditional conceptualisations of frailty which focus on the negative aspects and the 'burden' on health services. This approach ignores the active part older adults play, often without guidance or support from formal health services, in aiming to live well with pre-frailty and frailty. This has consequences for healthcare professionals and those designing services. There is currently a large focus on frailty, and frailty-prevention. However, if those people who could benefit from such services do not recognise the term as reflective of their experience, they are unlikely to engage well, if at all, with such initiatives.

The multi-faceted and highly complex experience of those at risk of developing frailty is supportive of future research and interventions which not only conceptualise, but also embrace, a multi-dimensional and assets-focused approach to working with those living with pre-frailty and frailty.

Appendix A **Hampshire Fire and Rescue Service Consent Procedures**



Hampshire Fire & Rescue Service HQ
[Details redacted to protect confidentiality of individuals]

[17th November 2016](#)

University of Southampton
University Road
Southampton
SO17 1BJ

For the attention of Southampton University,

Hampshire Fire and Rescue Service wish to grant permission for Southampton University to conduct research on the effectiveness of the STEER course, a work stream of the 'Fire As A Health Asset' project at HFRS.

Southampton University are invited to access participants via the STEER course and HFRS grant permission for these participants to be invited to further interviews and workshops, as required by the researchers.

HFRS shall provide Southampton University with access to anonymised data collected at all STEER courses, providing individual participant consent has been granted.

HFRS invite Southampton University to complete the research on HFRS property and grant permission for them to access relevant HFRS equipment and facilities including, but not restricted to, QTUG devices and HFRS meeting rooms.

We look forward to collaborating with Southampton University in the development and completion of this research.

If you require any further information then please do not hesitate to contact me.

Yours sincerely,

[Details redacted to protect confidentiality of individuals]

Falls Prevention Department



Hampshire Fire & Rescue Service HQ
[Details redacted to protect confidentiality of individuals]

[17th November 2016](#)

Sarah Mercer
University of Southampton
University Road
Southampton
SO17 1BJ

Dear Sarah,

In the first week of the STEER (Safety Through Education and Exercise for Resilience) course, instructors from Hampshire Fire and Rescue Service explain to all participants that data collected throughout the course will be sent to The University of Southampton to be included as part of the study they are conducting.

Whilst consent is not supplied in written form, participants verbally receive knowledge that the data shared will be fully anonymised. They are given clear options regarding the use of their data and have the choice to restrict their data being shared, if they so wish.

If you require any further information then please do not hesitate to contact me.

Yours sincerely,

[Details redacted to protect confidentiality of individuals]
Falls Prevention Department

Appendix B **Semi-Structured Interview Schedules**

Part B Participation – Interview Schedules.

B.1 First Interview

For information: Specific probing questions are contained in brackets beneath each question. Parentheses have been used to indicate content dependent on the participant's contributions.

My name is Sarah Mercer and I'm a doctoral student at the University of Southampton and an occupational therapist within the NHS. I'm working with Hampshire Fire and Rescue Service to evaluate the STEER Course. I would like to find out how being part of the STEER Course affects your health. During this interview I'd like to find out in detail about your reasons for joining the STEER group and get a picture of your life at the moment. When we meet near the end of the Course I'd like to discuss these things again and also your experience of the STEER Course.

We have the room for one hour and won't be disturbed. If you would like to pause the interview or take a break at any point please say. Do you have any questions before we begin?

How did you hear about the STEER Course and what made you decide to join?
[Intended as a partially conversational question to open the discussion, but quickly moving onto the essentially discussion points]

What was your reaction when you heard of this type of course being run by the Fire Service?

What are your expectations of the STEER Course?
[What do you expect to change as a result of the Course? Are there specific things you would like to improve?]

Thinking about your state of health at the moment, how would you describe it?
[Does your physical or mental health cause you any problem at the moment? Could you explain how you are affected by them?]

Please talk me through a typical day...
[Describe everything you do in a twenty-four hour period. Can you say a little more about the activities you complete before you do (activity mentioned by participant)]

What are the most important activities that you complete at the moment? Why?

What are the most enjoyable or valuable activities that you complete? [Can you explain why you enjoy (mentioned activity)? What is it about (mentioned activity) that makes it valuable to you?]

Describe any ways your health affects the type of activities you are able to do.

Thinking back over the past few years, can you explain if or how you have changed the type of activity you do?

[Are there activities you used to complete but no longer do so?]

How do you understand the reasons for your change in (the above – but will use participants words. For example “How do you understand the reasons why you don’t feel able to go shopping in the town centre anymore?”)

[Does your physical or mental health influence how you choose to spend your time?]

How satisfied do you feel about your life at the moment?

[Are there things you’d like to change? How does it affect your mood?]

Is there anything else you would like to say related to the things we have discussed?

Thank you for your time today. This is the end of the interview. As discussed I would like to meet again near or just after the end of your STEER Course to discuss your experience of the Course and re-visit the things we have discussed today. May we set a date and time for the meeting now? If you need to change or cancel the appointment you can do so by contacting me by email or telephone [written details given to participant].

End.

General prompts/probing questions which can be used as required:

Can you say a little more about that?

Can you give me an example of what you mean by (participants words, for example, “I used to do all sorts of things” or “I can’t do anything I want now”

To check understanding:

When you mentioned (participant’s words), did you mean (reflect back interpretation of participant’s words).

B.2 Interview at completion of STEER Course (Twelve-week)

My name is Sarah Mercer and I'm a doctoral student at the University of Southampton and an occupational therapist within the NHS. We met on [date of first meeting] to discuss your expectations of both participating in the STEER Course and experience of daily life. Today I'd like to revisit those topics and also discuss your experience over the past [number of weeks since first interview].

We have the room for one hour and won't be disturbed. If you'd like to pause the interview or take a break at any point please say. Do you have any questions before we begin?

Describe the experience of participating in the STEER Course.

When you started the STEER Course what were your expectations of the Course?
How has it met your expectations?

Describe the experience of attending a course like this in a fire station.
[How do you think the location influenced the experience? Would you have attended if it was held elsewhere?]

Thinking about your state of health at the moment, how would you describe it?
[Are there aspects of your physical or mental health that are problematic for you? Could you explain how you are affected by them? Wording of this section deliberately kept the same as first interview to attempt to keep answers as an account of current health status rather than comparison to first interview, at this stage only.]

Are there aspects of your health that have changed in the last [number of weeks since last interview]?
[Could you say more about those changes?]

Please talk me through a typical day...
[Describe everything you do in a twenty-four hour period. Can you say a little more about the activities you complete before you do (activity mentioned by participant)]

What are the most important activities that you complete at the moment? Why?

What are the most enjoyable or valuable activities that you complete? [Can you explain why you enjoy (mentioned activity)? What is it about (mentioned activity) that makes it valuable to you?]

Does your health affect the type of activity you are able to do?

Has anything changed regarding your experience of completing those activities since you

started the STEER Course? Can you explain in what way?

[Have the type of thing you do changed. Can you describe how the experience is different?]

This section will utilise the quantitative data gained from first and final assessment by HFRS – questions will be tailored to the participant. For example:

[You have experience a decrease of forty per cent in your risk of falls during the Course, has this had any effect on your day to day life? How do you feel about the change?

Do any of the results surprise you?

Your grip strength has improved by [amount] – has this changed your ability to complete any day to day tasks?

Your results have shown only a very slight change – have you experienced any changes in the way in which you complete daily activities that isn't reflected in those measures?]

How do you feel about your life at the moment?

[Are there things you'd like to change? How does it affect your mood?]

Is there anything else you would like to say related to the things we have discussed?

Thank you for your time today. This is the end of our interview.

End.

General prompts/probing questions which can be used as required:

Can you say a little more about that?

Can you give me an example of what you mean by (participants words, for example, "I used to do all sorts of things" or "I can't do anything I want now"

To check understanding:

When you mentioned (participant's words), did you mean (reflect back interpretation of participant's words).

B.3 Interview at three months post-completion of STEER Course

My name is Sarah Mercer and I'm a doctoral student at the University of Southampton and an occupational therapist within the NHS. We met on [date of first and second meetings] to discuss your expectations of both participating in the STEER Course and experience of daily life. Today I'd like to revisit those topics and also discuss your experience since you completed the STEER Course.

We have the room for one hour and won't be disturbed. If you'd like to pause the interview or take a break at any point please say. Do you have any questions before we begin?

Now that you have had some time since completing the STEER Course, could you please describe the experience of participating in the Course?

[Did you find anything helpful? Which aspects worked for you? Were there things that could have been improved? Are there any changes you would like to see in how the Course runs?]

Thinking about your state of health at the moment, how would you describe it?

[Are there aspects of your physical or mental health that are problematic for you? Could you explain how you are affected by them?]

Are there aspects of your health that have changed in the last [number of weeks since last interview]?

[Could you say more about those changes?]

Please talk me through a typical day...

[Describe everything you do in a twenty-four hour period. Can you say a little more about the activities you complete before you do (activity mentioned by participant)?]

What are the most important activities that you complete at the moment? Why?

What are the most enjoyable or valuable activities that you complete? [Can you explain why you enjoy (mentioned activity)? What is it about (mentioned activity) that makes it valuable to you?]

Does your health affect the type of activity you are able to do?

Has anything changed regarding your experience of completing those activities since you started the STEER Course? Can you explain in what way?

[Have the type of thing you do changed. Can you describe how the experience is different?]

This section will utilise the quantitative data gained from first, twelve-week and six-month

follow-up assessment by HFRS – questions will be tailored to the participant. For example:

[You have experience a decrease of forty per cent in your risk of falls during the Course, has this had any effect on your day to day life? How do you feel about the change?

Your grip strength has improved by [amount] – has this changed your ability to complete any day to day tasks?

Your results have shown only a very slight change – have you experienced any changes in the way in which you complete daily activities that isn't reflected in those measures?]

To what extent do you feel you have been able to maintain the changes you experienced during the STEER Course?

How do you feel about your life at the moment?

[Are there things you'd like to change? How does it affect your mood?]

Are there any other changes you have noticed since completing the STEER Course?

[Could you say a little more about them/describe them].

Is there anything else you would like to say related to the things we have discussed?

Thank you for your time today. This is the end of our final interview.

End.

General prompts/probing questions which can be used as required:

Can you say a little more about that?

Can you give me an example of what you mean by (participants words, for example, "I used to do all sorts of things" or "I can't do anything I want now"

To check understanding:

When you mentioned (participant's words), did you mean (reflect back interpretation of participant's words).

Appendix C **Standardised Operating Procedures**

Contents:

1. SOP-17- QTUG™ (Kinesis Health Technologies, 2014) Quantitative Timed Up and Go Test
2. SOP-17-SLS Single Leg Stance and Sit to Stand Transfers
3. SOP-17-BPHR Blood Pressure and Resting Heart Rate
4. SOP-17-WTBF Weight and Body Fat Percentage
5. SOP-17-PBAX Paper Based Assessments: PHQ 9 (Kroenke, Spitzer and Williams, 2001) and Falls Efficacy Scale – International (Kempen et al., 2008)
6. SOP-17-HT Height
7. SOP-17-GPST Grip Strength

Please note: All SOPs to be read and applied in conjunction with Hampshire Fire and Rescue Service risk assessment.

SOP-17- QTUG™ (Kinesis Health Technologies, 2014)

Variables to be measured: Frailty risk score (%) and falls risk score (%) as calculated using the Quantitative Timed Up and Go Test (QTUG™ (Kinesis Health Technologies, 2014))

Equipment to be used: QTUG™ (Kinesis Health Technologies, 2014). Assessment area containing chair and 3m marked turning point. Location specific equipment to be specified at the bottom of this document.

To be read in conjunction with: QTUG User Manual Version 2.1. (Kinesis Health Technologies, 2014)

Purpose of this SOP: To define procedures used to ensure safe measurement of participants' falls and frailty risk scores and to ensure measurements are reliable and repeatable by multiple facilitators.

Scope of this SOP:

1. To outline safe use of the Quantitative Timed Up and Go Test to calculate frailty and falls risk scores within a HFRS setting with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with QTUG™ User Manual Version 2.1 (Kinesis Health Technologies, 2014) and operating instructions.
2. Check equipment before use, ensure QTUG™ (Kinesis Health Technologies, 2014) is set up as per instructions in its manual and in the location specified at the bottom on this document. The location chosen should be the same for all measurements taken in this HFRS location and should be a firm, level surface that is free of obstacles. The chair used must match the specifications in the QTUG User Manual Version 2.1 and standardised across all HFRS STEER locations. If required, support can be given to members to access the measuring location but the test should be completed without mobility aids to ensure accurate reading.
3. Set up the QTUG™ (Kinesis Health Technologies, 2014) for the specific STEER Group member being tested. Explain the procedure to the group member. Discuss the falls and frailty related questions with the member and enter answers into the QTUG™'s tablet computer. Fix the QTUG™ sensors to the member with elasticated bandages as indicated in page 24 of the QTUG™ Manual Version 2.1 (Kinesis Health Technologies, 2014). Participant to wear footwear with a flat sole.
4. Ask STEER group member to 'Complete as fast as safely possible' as per the user manual, but will be advised that this is a measure of their usual walking pace to prevent risk of injury from rushing.
5. Ensure the QTUG™ (Kinesis Health Technologies, 2014) tablet has stored the results. Transfer the TUG time, falls and frailty scores to the participant's record sheet.

Location specific agreements

Name of HFRS site:

Location of QTUG™ (Kinesis Health Technologies, 2014) measurement station:

Location specific instructions (e.g. regarding floor surface, measurement of 3m distance, location of chair to be used):

SOP-17-SLSS

Variables to be measured: Duration STEER member can maintain an unassisted single leg stance and number of sit-to-stand (STS) repetitions completed in thirty seconds.

Equipment to be used: Upright chair (same as agreed in SOP-17-QTUG™), stopwatch.

To be read in conjunction with: this document only.

Purpose of this SOP: To define procedures used to ensure safe measurement of participants' ability to complete physical function tests of single leg stance and sit-to-stand repetitions and to ensure measurements are reliable and repeatable by multiple facilitators.

Scope of this SOP:

1. To outline safe measurement of single leg stance duration and sit-to-stand repetitions within a HFRS setting with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with SOP-17-SLSS and equipment to be used.
2. Check equipment before use, ensure equipment available matches with that specified at the bottom of this document. Set up the chair in the agreed location, ensuring that the space is free of obstacles and the chair is placed on a flat surface. Ensure chair is stable and able to support weight of participant.
3. Explain the procedure to the participant. Ensure footwear with a flat sole is worn.
Single leg stance: "Please stand up from the chair, when you are ready lift your left leg off the floor and hold it off the floor for as long as you can. I will time you". (Repeat on right leg).
Sit-to-stand repetitions: "You will have thirty seconds to stand up and sit back down on this chair as many times as you can".
4. Walking aids cannot be used. If a participant cannot complete the exercise without assistance please document this. If it is safe to do so they may complete the exercise with assistance (such as zimmer frame/walking stick) but their scores cannot be contributed to the study and the duration and/or repetitions must be scored as '0'.
5. Time the single leg stance from the moment the participant's foot leaves the floor until it is replaced. For the sit-to-stand only full repetitions occurring within the thirty second period (that is: sit – stand – sit) may be counted.

Location specific agreements

Name of HFRS site:

Location of single leg stance and sit-to-stand measurement station:

Location specific instructions (e.g. regarding location, chair to be used, stopwatch to be used):

SOP – 17 - BPHR

Variables to be measured: Blood pressure (mmHg) and resting heart rate (beats per minute – bpm) of STEER Course Participant.

Equipment to be used: Omron Automatic Blood Pressure Monitor Model: M2

To be read in conjunction with: Omron Automatic Blood Pressure Monitor Model: M2 Manual

Purpose of this SOP: To define procedures used to ensure safe measurement of participants' blood pressure and resting heart rate, and to ensure measurements are reliable and repeatable by multiple facilitators.

Scope of this SOP:

1. To outline safe use of the Omron automatic blood pressure monitor - model M2 within a HFRS setting with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with Omron Automatic Blood Pressure Monitor M2 Manual and operating instructions.
2. Check equipment before use. Ensure inflation/deflation of cuff.
3. Set up measuring area with chair and appropriate height table to rest arm on during measurements as in point 3.2 of the manual.
4. Take measurement on group members not less than 30 minutes after arrival at group session and ensure members have been sedentary during this time to ensure consistent reading.
5. Repeat measurement on same arm for each person and document their preferred arm in their notes.
6. Place the inflation cuff on the arm as directed in the manual with thick or tight-fitting clothing removed.
7. Activate monitor to inflate cuff and achieve blood pressure reading and pulse rate.
8. Repeat twice ensuring readings within a range +/- 10mmHg or +/-5 bpm. Record the average reading in member's record. If readings fall outside of these ranges check equipment for faults and test on another person. Repeat measurements once confident that equipment is operating correctly and record average results.

Location specific agreements

Name of HFRS site:

Location of blood pressure/pulse measurement station:

Specify chair and table to be used for all measurements:

SOP – 17- WTBF

Variables to be measured: Weight (kg) and body fat (%) of STEER Course Participant.

Equipment to be used: Tanita InnerScan Model: BC-568

To be read in conjunction with: Tanita InnerScan Model: BC-568 Manual

Purpose of this SOP: To define procedures used to ensure safe measurement of participants' weight and body fat percentage, and to ensure measurements are reliable and repeatable by multiple facilitators.

Scope of this SOP:

1. To outline safe use of the Tanita InnerScan BC-568 within a HFRS setting with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with Tanita InnerScan BC-568 Manual and operating instructions.
2. To place Tanita InnerScan BC-568 on the agreed measuring location (once agreed this must be specified at the bottom of this document and used for all measurements occurring in this HFRS locality). Measuring location must be a smooth, level surface within the HFRS building. It must be accessible at all times that measurements need to be taken.
3. Set up the Tanita InnerScan BC-568 as per manual instructions to record weight in kg and height in cm. Calibrate weight function with 10kg kettlebell. Error of +/- 0.2kg is acceptable. Record calibration check on chart stored with machine.
4. Conduct measurements at same point in the group to ensure consistency in time of day of measurement.
5. Ensure measuring location is free of obstacles and all surfaces are clean and dry.
6. Have a chair near to measuring location for participants to remove footwear safely.
7. Encourage participant to remove footwear, socks/tights and outer layers of clothing. Ideally participants will be measured on each occasion wearing trousers/skirt and shirt/t-shirt. Due to public location it is not possible to measure with less clothing, and consequently participants will be asked to dress in a similar way on each measurement day.
8. Set up Tanita InnerScan BC-568 as per manual instructions to achieve weight in kg and body fat percentage.
9. Ask participant to step onto Tanita InnerScan BC-568. Assistance can be given at this time but encourage participant to stand unaided and briefly remove walking aids if possible. Note on participant's record if weight was conducted with partial weight-

bearing through walking stick or other aid.

10. Ask participant to step off Tanita InnerScan BC-568 and repeat measurement two further times to ensure accuracy. Record the mean of the three measurements on the participant's record unless a variation of greater than 0.2kg occurs, in which case recalibrate the Tanita InnerScan BC-568 and repeat steps 9-10.

11. Provide assistance if required for participants to pick up the handheld sensors. Once in position operate the Tanita InnerScan BC-568 to determine a body fat percentage reading. No calibration of this particular feature is possible. Repeat measures three times and accept the mean reading, unless variation of greater than 5% occurs. Record this against the participant's record.

Location specific agreements

Name of HFRS site:

Agreed placement of Tanita InnerScan:

Date of SOP: January 2017

Author of SOP: Sarah Mercer (Clinical Doctoral Fellow, University of Southampton and Southern Health NHS Foundation Trust)

SOP – 17 - PBAX

Variables to be measured: Severity of depression and fear of falling.

Equipment to be used: Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer and Williams, 2001) and Falls Efficacy Scale – International (FES-I) (Kempen *et al.*, 2008).

To be read in conjunction with: PHQ-9 (Kroenke, Spitzer and Williams, 2001) and FES-I (Kempen *et al.*, 2008) assessment and scoring sheets.

Purpose of this SOP: To define procedures used to ensure safe assessment of STEER group member's fear of falling (measured by FES-I (Kempen *et al.*, 2008)) and severity of depression (measured by PHQ-9 (Kroenke, Spitzer and Williams, 2001)) and to ensure measurements are reliable and repeatable by multiple facilitators over a period of time.

Scope of this SOP:

1. To outline correct implementation of the paper-based assessments completed with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with assessments and their scoring so as to be able to direct STEER group members as to how to complete the forms.
2. Provide a quiet and confidential space for group members to complete the self-assessment. See agreed local arrangement at the bottom of this SOP.
3. Invite STEER group member to participate. Given them the assessment sheets and a pen. Explain how to complete the forms.
4. Answer questions as needed. Support any members who need adjustments such as questions to be read out.
5. Score each assessment as per the instructions on the form. Feedback the score to participant if they consent. Record the score on their record.

Location specific agreements

Name of HFRS site:

Location of confidential area for completing paper-based assessments:

Equipment required:

SOP – 17 - HT

Variables to be measured: Height (cm) of STEER Course Participant.

Equipment to be used: SECA 213

To be read in conjunction with: SECA 213 Manual

Purpose of this SOP: To define procedures used to ensure safe measurement of participants' height and to ensure measurements are reliable and repeatable by multiple facilitators.

Scope of this SOP:

1. To outline safe use of the SECA 213 height measurement device within a HFRS setting with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with SECA 213 Manual and operating instructions.
2. Check equipment before use, ensure SECA 213 is set up as per instructions in its manual and in the location specified at the bottom on this document. The location chosen should be the same for all measurements taken in this HFRS location and should be a firm, level surface that is free of obstacles. If required support can be given to members to access the measuring location.
3. Ask STEER group member to remove footwear to ensure accurate reading.
4. Ask STEER group member to stand within the measuring frame with back to the measuring stick, encourage good posture, "stand up and look straight forward". Record height, ensuring a level reading is taken as demonstrated in SECA 213 Manual.
5. Ask STEER group member to step out of measuring frame and then repeat step 4 twice to ensure accurate measurement. Results should be within +/- 1cm. Record average reading in member's record.

Location specific agreements

Name of HFRS site:

Location of height measurement station:

Location specific instructions (e.g. regarding floor surface):

SOP – 17 - GPST

Variables to be measured: Grip strength (kg) of STEER group member.

Equipment to be used: Takei Physical Fitness Test Grip - A (T.K.K. 5001)

To be read in conjunction with: Takei Physical Fitness Test Grip - A (T.K.K. 5001) Manual

Purpose of this SOP: To define procedures used to ensure safe measurement of participants' height and to ensure measurements are reliable and repeatable by multiple facilitators over a period of time.

Scope of this SOP:

1. To outline safe use of the Takei Physical Fitness Test Grip - A (T.K.K. 5001) grip strength measurement device within a HFRS setting with STEER Course participants.
2. To outline the steps required to ensure measurements are accurate irrespective of HFRS site location and HFRS STEER Course facilitator implementing the measurement.

Procedure to be adopted:

1. Facilitator to familiarise self with Takei Physical Fitness Test Grip - A (T.K.K. 5001) Manual and operation of the equipment.
2. Check equipment before use, ensure Takei Physical Fitness Test Grip - A (T.K.K. 5001) dynamometer is set up as per instructions in its manual and in the location specified at the bottom on this document. The location chosen should be the same for all measurements taken in this HFRS location include a chair so that participants can sit for the test so as to minimise other physiological processes.
3. Ask STEER group member to sit in the chair – demonstrate use of the Takei Physical Fitness Test Grip - A (T.K.K. 5001) dynamometer.
4. Ask STEER group member to hold the dynamometer with elbow bent at 90 degrees and squeeze the dynamometer as hard as possible with their left hand. Repeat this twice with one minute rest between attempts and record the greatest reading.
5. Repeat step 4 but with the right hand.

Location specific agreements

Name of HFRS site:

Location of grip strength measurement station:

Equipment required:

Appendix D **Participant Information Sheets**

Participant Information Sheet v.3

Study Title: Physical health, mental health and occupational performance in pre-frail older people attending a frailty prevention programme.

Researcher: Sarah Mercer

Ethics number: 22859

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

I am a doctoral student from the University of Southampton and an occupational therapist working within Southern Health NHS Foundation Trust. I am working in partnership with Hampshire Fire and Rescue Service to evaluate the STEER Course.

The STEER Course is an innovative frailty and falls prevention programme run by Hampshire Fire and Rescue Service (HFRS). In addition to the routine measurements and data collected by HFRS I wish to gather some detailed information about people's personal experience of participating in the Course and on their views about their health and daily life.

Little is currently known about the effect of a health promotion programme such as STEER, especially as it is being delivered outside of traditional health settings. For this reason there is an opportunity to discover what the experience is like for you as a participant. The needs of typical participants of STEER are also an area that is under-researched. This study gives the

opportunity to understand more about what life is like for you in relation to your health, well-being and the type of activities you complete each day.

Why have I been chosen?

You have previously been made aware that your routine data collected by HFRS contributes to the research study I am undertaking. I am approaching all STEER Course members to invite you to take part in an interview which will explore your experience of attending the STEER Course and how it has affected your daily life.

What will happen to me if I take part?

You will take part in three interviews of approximately one hour in a meeting room in the location of your STEER Course. These will be arranged at mutually agreeable times. Before taking part you will be required to read and sign a written consent form. The first will occur around week two to three and the second will be arranged near the end of the Course. You will also be invited to a follow up interview six months after completing your STEER Course. During the interview I will ask some questions to understand how you experienced the STEER Course and also some that focus on the wider experience of your health and how it affects your daily life. In order to increase my understanding of your experience of the STEER Course I am also asking you to allow HFRS to identify your routine measurements to me so that I may use them to guide the questions I ask in the second and third interviews.

Are there any benefits in my taking part?

There are no immediate benefits to participating in the research, but it is hoped that your information will support the development of the STEER

Course so that subsequent participants will benefit from a Course that has been fully evaluated.

Are there any risks involved?

There is a very small risk of emotional distress when discussing your personal experience of your health. If you feel upset at any time you are encouraged to let me know and/or request that the interview be stopped. The interview can be completed at a pace you are comfortable with or terminated completely.

Will my participation be confidential?

The interviews will occur on HFRS property. As a result other people in the building might be aware that you are participating in the research. The interviews will be conducted in a confidential space with only myself in the room. I will use an audiotape recorder to record the interview. The audio recording will be stored on a password protected computer and stored for ten years post-completion of the research in line with the University of Southampton's Data Management Policy. The recording will be transcribed, at which point I will remove identifiable information. Only the researcher and the supervisory team ([removed], University of Southampton) will have access to the audio-recording transcript. In the reports, papers and thesis produced from this study I will represent your contributions under a pseudonym to maintain your confidentiality and remove anything which could identify you to others.

Do I have to take part and what happens if I change my mind after agreeing to take part?

You are not obliged to participate in this research and if you do not choose to give permission your participation in the STEER Course will not be

affected. If you wish to withdraw at any time you can contact me on email: [removed] or telephone: [removed] or by letting the HFRS Staff that run your STEER Course know that you wish to withdraw from the research.

What happens if something goes wrong?

In the unlikely event that you have a complaint or concern about this study you may contact the Research Governance Manager at the University of Southampton.

Telephone: 02380 595058 or email: rgoinfo@soton.ac.uk

Where can I get more information?

If you would like more information about the study please contact myself, Sarah Mercer, by telephone: [removed] or email: [removed]. I will also be attending your first STEER Course to give more information and arrange the initial interviews.

Appendix E Consent Forms

CONSENT FORM Part B – Single Participant - Version 2

Study title: Physical health, mental health and occupational performance in pre-frail older people attending a frailty prevention programme.

Researcher name: Sarah Mercer

Ethics reference: 22859

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (2017/v3) of participant information sheet) and have had the opportunity to ask questions about the study.

☐

I agree to take part in this research project and agree for my data to be used for the purpose of this study.

☐

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected.

☐

I agree to the interview being audiotaped on the condition that the recording and subsequent transcript are stored in accordance with the conditions of the Data Protection Act.

☐

I understand that the results of this study may be published as papers at academic conferences and/or journals and my anonymised data might form part of this.

☐

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.

Name of participant (print name).....

Signature of participant.....

Date.....

Consent taken by (print name and sign).....

Date.....

CONSENT FORM Part B – To Include Accompanying Person - Version 2

Study title: Physical health, mental health and occupational performance in pre-frail older people attending a frailty prevention programme.

Researcher name: Sarah Mercer

Ethics reference: 22859

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (2017/v3) of participant information sheet) and have had the opportunity to ask questions about the study.

☐

I agree to take part in this research project and agree for my data to be used for the purpose of this study.

☐

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected.

☐

I agree to the interview being audiotaped on the condition that the recording and subsequent transcript are stored in accordance with the conditions of the Data Protection Act.

☐

I wish to be accompanied in the interview

by

I understand their contributions will form part of the research data and that they will have to sign a consent form to participate.

I understand that the results of this study may be published as papers at academic conferences and/or journals and my anonymised data might form part of this.

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.

Name of participant (print name).....

Signature of participant.....

Date.....

Consent taken by (print name and sign).....

Date.....

CONSENT FORM Part B – Accompanying Participant - Version 2

Study title: Physical health, mental health and occupational performance in pre-frail older people attending a frailty prevention programme.

Researcher name: Sarah Mercer

Ethics reference: 22859

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (2017/v3) and have had the opportunity to ask questions about the study.

☐

I am accompanying (*name of STEER Course participant*). I understand that the interview is about their experience but that any contributions I may make could be used as part of the findings of the study.

☐

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected.

☐

I agree to the interview being audiotaped on the condition that the recording and subsequent transcript are stored in accordance with the conditions of the Data Protection Act.

☐

I agree to take part in this research project and agree for my data to be used for the purpose of this study.

☐

I understand that the results of this study may be published as papers at academic conferences and/or journals and my anonymised data might form part of this.

☐

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.

Name of participant (print name).....

Signature of participant.....

Date.....

Consent taken by (print name and sign).....

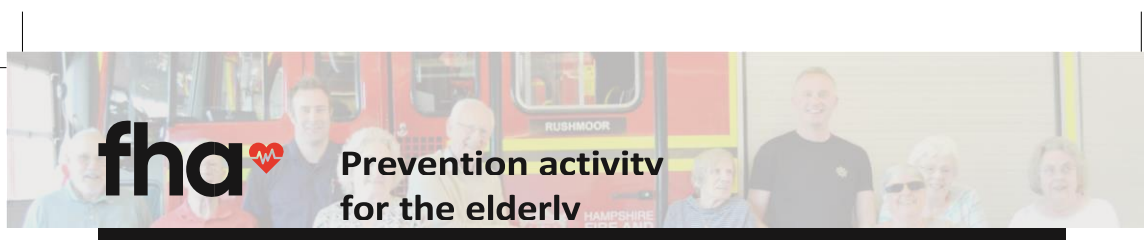
Date.....

Appendix F HFRS Course Information, Inclusion Criteria and Screening Information

The course consists of twelve, two hour sessions which target the 12 elements of frailty identified by the British Geriatric Society (BGS) publication; 'Fit for Frailty'.

Exercises are low to moderate level that are based on daily activities and can be continued in the home environment. This innovative approach aims to help older people to be happy, healthy and remain in their home safely. It builds confidence, reduces the risk of a fall occurring, and increases engagement in community activities.

The transformational course has been produced in consultation with geriatricians, GPs, BGS and other medical and exercise professionals. Existing signposting and safeguarding policies are in place to ensure the individual receives the most appropriate assistance throughout the course.



All courses are free to the user, and held at fire stations across the county

STEER course criteria

Attendees



Must be at risk of becoming frail due to one of the following:

- mild cognitive impairment
- mobility issue but is able to participate in exercise
- obesity / poor nutrition / dehydration
- taking four or more different types of medication
- physically inactive
- vision impairment
- a low mood, loneliness or isolation

The attendee must also be:

- able to attend the whole 12 week course
- over the age of 65 or be referred by a health professional
- able to participate in low to moderate physical activity

Appendix G Introductory PowerPoint Slides

STEER Course Evaluation

University of Southampton – Faculty of Health Sciences

Seah Mercer
July 2017




What's Involved?

- Part A – Evaluation of the measures routinely collected by Hampshire Fire and Rescue Service
- Part B – Interviews with participants to find out about their experience of STEER





Interviews

- 3 Interviews
 - First on Week 2-3 of STEER
 - Second on Week 11-12 of STEER
 - Final Interview 6 months after completing STEER
- Held at the Fire Station
 - Approximately 1 hour long





What Will I Have To Do?

- Talk to me about your experience of STEER
 - What you liked/didn't like.
 - What has changed during your participation?
- Tell me about your daily life and activities
 - What's important to you?
 - How do you spend your time?
 - Does your health influence what you do?





Do I Have To Take Part?

- No. The interviews are voluntary and does not impact your participation in the STEER Course.
- 15 participants across Hampshire.
- Detailed information is provided the in the Participant Information Sheet supplied.

Appendix H **Field Notes from Planning/Observation**

Stages

Field Notes

Meetings with Hampshire Fire Rescue Staff and Observations of STEER Courses during Research Design Phase.

H.1 Introductory Meeting

Date: 27/05/2016

Present: [removed] (Fire as a Health Asset/Station Manager - Hampshire Fire and Rescue Service (HFRS)), [removed] (STEER Course Facilitator - Hampshire Fire and Rescue Service, Supervisory Team (University of Southampton) and Sarah Mercer (researcher).

Location: Hampshire Fire and Rescue Service Headquarters.

Purpose of Meeting: Introductions of collaborators and expectations regarding research project.

Description: Discussion about STEER Course and outcome measures used. HFRS Staff introduced the Course and explained it has format of education (taken from Fit for Frailty, consultation occurred with Dr Gill Turner to help guide their development of the Course). The exercises are designed to use functional movement: for example water ball lifts into a cupboard. Course instructors have observed good changes in people and cite return to activity – one participant is now playing golf again.

We discussed potential to implement additional outcome measures and potentially complete interviews or focus groups with participants and Course instructors. Paul and Andy were supportive of this and explained that their administration team send out material prior to engagement in the Course, so this could be modified to include measures related to the research.

Reflections: Current outcome measures are focused on physical changes, yet the anecdotes that [Removed] cited were largely related to change in mental health or activity participation – this will be important to capture. HFRS appear very receptive to a research project and happy to accommodate good practice. There is an element of them being unfamiliar with research procedures, so good communication as to rationale for methods/measurements/procedures will be important.

Outcomes/For Follow-Up: HFRS to send me the outcome measures used. I will review and email them any additional items – particularly to capture mental health outcomes. To confirm date for observation of a STEER Course once next Courses commence in August.

H.2 Station A Observations

Date: 21/06/2016

Setting: [Removed] Fire Station – Large operational fire station with STEER Course operating in end bay of the appliance bay. Large industrial space with rubber mats placed on the floor in a central square. Two fire-engines remain in the bays next to the STEER Course area. The session commenced in a conference room with tables in a ‘u-shape’ around a projection screen with Course facilitator standing to side of room with laptop access to PowerPoint. Tea and coffee available on arrival, but most participants arrived with a water bottle and drank from this.

Session: This was week 2 of the Course. Prior to this the participants had completed baseline assessments on week 1 but this was their first experience of the usual format of the Course. After introductions, health and safety introductions/reminders and recap of the Course format (that they would be in the conference room for approximately one hour, and then move to the appliance bay for exercises). PowerPoint was presented – the topic was ‘fall-proofing your home’ and outlined the incidence and risk of falls, as well as means of reducing those risks. The concept of ‘Safe and Well’ home visits was introduced, where participants were encouraged to request a home visit from the Fire Service if they had concerns. Throughout the presentation interaction from the participants was actively encouraged, and despite being the first full session the participants appeared comfortable to contribute their thoughts and ideas.

After the educational component was completed the participants moved to the appliance bay. This evoked some questions about the operation of the fire station, which Course facilitators appeared happy to accommodate. The exercises were then introduced with a member of the facilitation team demonstrating each of the twelve circuit ‘stations’. Participants then completed a group warm up with walking around the edge of the area and completing some dynamic stretching and mobilisation. The circuit then commenced with a separate ‘station’ for each participant. The duration was timed by a Course facilitator and I was advised this will gradually be increased over the coming weeks. The two facilitators provided individual support where needed – providing guidance on technique and adaptations to the exercise. Two rounds of the exercises were completed with a short water break between. The session concluded with a cool down and stretching. Participants were reminded that they might feel sore the next day and this was

expected. The session concluded with arrangements for the following week: to consider the fall-proofing messages and take action where required, and to meet the following Tuesday at 10am in the conference room.

Reflections: The level of ability of participants appears highly variable, but accommodations are being made to alter the exercise task to suit ability. There is a big focus on good technique in relation to squatting and lifting. The environment does appear to be unusual and noticeable to participants, judged by their intrigue regarding the processes involved in fire-fighters getting ready to operate the appliances. In the early stages of the Course there appears to be good rapport between participants and facilitators, with participants feeling able to contribute. There is an atmosphere of informality, yet the session is highly structured and runs well to time. The exercise section is very focused on good technique and an expectation of completing the tasks with good biomechanical form. Allowances are made for individual ability, but it is not clear if this is what HFRS expected to need to do, or whether they anticipated a more homogenous group.

Action Points: Discuss the referral criteria and accepted participants with HFRS staff.

H.3 Meeting with HFRS STEER Course Manager

Date: 14/11/2016

Location: HFRS Property.

Agenda/Discussion:

1. Informal discussions with participants to determine appropriate style of involvement. We have been discussing for some time the best way to involve participants in the research design. HFRS has arranged for all those that wish to contribute to meet before their STEER Course at [Removed] Fire Station at 13.00 on 28/11/2016 to hear about the potential research project and contribute their views.
2. Level of ability of participants. HFRS confirmed they do have official criteria for participants, which he will email me but also that they have noticed that people sent by GP and community teams are often slightly less able than they were intending. They do not exclude them and will adapt the Course to suit, but they are working on their education of referral partners to ensure people are closer to the intended criteria.

Action Points:

1. Attend [Removed] Fire Station on 28/11/2016 to discuss potential research project with current participants. Also observe their STEER Course at 14.00.
2. HFRS to send inclusion criteria – received via email 17/11/2016.

H.4 Station B Observation

Date: 28/11/2016

Setting and Session: [Removed] Fire Station – this is a retained fire station. The staff operating the Course also conducted the Course at Station A. In order to access the appliance bay the only fire engine is parked in front of the station, blocking access to parking. The education component is completed in a small general room, with small kitchenette attached. There is a large central table that the twelve participants can sit around. The format of the session is identical to that of Station A. Participants contribute different ideas and opinions which are used and included by HFRS staff. The exercise session then takes place in the appliance bay. There is no additional noise or distraction at this location as the only people on site are related to the Course. Participants are aware, however, that there is still potential for HFRS to receive a call-out at which point retained fire-fighters from the local area would arrive at the station and operate the fire appliance. Due to space constraints the STEER participants would need to move out of the appliance bay for this to happen.

Informal discussion with participants about a potential research project occurred at this site: General feedback is very positive, with an understanding that it's important to find out if STEER works. Participants felt very strongly that STEER was a very positive thing and they would "welcome the chance to talk about it". Discussion occurred about the number and type of interviews/focus groups required – support received about doing it at the same time as HFRS were doing their measurements. Although one participant said, "I only live two minutes away, any time is fine". I asked about the wider concept of discussing their experience of their health over the period of the Course. This, again, was welcomed. With comments like, "it's nice to be asked". I asked if there was a limit to which people felt comfortable discussing their health. In general no concerns raised, however one participant said, "as long as it's not too personal, like...". Due to the informality of these discussions no probing occurred and it was used to establish what level of commitment, type of data collection method and questioning would be acceptable to participants. The conclusion was that a preference for one-to-one interviews as they would be more suited to sharing details about health, and with questions that allowed for whatever level of detail felt appropriate for the participant. Some participants expressed that they would like to be

interviewed with their partner as attending STEER was something they'd done together. It was made clear at this point that while their group would not be included in the study, this would be an entirely optional and additional component for a small number of participants.

H.5 Meeting with HFRS Staff

Date: 05/12/2016

Present: [removed] (Fire as a Health Asset/Station Manager - Hampshire Fire and Rescue Service (HFRS)), Sarah Mercer (Clinical Doctoral Research Fellow, University of Southampton/Southern Health NHS Foundation Trust).

Location: HFRS Headquarters.

Agenda/Discussion:

1. Discussed outcomes of discussion with Station B participants. This has informed a design of three interviews to be held at the same time as STEER measurements, potentially some people may choose to be interviewed with partners. HFRS happy with this and supportive that we now proceed to get ethical approval.
2. Data protection and consent procedures already in place. Station Manager confirmed that HFRS have a data protection statement and they operate within the limits of this. Consent to use the data that HFRS collect for evaluation purposes has been sought since the start of STEER. Station Manager will provide me with a letter confirming how this is done.
3. Outcome measures and equipment. Station Manager was unsure of the exact models of equipment used, but will email me with details of these. He is happy if I create Standardised Operating Procedures based on the practises I have observed and operators' guidelines to ensure that all new Courses commence in the same way.

Action Points:

1. Prepare Research Proposal for peer review/ethical approval – email to HFRS for final review before submitting.
2. HFRS to email details regarding data protection and consent – received 06/12/2016
3. HFRS to send details of manufacturers and model numbers of all equipment. Received via email on 06/12/2016.

H.6 Email Communication

Date: 06/02/2017

Email communication from myself to Station Manager – HFRS to request copies of HFRS Risk Assessments regarding STEER. Response and documents received on the same day.

H.7 Meeting with Station Manager – Fire as a Health Asset - HFRS

Date: 10/04/2017

Cancelled by Station Manager as he is leaving his post. He advises that his successor will make contact to arrange a new meeting time once in post.

H.8 Meeting with STEER Lead

Date: 10/07/2017

Present: [removed] (new to role – now STEER lead) and Sarah Mercer (Clinical Doctoral Research Fellow, University of Southampton/Southern Health NHS Foundation Trust).

Location: HFRS Property.

Purpose of meeting: to meet the new STEER lead and make plans for data collection as ethical approval has now been granted.

Agenda and Discussion:

1. Supply of Participant Information Sheets. Agreed that I would send an electronic copy to the administration team who would now routinely send this to all new STEER Course participants with the measures they distribute and a covering letter from HFRS explaining about the research.
2. STEER Courses about to commence. [removed] advised I email HFRS directly to get the dates.
3. Inter/Intra-rater testing of Course Facilitators. Advised only one member of staff would be completing the baseline/twelve-week/six-month assessments and so inter-rater testing would not be possible, however he understood the rationale and permission given to complete intra-rater assessment at the first included Course.

4. Supply of routine data. I explained the terms of my ethical approval and support was given to supply the data in the approved format. He requested that I liaise directly with the administration team.
5. Any other business: STEER Lead explained that HFRS had partnered with ITN Productions to produce a short film about the STEER Course for the Royal Society of Public Health Awards. He asked me to appear on camera to discuss the research project. Agreed I would discuss with supervisory team.

Outcomes/To Follow Up:

1. Supply Participant Information Sheets (PIS) to administration team and request anonymised data to be prepared, so that it can be supplied on an encrypted USB. Administration team to routinely supply (PIS) from now onwards.
2. Email HFRS to arrange start dates for the next Courses.
3. Complete intra-rater assessment at first included Course.
4. Discuss public health film with supervisory team.

H.9 Email Communications with [removed] and [removed] (HFRS)

Date: 19-21/07/2017

Email sent by myself to HFRS

Sent: 19 July 2017 14:24

Subject: STEER Data

Hi [removed],

I've been having a preliminary look at the data and have had a few thoughts that might be important for future test days at the STEER Courses. Firstly it's really exciting to see some of the fully completed outcomes as well as how many others will be completed over the next few months. As you highlighted there are a few areas where there might be some discrepancies with how the data is being collected, which we can definitely address. I had a few thoughts and questions:

1. It appears that the FES-I is the item most often missed off – is there a reason why it's more difficult to get it completed? (I'm just wondering if we need to problem-solve it in any way, or if it's simply a case of reminding facilitators to have it completed at all test sessions).
2. Would it be possible to have all measures repeated at the 12 and 36 week points? (weight, blood pressure etc.) – I'm conscious there might be time constraints in the final session that make it hard to get them all done, especially now you're running more courses with 9+ participants.
3. The 'Station A 2' sheet didn't have the gender of participants – would it be possible to send that over please?
4. I'd discussed with [removed] previously adding in an outcome about mental health – but assume this has gotten lost along the way. Could we add it in to all active STEER Courses from now on please? The single sheet attachment (PHQ 9 Depression (Kroenke, Spitzer and Williams, 2001)) is the one to be given to STEER members, there is also some guidance (PHQ 9 Guidance (Kroenke, Spitzer and Williams, 2001)) for facilitators as this might potentially highlight someone with undiagnosed depression who would need to be signposted to their local GP (or potentially to emergency services should they express suicidal ideation, though I would expect this to be highly unlikely).

I think that's all for now. Do I need to speak to [removed - HFRS] to arrange the SOP calibrations with the facilitators? If you could ask him to get in touch that would be great, as I'm conscious there are probably some Courses due to have their 12/36 week tests done soon.

Best wishes,

Sarah

Sarah Mercer

Clinical Doctoral Research Fellow and Occupational Therapist,

University of Southampton and Southern Health NHS Foundation Trust,

Response

Hi Sarah,

I am going to try and answer the questions you have raised below.

1. It has been missed on a few occasions, its [sic] not difficult it has just been missed. I have dealt with this and with the new system it should not be missed off any more.
2. The weight, blood pressure and resting HR test are done at week 1 to make sure they are safe to exercise. We have found that due to most people being on medication to reduce blood pressure and HR that these scores do not change. We decided that we would use it as a safety measure and not as a test of improvement but happy to be led by you???? The body weight was another measurement that did not change as the course is not designed for weight loss and as we don't do anything with it we felt it was not worth doing at week 12 but again happy to be led by you??? We are looking at ways to refer overweight people into to NHS weight management support but that work is ongoing.
3. I will get the gender data for you.
4. I will add the questionnaire to the end of the cognitive impairment and depression session.

[Signature removed]

H.10 Meeting with STEER Course Facilitator - HFRS

Date: 24/07/2017

Present: [removed] (STEER Course Facilitator, HFRS) and Sarah Mercer (Clinical Doctoral Research Fellow, University of Southampton/Southern Health NHS Foundation Trust)

Location: HFRS Property.

Agenda/Discussion:

1. Mental Health Outcomes – As I'd recently obtained the anonymised outcome measures I noted the absence of PHQ-9 (Kroenke, Spitzer and Williams, 2001) as agreed to be implemented by Station Manager. [removed] was aware of this, and he stated it could now be included.

2. New STEER Courses – Station C – 14.00 08/08/17 and Station A 10.00 08/08/17. Consent given by [removed] to attend and he would advise the Course facilitator. Also expecting Courses to start in other locations x 2 later in September/October.
3. Intra-rater testing. [removed] stated it would not be possible to test the Quantitative Timed Up and Go Test on me as it had a minimum age of 60 years. I explained that we could still complete the tests and enter this age, to check consistency and the use of Standardised Operating Procedures. He was accepting of this.
4. Discussed the lack of repetition of blood pressure/weight outcomes. [removed] explained that it had been too time consuming and as they'd noticed little change in the early courses they were now leaving this out. They were not prepared to implement this again as it "was not a weight-loss intervention".

Outcomes:

1. Re-send PHQ-9 (Kroenke, Spitzer and Williams, 2001) (3rd time).
2. Attend new Courses and recruit 4 participants per site (and 4 per site at those commencing in September/October).
3. Complete intra-rater assessment on weeks 1 and 2 of the STEER Course.

Reflections:

There have been some challenges regarding the data collection implemented by HFRS, and I am aware of some frustration that I am feeling. However, my job is to evaluate the intervention as it stands, and so it is not my role to control every aspect.

Was there anything else I could have done? This was the first point I could see the data being collected, it would not have been ethical to do so before, therefore I was reliant on verbal assurances from HFRS (which were received on several occasions). There was also no reason to doubt that PHQ-9 (Kroenke, Spitzer and Williams, 2001) was being included as it was received positively.

Notes completed in retrospect of this meeting (01/09/2017):

The gender information was obtained on subsequent fieldwork, where I was able to ask a new member of STEER Course facilitation to provide me with the gender codes required.

PHQ-9 (Kroenke, Spitzer and Williams, 2001) was not implemented as agreed. As a further request might have been detrimental to partnership relations with HFRS and would only have been achieved with a small number of participants (approximately 24 people), it was decided to abandon this outcome measure.

Appendix I HFRS Risk Assessment

Ref No:

FM/8/1/2

Hampshire Fire and Rescue Service –Risk Assessment Record

| | | | | |
|-------------------------|---|--------|---|--------------------------------------|
| Initial Risk Assessment | 1 | Review | 1 | Please place a ✓ in the relevant box |
|-------------------------|---|--------|---|--------------------------------------|

| 2. Task | 3. Hazard and Outcome(s) | 5. Control Measures In Place | 6. Level Of Risk | | | 7. Control Measures Required | 8. Level Of Risk | | |
|---------------------|--------------------------|--|------------------|---|---|---|------------------|---|---|
| | | | L | S | R | | L | S | R |
| Visitors on Station | Unfamiliar surroundings. | Workplace Risk Assessments. SO/2/9 Event planning & running events. | 2 | 2 | 4 | Clear cordoning of restricted access areas. Signage to indicate location of permitted access. Safety brief for exhibitors/visitors. | 1 | 2 | 2 |

| | | | | | | | | | |
|-------------------------------------|---|---|----------|----------|----------|--|----------|----------|----------|
| | ----- Musculoskeletal injuries resulting from slips trips & falls. Unauthorised access to closed areas. Accidental obstruction of operational personnel. | SO/2/5 Insurance. SO/8/1/4/4/2 Public Safety | | | | Regular checks by station personnel to ensure no unauthorised access. Guides to show visitors access route to event. | | | |
| Elderly/people with mobility issues | Access to Station | Workplace risk assessment | 2 | 2 | 4 | Designate a safe and suitable access route and escort as required | 2 | 2 | 4 |

| | | | | | | | | | |
|----------------------|--|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Visiting the station | <p>Unable to gain access to the station.</p> <p>Musculoskeletal injury due to slips, trips & falls as a result of unsuitable access routes to station.</p> | <p>SO/2/9 Event planning & running events.</p> <p>SO/2/5 Insurance.</p> <p>SO/8/1/4/4/2 Public Safety.</p> <p>SO/1/6/3 Equality & Diversity Strategy.</p> | | | | <p>in/out of station, Make any reasonable, temporary and reversible alterations/adjustments for access (removable ramps etc.).</p> | | | |
| Visitors to station | <p>Wet corridors/appliance room floor.</p> <p>Uneven floor coverings, pathways/drill yard. Trailing cables</p> <p>-----</p> | <p>SO/2/9 Event planning & running events.</p> <p>SO/2/5 Insurance.</p> <p>SO/8/1/4/4/2 Public Safety.</p> <p>SO/1/6/3 Equality & Diversity Strategy.</p> | 2 | 3 | 6 | <p>Before the event the floors should be cleaned dried and inspected for damage. Any potential hazards should be cordoned off. The external pathways & drill yard should be inspected and any hazards cordoned off. Extension cables to be gaffer taped to floors.</p> | 1 | 3 | 3 |

| | | | | | | | | | |
|-----------------------------------|--|--|---|---|---|--|---|---|---|
| | Musculoskeletal injury due to slips, trips & falls as a result of slippery or uneven floors. | | | | | | | | |
| Refreshments & Welfare Facilities | <p>Hot surfaces/water, spills, breakages.</p> <p>Food preparation.</p> <p>Temperature -----</p> <p>Burns/scalds, slips, trip & falls resulting in musculoskeletal injuries.</p> <p>Lacerations/pun</p> | <p>SO/2/9 Event planning & running events.</p> <p>SO/2/5 Insurance.</p> <p>SO/8/1/4/4/2 Public Safety</p> <p>SO/8/6/1 Food Safety.</p> <p>Station heat/ventilation systems.</p> <p>SO/9/6/3/3 First Aid & Trauma Care Training</p> | 2 | 3 | 6 | <p>Ensure adequate cordoning between water boilers and the public. All spills/breakages to be cleaned up & dried immediately, the area to be suitable cordoned during cleanup.</p> | 1 | 3 | 3 |

| | | | | | | | | | |
|--|--|---|---|---|----|---|---|---|----|
| | cture wounds. Food poisoning. | | | | | | | | |
| Senior Citizens moving around the station | Mobility Issues. ----- Injury resulting from inability to negotiate station environment alone. Exclusion from certain aspects of the event. | SO/2/9 Event planning & running events. SO/2/5 Insurance. SO/8/1/4/4/2 Public Safety SO/1/6/3 Equality & Diversity Strategy. | 2 | 2 | 4 | If possible allocate separate routes for pedestrians and powered wheelchair/scooters. Allocate station staff to marshal all visitors. | 1 | 2 | 2 |
| Emergency response | Vehicle – pedestrian collision. Accidental obstruction of responding personnel | SO/2/9 Event planning & running events. SO/2/5 Insurance. SO/8/1/4/4/2 Public Safety. SO/9/6/3/1 Service Drivers – Grading & Training. | 3 | 5 | 15 | Appliances to be parked in a position that keeps them ready for operational deployment, but is still completely segregated from pedestrian traffic routes. Restrict access to the appliances. Safety brief for visitors on arrival. | 2 | 5 | 10 |

| | | | | | | | | | |
|----------------------|--|--|---|---|----|---|---|---|---|
| | ----- Musculoskeletal injuries, death, stress. Delays in responding to incidents. | SO/10/43 Service Vehicles. SO/7/23/1/1 Road Risk Management. SO/9/6/3/3 First Aid & Trauma Care Training | | | | | | | |
| Emergency Evacuation | Panic. Fire. Other emergency evacuation. ----- Stress. Musculoskeletal injuries resulting from slips, trips & falls while | SO/8/1/9 Workplace Fire Safety. SO/2/9 Event planning & running events. SO/2/5 Insurance. SO/8/1/4/4/2 Public Safety. Station Fire Risk Assessment. AFD System. | 3 | 4 | 12 | Nominate station staff to act as wardens to assist in the event of an evacuation. | 2 | 4 | 8 |

| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|
| | <p>rushing to evacuate.</p> <p>Burns.</p> <p>Smoke inhalation.</p> | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|

**Appendix J Poster from Royal College of Occupational
Therapists' Annual Conference 2018**

Occupational Performance in People with Pre-Frailty Participating in a Fire Service-Led Frailty Prevention Group

Sarah Mercer (sm7e14@soton.ac.uk, @pd2ot), Dr. Bronagh Walsh and Dr. Julie Wintrup.

Introduction

Frailty and its linked decline in mobility and **difficulty in completing necessary occupations** has become a key area of focus for health services due to associated adverse health outcomes (British Geriatrics Society 2014).

Hampshire Fire and Rescue Service have **developed a frailty prevention course**, the 'Safety Through Education and Exercise for Resilience (STEER)' Course, which engages older adults who are vulnerable to becoming frail, and has allowed **exploration of the effect of 'pre-frailty' on the occupational performance** of participants.

Methods

- Mixed methods phase of the study included 8 participants who completed semi-structured interviews at baseline, at the end of the STEER Course and six-months after completing the Course.
- Baseline interviews were analysed using framework analysis to answer the research question: **What is the experience of pre-frailty on occupational performance and engagement?**



Participants in a STEER Course

Findings

- All participants experienced symptoms of emerging frailty. It often resulted in changes in the satisfaction with, or modification of occupation performed: *"I can no longer have a bath, because I cannot get out of the bath, um, I can't push myself up into a standing position, so I'm now needing to have a shower, which I don't like"* (Participant 8).
- Occupational performance often limited by external factors: *"Well, I'd like to be richer! [laughs] so that I could go out and about because I'm just so tied with the buses, and I can't get, get very far at all"* (Participant 2).
- Questions about health status were met with a response about the ability to independently complete activities: *"I don't have a great deal of difficulties doing things – I do all my own housework, gardening..."* (Participant 1) *"I would say I'm fit, not healthy, if you understand what I mean?"* (Participant 6)

Discussion

- For those living with pre-frailty it was **rare** that internal factors **fully prevented participation** in occupation.
- For some participants true **engagement or absorption** was limited by elements of pre-frailty such as illness symptoms, weakness or fatigue. Fear of the negative consequences of not completing valued occupations, such as social isolation or reduced mobility, is a motivating factor, indicating that occupational engagement as defined by Morris and Cox (2017) was driven by an awareness of changing frailty state.
- Most participants were already living with frailty symptoms, yet were fit, active and not needing help with daily activities. This **challenges the classification of frailty** as proposed by Rockwood et al. (2005) and warrants further examination.

Conclusions and Next Steps

- Living with pre-frailty may change the experience of occupational performance with age-related conditions influencing **level of satisfaction with, or duration of, occupational engagement**.
- The **ability to complete chosen occupations independently** was identified as a marker of 'aging well'.
- Social and environmental factors** are more likely to influence occupational performance than physical limitations.
- Quasi-experimental pre/post test analysis of change during STEER Course ongoing with 250+ participants.

References

British Geriatrics Society (2014) Fit for Frailty - Consensus best practice guidance for the care of older people living with frailty in community and outpatient settings. London: British Geriatrics Society
 Morris K and Cox D (2017) Developing a descriptive framework for "occupational engagement". Journal of Occupational Science 24(2): 152-164
 Rockwood K, Song X, MacKnight C, Bergman H, Hogan D, McDowell I and Mitnitski A (2005) A global clinical measure of fitness and frailty in elderly people. CMAJ: Canadian Medical Association Journal 173(5): 489-495

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HAMPSHIRE FIRE AND RESCUE SERVICE

Appendix K Normal Distribution Checks of Dependent Variables

The dependent variables checked for normality were:

- Maximum grip strength (kg),
- Sit to stand transfers completed in thirty seconds (frequency/30s)
- Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)) falls risk estimate (FRE (%))
- Quantitative Timed Up and Go (QTUG™ (Kinesis Health Technologies, 2014)) Frailty Score (QTUG™ Frailty) (%)
- Falls Efficacy Scale – International (FES-I) (Kempen *et al.*, 2008) score

They are each captured at baseline, STEER Course completion (twelve-week) and at six-month follow up and were each inspected for level of fit with a normal distribution with the following expectations:

- Skewness and Kurtosis z-values between -1.96 and +1.96 at $P < 0.05$ (Ghasemi and Zahediasl, 2012)
- Shapiro-Wilk test p-value: Above 0.05 (Ghasemi and Zahediasl, 2012)
- Visual inspection of histograms and normal Q-Q plots for fit with a normal distribution, although this was applied with caution as it is known to be a less reliable test (Altman and Bland, 1995; Ghasemi and Zahediasl, 2012)

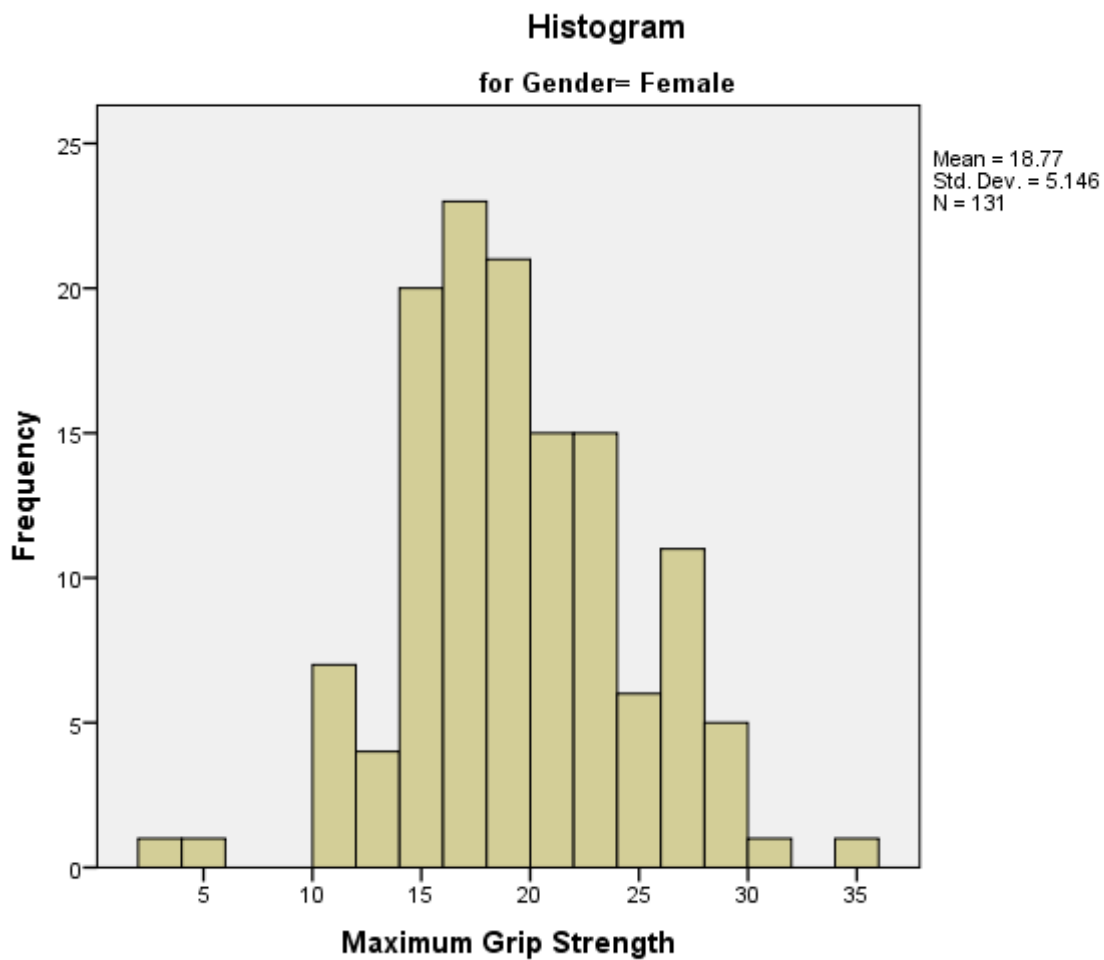
The results follow.

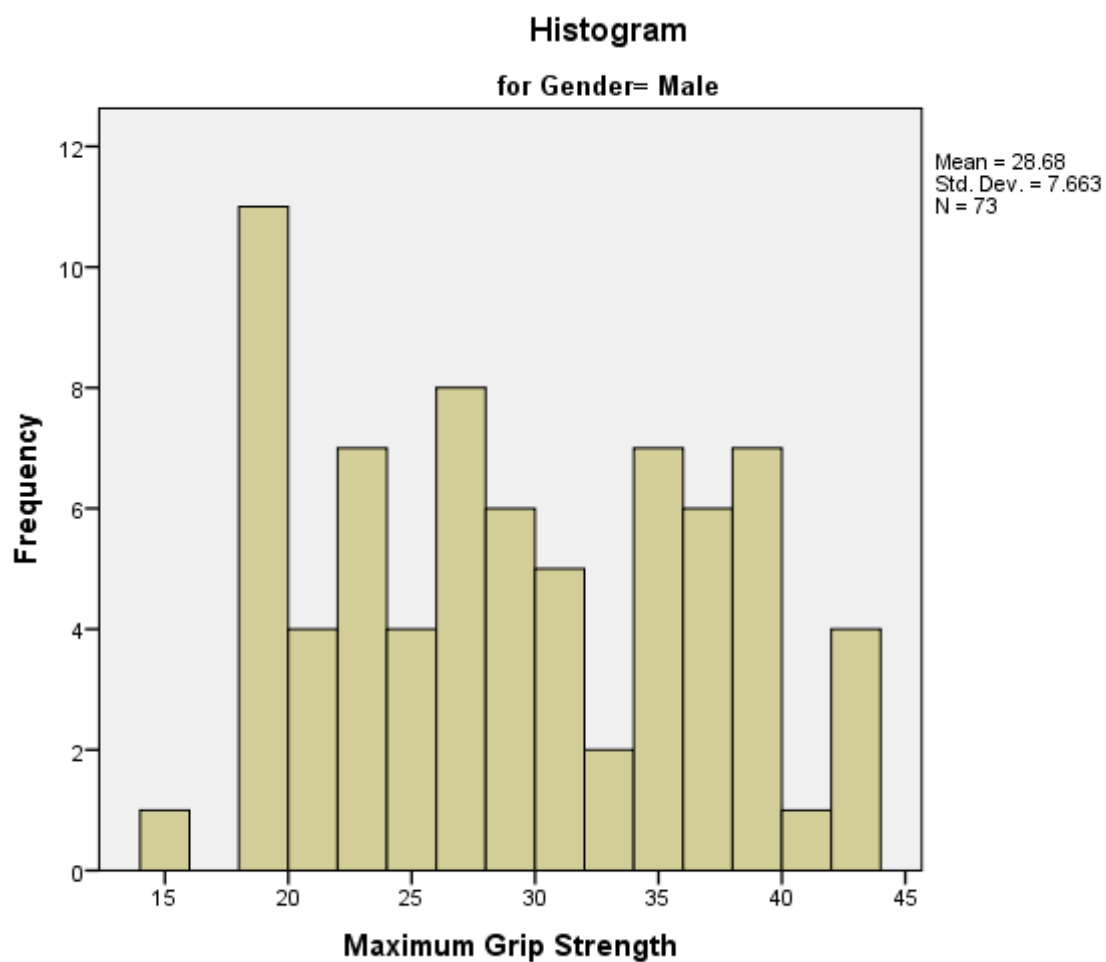
K.1 Maximum Grip Strength

Baseline:

| Maximum Grip Strength (Baseline) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|----------------------------------|---------------|---------------|----------------|----------------------|
| | Female (131) | 0.131 (0.212) | 0.532 (0.420) | 0.101 |
| | Male (73) | 0.121 (0.281) | -1.156 (0.555) | 0.007 |

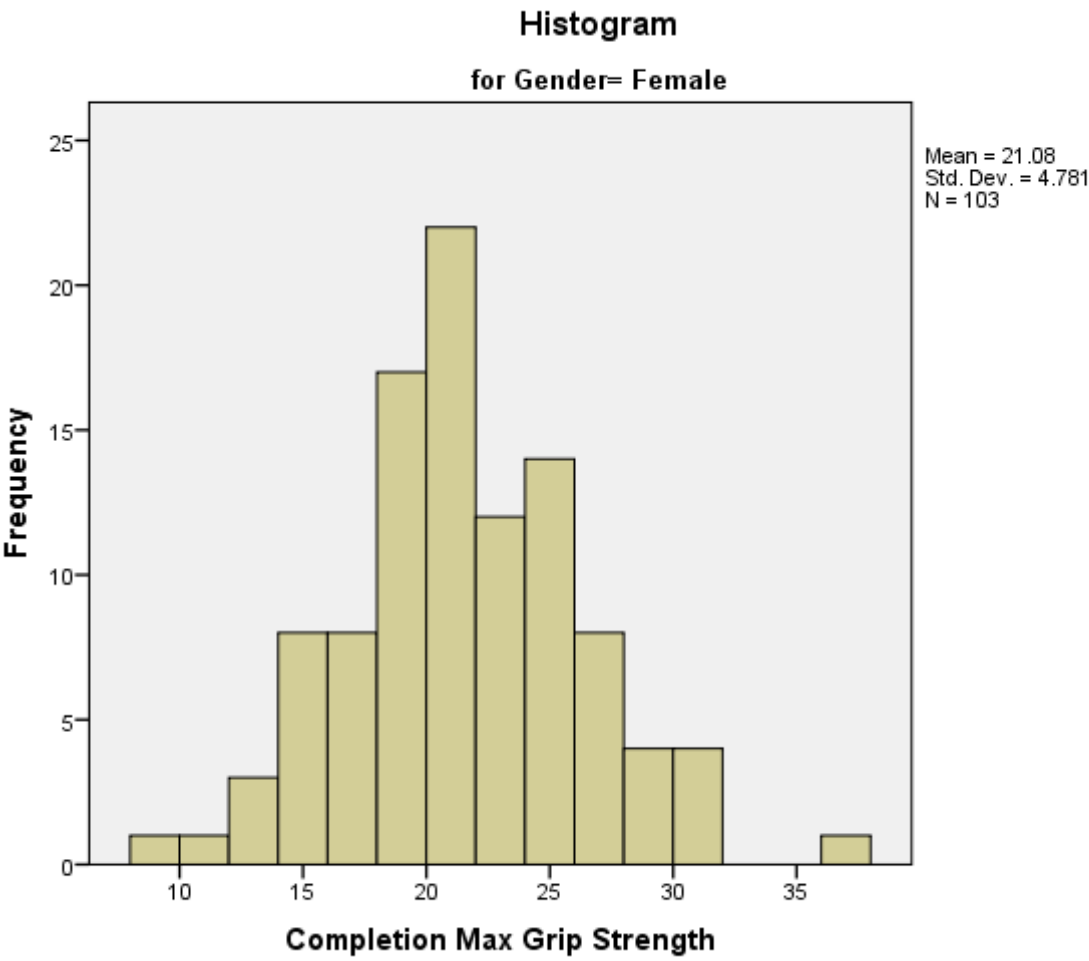
Calculation of z-values for the skewness and kurtosis, as well as visual inspection of the histograms and the Shapiro-Wilk p-values confirmed that maximum grip-strength at baseline for the female participants was normally distributed, whereas the male participants' data were not normally distributed.

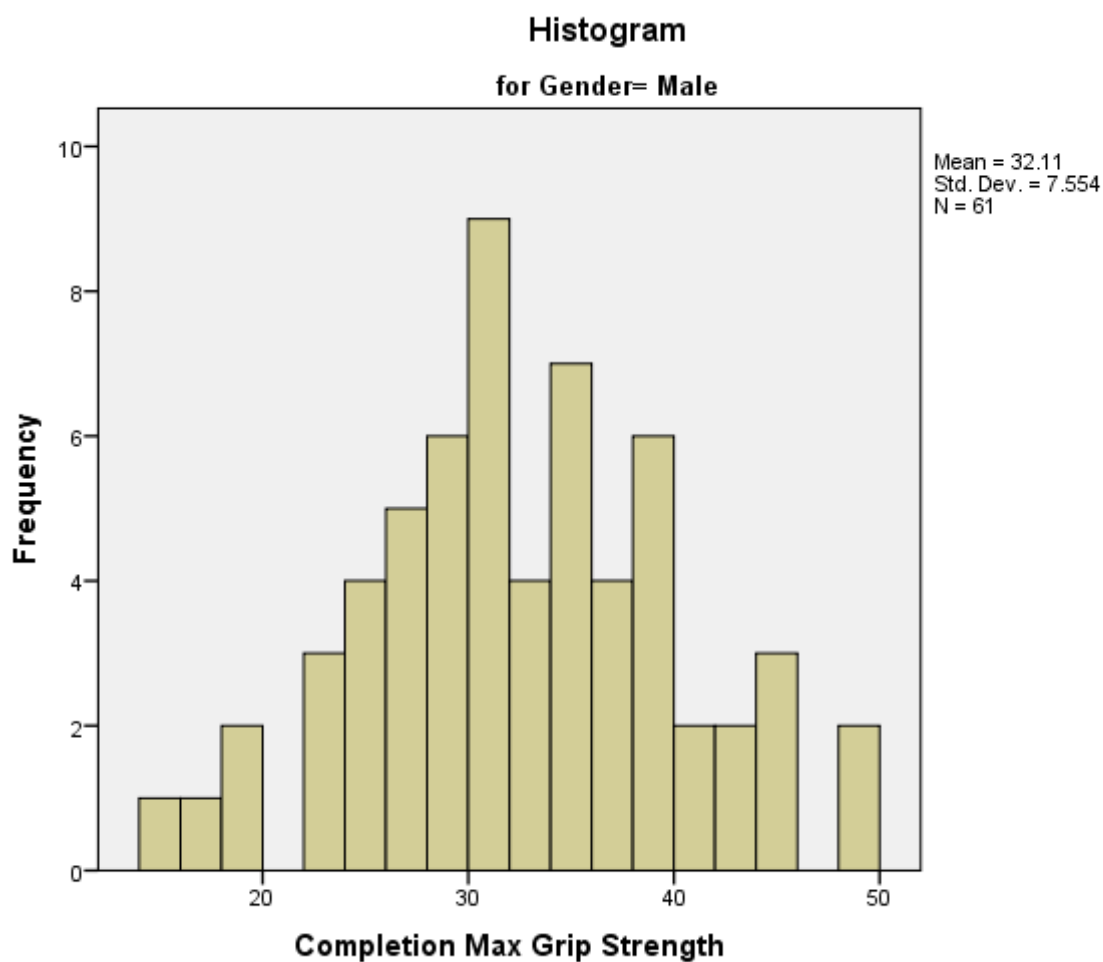




Twelve-week /Course Completion

| Maximum Grip Strength (Twelve-Week) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|-------------------------------------|---------------|---------------|----------------|----------------------|
| | Female (103) | 0.217 (0.238) | 0.325 (0.472) | 0.638 |
| | Male (61) | 0.004 (0.306) | -0.216 (0.604) | 0.817 |

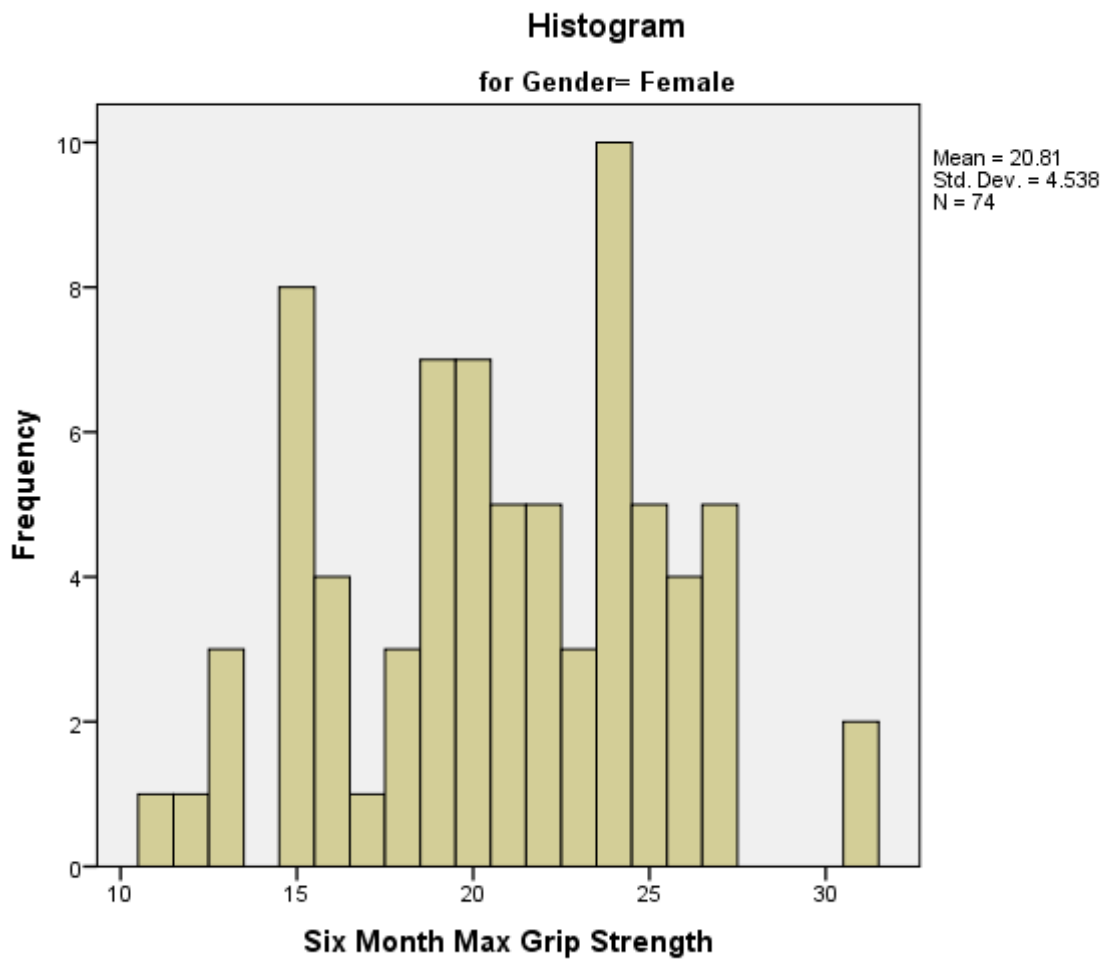


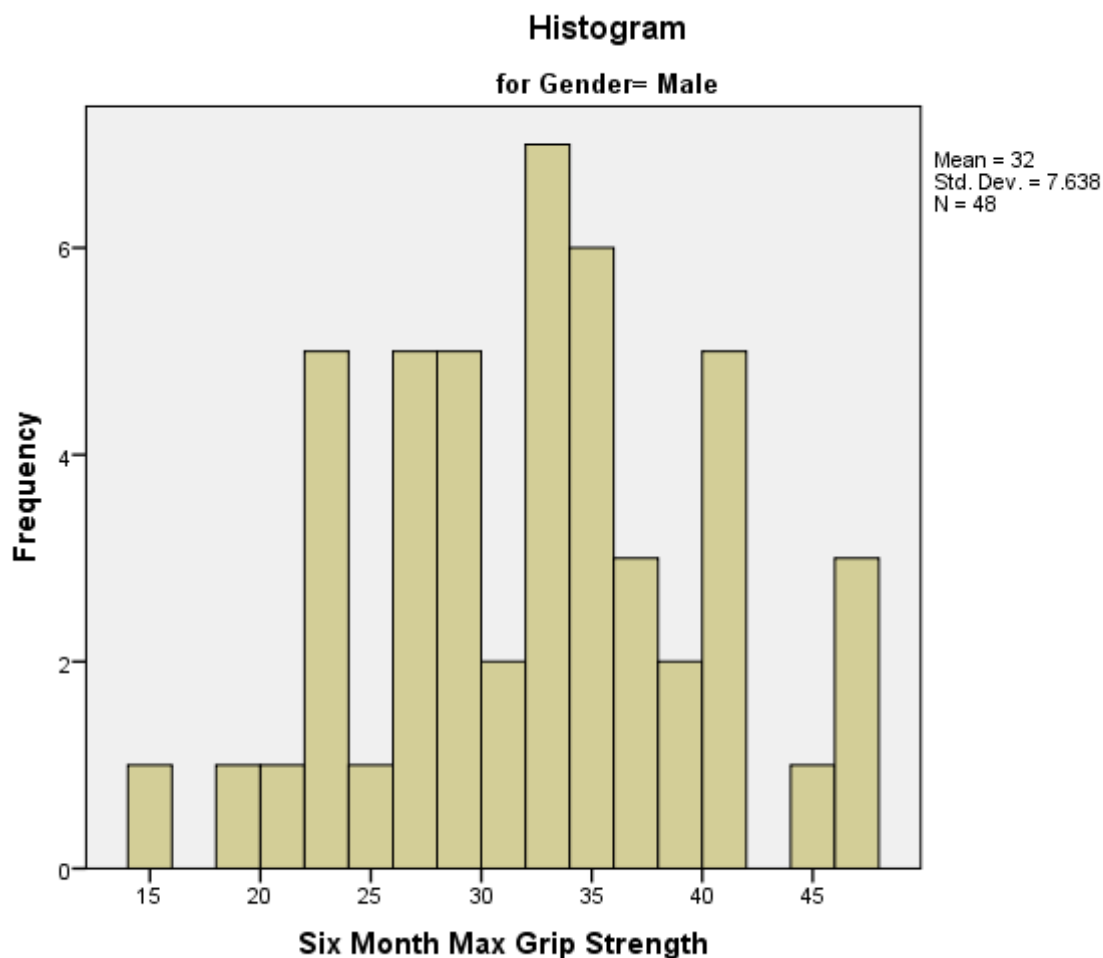


At twelve-weeks/STEER Course completion the z-values, Shapiro-Wilk p-values and visual check of histograms suggest that both male and female participants' grip strength is approximately normally distributed.

Six-Month Follow Up

| Maximum Grip Strength (Twelve-Week) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|-------------------------------------|---------------|----------------|----------------|----------------------|
| | Female (74) | -0.098 (0.279) | -0.580 (0.552) | 0.149 |
| | Male (48) | 0.025 (0.343) | -0.343 (0.674) | 0.746 |



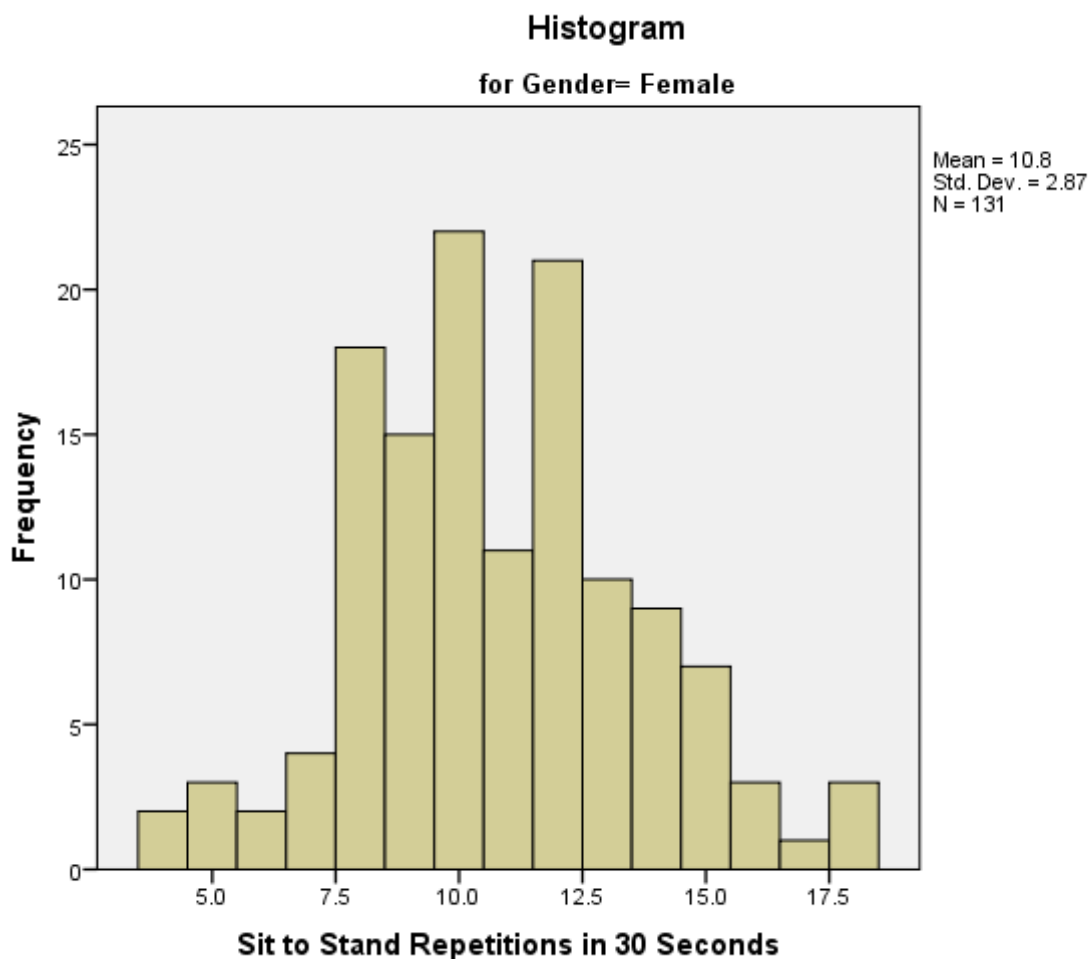


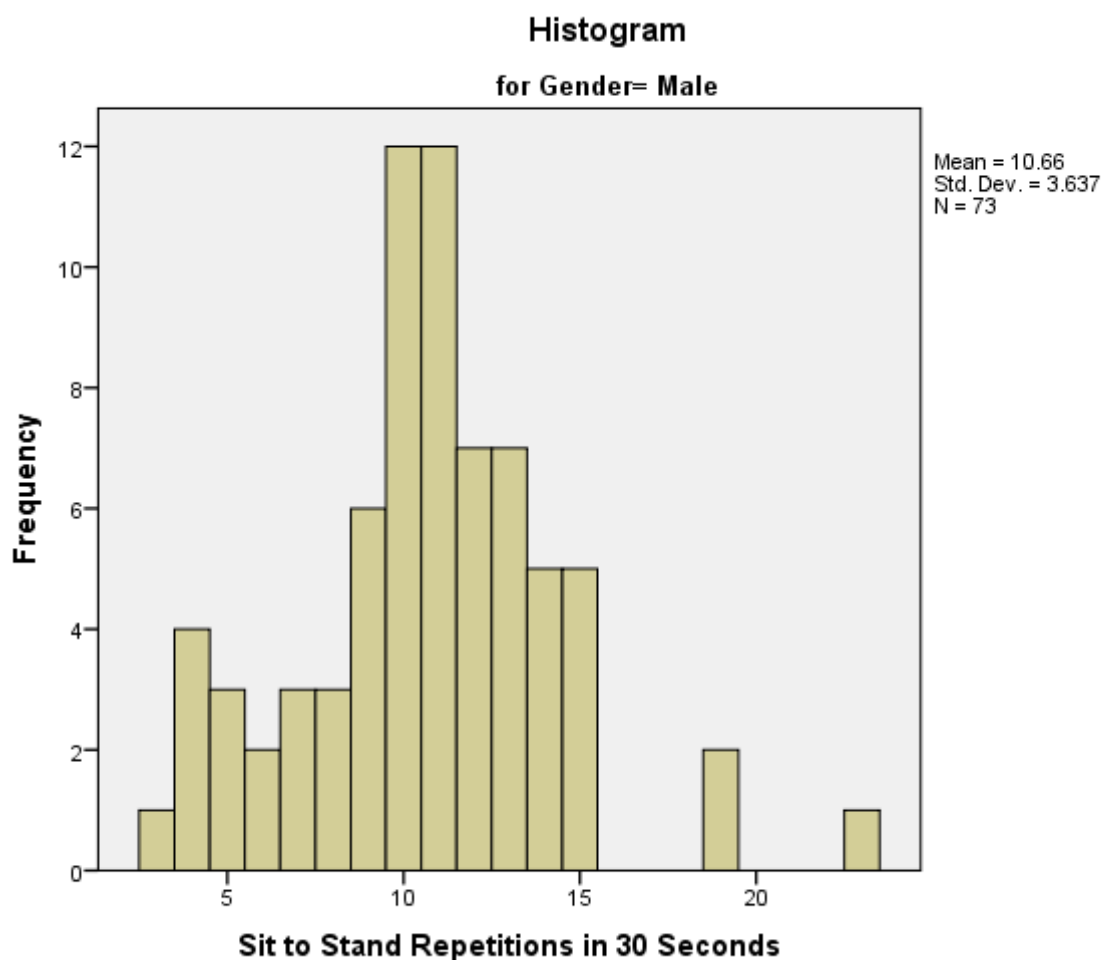
At the six-month follow up testing the calculated z-values of skewness and kurtosis, Shapiro-Wilk p-value and visual inspection of the histogram also confirmed that both male and female participants' maximum grip strength data were approximately normally distributed.

Maximum grip strength (kg) was an approximately normally distributed variable for women at all three time-points, but for men only at the twelve-week Course completion assessment and six-month follow-up.

K.2 Sit To Stand Transfers

| Sit To Stand Repetitions (Baseline) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|-------------------------------------|---------------|---------------|---------------|----------------------|
| | Female (131) | 0.193 (0.212) | 0.013 (0.420) | 0.041 |
| | Male (73) | 0.337 (0.281) | 1.320 (0.555) | 0.014 |



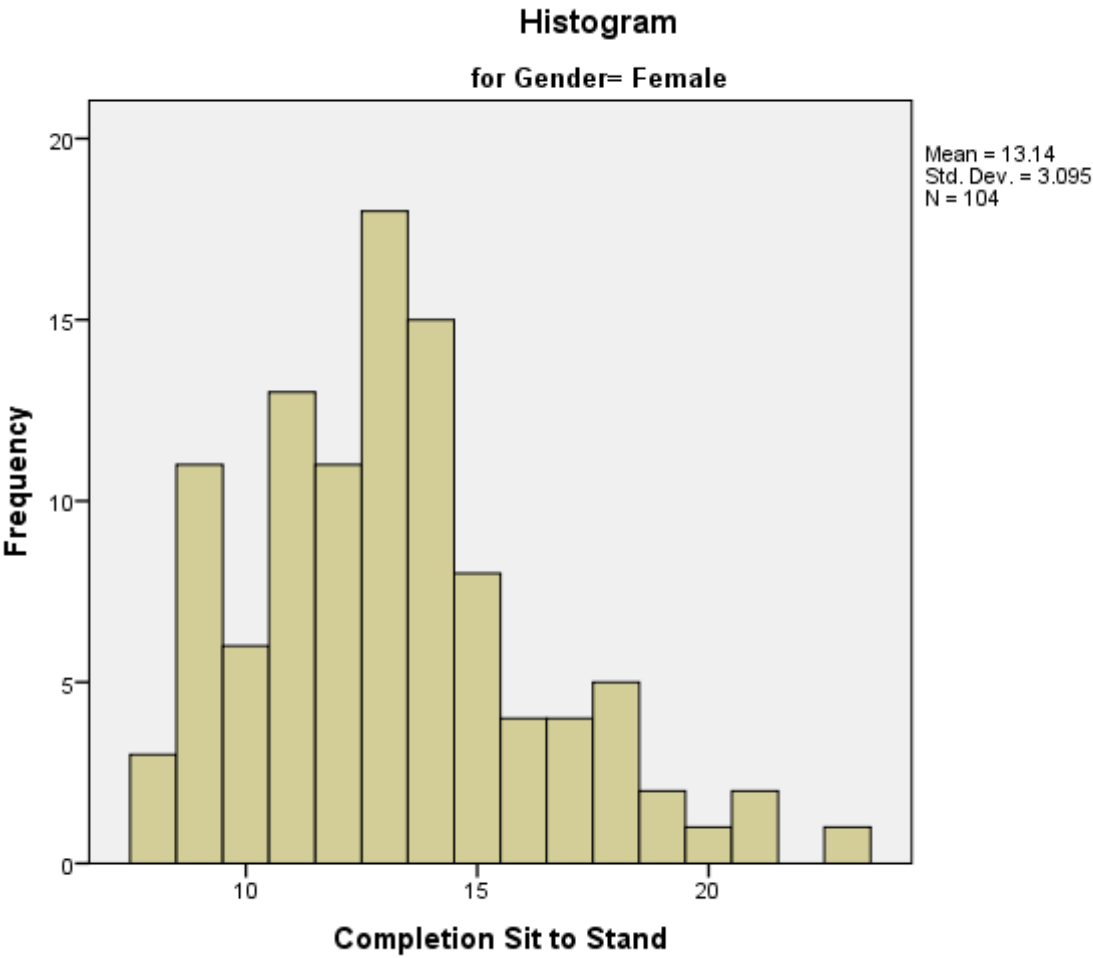


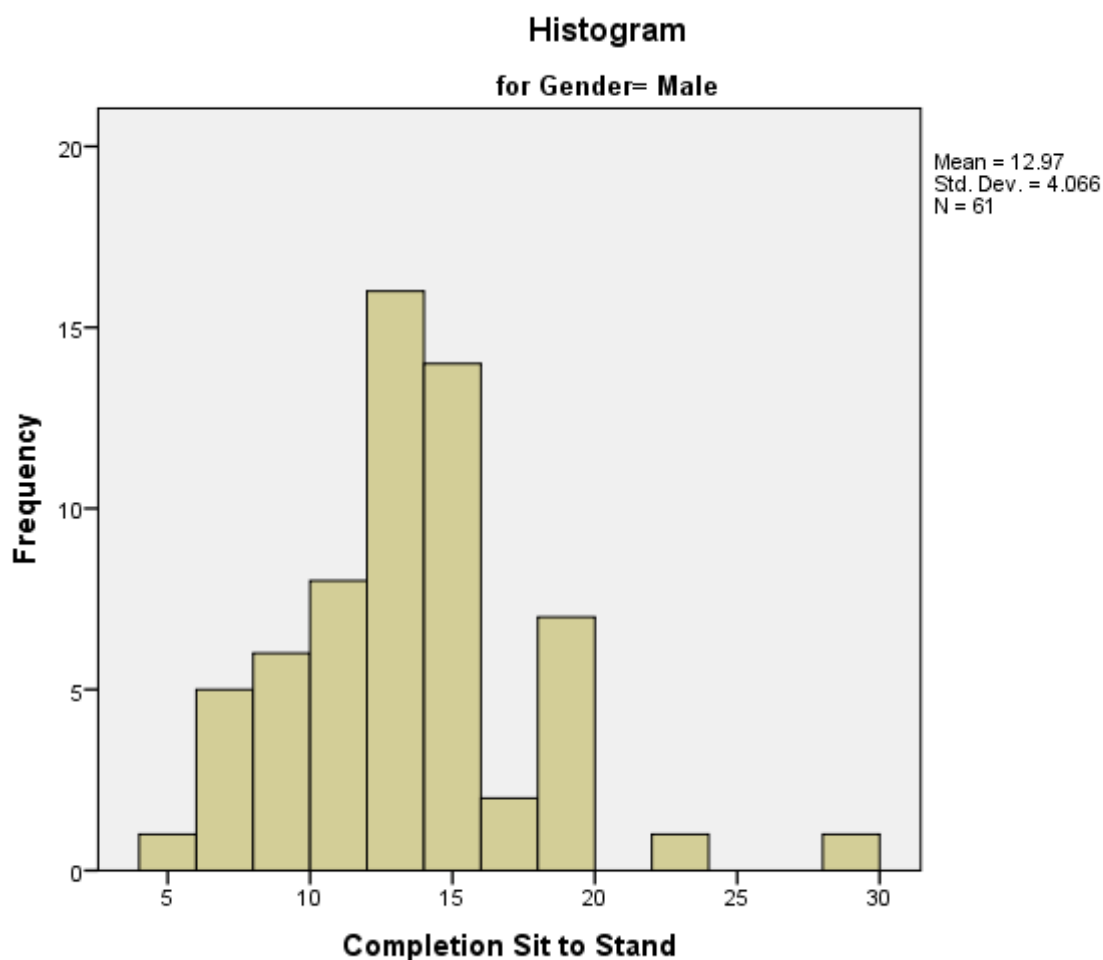
For female participants at baseline the skewness and kurtosis z-values and inspection of the histogram suggest the data is approximately normally distributed, however the Shapiro Wilk p value of 0.041 suggests it is just outside the range of an acceptable normal distribution. For the male participants all parameters suggest the data is not normally distributed which is due to a number of outlying participants who scored a high number of repetitions. The male sample is, perhaps, more influenced by the smaller sample size.

Twelve-week /Course Completion

| Sit To Stand Repetitions (Twelve-Week) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|--|---------------|---------------|---------------|----------------------|
| | Female (104) | 0.696 (0.237) | 0.484 (0.469) | 0.001 |
| | | | | |

| | | | | |
|--|-----------|---------------|---------------|-------|
| | Male (61) | 0.841 (0.306) | 2.258 (0.604) | 0.006 |
|--|-----------|---------------|---------------|-------|

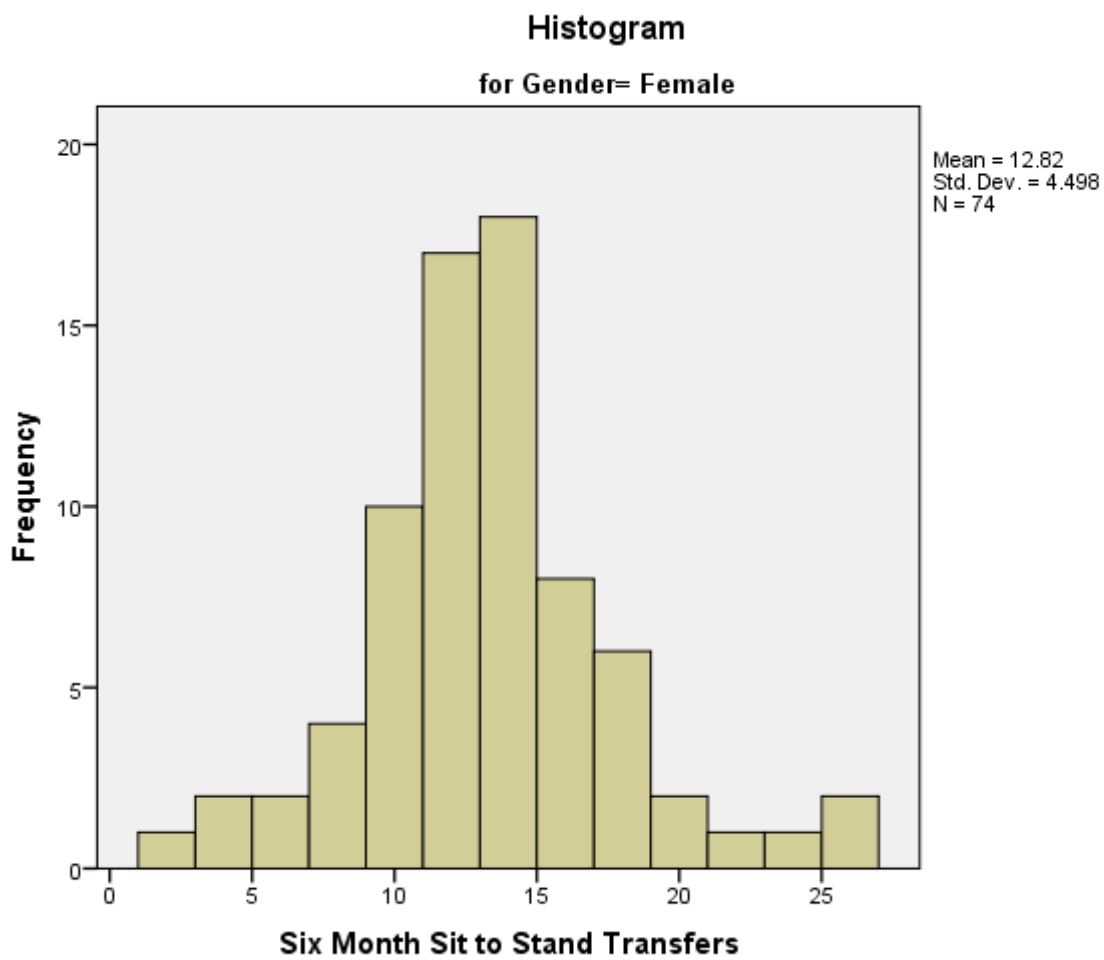


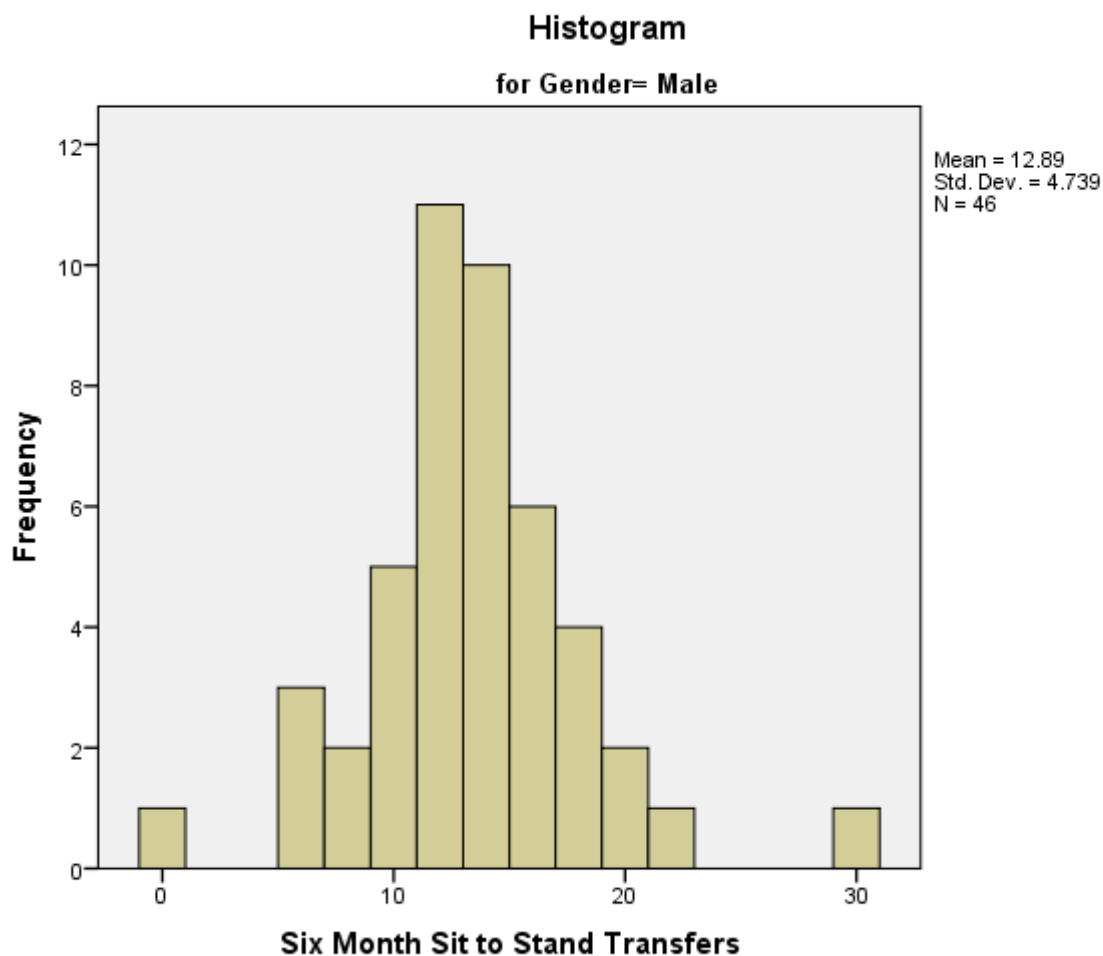


At the STEER Course completion, twelve weeks after the first testing, the data for male and female participants fails to meet the criteria for a normal distribution on all three tests. The histograms demonstrate the weighting of data towards the lower frequencies with high outliers present for both genders.

Six-Month Follow Up

| Sit To Stand Repetitions (Six-Month) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|--------------------------------------|---------------|---------------|---------------|----------------------|
| | Female (74) | 0.378 (0.279) | 1.447 (0.552) | 0.019 |
| | Male (46) | 0.465 (0.350) | 2.641 (0.688) | 0.079 |





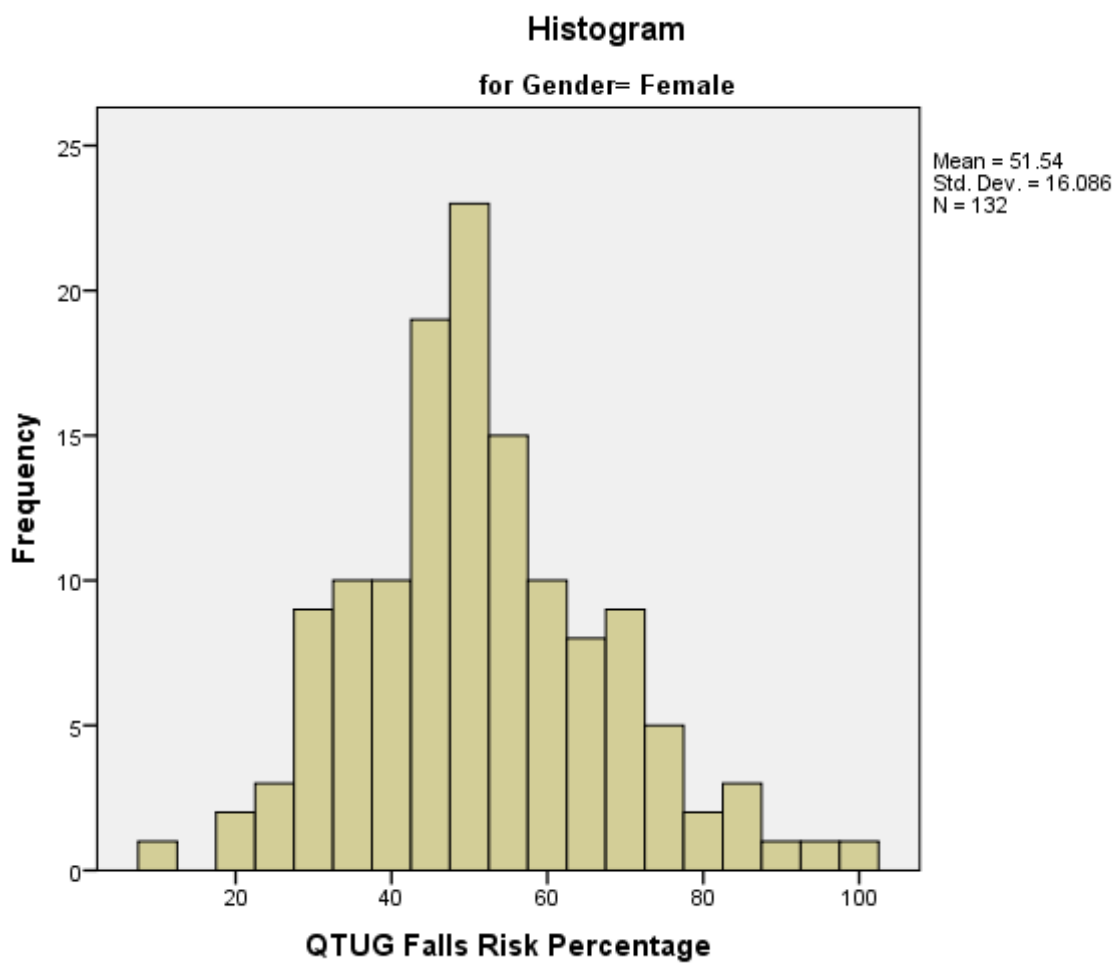
At the six-month follow-up assessment the outliers for men and women are reflected in kurtosis z-values which do not suggest a normal distribution, which is evident on the histograms. Their skewness, however, is minimal.

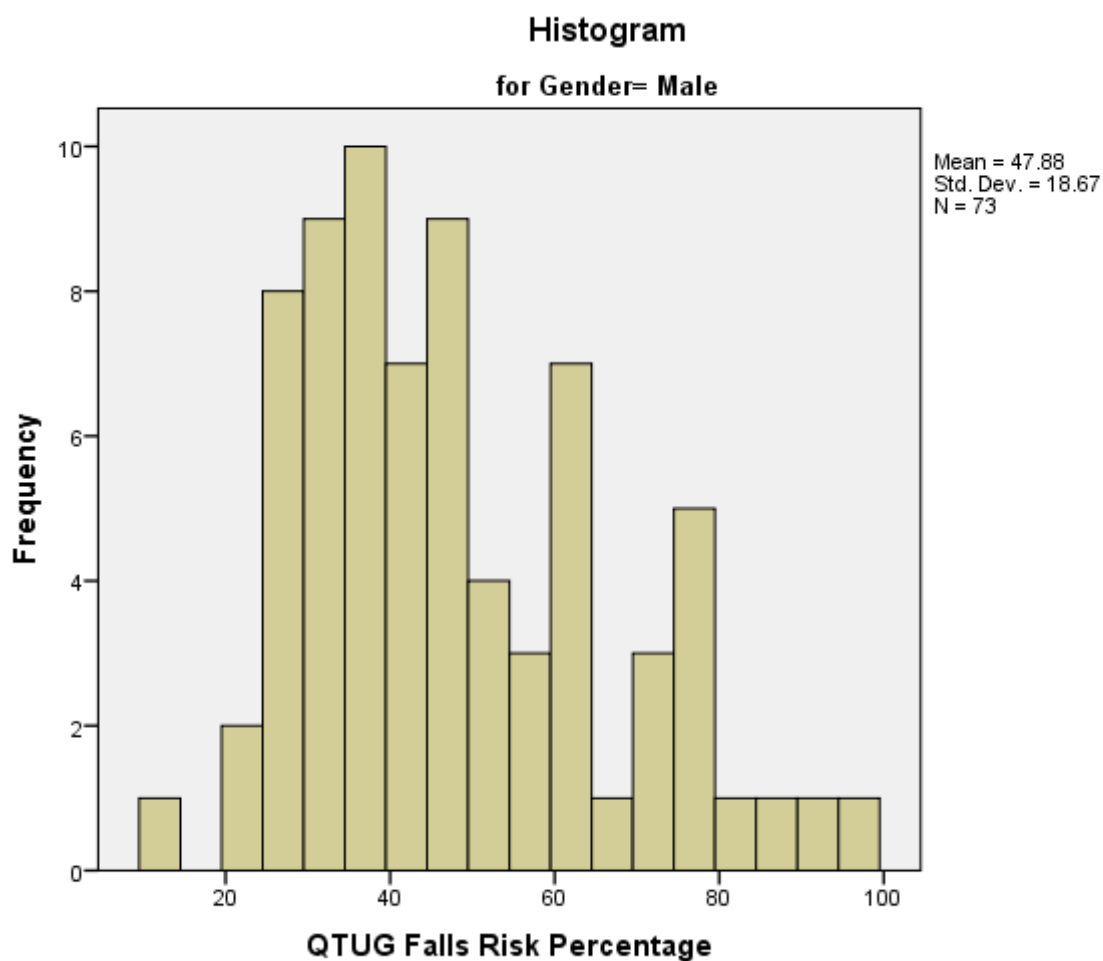
In summary, at all three time-points, the sit-to-stand data has a poor fit with a normal distribution and suggests analysis by non-parametric methods.

K.3 Quantitative Timed Up and Go Test – Falls Risk Estimate (QTUG™ (Kinesis Health Technologies, 2014) FRE)

Baseline

| QTUG™ (Kinesis Health Technologies, 2014) FRE (Baseline) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|--|---------------|---------------|----------------|----------------------|
| | Female (132) | 0.400 (0.211) | 0.263 (0.419) | 0.217 |
| | Male (73) | 0.721 (0.281) | -0.138 (0.555) | 0.002 |



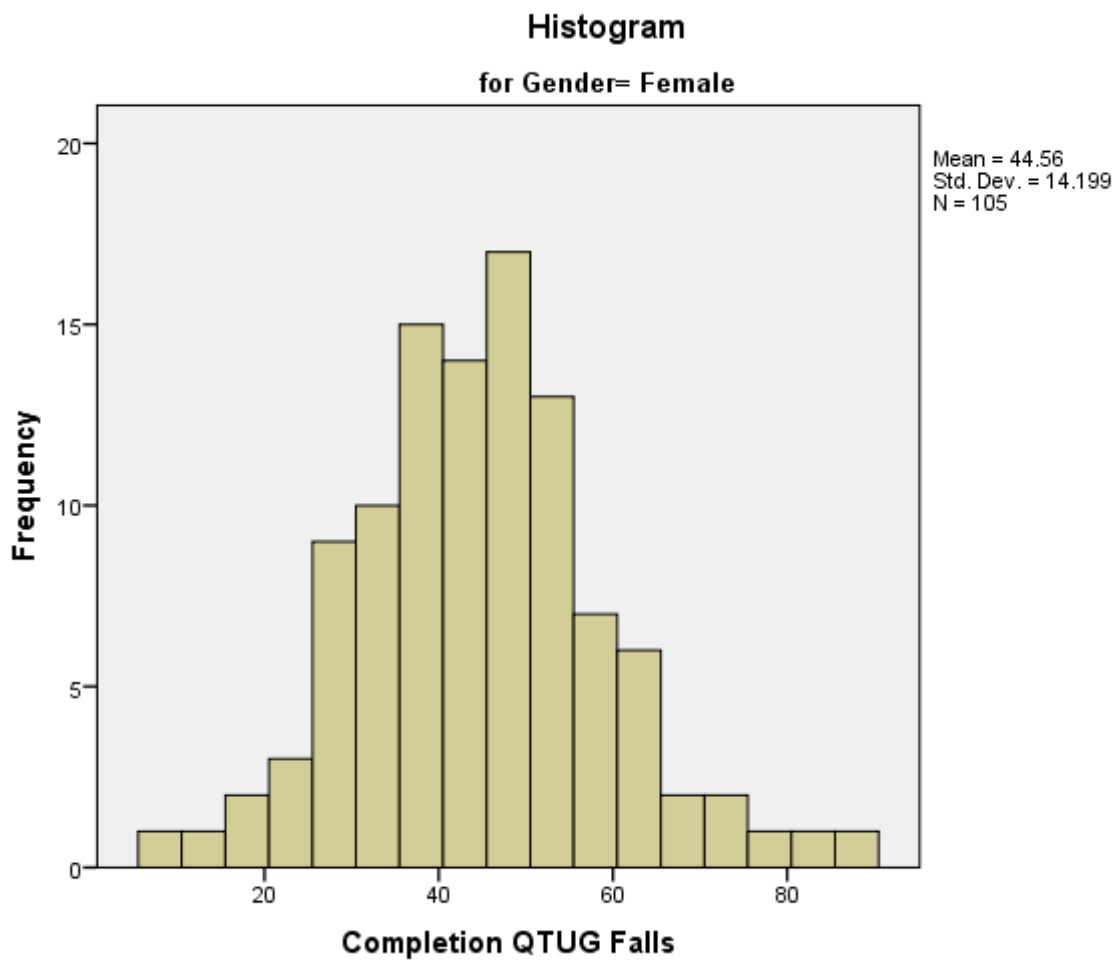


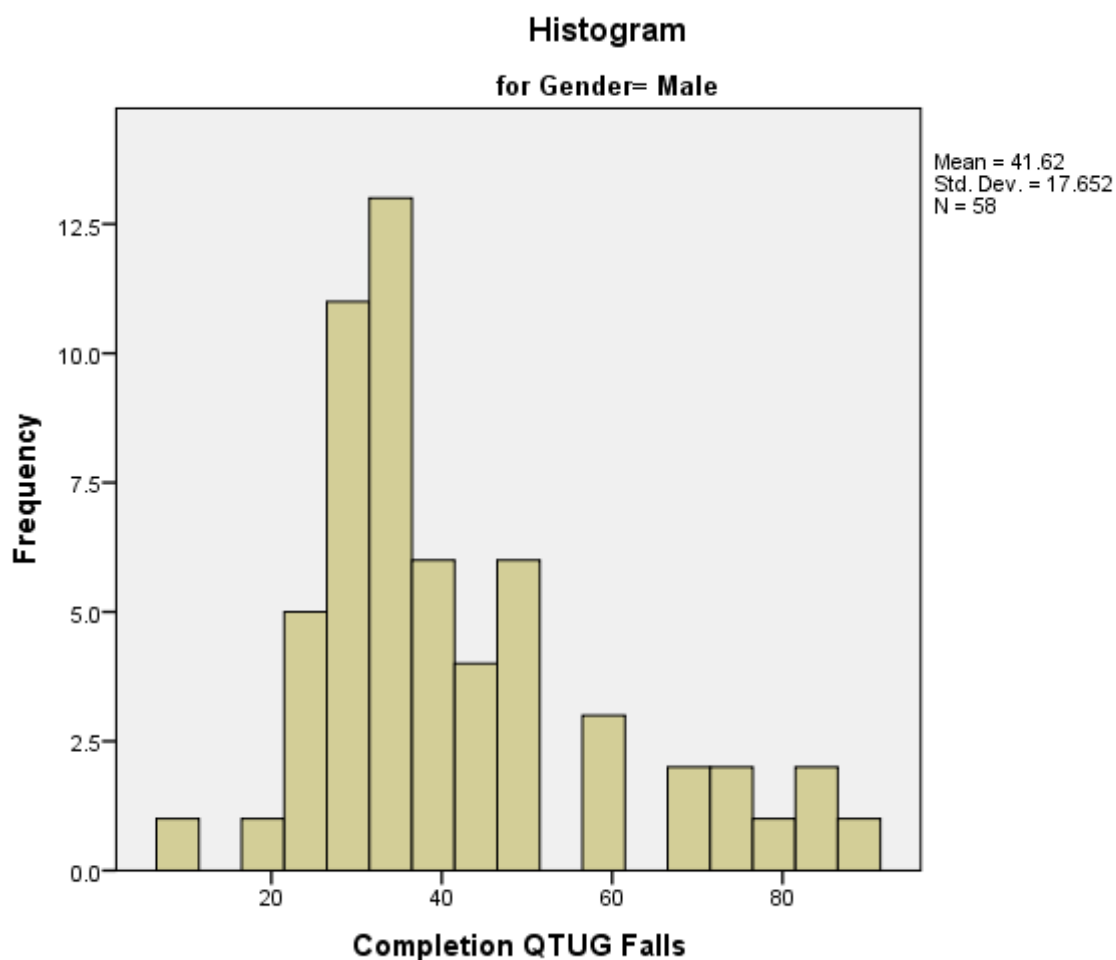
While the histogram for female participants is not perfectly symmetrical the z-value for skewness and kurtosis confirm an approximately normal distribution, further supported by a Shapiro-Wilk p-value of 0.217. For male participants only the z-value for kurtosis is within acceptable range. The skewness towards the lower values is reflected in the histogram and skewness z-value. As with the above data it is possible that the lower number of male participants is contributing to the poor fit with a normal distribution.

Twelve-week /Course Completion

| QTUG™ (Kinesis Health Technologies, 2014) (Twelve-week /Course Completion) | Gender (n) | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|--|------------|---------------|---------------|----------------------|
| | | | | |

| | | | | |
|--|--------------|---------------|---------------|-------|
| | Female (105) | 0.380 (0.236) | 0.570 (0.467) | 0.514 |
| | Male (58) | 1.144 (0.314) | 0.732 (0.618) | 0.000 |



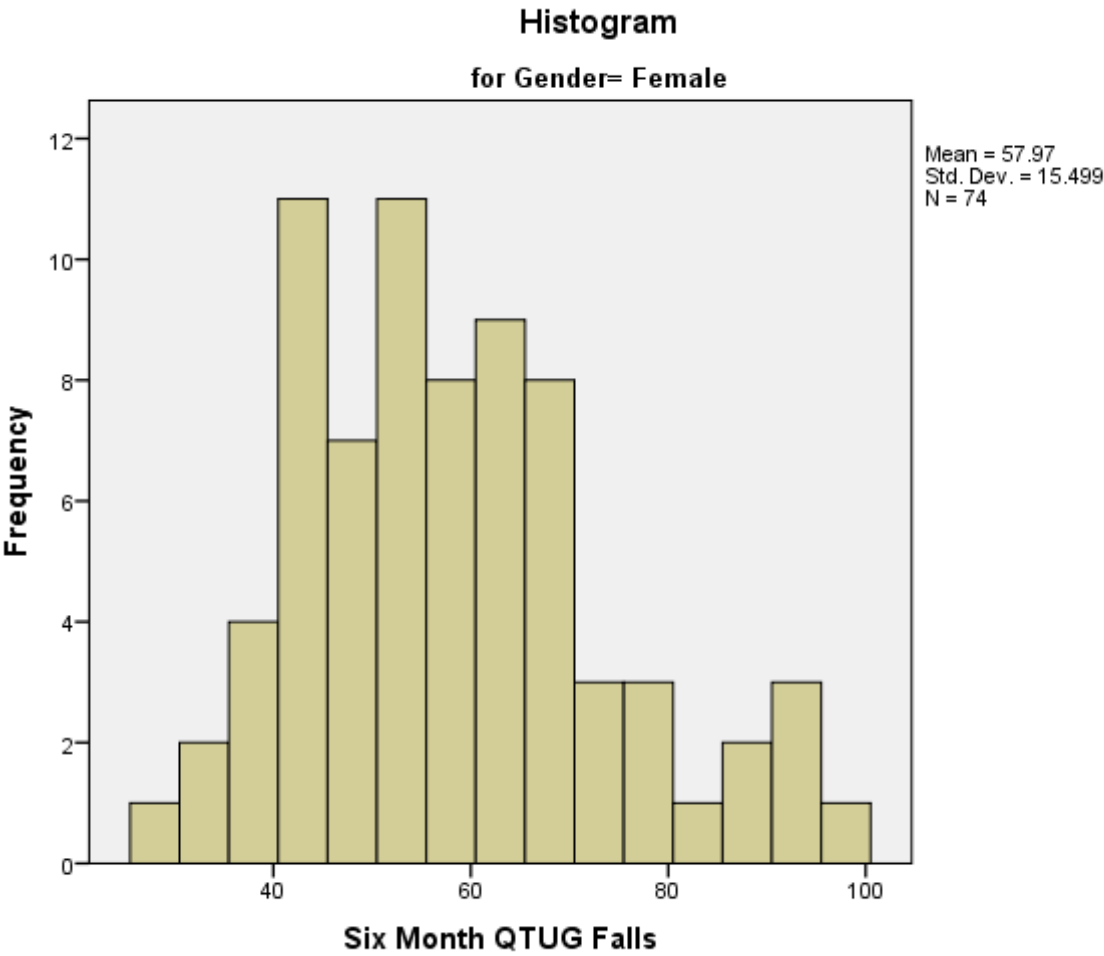


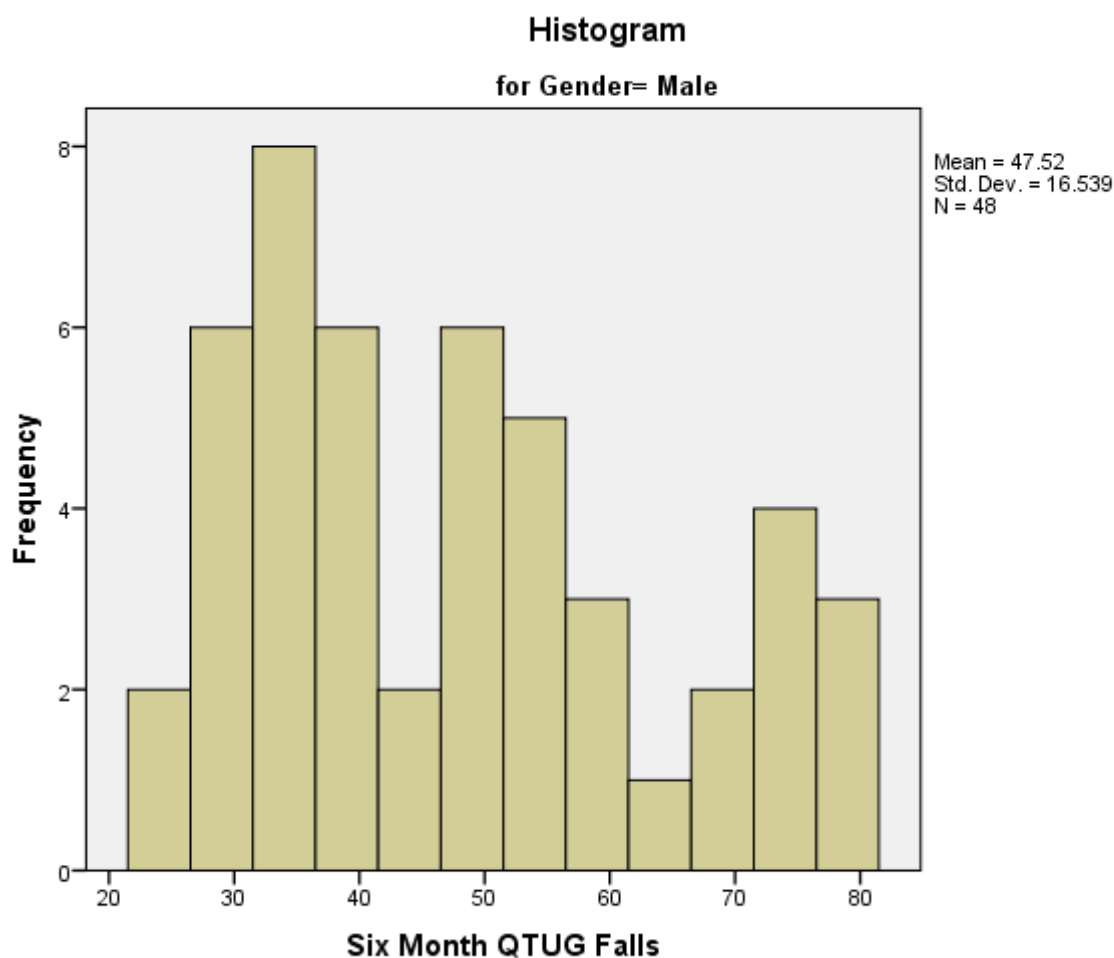
The FRE results at twelve weeks mirror those at baseline, with female participants' data being confirmed as approximately normally distributed by all three measures whereas the male participants' data is heavily skewed towards the lower values and does not have a normal distribution.

Six-Month Follow Up

| QTUG™ (Kinesis Health Technologies, 2014) FRE (Six-Month Follow Up) | Gender (n) | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|---|-------------|---------------|---------------|----------------------|
| | Female (74) | 0.650 (0.279) | 0.135 (0.552) | 0.027 |
| | | | | |

| | | | | |
|--|-----------|---------------|----------------|-------|
| | Male (48) | 0.518 (0.343) | -0.954 (0.674) | 0.003 |
|--|-----------|---------------|----------------|-------|





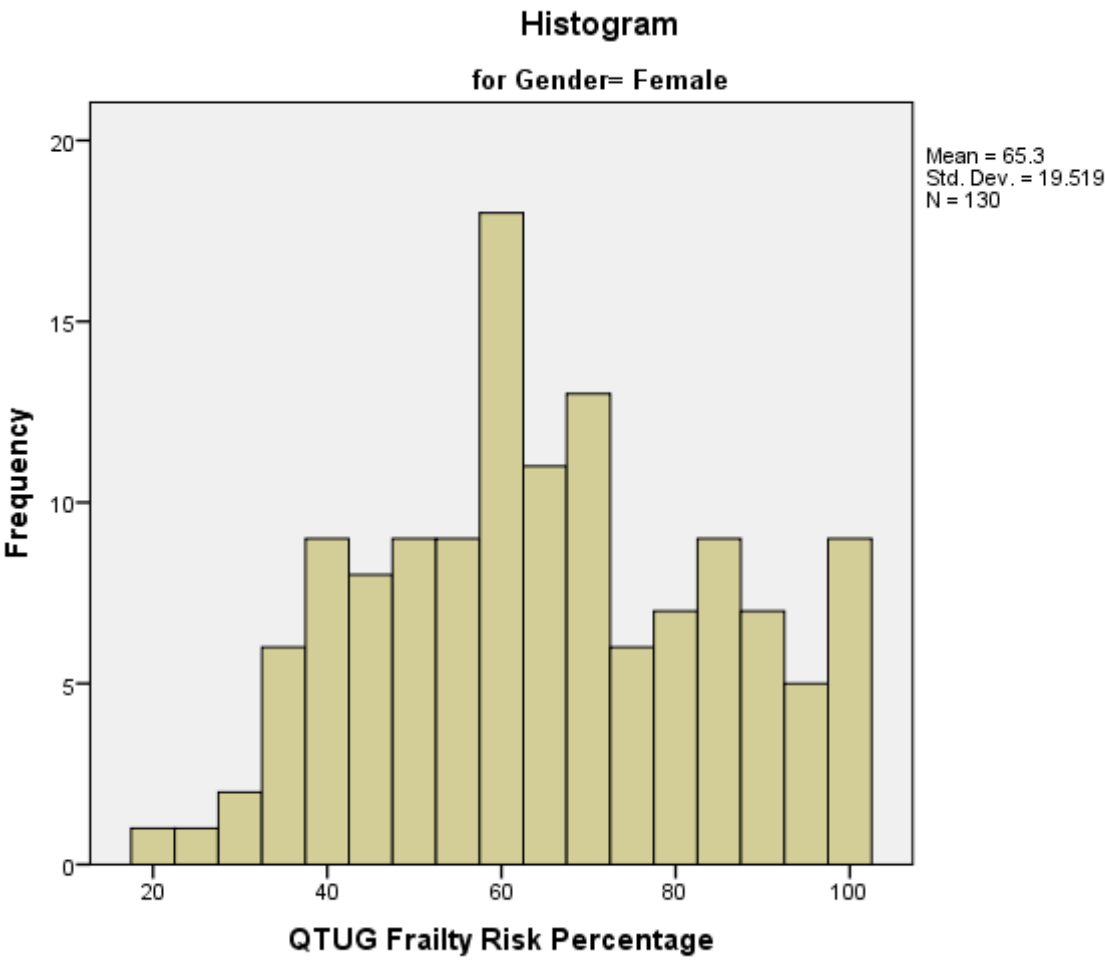
At six-month follow up neither male nor female participants' data exhibit a normal distribution. The only parameter that is within range is the skewness and kurtosis z-value for male participants. The remaining five criteria are not met.

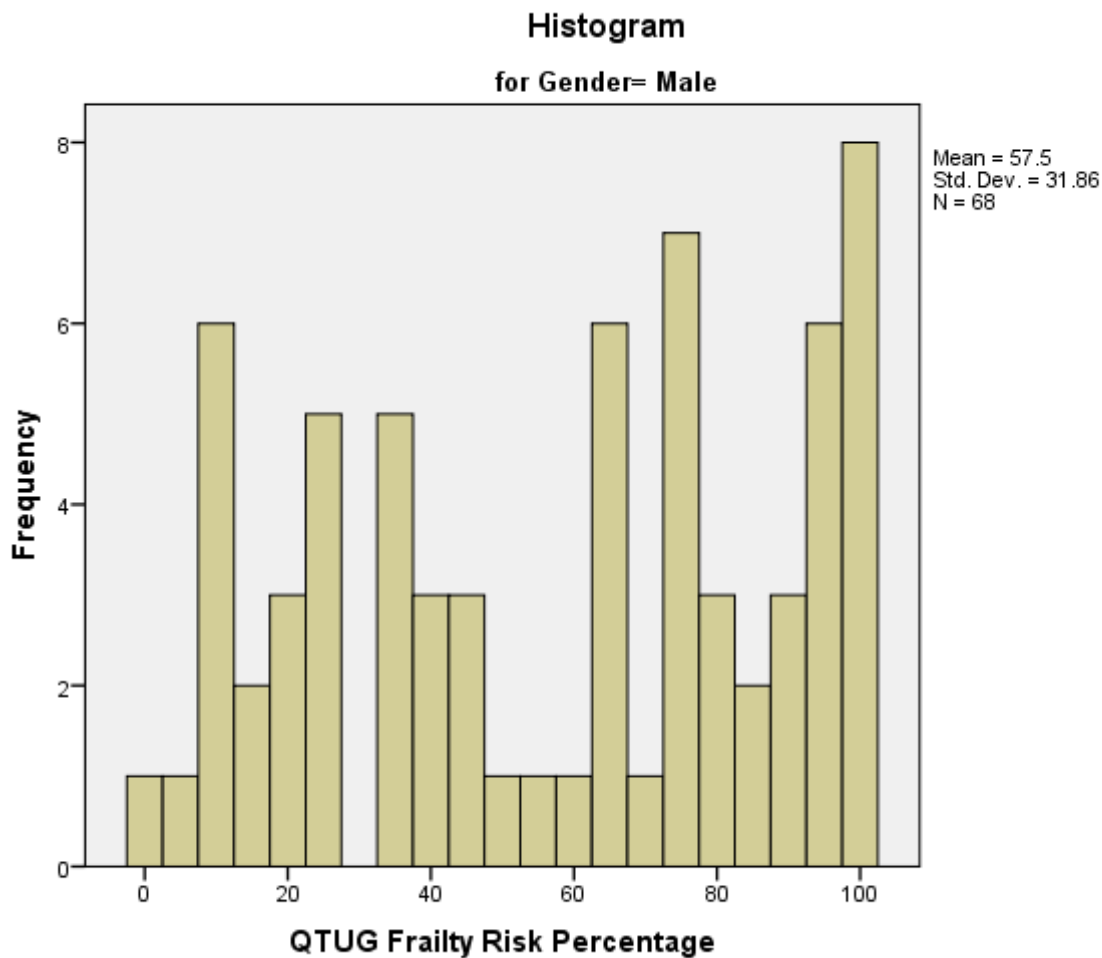
The QTUG™ (Kinesis Health Technologies, 2014) FRE demonstrates a normal distribution only for female participants at baseline and Twelve-week/Course completion. At six-month follow up for both genders, and all time-points for male participants the data is influenced by a larger proportion of the sample achieving a low QTUG™ (Kinesis Health Technologies, 2014) FRE.

K.4 Quantitative Timed Up and Go – Frailty Score (QTUG™ (Kinesis Health Technologies, 2014) Frailty)

Baseline

| QTUG™ (Kinesis Health Technologies, 2014) Frailty (Baseline) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|--|---------------|----------------|----------------|----------------------|
| | Female (130) | 0.020 (0.212) | -0.774 (0.422) | 0.030 |
| | Male (68) | -0.190 (0.291) | -1.393 (0.574) | 0.000 |



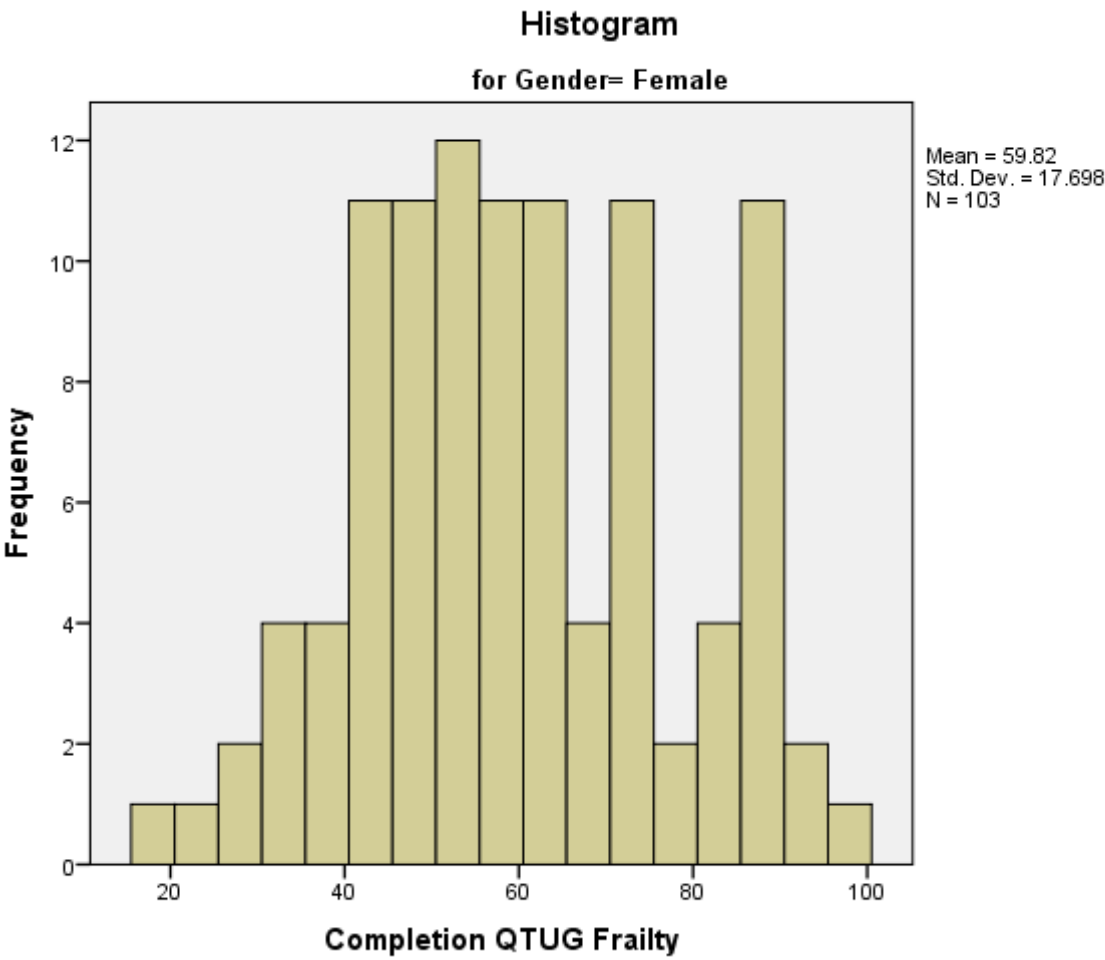


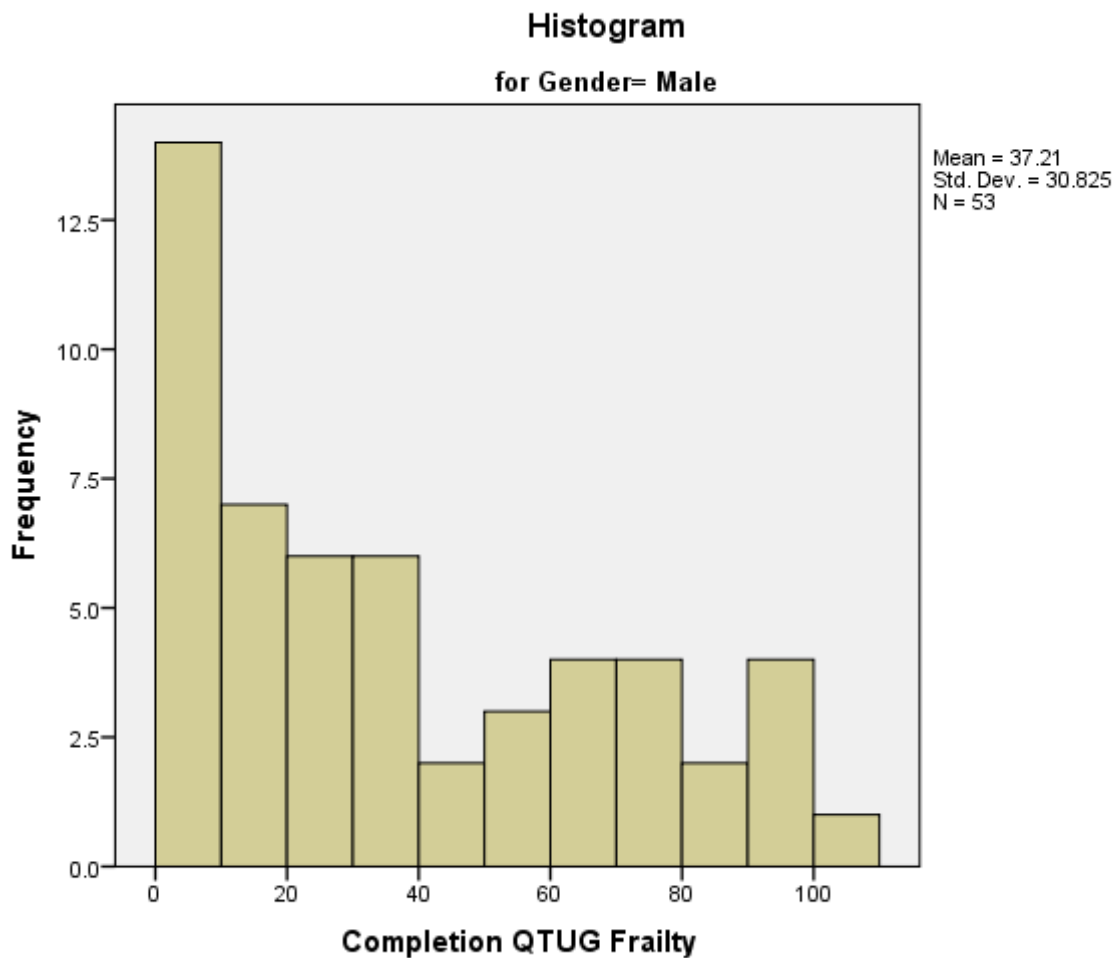
Both genders at baseline demonstrate approximately symmetrical results, however they are both have a kurtosis z-value which indicates they are not normally distributed. This is evident on the histograms where a notable proportion of participants score in excess of 80% for the QTUG™ (Kinesis Health Technologies, 2014) Frailty score.

Twelve-week /Course Completion

| QTUG™ (Kinesis Health Technologies, 2014) Frailty (Twelve-week /Course Completion) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|--|---------------|---------------|----------------|----------------------|
| | Female (103) | 0.158 (0.238) | -0.602 (0.472) | 0.095 |

| | | | | |
|--|-----------|---------------|----------------|-------|
| | Male (53) | 0.596 (0.327) | -1.028 (0.644) | 0.000 |
|--|-----------|---------------|----------------|-------|



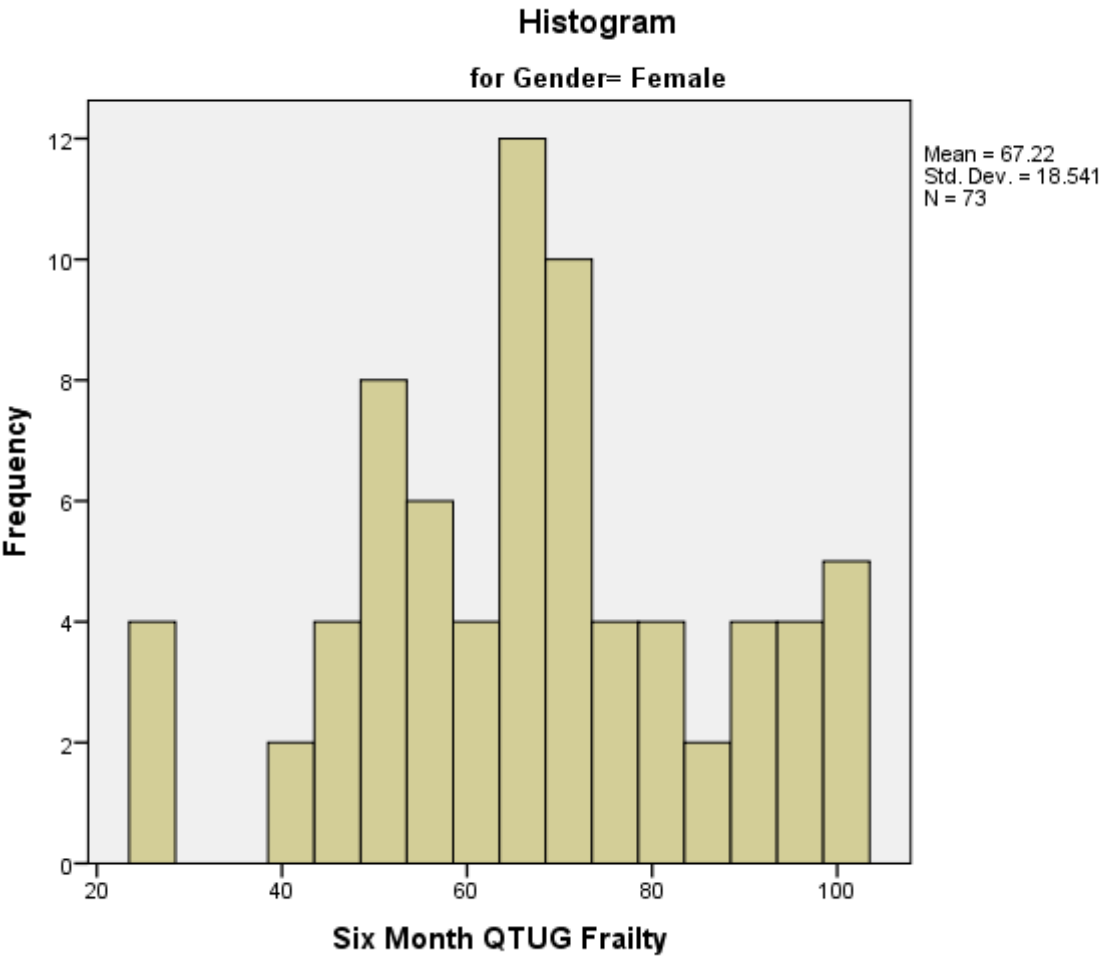


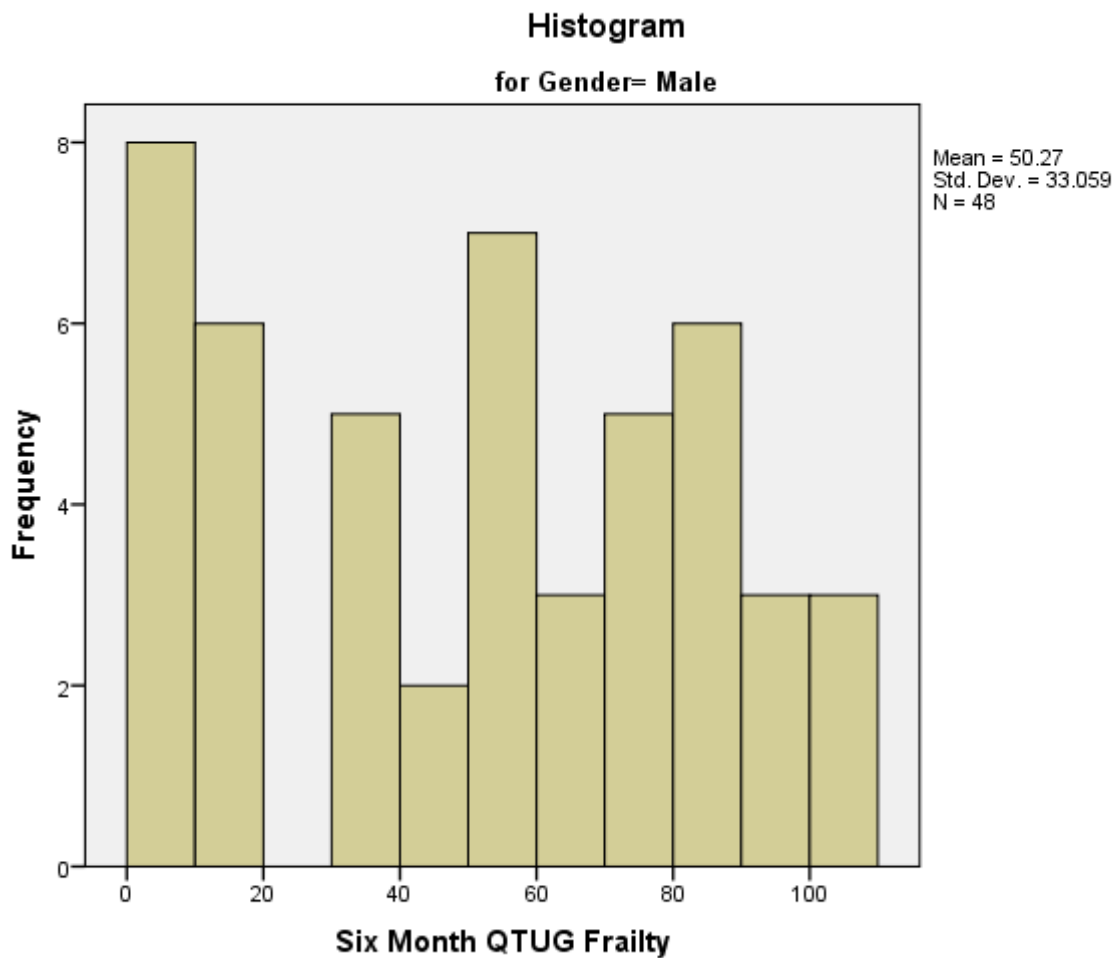
At twelve weeks the data for female participants meets the criteria for an approximate normal distribution on skewness and kurtosis z-values and Shapiro-Wilk p-value. Its histogram is a close visual fit with a normal distribution, however an outlying high frequency of participants scoring between 80-85% does not fit the expected curve. For male participants all three criteria suggest the data is not normally distributed with it being skewed towards the lowest figures.

Six-Month Follow Up

| QTUG™ (Kinesis Health Technologies, 2014) Frailty (Six-Month Follow Up) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|---|---------------|----------------|----------------|----------------------|
| | Female (73) | -0.088 (0.281) | -0.252 (0.555) | 0.059 |
| | | | | |

| | | | | |
|--|-----------|----------------|----------------|-------|
| | Male (48) | -0.105 (0.343) | -1.365 (0.674) | 0.002 |
|--|-----------|----------------|----------------|-------|





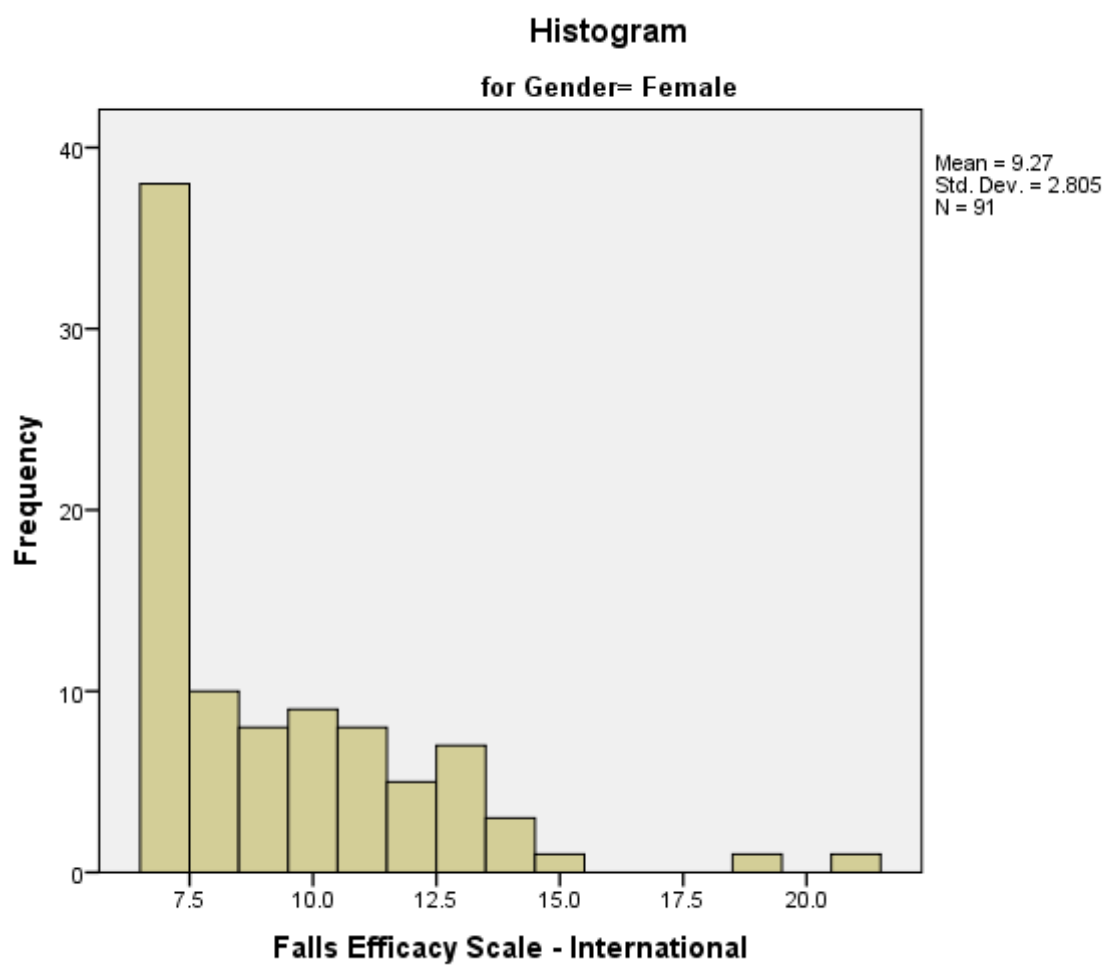
At six-month follow-up the data for female participants demonstrates a fit with a normal distribution on skewness and kurtosis z-values, Shapiro Wilk p-value and visual inspection of the histogram. However the male participants' data experiences kurtosis towards the lower values and is not normally distributed.

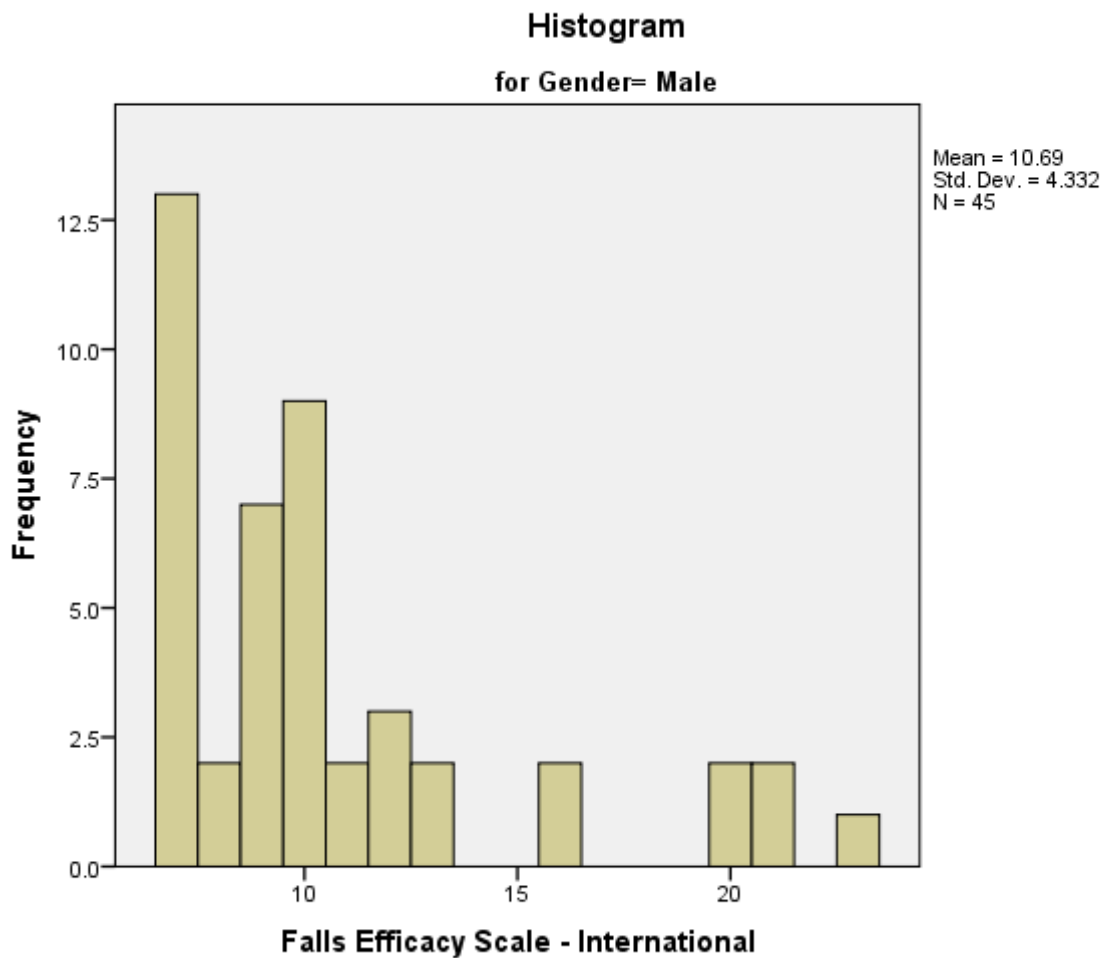
While the data demonstrates an approximately normal distribution for women at twelve-week and six-month follow up, as it is not a close fit combined with evidence that all other data groupings are not normally distributed this variable will be considered to not have a normal distribution.

K.5 Falls Efficacy Scale – International (FES-I) (Kempen *et al.*, 2008)

Baseline

| FES-I (Kempen <i>et al.</i> , 2008) (Baseline) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|---|---------------|---------------|---------------|----------------------|
| | Female (91) | 1.583 (0.253) | 3.259 (0.500) | 0.000 |
| | Male (45) | 1.544 (0.354) | 1.581 (0.695) | 0.000 |



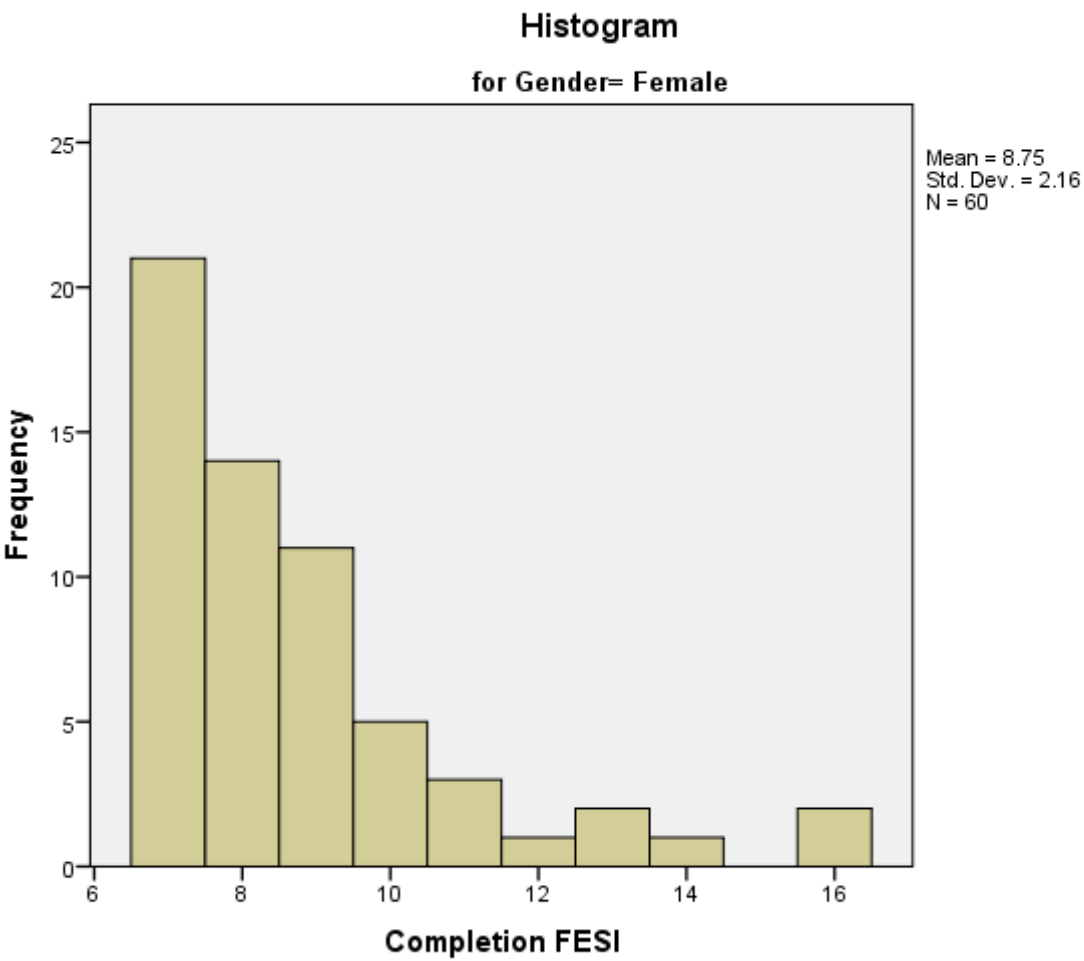


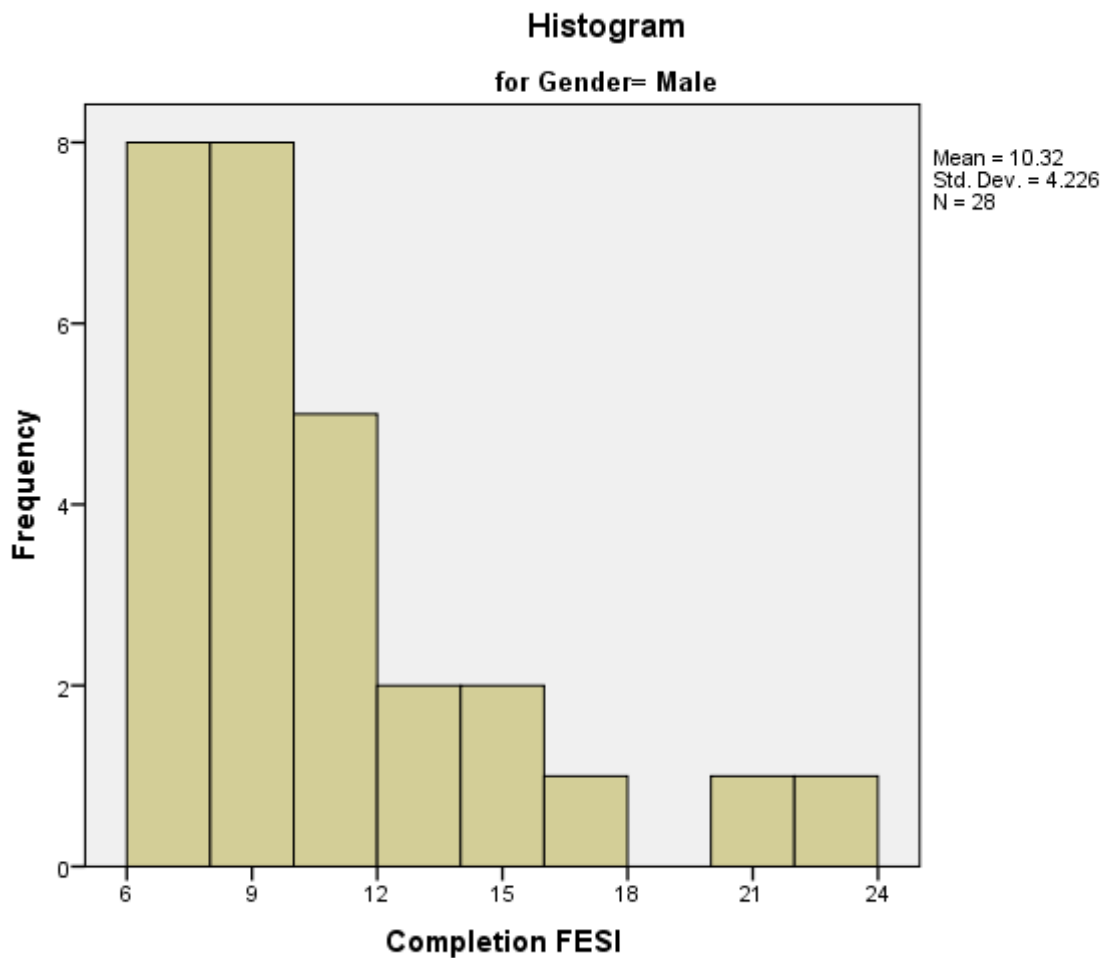
The FES-I (Kempen *et al.*, 2008) measures concern about falling. For both men and women at baseline there is skewness towards the lowest scores rendering all three criteria as incompatible with a normal distribution. This variable also has a lower sample size, exacerbating the effect, however it is likely that the measure might need to be reviewed for its ability to capture accurately the psychosocial element of falls risk for STEER participants.

Twelve-week /Course Completion

| FES-I (Kempen <i>et al.</i> , 2008) (Twelve-week/Course Completion) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|---|---------------|----------------|---------------|----------------------|
| | Female (60) | 1.775 (0.3309) | 3.169 (0.608) | 0.000 |
| | | | | |

| | | | | |
|--|-----------|---------------|---------------|-------|
| | Male (28) | 1.773 (0.441) | 2.823 (0.858) | 0.000 |
|--|-----------|---------------|---------------|-------|

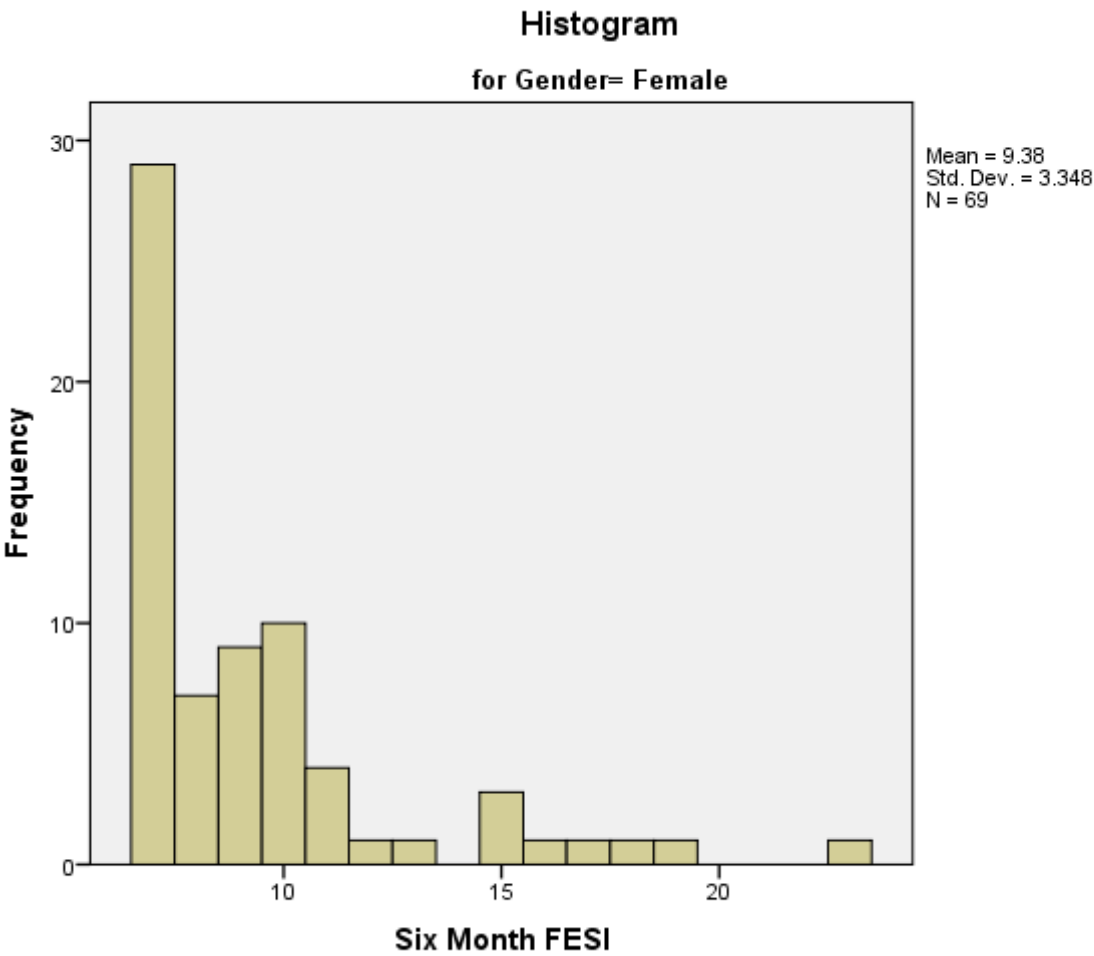


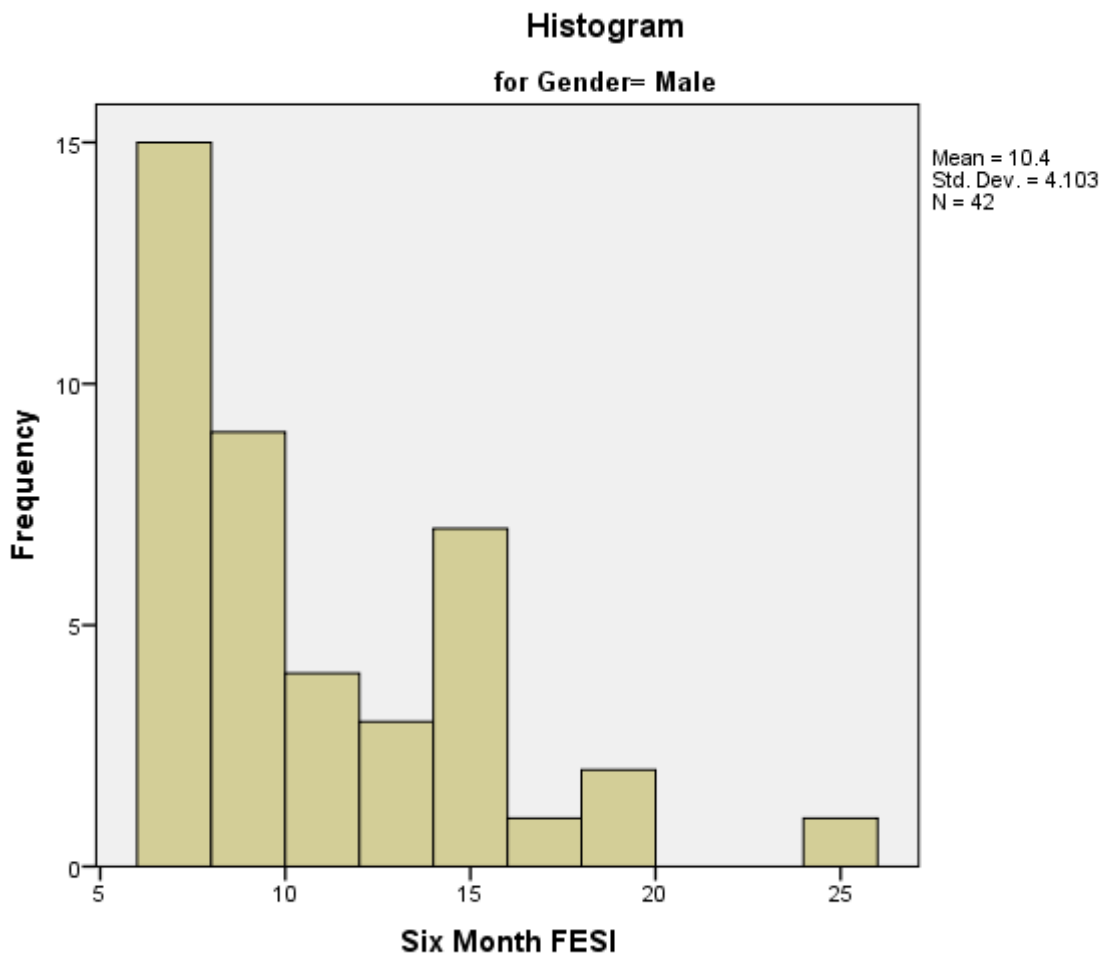


At the twelve-week/Course completion point scores remained skewed towards the low, desirable outcome for the FES-I (Kempen *et al.*, 2008). It is unsurprising that analysis using the three criteria demonstrated this dataset was not normally distributed for either gender.

Six-Month Follow Up

| FES-I (Six-Month Follow Up) | Number/Gender | Skewness (SE) | Kurtosis (SE) | Shapiro-Wilk p-value |
|-----------------------------|---------------|---------------|---------------|----------------------|
| | Female (69) | 2.020 (0.365) | 4.284 (0.570) | 0.000 |
| | Male (42) | 1.381 (0.365) | 1.751 (0.717) | 0.000 |





There was an increase in available data for the FES-I (Kempen *et al.*, 2008) at six-month follow up compared to Course completion and comparison with the other outcome measures suggest that the FES-I (Kempen *et al.*, 2008) is not as routinely captured at the assessment points. Despite this, the skew towards the lowest scores remains and the data for either gender is not normally distributed.

K.6 Conclusion

This analysis of distribution has indicated that no single outcome measure had an approximately normal distribution at all the time-points for both genders.

Appendix L **Reflective Log Example**

The reflective cycle of description, feelings, evaluation, analysis, conclusion and action planning was used to guide reflections on the interview sessions (Gibbs, 1988). They were completed on the same day as the interview, although usually due to time constraints at the HFRS venue these occurred once back in my usual workplace.

L.1 Example of Reflection – Baseline Interview

L.1.1 Description

Reflection following first interview. A female participant was interviewed immediately after her first STEER exercise session (week 2). We had access to a private secure space. Room set up with office style chairs – able to do so without tables/other barriers between ourselves. The office style chairs were on castors and this caused some distraction. The participant's interview was completed within 25 minutes, which was shorter than had been anticipated. They gave short answers to questions. The participant reported a daily routine with many activities and few concerns (at the superficial level).

L.1.2 Feelings

I had doubts that I was eliciting sufficiently deep discussion, as well as concern that participant's ability level might be reflected across all participants and that I might have misjudged the type of problems people have been experiencing.

L.1.3 Evaluation

The interview was constructive, and the environment supportive of good quality discussions. The interview schedule was easily understood by the participant and questions readily answered. The areas for development include more supportive seating and having the confidence to probe more fully, even when a participant initially is reporting minimal difficulties.

L.1.4 Analysis

On review of the recording, although the participant gave short answers they were concise and full of detail and valuable content was obtained. This also allowed for consideration of the difficulties being discussed, and although there was a sense of minimal concern about activity

completion the interview was full of discussions of limitations and challenges linked to health related changes.

L.1.5 Conclusion

Many of my concerns appear unfounded and are potentially driven by 'first interview nerves'. There appeared to be good depth of the discussion and lots of valuable data created. Although the participant had a very active life there was considerable evidence about challenges they were facing.

L.1.6 Action Plan

- (a) Source static chairs for follow up interviews.
- (b) Encourage further elaboration in following participants
- (c) Review again, by reflection, following interview with another participant.

L.2 Second Interview Reflection

L.2.1 Description

The second research interview completed, at a different location to the above. The interview took place in a smaller room, but still allowed for privacy and the room to be set up with two chairs facing. The interview lasted approximately 50 minutes and detailed discussion occurred. The participant appeared comfortable and willing to talk. It was possible to complete all questions and remain 'on topic'. Interview was paced well with equal time spent on each question. Thorough consideration of topics occurred, with the participant providing detailed information. There was repetition of content around the effect of bereavement. The participant also discussed some content that appeared to be seeking advice and support – signposting to the relevant agency occurred as while this would have been within my remit as an occupational therapist, it was beyond the scope of my role as an independent researcher.

L.2.2 Feelings

I was nervous prior to the interview, in case there was repetition of the first interview in terms of concerns that participants would not report any challenges they had faced (reflection, which challenged this concern, had not occurred prior to the second interview as they were held on the same day). I was conscious of my desire to help the participant with regard to their occupational engagement.

L.2.3 Evaluation

The interview appeared to go very well and provided detailed content. While there was some repetition of shared experiences between the first two participants review of the recording confirms this was not a lead discussion, but occurred in response to changes in activity participation questions.

The interview demonstrated the ability of the content to be difficult or upsetting for participants. While this only occurred at a low level here, it was important that strategies to deal with distress were included in the interview plans/ethics arrangement.

L.2.4 Analysis

At this early stage the interviews appear able to generate detailed insight as to the experiences of participants. The emotional demand of contributing such information need not be underestimated, but at the same time need not be avoided as it can be contained within the structure of the interviews and by the skills of the researcher.

L.2.5 Conclusion

This interview provided confirmation of the suitability of the interview schedule for participants, and provided detailed information. There was a challenge experienced in regard to a desire to help the participant, but this had been accounted for in the interview preparation and so it was easy to action appropriate steps.

L.2.6 Action Plan

1. Continue interviews with awareness to not focus on the effect of bereavement, to ensure any content relating to this has not been lead or drawn out but occurred 'organically' as this appears to be an important experience for the first two participants.
2. Signposting of participant to relevant therapy services occurred, and can be replicated if required in subsequent interviews.

Appendix M Excerpt from Interview Transcript and Initial Codes

| | Timespan | Content | Category | Code |
|---|-----------------|--|----------|--|
| 1 | | Participant 8 Baseline Interview [Discussion begins at 4.02.7] | | |
| 2 | 4:02.7 - 4:02.9 | I: I'm interested in how you first heard about the STEER Course? | | |
| 3 | 4:02.9 - 5:07.3 | P8: Right, we heard about it--my sister and I heard about it from a friend, we're both in the W.I. so we've got quite a lot of friends out of it. [Female friend who came on previous STEER Course], who came on the last Course, um, and, she told, she must have told my sister more about it because they are particular friends and, uh, she was keen. She thought it was good, so that's how we heard about it, but I didn't know any details at all, about the exercises or anything like that. But it sounded a really good idea - to build up your resilience before you get to a bad state - having come on it I think, "tch, I should have been here ten years ago!" [laughs], but I was working then, so that wasn't an option. But I think it's a great idea to try and stop problems from happening, or to push them back as far as possible. | | <p>Peer feedback encouraging recruitment to STEER</p> <p>Limited awareness of format/content of STEER prior to commencing</p> <p>Positive perception of STEER despite limited awareness of content.</p> <p>Motivation for attending STEER</p> <p>Frailty prevention as desirable and achievable.</p> |

| | | | | |
|---|-----------------|---|--|---|
| 4 | 5:07.2 - 5:16.5 | I: And you mentioned the bit about as you came to understand what was about - how did it happen? Was it through your friend, or through the information given? | | |
| 5 | 5:16.4 - 5:53.2 | P8: Didn't get much information at all, I didn't go online to find out about it or anything like that. All we know is that [friend previously mentioned in 4.02.9] and [female friend] thought it was really good - they are both really keen walkers, and are pretty fit, um, but I didn't hear any-- I didn't question her about it, I didn't. So I came here without knowing too much about it - it was a bit of an eye opener, "good heavens", you know?! Those engines look so big [laughs]. I: They are, indeed! | | Decision to join based on peer recommendation rather than awareness of Course content/format First impressions of STEER – influence of environment |
| 6 | 5:53.2 - 5:58.3 | I: What was your reaction, you just mentioned the engines, of the fire service running the programme? | | |
| 7 | 5:58.3 - 7:52.1 | P8:Um, I thought, um, "do these people know what it's like to be old?" and "do they, um, you know, have they been trained, have they been <i>told</i> that some of us [laughs] aren't very active?". Um, so, uh, but, but, you know, obviously people have been trained. And, uh, they're very good. Possibly, when they first started, it was a bit of an eye-opener for some of the trainers, unless perhaps they've got grand--close relations, grandparents, and have seen how they | | Perceptions of Fire Service's comprehension of the experience of being an older adult Experience of understanding/training of Course facilitators Working with older adults being something that requires experiential understanding. |

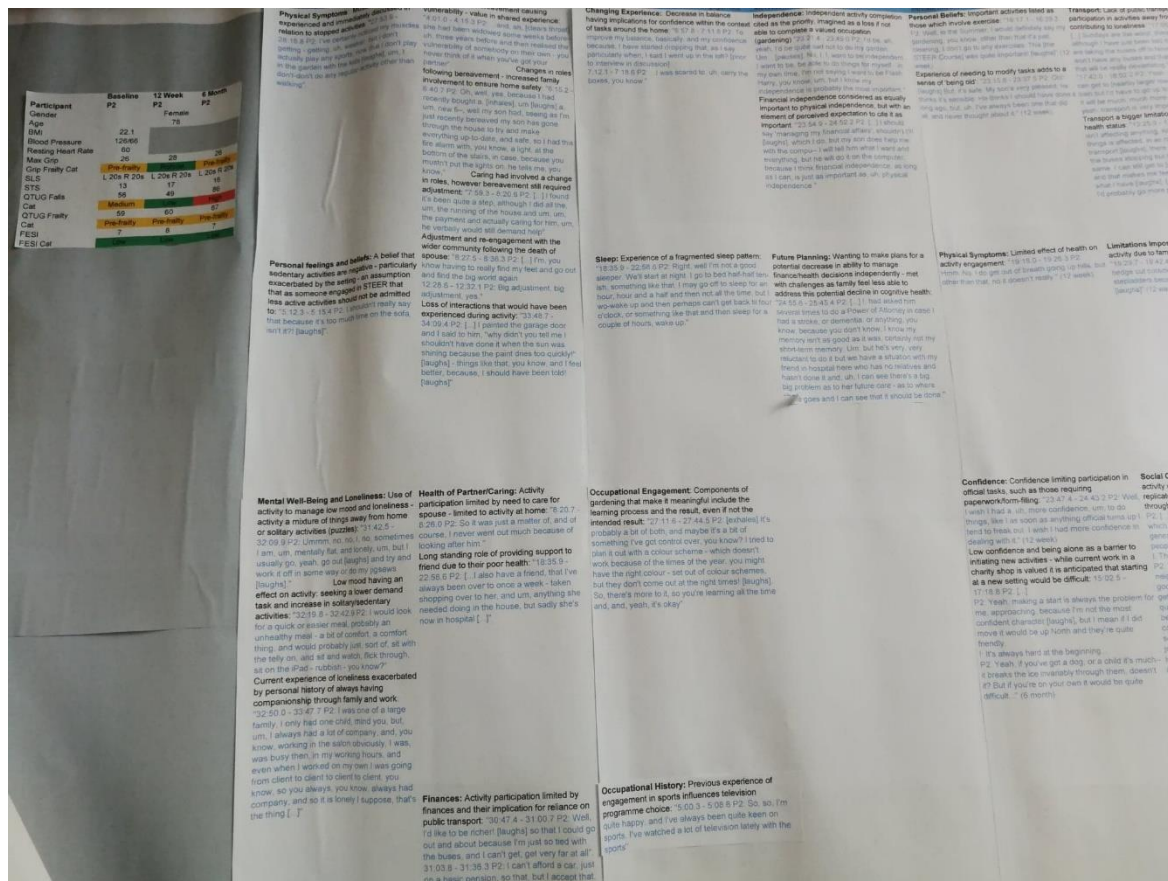
| | | | | |
|---|-----------------|---|--|---|
| | | <p>deteriorate. My sister and I, lived with our Mum until she was ninety-six, um, when she unfortunately broke her hip - her last six months were in hospital and weren't very good, um, it was lovely when we were all living at home, because we kept an eye on her and we take the credit for her doing so well and living so long, because we were looking after her, but still taking her out to the shops when Sunday trading was a huge boom when that came in, um, so, uh, we hadn't had any experience of any other older people, and of course, Mum, being born in nineteen eleven - a time where everybody walked everywhere, including to and from school, four times a day, um, which was over a mile, so, that's how much she started with, I'm afraid, uh, that's not how we do things now [laughs] - I wonder what effect it's going to have on children, who don't, you know, modern children who don't walk as much as they used to - it's good exercise, isn't it?</p> | | <p>Personal account of developing own understanding of the aging process.</p> <p>Preposition that older adults now age better than generations to come.</p> |
| 8 | 7:52.5 - 8:02.2 | <p>I: Okay, so, when you began -- I suppose signed up for the Course, what were your expectations of it and what were you hoping to achieve?</p> | | |
| 9 | 8:02.1 - 9:26.5 | <p>P8: Um, I thought there would be, sort of lectures and talks, about, you know, hazards to avoid, and things like that, um, the only exercises that I've been used to are sort of arms up and swinging, and walking up and down and things like that, so trying to um, get up of a</p> | | <p>Expectations of STEER Content</p> |

| | | | |
|----|------------------|---|--|
| | | <p>chair, which for most people is dead easy, um, to me, was a problem - I can't do it yet - I am practising! Um, so, doing practical things, like that, was a surprise, because my approach has always been, oh, work at it, get the muscles in tune first and then try and do things, that's obviously, too slow and it hasn't worked for me because I stopped going to the U3A classes that I went to - I went onto chair-based exercises, but I found those frustrating because, well, sitting down all the time - I wanted to get up! Stand up! And do things. I had a mixture of chair-based and more, standing and moving exercises really. But this is, this is good, because it's more focussed on actually-- actual situations.</p> | <p>STEER exercise component experienced as more demanding than other exercise classes that have been completed.</p> <p>Level of demand prompting a change in exercise type.</p> <p>Level of demand too low.</p> <p>Perception of the 'just right' level of exercise.</p> <p>Value in STEER exercises having 'real-life' translation.</p> |
| 10 | 9:26.5 - 9:34.7 | <p>I: Are there specific changes that you're expecting to see in yourself?</p> | |
| 11 | 9:34.7 - 10:53.1 | <p>P8: I would love to see some changes. I would like-- I can no longer have a bath, because I cannot get out of the bath, um, I can't push myself up into a standing position, so I'm now needing to have a shower, which I don't like - we don't have a shower room, we have a shower over the bath, the floor of the bath is slightly curved, um, which I'm not terribly happy about and it makes such a mess everywhere - I spend half an hour afterward drying down the walls, because my sister uses it as a bath, so, um, I can't just go out and leave it to dry. So I hope, I'd love, to get up from the bath,</p> | <p>Personal goals from STEER participation</p> <p>Physical ability preventing bathing.</p> |

| | | |
|--|---|--|
| | <p>um, I'd like to get up from a seat not holding on. Tom [STEER Course facilitator] said I could push down, to get myself up a little way - on a <i>loo</i>, sometimes I go into a loo and there's nothing there to hold onto, to get me up, so I've got to be able to - I want to be able to improve that. Just ordinary, everyday, things, which I used to absolutely take for granted, but, as I've put on <i>weight</i>, and it's gone the - right in the middle of me, um, it's meant ordinary things just become a difficulty.</p> | <p>Desire to regain the ability to complete bath transfers, to allow participation.</p> <p>Application of sit to stand transfers to the ability to complete toilet transfers in any environment.</p> <p>Goals centred on routine activity.</p> <p>Weight gain as cause of problem with routine activities.</p> |
|--|---|--|

Example Photographs from Manual Matrix





Appendix O **Excerpt from Case-by-Case Framework**

The following is an extract from the case-by-case matrix which includes Participant 6’s contributions to the domain of ‘Physical Health and Mental Well-Being’. The first two columns were created from baseline interviews and the final two columns from twelve-week interviews (as Participant 6 did not attend 6 month follow up).

| Category 2: Physical Health and Mental Wellbeing | | | |
|---|---|---|---|
| Prior to intervention | | During/after intervention | |
| Descriptions and Experiences of PH and MWB | Processes Related to PH and MWB | Descriptions and Experiences of PH and MWB | Processes Related to PH and MWB |
| <p>Personal Definition of Health: Fitness and health not being mutually inclusive concepts. Being able to be fit, despite having a number of health conditions, health, therefore, understood as being about physical symptoms yet immediate discussion is about the ability to complete intense activities: "14:34.1 - 17:13.6 P6: I would say I'm fit, not healthy. If you understand what I mean? I: Can you tell me a bit more about what you mean by that? P6: Well, I walk, and I, uh, I don't go out on all-day walks any more the most I do now is nine miles, which is like a half-a-day walk. Um, but I walk every fortnight with the, uh, the walking group, which this Friday is nearly six miles. It's usually around five miles. I swim every week. And go to aerobics. Every week. I do high-impact aerobics. But! I have high blood pressure, uh, I've got osteoporosis, severe arthritis in my lumbar area, and uh, is that me? Yeah, so, I feel I'm fit but I've got all these other things wrong with me, so...[...]"</p> | <p>Self-Management: Needing to find the time to fit in exercise to maintain health. Burden of treatment and interruption of normal activities: "14:34.1 - 17:13.6 [...]" P6: I do them, twice a day, and then 'cause I have to fit in these things [STEER exercises] too! [laughs] I: Life's busy! P6: And I went to the physio again this week, so that's the second time and she gave me six others to do, but she said, "I'm not expecting you to do them every day, do something-- some one day and some another day". But, I don't know how I'm going to fit it all in. [laughs] We live quite a busy life, don't we? [looks to P7]. [...]"</p> <p>Exercise as the most important management strategy for health and wellbeing: "27:06.5 - 27:17.3 I:[...] if I asked you what are the most important things that you do for your health and your wellbeing, what would they be? 27:17.3 - 27:34.8 P6: Exercise! P7: Like I say, take all the tablets the doctor prescribes! P6: No, I feel, um, you know, swimming, aerobics, walking, that's what I feel."</p> | <p>Personal Definition of Health: Separating fitness and health, yet answering the question in terms of fitness - suggestive of a concept of health that is more than about physical symptoms: "9:48.5 - 13:10.7 P6: I would say I'm fit, but not healthy, if that makes sense? I: Can you say a bit more about that? P6: Well, because, I consider for my age I do swimming every week, aerobics, I do high-impact aerobics, um, I don't have to do all of it high impact, I used to, I do good--quite a bit of the class still and walk. [...]" (12 week) 9:48.5 - 13:10.7 P6: [...]but why I say I don't think I'm healthy - I've got high blood pressure which is controlled with tablets. Osteoporosis. Severe arthritis in my lumbar area and..so I'm not what you call healthy, well, I don't think you are if you've got high blood pressure." (12 week)</p> | <p>Self-Management: Engagement with a physiotherapist, plus daily completion of prescribed exercises used to maintain function/ability to participate in activity: "9:48.5 - 13:10.7 [...]" P6: Yeah, that was when I had the flare-up, yeah, he sent me to the physio, yeah, I still do the exercises every day. P7: She's very good, she religiously does them every morning. P6: Well, I want to be able to do these things." (12 week)</p> |
| <p>Life Satisfaction: Immediate response is positive, in spite of subsequent reflection on lost activities due to partner's health: "41:05.7 - 42:14.0 P6: Well, satisfied! P7: Yeah, I would say satisfied. P6: Yeah. I am. Are you? P7: Yes. P6: I wish that I could, that we could go walking. We used to do a lot of walking ourselves. And I, that's one wish. If he gets his hip done we'll be able to do that again. P7: Not if I can't walk, and it takes me, sort of, two years to get back to where I was. P6: Yeah, he's got age against him. Um, otherwise, no, satisfied.[...]"</p> | <p>Health Beliefs: Exercise as health promoting is a belief generated externally and taken to be accurate with little questioning, becomes assumed and accepted: "27:38.1 - 29:09.6 P6: Well, because they say, "exercise is good for your health", and I assume they're right. P7: [referring to STEER Course content] What they were saying is that if you were in bed for a week, how long it takes to recover, your muscle power, P6: That's what [STEER Course Facilitator's name] was saying today. P7: I couldn't believe the figures about [inaudible] P6: I couldn't really. But, um, yes, I think you need to keep moving."</p> | <p>Changing Health Status: No changes identified during STEER Course: "14:12.5 - 14:18.4 I: Now you've mentioned your hip [P7], is there anything else that's changed in the last twelve weeks regarding your health? 14:18.4 - 14:27.7 P6: Mine hasn't changed." (12 week)</p> | |

Appendix P **Excerpt from Between Case Comparative Matrix**

| | |
|--|---|
| <p>Theme 3: A Changing Experience of Health and Well-Being</p> <p>Changing Health Status: Awareness of a change in health status or functional ability was discussed by many. Disgust at a recent deterioration in health, particularly as there is a sense it is not deserved due to a healthy lifestyle and incompatible with a sense of not 'being old': "9:51.3 - 10:07.0 P2: Recently come to light, but I think, probably, has been ongoing, perhaps always been there because my niece has a pacemaker and is, you know, your age, there probably is something...yeah. 10:07.0 - 10:11.6 I: [confirming] genetic? [pause] How have you felt getting these diagnoses quite recently? 10:11.6 - 10:12.8 P2: Disgusted! [laughs] 10:12.8 - 10:16.0 I: Can you say a bit more about that? 10:16.0 - 10:48.6 P2: Well, I mean, I'm not old, well I don't think of myself as old, I've always thought I lead a healthy life, like never smoked, don't drink, you know, I exercise I was always representing the school in sports and things, so I'm, I've always been very active, um, even in my professional life I stood all the time - I must admit it gave me an awful lot of varicose veins but I had..." Recent experience of a decline in functional ability prompting thoughts about future planning: "20:00.0 - 20:32.3 P1: I suppose I'm just sensible really, you know, I've already fixed up about, since my husband died, my will, my powers of attorney, that sort of thing, should anything happen and I just like to be one step ahead so that I don't wait until it actually happens and it's all too late. I mean, I love my house I've got at the moment - I can cope in there really at this stage, no problem, but as I said that long walk back on the [holiday] I really sort of thought "Ooh, Ooh, I'm not, perhaps, as fit as I thought I was"... "Awareness of a change in cognitive function, and then triggering a desire to make plans for the future, prompted by experience of a friend. : "24:55.6 - 25:45.4 P2: So, so I, like to be in control, though I don't know what you feel, I, I, had asked him several times to do a Power of Attorney in case I had a stroke, or dementia, or anything, you know, because you don't know, I know my memory isn't as good as it was, certainly not my short-term memory. Um, but he's very, very reluctant to do it but we have a situation with my friend in hospital here who has no relatives and hasn't done it and, uh, I can see there's a big, big problem as to her future care - as to where she</p> | <p>Theme 4: Response to the Changed Experience</p> <p>Self-Management Strategies: Despite some discussion about an inevitability of worsening health with age, self-management of physical symptoms and mental well-being was widely adopted: Having awareness of methods to reduce stiffness, motivated by transfer of benefit : "7:57.8 - 8:15.1 P1: I try and exercise, um, stretching and um, um, various exercises, every day, at home. Um, as I said, I find if I don't, I stiffen up. But when I do it I sleep a lot better and I don't feel stiff anywhere." Experiencing low mood and loneliness, mitigated by engagement in activities - seen as something that can be escaped through participation: 31:42.5 - 32:09.9 P2: Ummm, no, no, I, no, sometimes I am, um, mentally flat, and lonely, um, but I usually go, yeah, go out [laughs] and try and work it off in some way or do my jigsaws [laughs]." The challenge of finding motivation to re-engage in activity, but awareness of its positive impact on health: "8:51.3 - 10:20.7 P4: [...]" P5: You've got to make that effort, at first, 'cause I had to make an effort to go back to my dancing, to [inaudible] club and I felt strange, but as soon as I got back, I was just back to normal sort of thing. [...]" Using exercise to manage health, outcomes as motivation: "29:05.4 - 33:44.4 [...]" P4: Yeah, you've picked yourself up well. P5: That's why I push myself to do these exercises, because I think "they are helping with your breathing". Yes. I: And that's a big driver? P5: Yes, it is, yes. [...]" Exercise as the most important management strategy for health and wellbeing: "27:06.5 - 27:17.3 I:[...] if I asked you what are the most important things that you do for your health and your wellbeing, what would they be? 27:17.3 - 27:34.8 P6: Exercise! P7: Like I say, take all the tablets the doctor prescribes! P6: No, I feel, um, you know, swimming, aerobics, walking, that's what I feel." Awareness that orthotics may improve biomechanical limitations with application to balance: "14:01.6 - 17:03.8 P8: [...]" Um, I have got, um, what do you call them? Orthotics, and I've been wearing them to the class because I do think they'll help. I haven't generally worn them that much, since I've got them, but I'm finding now, because I'm concentrating on balance, um, it's helpful to have them. [...]" Social activities improving mood, even if naturally more introverted: "22:25.8 - 25:06.4 P8: [...]" P8: Well, I certainly feel brighter when I've been in company, my spir--my mood lifts and, uh, underneath I'm quite shy, I don't find it that easy to strike up conversations with people, and I do envy people who find it really easy." Experience of exercise improving mood, even as someone who doesn't enjoy the process of exercising: "32:00.8 - 38:06.2 P8 [...]" and doing exercise, normally, makes you feel better, doesn't it? Yes. I went home yesterday [after STEER Course] feeling--after the STEER class - feeling much happier than I did coming in"</p> |
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Appendix Q **Publication and Dissemination Plan**

The research partnership with HFRS has required regular information sharing to ensure they have been able to adapt to the evaluation results and findings in a timely manner. To date this has included confidential reports outlining baseline descriptive data, quantitative change data and preliminary findings regarding the evaluation of the STEER Course. The reports were confidential to ensure they could implement any outcomes suggested and develop the Course, without limiting publication potential of the research.

A stakeholder engagement event, involving HFRS staff and STEER Course participants, is being arranged following thesis submission. This will allow sharing of the results and findings and workshops to plan adjustments and development of the STEER Course in a manner that combines the research data with the views and wishes of those directly involved.

A poster outlining preliminary findings regarding occupational experiences from the baseline interviews was presented at the Royal College of Occupational Therapists Annual Conference, Belfast, in June 2018. It is included in Appendix J.

Writing for publication is in progress, with the thesis divided into the following papers:

Topic 1: Evaluation of the STEER Course. The STEER Course setting was unique and so the combined results and findings specific to the Course warrant consideration:

Paper 1: Mixed methods evaluation of participation in the STEER Course, including change data and qualitative reports regarding the intervention.

Topic 2: Experiential accounts of living with pre-frailty and frailty.

Paper 2: Qualitative analysis of the experience of living with pre-frailty or frailty. This will include perceptions about, health and frailty status, as well as functional changes in the context of meaningful activities.

Topic 3: Experiential accounts of activity participation. As highlighted in the literature review, there is insufficient evidence about experiential accounts of people living with all stages of frailty. The views of those who identify as being at risk of frailty will be discussed (incorporating the understanding that self-identification of frailty status might not align with measured frailty).

Paper 3: Qualitative analysis of occupational engagement and performance for people at risk of, or living with, frailty.

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