



**UNIVERSITY OF
STIRLING**

Reporting, Referral, Attendance and Prescription
within Scottish Exercise Referral Schemes: Four
linked studies

By

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A thesis submitted to the faculty of Faculty of Health Sciences and Sport, University of
Stirling in partial fulfilment for the degree of
Doctor of Philosophy.

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February 2020

“If exercise could be packed into a pill, it would be the single most widely prescribed and beneficial
medicine in the nation.”

Dr Robert Butler, 1978

Declaration

I declare that the thesis was composed by myself under the supervision of Dr. Stuart Galloway, Prof. Gill Hubbard, Prof. Trish Gorely and Dr. Angus Hunter. All data were collected and analysed by myself; exceptions to this are as follows: (i) Mr Robert Polson, conducted electronic database searches and is presented in Chapter 2; (ii) Employees of two different exercise referral schemes removed data from in-house databases, which are presented in Chapters 3 and 4. Neither the thesis nor the original work has been submitted to this or any other institution for a higher degree.

A handwritten signature in black ink, appearing to read 'Shore', written in a cursive style.

Colin Shore (21/2/2020)

“The copyright of this thesis belongs to the author, under the terms of the United Kingdom copyright act, as qualified by the University of Stirling regulations. Due acknowledgement must always be made of the use of any material contained in, or derived from this thesis.”

Acknowledgements

I would like to thank several people for their help, support and contribution to this research. Firstly, I would like to thank my primary supervisor, Dr Stuart Galloway. Thank you for your time, constant open-door policy, outstanding support, belief and guidance during the PhD journey. Furthermore, thank you for the various running trips to mitigate all the cake you supplied. My Second supervisor, Prof Gill Hubbard for installing the necessary confidence and motivation to complete this thesis and to forge my own path. Further recognition to Prof Trish Gorely and Dr Angus Hunter for providing support that went beyond academic tutelage in helping prepare writings, publications and conference presentations. I would especially like to thank Stuart, Gill, Trish and Angus for ensuring that the PhD was a relaxing and seamless process. It has been a privilege to work alongside you all; long may it continue.

Thanks to Bill Biss, Tom Kilner and Rog Owen for believing in me and spurring on my pursuits. A very special thanks to Heather McCartney; your support has been truly invaluable. Thank you very much too all members of the Physiology, Exercise & Nutrition Research Group, your academic and social support has been unfaltering. To my fellow PhD students who I have shared this trip with, Danielle Mitchell for constantly laughing at my jokes and Nadine Thomas for being an excellent running partner. Jordan Philpott, Kirstin MacGregor, Nidia Rodriguez-Sanchez and everyone else I have shared an office with, thank you for putting up with my questions and quizzes.

I would like to thank all those involved in the studies. I am extremely grateful to the exercise referral schemes who allowed access to their data. Furthermore, thanks to the various exercise referral instructors who helped gather data and acted as participants. Even though they may never see this thesis, without them the research could not have happened.

Lastly, I would like to thank my family for their support. Especially my mum, who sadly passed away during my PhD journey. I hope I have done you proud.

Abstract

This thesis reports four studies, presented across five thesis Chapters, examining pathway from referral through to prescription of exercise referral schemes (ERS). The overall purpose of the research was to open the 'black box' and provide a rich description of key components of the ERS pathway. The first study presented in **Chapter 2**, aimed to understand ERS uptake, attendance, and adherence. A review of reviews, of ERS was conducted, because of the large number of reviews previously conducted. The study shows, 1) a lack of robust and consistent recording and reporting of the ERS pathway; 2) a lack of reporting about the demographic characteristics of participants choosing not to take-up their referral; and 3) lack of reporting upon the prescription delivered to participants in the programme. A lack of reporting prevents assigning a true reflection on the effectiveness of ERS.

The second study presented in **Chapter 3**, reports upon the sociodemographic characteristics of two different groups of individuals referred to ERS - non-attenders and attendees. The study aimed to understand who was being referred but choosing not to uptake referral, a sub-population missing a potential opportunity to improve their health and physical activity (PA) levels. Secondary analysis of an ERS database was conducted to address this aim. Furthermore, the study aimed to understand if attendee demographic characteristics influenced the number of sessions attended. The study shows, 1) the sociodemographic profiles of non-attenders is very similar to those who attend ERS; 2) there is a high, early withdrawal rate of attenders where 68% of the cohort exited the scheme at five exercise sessions or less out of a potential 20 sessions. Knowledge of sub-populations referred to ERS, in conjunction with knowledge of when they stop attending sessions, provides critical information in understanding whom may be at risk from not being in a position to benefit from taking up and completing their prescription.

The third study conducted used a mixed-methods design and is presented across **Chapters 4 and 5** of the thesis. The aim of the quantitative component of study three was to describe the frequency, intensity, type and time of prescribed exercise using an ERS database. A secondary analysis of exercise

prescription cards was conducted to address this aim. The study shows, 1) mean frequency of prescription was four (range 1-11) exercises per session; 2) the most common intensity of the prescription was moderate; 3) thirty-eight different types of exercises were identified from the database; and 4) just over half of the time of the session, 35 minutes (range 5-70), participants were prescribed cardiovascular-based exercise. Knowledge of the dose of prescribed exercise prescribed within ERS provides critical information in understanding and tailoring exercise prescription towards preventing and self-management of non-communicable disease.

The qualitative component of study three, presented in **Chapter 5**, aimed to explore exercise referral instructors' perceptions and experiences of prescribing and delivering exercise with a view to understanding the ways in which uptake, attendance and adherence to the prescribed exercise is addressed by instructors. Thematic analysis was used to analyse semi-structured interviews. The study shows, 1) instructors perceived that referring health professionals fail to provide sufficient information about ERS to participants; 2) an instructor's key role appears to be that of support to aid uptake and attendance; and 3) in prescribing exercise, instructors perceive that their main objective is to promote independence and autonomy of participants in activities of daily living. Knowledge of how exercise referral instructors perceive that they motivate participants to improve uptake, attendance, and why they prescribe certain exercise within referral schemes provides critical information in understanding what approaches may work in engaging participants to tackle non-communicable disease via an exercise prescription.

The fourth study presented in **Chapter 6**, aimed to explore healthcare professionals' (general practitioners, practice nurses) and general medical practice administration staff perceptions of promoting PA (a term that includes exercise but is much broader and includes any bodily movement requiring energy such as, housework or gardening) in primary care. Exploring job perception, barriers and facilitators, what PA is promoted and to whom and how best to structure exercise prescription. Thematic analysis was used to analyse semi-structured, group-interviews. The study shows, 1) health

professionals are mindful of over medicalising PA; 2) barriers to promoting PA in primary care include, time, patients complex lives, limited knowledge of PA opportunities and limited capability to follow up patients; 3) facilitators to promoting PA in primary care include, clinical protocols such as annual reviews and peer support; 4) PA promoted is generic; professionals advocate doing more than what is currently performed; and 5) future ERS need to be centralised, easily accessible, tailored and sustainable. Knowledge of current PA promotion processes within primary care provides critical information in understanding approaches to tackle non-communicable disease via an exercise referral through primary care.

The studies presented in this thesis yield novel evidence about the ERS pathway and improves understanding of key components that influence the effectiveness of ERS. The research provides new knowledge about inconsistent reporting of ERS (study one), socio-demographic characteristics of non-attendees and attendees (study two), exercise prescription (FITT) and instructors' perceptions of motivating people to exercise (study three), and primary care health professionals' perceptions of PA promotion in primary care (study four). The overall purpose of the research was to open the 'black box' and provide a rich description of key components of the ERS pathway. Focusing solely on outcome measures is important, however, without recording the how's and whys we may fail to identify best or current practice, judging effectiveness inappropriately.

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Publications in peer-reviewed journals

Shore, C. B., Hubbard, G., Gorely, T., Polson, R., Hunter, A. M., & Galloway, S. D. (2019). Insufficient Reporting of Factors Associated with Exercise Referral Scheme Uptake, Attendance, and Adherence: A Systematic Review of Reviews. *Journal of Physical Activity and Health*, 16 (8), 667-676.

<https://doi.org/10.1123/jpah.2018-0341>

Conference proceedings

Shore, C. B., Galloway, S. D., Hubbard, G., & Gorely, T. (2018). If you provide it, they still do not go: The reality of attendance frequency within a Scottish exercise referral scheme. *7th International Society for Physical Activity and Health Congress*. Oral E-poster. October. London, United Kingdom.

Shore, C. B., Hubbard, G., Gorely, T., Hunter, A. M., & Galloway, S. D. (2019). What is the prescribed exercise dosage within referral schemes in rural Scottish Communities? *15th Annual meeting and 10th conference of Health Enhancing Physical Activity Europe*. Oral presentation. August. Odense, Denmark.

In preparation

Shore, C. B., Hubbard, G., Gorely, T., Hunter, A. M., & Galloway, S. D. (2020). Socio-Demographic Patterning of Non-Take-Up, Attendance and Session Count within a Scottish Exercise Referral Schemes. **In preparation for submission to *Journal of Epidemiology and Community Health*.**

Shore, C. B., Hubbard, G., Gorely, T., Hunter, A. M., & Galloway, S. D. (2020). Reporting of Prescribed Dosage of Exercise within Exercise Referral Schemes in Scottish Communities. **In preparation for submission to *The Journal of Sport and Health Science*.**

Shore, C. B., Galloway, S. D., Gorely, T., & Hubbard, G. (2020). Exercise Referral Instructors Perspectives on Prescribing Exercise to Increase Uptake, Attendance and Adherence to Exercise Prescription: A Qualitative Study. **In preparation for submission to *Qualitative Research in Sport, Exercise and Health*.**

Shore, C. B., Hubbard, G., Galloway, S. D., Walker, K., & Gorely, T. (2020). Exploring Healthcare Professionals Perspectives on Physical Activity Promotion and Referral in Primary Care: A Qualitative Study. **In preparation for submission to *British Journal of General Practice*.**

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Chapter 1. INTRODUCTION

Mounting evidence has shown exercise can act as an adjunct therapy or replacement to medication for prevention and control of non-communicable diseases (NCD), across the life-course (Mikklesen et al., 2019). Exercise referral schemes (ERS) are a non-pharmacological intervention available in primary care (NICE, 2014) for disease prevention and health improvement. ERS is known by a number of different names, such as 'physical activity referral schemes', 'GP referral scheme' or 'exercise on prescription'; however, this thesis will use the term, exercise referral scheme. The aim of ERS is to increase physical activity (PA) participation in those who have, or are at risk of, NCD (Jepson, Robertson and Doi, 2010; Buxton and McGeorge, 2018). PA is a term that includes exercise but is much broader and includes any bodily movement requiring energy such as, housework, gardening. Despite the popularity of ERS, there is a lack of evidence for their overall effectiveness in improving NCD risk factors by increasing PA levels (Pavey et al., 2011a; Morgan et al., 2016).

ERS are complex multi-faceted interventions; often multi-agency between local general medical practices or NHS health services and voluntary, local council or privately-operated leisure service providers (Jepson, Robertson and Doi, 2010). Primary and some secondary healthcare professionals (HCPs) act as referring partners where they will refer 'at risk' individuals to scheme providers.

Referral and subsequent uptake and attendance in ERS, often at a subsidised rate or free of charge, allows participants to undertake a programme of supervised, safe, appropriate, prescribed exercise, where they may benefit physiologically and psychologically from increasing their level of PA (Jepson, Robertson and Doi, 2010). Variability in ERS delivery exists between schemes (NICE, 2014; Arsenijevic and Groot, 2017; Pavey et al., 2011a; Buxton and McGeorge, 2018), however, the commonality across ERS is to provide a tailor-made, easily accessible programme of PA that will suit and benefit the participants' needs (Pavey et al., 2011a). Commonly, evaluation of ERS effectiveness focuses upon the 'what's', i.e. what are the improvements? However, it is critical to understand the 'how's', i.e. the pathway process from referral, prescription to outcome, of such a complex multi-

faceted intervention. Outcomes or the 'what's' are determined by a variety of factors, including, but not limited to, ERS characteristics and involvement of various stakeholders, such as health professionals who refer and ERS instructors. Therefore, it is crucial to understand this pathway.

This chapter will describe the current knowledge of ERS, providing a breakdown of the constituent stepping-stones in the ERS pathway. This chapter will discuss why there is a need for ERS via one of its main aims, management or prevention of NCD. The chapter will define PA to provide context in understanding the type or exercise prescription used in prevention and management of those at risk of NCD. Evidence of seven NCD's, reported across the studies of this thesis, will provide an insight into the ability of ERS's to manage such conditions. Lastly, the chapter will describe the research aims of this thesis.

1.1. Exercise referral schemes

ERS have been seen, as one of the most popular non-pharmacological interventions available to HCPs to promote PA, for individuals to become more active to subsequently prevent or manage any risk of NCD (Buxton and McGeorge, 2018). However, since their inception, ERS have come under immense scrutiny, with their effectiveness continually questioned (NICE, 2014; Buxton and McGeorge, 2018). A key aspect of the criticism over effectiveness surrounds schemes being delivered, implemented, and evaluated in different ways (Buxton and McGeorge, 2018). Over time, evaluations of ERS have examined the same key outcomes i.e. improvements in participants' PA levels and/or clinical health markers. Evaluations have included experimental quantitative (controlled and randomized controlled trials); non-experimental quantitative (uncontrolled longitudinal cohort studies); and qualitative research (Gidlow, Johnston, Crone & James, 2005). Irrespective of the evaluation method employed, four consistent messages are present. First, ERS have a low uptake rate. Second, for those who choose to start ERS there is a high dropout rate, or low session count i.e. attendance is poor. Third, there is limited evidence about sustained long-term

increases in PA, or positive changes in clinical health markers. Last, there is a lack of detail upon what is prescribed in ERS and the adherence to the prescription (Ackerman, Deyo & Logerfo, 2005; Gidlow, Johnston, Crone & James, 2005; Morgan, 2005, Pavey et al., 2011a; Williams et al., 2007).

1.1.1. Exercise referral schemes in Scotland

In 2010, NHS Health Scotland published an audit of ERS provision in Scotland (where the research for the thesis took place) where it identified 49 schemes (Jepson, Robertson and Doi., 2010). However, a follow up audit published in 2018 reports a smaller number of schemes (N=26) (Buxton and McGeorge, 2018). Buxton and McGeorge acknowledge that this disparity may be due to: 1) the more formal inclusion criteria compared to the 2010 audit; 2) failure of schemes to return the self-report questionnaire; 3) failure to capture initial scheme details via a mapping exercise; and, 4) the changing landscape of public health due to significant cuts in local government funding, leading to uncertainty on how many ERS are currently in existence across Scotland. Contextually, one study within this PhD thesis was conducted within ERS operating in a health board in which the 2018 audit indicated there was no ERS provision.

A main conclusion point from the 2010 audit was the inability to ascertain the number of referred patients who completed and benefitted from ERS (Jepson, Robertson and Doi, 2010). The 2018 audit reported that 20% (N=5/25) of schemes were unable to provide details about the number of participants starting a scheme and if and when they dropped out (Buxton and McGeorge, 2018). Thirty-two percent of schemes were unable to provide data surrounding numbers completing the scheme (Buxton and McGeorge, 2018). ERS's stated their overall aim was to improve health and wellbeing and provide opportunities to increase PA levels (Buxton and McGeorge, 2018). Two-thirds of schemes (N=17) reported that they reviewed the participants' medications and medical history during an initial consultation (Buxton and McGeorge, 2018). However, there was no indication if this was reviewed at any other time in the ERS pathway. Ninety percent of schemes collected data on

follow-up of PA levels, across different periods (e.g. 3-12 months). Evaluation of health and wellbeing varied. Mood and quality of life ([81%, N=17] and [71%, N=15] respectively), weight (62%, N=13) and Body Mass Index (57%, N=12) were reported as outcome indicators, while 20-50% of schemes collected data on body composition, waist circumference, physical fitness and blood pressure (Buxton and McGeorge, 2018). The 2018 report concludes that ERS across Scotland operates at different capacities, and with different operational standards.

To understand the scrutiny of ERS as a whole in Scotland, it is important to unpick the ERS journey to its constituent parts. There are three key components to the ERS journey. First, the process of referral from the HCPs to ERS. Second, a referred individual's decision to take up the referral and subsequently attend and complete the scheme. Third, the characteristics of the scheme, i.e. the frequency, intensity, type and time of prescribed exercise and participant adherence to the prescription. Furthermore, these three elements of the ERS pathway require consistent recording and reporting to understand the interpretation, translation and implementation of research findings (Slade et al., 2016, Webb et al., 2016), into outcome effectiveness. The following sections discuss each of the three key components of the ERS journey in consecutive order. The studies comprising the research for this thesis that relate to each component in the pathway are referred to where relevant.

1.1.2. Referral process from healthcare professional to ERS

Some ERS schemes use self-referral but most rely on HCPs referrals. Hence, there is a strong rationale to examine HCPs attitudes towards referring individuals on to ERS, because their attitudes are likely to influence who uses ERSs. HCPs in primary care can play an important role in encouraging and facilitating lifestyle change among their patient group, in part, due to high level of contact and therefore referring opportunities (Douglas et al., 2005; PHE, 2016). Subsequently, integrating PA promotion into healthcare is seen as one of the seven 'best investments' for reducing physical

inactivity levels (PiA) (Lowe et al., 2017; GAPA, 2011). Around the expansion of ERS in the early 1990s, evidence suggested that General Practitioners (GP) were uninterested in exercise promotion, with GP's rating training in exercise counselling as less important than ten other health behaviours (Miilunpalo, 1991). Fewer than half of GP's asked exercise history as a part of their routine assessment of patients (Wilford et al., 1992). Thirty-one and thirty-six percent of GP's "always" or "occasionally", promoted exercise with their patients, respectively (Calnan and Williams, 1993). Recent evidence suggests these levels of awareness surrounding the importance of PA may not have improved. In one study, trainee Doctors underestimated the risk of PiA; 68% were able to correctly identify adult PA guidelines, in comparison, 97% correctly identified the United Kingdom's alcohol guidelines (Dunlop and Murray, 2013). Further, a more recent study surveyed GP's in England, concluding that only 20% were aware of the most recent national PA guidelines (Chatterjee et al., 2017).

Only a few studies have examined the actual process of referral from the perspective of the HCPs doing the referral (Din et al., 2015; Graham, Dugdill and Cable, 2005; Persson et al., 2013; Singh 1997). These studies identified several barriers to referral; for example, perceptions of patient likelihood to exercise, and concerns around giving advice that is not associated with the primary reason of the visit to the GP. Further barriers include concerns around their own expertise and whether it was within their remit, time constraints, and a lack of perceived importance or priority of PA, relative to other health promotion activities (e.g., smoking cessation) (Din et al., 2015; Graham, Dugdill and Cable, 2005; Persson et al., 2013; Singh 1997). This evidence suggests that in the context of referral to ERS clinicians are apprehensive about their own levels of expertise surrounding PA, priority setting of PA and time constraints to promote PA.

Knowing that PA promotion is a public health priority and that effective strategies are needed to increase PA levels across the population (Lowe et al., 2017), it is wise to increase understanding around the decision-making process of HCPs in promoting PA or referring to ERS. What basis do they

refer upon, who do they deem appropriate for PA promotion and what facilitators and barriers influence PA promotion and referral? In study four (**Chapter 6**), primary care health professionals' perceptions of PA promotion in primary care are explored with a view to understanding referral, which is a key component of the ERS pathway.

1.1.3. Uptake, attendance, and adherence of ERS

A referred individual's decision to take up the referral to ERS and subsequently complete the scheme is another key component of the ERS pathway. Despite mounting evidence concerning the health benefits of PA and development of PA guidelines, PA levels and exercise behaviour at a population level are decreasing (Pedersen and Saltin 2016). In order to engage people in initiatives, such as ERS, in-depth understanding of who does and does not attend ERS is imperative. Moreover, identification of those at risk of not attending and therefore not reaping the potential benefits of exercise to prevent/manage an NCD is also important (Pavey et al., 2012). Evidence surrounding uptake (as highlighted in **Chapter 2**, definitions of uptake vary) of ERS is inconsistent but suggests that the number of participants taking up an offer of referral fluctuates between primary studies; however historically, across systematic reviews that have focused upon uptake, reporting of pooled data has not changed dramatically. The first review in 2005 reported uptake was <67% (Gidlow et al., 2005), and a review two years later reported pooled uptake of 66%, across primary studies (Williams et al., 2007). Two linked reviews, which reported upon one systematic search process, reported uptake at 66% (95% CI, 57%–75%) in observational studies and uptake of 80% (95% CI, 61%–98%) in randomised controlled studies (Pavey et al., 2011a; Pavey et al., 2012). One further review built upon this systematic search, reporting uptake as a range between 35% and 85% (Campbell et al., 2015).

Evaluations of ERS uptake (for the purposes of the research for this thesis, uptake refers to a participant starting ERS by attending at least one session) have predominately focussed on

describing the clinical and demographic characteristics (e.g., age, medical condition), in an attempt to explain uptake levels (Pavey et al., 2011a; Pavey et al., 2012). However, most reviews are less clear on which demographics influence take-up to ERS. Being female and older age appears to be the most consistent demographic predictors for uptake of ERS (Pavey et al., 2011a; Gidlow et al., 2005). It is uncertain if medical condition and socio-economic characteristics influence uptake. One review reported that participants who were more deprived coupled with a respiratory diagnosis were more likely to take up ERS than those who were least deprived, with the same medical condition (Pavey et al., 2012). An earlier review did not find relationships between conditions and uptake (Pavey et al., 2011a). Further, few studies provide details of participants who fail to take-up ERS (non-attenders). Gidlow reported that uptake was greater for females (60% vs 40%, respectively) (Gidlow et al., 2005). However, these figures represent individuals starting ERS. This allows us to say that of those who start the programme, there are more females. However, without the ability to compare details of those referred, those who choose not to take up ERS (non-attenders) and those who start (attenders), there is a lack of clarity about uptake of ERS.

For those who attend ERS, physiological and psychological benefits are achievable (Taylor et al., 1998; Leijohn et al., 2009; Edmunds et al., 2007). The physiological and psychological benefits that are potentially achievable from PA are presented later in this chapter below. However, failure to complete the prescribed number of weeks of ERS may reduce any potential opportunity a participant has for achieving these benefits. ERS duration varies between schemes and for the purpose of this thesis; duration of ERS is seen as the number of weeks the scheme lasts, e.g. 10 weeks. Furthermore, definitions of what constituents completing the scheme vary. Common in the literature, adherence is the term used to describe 'completing the scheme', where it is defined as either completing a set percentage of sessions within the duration of the scheme (e.g. 75%) or attending an exit interview at the end of the scheme (Pavey et al., 2012). However, these definitions fail to take into account the number of sessions completed or what is performed in the exercise sessions, i.e. exercise prescription. Therefore, for the purposes of the research for the thesis the

following definitions will apply. 'Attendance' is defined as the number of sessions completed or session count, regardless of scheme duration. Adherence is defined as a combination of session count (attendance) and performing the required exercise prescription, i.e. number of sessions attended x number of prescribed exercises completed.

Much like ERS uptake, reviews have struggled to provide clarity upon individual characteristics that relate to ERS attendance. Reviews report that being male is a greater predictor of higher attendance (Pavey et al., 2011a; Pavey et al., 2012; Gidlow et al., 2005). Hence, based on current evidence, attendance is greater in males than females (Pavey et al., 2012). Similar to uptake of ERS, being older age has been shown as a positive factor for greater attendance (Pavey et al., 2012; Gidlow et al., 2005). Similarly, reporting of medical conditions and their influence on attendance is not clear (Gidlow et al., 2005; Pavey et al., 2012). Nonetheless, drop out (for the purposes of research for this thesis drop out is defined as exiting ERS before the completion of the scheme) from ERS is high, irrespective of gender, socioeconomic status or medical condition (Gidlow et al., 2005; Pavey et al., 2011a; Pavey et al., 2012). Systematic reviews have reported a range of attendance rates between 12% - 25% (Gidlow et al., 2005), 12% - 42% (Williams et al., 2007) and 25% and 86% (Campbell et al., 2015). However, what these rates and current published definitions do not tell us is when a participant exited the scheme. Therefore, there is a need to understand when participants exit ERS, e.g., one session into the programme, or if they attended all the sessions bar the exit interview.

Current literature on ERS sometimes use the term adherence when referring to attendance and vice versa thereby making it difficult to draw meaningful comparisons between studies about ERS.

Adherence, defined as a combination of attending a session and performing the prescribed exercise is missing from the literature. However, both attendance and adherence are crucial components within the ERS pathway. Not knowing the extent a participant attends and adheres to their exercise prescription within ERS reduces any clarity about effectiveness. Therefore, there is a lack of clarity about uptake, attendance and adherence. In particular, there is limited evidence about the socio-

demographic and clinical characteristics of individuals in relation to uptake, attendance and adherence. Two studies (study one and two) conducted as part of the research for this thesis address these two key limitations. **Chapter 2** presents a review of reviews of ERS in order to determine the level of reporting around who is referred, who is most likely to take up a referral, attend and adhere. **Chapter 3** presents secondary data analysis of an ERS in order to determine if there are difference between individuals who take up (attenders) and do not take up (non-attenders) ERS, and when attenders exit the programme.

1.1.4. Exercise referral prescription

A third key component of the ERS pathway is the exercise prescription. It is vital to understand what happens in sessions in order to understand the effect of ERS. Precise information about the type of exercise, as well as details such as its dosage, defined as, a combination of intensity and frequency, whether it requires supervision or not, are required to understand the intervention and how to replicate it (Slade et al., 2016). Prior to establishing the current knowledge of ERS prescription, this sub-section will define PA.

The terms “physical activity” and “exercise” are commonly interchanged with each other, yet they represent very distinct concepts (Caspersen et al., 1985). PA is any bodily movement produced by contraction of the skeletal muscles thereby increasing energy expenditure (Caspersen et al., 1985; WHO, 2010). Exercise is a sub-category of PA, in that it is a structured, repetitive movement with the objective of improving or maintaining physical fitness (Caspersen et al., 1985; WHO, 2010). Physical fitness is the ability to carry out daily tasks with vigour, alertness, without undue fatigue and with ample energy (Caspersen et al., 1985). By definition, physical fitness is a variable attribute. Physical fitness can be broken down into two separate components, health-related physical fitness and skill-related fitness (Caspersen et al., 1985; WHO, 2010). The health-related component of physical fitness is further comprised of 1) cardiorespiratory fitness (CRF) (endurance), 2) body composition, 3)

muscular strength 4) muscular endurance, and 5) flexibility (WHO, 2010). It is important to note that these components are rarely reported as outcomes in ERS. Yet, one or more of these components will be relevant to people with a specific NCDs, for example, muscular strengthening exercise maybe particularly relevant to people at risk of falls.

The use of frequency, intensity, type and time (FITT) is common both in research and practice to understand the amount of PA prescribed or performed. Frequency refers to the number of sessions or bouts- / days-per week on which PA is performed (WHO, 2010). Intensity encompasses the rate or effort needed to undertake the activity (WHO, 2010). Intensity classification can be defined as an absolute intensity (e.g., metabolic equivalent of task (METs)), or as relative intensity. Relative intensity is more subjective and takes into account an individual's physical fitness (WHO, 2010). Measurement of relative intensity can be via an objective measure, such as a percent of a person's maximum heart rate during the activity or via a subjective scale, such as the rating of perceived exertion (Eston and Williams, 1988; Borg, 1982). Type is used in research and practice to describe the method in which activity is performed (WHO, 2010), for example, playing football, jumping, brisk walking, or swimming. Time, commonly expressed in minutes, relates to duration of PA prescribed or performed. Subsequently, as the use of FITT is commonplace in both research and practice, it would be expected to be present in studies of ERS in order to provide understanding of what ERS participants have been prescribed. Furthermore, an exercise prescription in theory, should address the reason why an individual is referred to ERS. For example, the FITT of exercises to improve mobility will differ from the FITT of exercises to reduce body weight.

ERS are highly heterogeneous (Moore et al., 2012) and descriptions of the prescribed exercise dosage are often suboptimal, prompting a lack of clarity about what the exercise prescription is (Slade et al., 2016). Resistance training, outdoor walking, swimming, aerobics, gym sessions and group exercise are all types of PA or structured exercise that have been reported in ERS (Arsenijevic and Groot, 2017; Orrow et al., 2012; Webb et al, 2016). Webb et al. (2016) explored a three-arm

intervention between laboratory-based exercises vs. community walking exercise, vs. attendance at the National Exercise Referral Scheme of Wales (NERS). However, description of the NERS programme in the published results amounted to, twice-weekly 35 min group exercise sessions (Webb et al., 2016). One study described ERS programme as lasting one-hour (range 45 to 90 minutes) and participants usually attended a minimum of two or three sessions a week (Tobi et al., 2012). Last, one study detailed ERS including the option for supervised group-based activities or independent activities, within the local leisure facilities (e.g., use of gym, swimming pool, and classes) or the community (e.g., health walks, walking football groups, home exercises; Prior et al., 2019).

Based on the current knowledge of exercise delivered in ERS, as a research community, all that can be drawn upon is the generic and heterogeneous nature of exercise prescription within ERS. A lack of detailed information upon the FITT of prescribed exercise prevents the ability to investigate outcomes to the intervention or between ERS's. Crucially, it makes it almost impossible to assess if the prescription is fit for purpose i.e. addresses the needs of individuals being referred who will have a range of different NCD that require different prescriptions. One study (study three) conducted for the purposes of this PhD address this gap. **Chapter 4** presents an analysis of the FITT of prescribed exercises from an ERS. Furthermore, **Chapter 5** presents analysis of interviews conducted with the exercise referral instructors, providing a qualitative insight into the FITT of the exercise prescription. In addition, **Chapter 5** explores how exercise referral instructors motivate participants to uptake and attend ERS and adhere to the FITT of the programme. Considerable effort has been devoted to understanding PA behaviours (Stevens et al., 2017). As discussed above, research focusing on uptake and attendance to ERS has largely examined associations between uptake and attendance and demographic factors such as age, gender or referral condition (Pavey et al., 2011a, Pavey et al., 2012). Similarly, previous ERS research has provided qualitative insights towards the motivation of individuals to engage with ERS (Enyon, O'Donnell and Williams, 2016). This body of previous work has largely focused upon behaviour change theories that predominantly focus on individuals'

motivations, such as self-determination theory (Enyon, O'Donnell and Williams, 2016; Moore, Moore and Murphy, 2011).

Ultimately, the individual stands to benefit from ERS. However, they are referred to ERS by an HCPs; they are prescribed exercise by one or multiple exercise referral instructors and may well exercise within a group class at the ERS. Therefore, it is important to recognise individuals in an ERS function in partnerships and as group members (Stevens et al., 2017). Therefore, research about ERS has begun to move beyond an exclusive focus on individual-level approaches to consider the numerous individual, environmental, policy, and social determinants of PA (Cruwys et al., 2015, Stephens et al., 2017; Henderson et al., 2018). One key component is the exercise referral instructor. Exercise referral instructors are well placed to offer insights into reasons for prescribing certain exercises (**Chapter 4**). Moreover, instructors are likely to influence participants' uptake, attendance and adherence to the prescription. Therefore, there is a need to understand how and why exercise referral instructors help people engage with ERS (**Chapter 5**), since this may improve understanding of factors that influence the efficacy of ERS for primary and secondary prevention and self-management of NCDs.

1.2. Why there is a need for ERS

So far, this introductory chapter has highlighted three elements of the ERS pathway: referral of participant to ERS from HCPs; participant's choice to uptake, attend and complete the duration of ERS; and the ERS prescription and adherence to the prescription. The thesis will now establish why there is a need for such an intervention, by addressing a key aim of ERS, preventing or self-managing NCD; ERS follows the logic of a medical model of delivery: prognosis of an extant or likely pathological problem, and subsequent 'prescription' of a course of exercise-based treatment (Henderson et al., 2018). In the 2018 audit, Scottish ERS's stated their aim was to improve health and wellbeing (Buxton and McGeorge, 2018). Referral to ERS from an HCP is on a clinical decision

that the HCPs deems the person at risk or needs to manage their NCD and PA is an appropriate tool to do this. NICE guidelines state referral to ERS is on the basis that increasing ones PA levels has a range of positive health benefits (NICE, 2014). Subsequently, the following subsection will now focus upon NCD and the importance of PA in preventing and self-managing NCD.

1.2.1. Non-communicable disease

A range of people with differing NCD's, such as depression, cardiovascular disease, lower back pain, are referred to ERS. However, published evaluations of ERS fail to assess the extent to which the exercise prescription addresses the condition. The following section summarises the burden of NCD, as it constitutes a major public health challenge, of which HCPs' play an important role in combating.

It is estimated around 41 million deaths that occurred globally in 2016 were due to NCD (WHO, 2018). The majority of deaths were caused by the four main NCDs: diabetes, chronic respiratory diseases, cancer and cardiovascular diseases (CVD) accounting for 4%, 9%, 22% and 44%, respectively (WHO, 2018). NCDs are caused by and share, to a large extent, four behavioural risk factors; tobacco use, unhealthy diet, not meeting PA guidelines or PiA and the harmful use of alcohol, all of which are common facets of 21st-century lifestyles (WHO, 2010). PiA (6%) and tobacco use (9%) have been identified as two of the four leading risk factors contributing towards global mortality (6% of deaths globally) alongside high blood pressure (13%) and high blood glucose (6%) (WHO, 2010).

Between 2007 and 2010 global mortality rates of CVD further shifted from 218 deaths per 100,000 to 232 deaths per 100,000 despite increasing interventions, such as medication that prevent deaths (IHME, 2018). Hypertension rates rose to nearly one billion in 2008, from 600 million in 1980 (WHO, 2010), while obesity prevalence nearly doubled between 1980 and 2008 (WHO, 2010). Forecasted increases over the coming years, suggest that if global cancer rate of growth remains unchanged, the

incidence of 12.7 million new cancer cases in 2008 will rise to 21.4 million by 2030 (WHO, 2010). The Global Burden of Disease study (Hay et al., 2016) reported musculoskeletal (MSK) disorders as the second most common cause of disability worldwide, measured by years lived with disability. Lower back pain being the most frequently reported condition. It is further estimated that disability due to MSK disorders increased by 45% from 1990 to 2010 (Hay et al., 2016). Considering the prevalence of NCD within Scotland (where the primary research for this PhD was conducted), the public health priorities report highlighted that 65% of Scottish adults are overweight (ScotGov, 2018). In 2016, ischaemic heart disease was the leading cause of early death in Scotland contributing to 81,600 total years of life lost (NHS Scotland, 2018). As demonstrated, there is a strong epidemiological evidence base reporting prevalence of NCDs and there is increasing recognition by WHO of lifestyle behaviours as risk factors for NCDs (Lee et al., 2012; Ekelund et al., 2016). The increasing prevalence of NCD is overwhelming, of which there is a need to address such rates.

Primary care is a core process of a national health system. Primary care is accessible to all and can undertake the management of NCDs by providing first contact, continuity of care, and integration of care (Varghese et al., 2019). Due to an ageing population and increasing numbers of people with complex conditions, the workload for HCPs has increased substantially (Baird et al., 2016). Consultations grew by more than 15 per cent between 2010/11 and 2014/15 in England (Baird et al., 2016). Over a 10-year period, Scottish primary care has seen a 20% increase of patients aged 65 years and over (ISD, 2018).

Primary care has had to develop its service to help manage the increase in demand for appointments, for instance expanding services led by other members of the primary care team such as nurses, pharmacists and paramedics (Baird et al., 2016). Moreover, some primary care facilities use administrative staff to guide patients through a set of clinical questions, determining which HCP is best suited to be seen (Baird et al., 2016). Further recommendations to help address some of the burdens upon primary care is to harness community assets to support and improve the health of

local populations through social prescribing (Brandling and House 2009), such as ERS. As previously established, one of the aims of ERS is to help manage individuals who have, or are at risk of, NCD (Jepson, Robertson and Doi, 2010; Buxton and McGeorge, 2018). ERS represents one tool that is available for HCPs in primary care to help deal with NCD. This thesis shall now address why PA and exercise is an important tool available to health HCPs.

1.2.2. Physical Activity Benefits

PA has long been hailed a virtue to health promotion, with the earliest records of organised exercise dating from ancient China approximately 2500 BC. Ancient Greek scholars Hippocrates and Plato viewed gymnastic activity as a means of treating disease and disability (MacAuley, 1994). Within the last few centuries, we have seen an ever-growing body of work commenting on the relationship between PA and health. One nineteenth century epidemiological study reported that university oarsmen in the Oxford and Cambridge boat race from the years 1829-1869, had an increased life expectancy of 2.2 years (Morgan 1873, cited in MacAuley, 1994). The relationship between NCD and PA continued to be explored, with what some see as the first empirical investigation of the exercise hypothesis, when Morris *et al.* (1953) reported lower rates of coronary heart disease (CHD) in bus conductors and post-men, compared to their less occupationally active peers of bus drivers and deskbound clerks. Comparatively, Paffenbarger *et al.* (1986) reported mortality rates were significantly lower among physically active alumni with or without consideration of early parental death, hypertension or cigarette smoking (Paffenbarger, 1986). Research examined the physiological effect of PA and CRF, reporting that high levels of CRF protected against CHD (Wilhelmsen *et al.*, 1981). Marty Karvonen and Henry Taylor showed lower rates of heart disease among those in more active jobs than those in sedentary jobs (Blair and Powell, 2014). As evidence continued to build around PA and health, one of the seminal actions was the American Heart Association labelling

insufficient physical activity, or not meeting PA guidelines (PiA) as the fourth risk factor for heart disease (Blair and Powell, 2014).

Sixty-years on from Morris and colleagues' seminal paper (Morris et al., 1953), studies have continued to provide evidence that a lack of PA is a major risk factor for morbidity and premature mortality (Lee et al., 2012; Ekelund et al., 2016). It is commonly accepted that regular PA reduces the risk of a range of NCD including CHD, stroke, type 2 diabetes, and some cancers (Lim et al., 2012; Forouzanfar et al., 2015; Kyu et al., 2016). Systematic reviews, meta-analysis and position stands suggest that PA carried out at accepted doses (time and intensities): increase CRF; decrease insulin resistance; improve glycaemic control; and improve lipid profile in diabetic populations (de Carvalho Souza Vieira et al., 2018; Colberg et al., 2016; Snowling and Hopkins 2006). Small but meaningful reductions in BP have also been observed in both hypertensive and normotensive participants, across overweight and normal-weight participants, performing regular aerobic exercise (Whelton et al., 2002). Exercise has been shown to promote improvements in clinical, functional, and in some populations, survival outcomes in cancer patients regardless of the type of exercise performed (Stout et al., 2018). Exercise can improve function and pain in MSK conditions (Smith et al., 2017). It is further associated with psychological benefits such as a reduction in risk for clinical depression, higher self-esteem and a sense of wellbeing (Firth et al., 2016; Rosenbaum et al., 2014). Subsequently, PA or exercise is an important component of self-management of treatment programmes for those at risk or managing NCD (Grady and Gough, 2014).

The following sub-section will provide a summary of the FITT of exercise prescription recommended for seven NCD's, which are relevant to the primary studies within this thesis. These seven NCD's represent conditions for which individuals are commonly referred to ERS, namely, CVD, MSK conditions, frailty and mobility, mental health conditions, cancer, respiratory conditions and neurological conditions. The evidence will draw primarily upon systematic reviews and meta-analyses, and where required primary studies. Second, the relevant NCD will be addressed within

the context of ERS, where it will become clear that the evidence base is lacking in reporting FITT of the exercise prescription.

1.2.2.1. Physical activity in people with cardiovascular disease

CVD is a broad overarching term referring to conditions that affect the heart or blood vessels, for example, coronary heart disease, angina, heart attack, peripheral arterial disease, hypertension, and stroke. Subsequently, exercise prescription requires tailoring to the condition present. The American Heart Association has endorsed moderate-intensity resistance exercise as a complement to aerobic exercise to help prevent, control and treat hypertension (Whelton et al., 2017). One systematic review of 38 primary studies reported that a variety of exercise modalities have positive effects on central hemodynamics, arterial stiffness and cardiac function in patients with CVD (Zhang et al., 2018). A recent Cochrane systematic review assessing 63 studies with 14,486 participants suffering from coronary heart disease reported that aerobic exercise, delivered as part of a rehabilitation programme, reduced cardiovascular mortality and future hospitalisation (and associated healthcare costs) and improved quality of life markers (Anderson et al., 2016). Fifteen minutes of leisure-time PA confers a 15% mortality reduction in relation to cardiovascular mortality (Gielen et al., 2015). Aerobic exercise in patients with heart failure (reduced ejection fraction), is both safe and induces reverse cardiac remodelling with reduced end diastolic volume, and improved systolic and diastolic function (Gielen et al., 2015). One review recommends that programme duration should be greater than 24 weeks; frequency of sessions should be 3-5 times per week and each session should be at least 40 minutes (Hansen et al., 2018). Cardiovascular exercise, initially performed at low intensities, and then progressed. Dependent upon co-morbidities, resistance exercise added in. Dynamic resistance exercise training at a moderate intensity, which includes 8–10 exercises for the large muscle groups (one set/ exercise: 8–12 repetitions per set, with progressive build up to two or three sets per exercise) (Hansen et al., 2018).

Based on the above evidence, it appears that the strongest evidence is in favour an exercise prescription that includes aerobic and resistance exercises, performed 3-5 times per week, to prevent primary and secondary cardiovascular disease. One systematic review of ERS, by Rowley and colleagues (2018) was only able to draw upon limited detail, reporting one-two exercise sessions per week. Promising, albeit with limited detail, the majority of primary studies reporting was of one-to-one gym based cardiovascular and resistance activities as their main modality.

1.2.2.2. Physical activity in people with musculoskeletal conditions

MSK is an umbrella term for a number of different conditions. Low back pain and neck pain are the most common MSK conditions while osteoarthritis is the most common joint disorder (Pedersen and Saltin, 2015). Strong evidence exists that both aerobic and resistance exercise have positive effects on self-reported pain and general level of functioning within individuals suffering from osteoarthritis (Zhang et al., 2010). One meta-analysis reported that physical training had a significant long-term effect compared to no exercise or conventional treatment on lower back pain (OR: 0.66, 95% CI: 0.48–0.92). They were not able to conclude what the most effective type of physical training was, suggestive that, there may be a modality to suit the needs of different individuals (Oesch et al., 2010). One review reported that core stability exercises, classified as resistance exercises, are more effective than general exercise, in decreasing pain in patients with chronic low back pain in the short term (Wang et al., 2012). However, one review was unable to recommend optimal resistance training intensity or volume for low back pain patients, in part due to widely differing resistance training methodology employed (Kristensen and Franklyn-Miller, 2012). One review reported that patients with rheumatoid arthritis who performed either aerobic or resistance exercise improved endothelial function, BP, lipid profile. Improvements in muscle mass was achieved from combining resistance and aerobic exercise (Mancora et al., 2005; Lemmey et al., 2009) (Pedersen and Saltin, 2015). One review commented that regular practice of resistance exercise might prevent and

control the development of several MSK chronic diseases (Ciolac et al., 2016). The review continued to comment that outcomes of resistance training programmes in Osteoporosis is greater when it extends for at least 1 year. However, significant effects can be observed after 4 or 6 months.

Based on current evidence of effectiveness, there is strong evidence that a combination of training protocols is effective, however, it is challenging identifying just one recommended exercise prescription for people with MSK conditions. Nonetheless, there is evidence that resistance and aerobic exercises that is tailored to the condition may result in improvements across different sub-categories. A recent systematic review examining the effects of ERS in persons with MSK conditions concluded that research reviewing MSK disorders is extremely limited (Rowley et al., 2018). Only three articles showed some relevance to the disorder, clinical MSK measures was not reported, and exercise prescription was limited to one-to-one cardiovascular and resistance exercise (Rowley et al., 2018).

1.2.2.3. Physical activity in people with frailty and mobility conditions

While a standardised definition is lacking, frailty is prevalent in old age and associated with a high risk of falls, hospitalisation and mortality (Freid et al., 2001). A 2001 Cochrane Review concluded that exercise prevented fractures associated with falls (Gillespie et al., 2003). One meta-analysis examining combined muscle and balance training in 1016 older women (65-97 year old), reporting a reduction in the risk of fall to 0.65 (95% CI: 0.57–0.75) and the risk of fractures to 0.65 (95% CI: 0.53–0.81) (Robertson et a., 2002). A recent review explored 46 studies, reporting that a combination of muscle strength training and protein supplementation was the most effective intervention to delay or reverse frailty (Travers et al., 2019). A 2017 review reported exercise to have a positive effect on measures of frailty (e.g. psychological wellbeing, cognition and physical functioning) and outcome measures such as quality of life. However, they could not conclude upon the most effective exercise programme (Silva et al., 2017). A review by Bray *et al.* (2016) recommended a mixture of aerobic,

resistance, balance and flexibility training per session. Furthermore, combining multiple components has the most profound effect on improving functional capacity, in comparison with just one form of exercise. Each component is to be performed 2-3 times per week (Bray et al., 2016). Optimal duration for each session should be 45-60 minutes for pre-frail adults and 30-45 minutes for frail adults. Intensity for aerobic activities should be at a moderate intensity with progression to more vigorous levels. Resistance training is both safe and more effective at higher intensities; however, progression should be from low to moderate towards higher intensities (Bray et al., 2016).

Based on the above evidence, it appears that the strongest evidence is in favour an exercise prescription that combines aerobic and resistance exercises as well as introducing additional training, such as balance training and flexibility. However, there is lack of evidence across reviews or primary studies of ERS of exercise prescription related to frailty. The current evidence for ERS suggests that participants tend to be older, so in theory, participants presenting should be receiving a programme that might include a combination of aerobic, resistance, balance and flexibility training.

1.2.2.4. Physical activity in people with mental health conditions

Depression is a common cause of morbidity and mortality worldwide and commonly treated with antidepressants and/or psychological therapy (Pedersen and Saltin 2015). Globally, anxiety is the most common mental health problem, in addition to be a standalone condition; it appears as a symptom within other mental health conditions, such as depression. Anxiety and depression can also be associated with CVD, cancer or chronic obstructive pulmonary disease (Pedersen and Saltin, 2015). A 2010 review supported two exercise sessions per week, each of 45 min duration, leading to improved outcome measures of mental well-being, not simply measures of depression or anxiety (Windle et al., 2010). Firth and Colleagues (2015) reported that schizophrenia patients with psychiatric symptoms who performed moderate-to-vigorous exercise significantly improved total

symptom scores (Firth et al., 2015). A 2013 Cochrane review summarised the greater the number of exercise bouts performed, the greater positive effect on mood; additionally, resistance and mixed training were more effective than aerobic activities alone (Cooney et al., 2013; Pedersen and Saltin; 2015). One review found that the most consistent improvements in mood appear to be associated with less than three exercise sessions per week. However, session duration to be of more than 45 min or based on participant "needs" and performed at a low- to medium-intensity (Arent et al., 2000).

Based on current evidence of effectiveness it is challenging identifying an exercise prescription for people with mental health conditions, notably around the frequency of sessions. Reporting upon the type of exercise prescribed to individuals with mental health problems in ERS is limited to one-two exercise session per week weekly, within one-to-one gym-based PA, consisting of both cardiovascular and resistance training activities (Rowley et al., 2018). There is no reporting upon intensity levels.

1.2.2.5. Physical activity in people with a cancer diagnosis

The most common cancers in the UK are breast, lung, prostate and colorectal, accounting for over half of all new cases (53% combined) (Cancer Research UK, 2016). Of these, prostate and female breast cancers have been shown to be most prevalent, accounting for 31% and 46% of male and female cancers respectively (Maddams et al., 2009). One meta-analysis (Lahart, Metsios, Nevill, & Carmichael, 2015) summarised 22 prospective cohort studies examining the relationship between PA, recurrence and mortality among breast cancer survivors. Survivors with the highest level of recreational PA post-diagnosis had 21% reduced risk of breast cancer events, 41% reduced risk of breast cancer mortality and a 48% reduced risk of all-cause mortality (Lahart, Metsios, Nevill, & Carmichael, 2015). Furthermore, survivors meeting recommended PA guidelines (combination of a minimum 150 minutes of aerobic activity at a moderate intensity over a 7-day period, activities that

promote muscle growth on 2-3 days per week and reducing sedentary time) post-diagnosis had a 36% reduced risk of all-cause mortality (Lahart, Metsios, Nevill, & Carmichael, 2015). Similarly, one review reported those with the highest levels of PA, compared to the lowest had a 42% reduced risk of colorectal cancer mortality and a 39% reduced risk of all-cause mortality (Schmid & Leitzmann, 2014). A dose-response relationship between post-diagnosis PA and total mortality, suggests that performing five, ten, or fifteen metabolic equivalent of task hours per week is associated with 15%, 28% and 38% reductions in total mortality (Schmid & Leitzmann, 2014). One review has suggested that increasing muscle strength and CRF may reduce symptoms of fatigue (Pedersen and Saltin 2015). A recent review suggested that effective exercise prescription should include moderate-intensity aerobic training at least three times per week, for at least 30 min, for at least 8 to 12 weeks (Campbell et al., 2019). The addition of resistance training to aerobic training, at least two times per week, performing at least two sets of 8 to 15 repetitions at minimum moderate intensity, appears to result in similar benefits (Campbell et al., 2019). Performing just resistance exercise does produce some health-related outcomes. However, for some specific outcomes the evidence is suggestive that resistance training alone may not be enough, or is lacking altogether (Campbell et al., 2019).

Based on the above evidence, the strongest evidence is in favour an exercise prescription that combines aerobic and resistance exercises. Furthermore, the greater frequencies of PA bouts, performed at a moderate or above intensity will illicit outcomes that are more favourable. No systematic review or primary study conducted in ERS provides evidence upon exercise prescription for cancer.

1.2.2.6. Physical activity in people with a respiratory condition

Chronic respiratory diseases, for example chronic obstructive pulmonary disease (COPD), asthma, and pulmonary hypertension are diseases of the airways and other structures of the lung (WHO, 2007). The positive impact of exercise for patients with COPD is well documented across a range of

meta-analyses (Lacasse et al., 1996; Lacasse et al., 2002; Lacasse et al., 2007; Salman et al., 2003). A 2015 review and meta-analysis which looked at exercise therapy that included exercise considered to be aerobically demanding, reported significant improvement across different quality of life domains (Chronic Respiratory Questionnaire scores for dyspnoea, fatigue, emotional function, and mastery). One review recommended two aerobic options for those with COPD (Gloeckl et al., 2013). Continuous or interval training performed 3-4 days per week, starting at 10-20 minutes per session, progressing to 30-45 minutes, inclusive or rest time for interval sessions. Intensity should start at moderate level for those who are performing continuous exercise. For those performing interval training, intensity needs to be at high intervals, while the rest periods are at low intensity (Gloeckl et al., 2013). Strength training is additionally recommended, that target the major muscle groups of upper and lower extremities, 2-3 times per week. Each exercise to be performed between 2 to 4 sets, of 6 to 12 repetitions (Gloeckl et al., 2013). One review was unable to determine the ideal frequency, duration and intensity of exercise for the treatment of pulmonary hypertension (Chia et al., 2016). Chia and colleagues concluded that based upon its findings exercise should occur on at least 5 days per week, for at least 2 hours per day and included a combination of aerobic, strength and respiratory muscle training. However, this was deemed impractical and similar positive clinical effects were reported with exercise prescription prescribed at 2-3 times per week, 1 hour in duration and include aerobic, strength and respiratory muscle training (Chia et al., 2016).

Based on the above evidence, exercise prescription should include both aerobic and resistance exercises. Intensity for aerobic exercises should be either moderate or high levels. The greater number of sessions completed will illicit greater outcomes, however a minimum of 2-3 sessions per week. A review by Pavey (2011b) only reported on one primary study that included poor respiratory function as a referral condition in ERS (Isaacs et al., 2007). The primary study concluded that supervised exercise classes, such as ERS might not be more effective than the provision of information (Isaacs et al., 2007). The reporting of the FITT of the exercise classes amounted to 10-week block, two to three times per week. Classes were either aerobic based classes, a gymnasium

based classes using aerobic machines (e.g. bikes, treadmills), a body conditioning class focused upon resistance exercises, aqua aerobics with a strengthening component or swimming lessons (Isaacs et al., 2007).

1.2.2.7. Physical activity in people with a neurological condition

Neurological conditions are broad, including subcategories such as, Alzheimer disease, multiple sclerosis, dementia, epilepsy, and Parkinson disease (Chin and Vora, 2014). Neurologic disorders combined with cerebrovascular disease represent 7.1% of the total global burden of disease measured in disability-adjusted life year (Chin and Vora, 2014). The evidence base around PA and dementia predominately focuses on attenuating cognitive decline. A Cochrane review found promising evidence that exercise programmes can have a significant positive impact on an individual's ability to perform activities of daily living and possibly improves cognition (Forbes et al., 2015). One review found that aerobic exercise performed two times per week at a moderate intensity increases aerobic capacity and muscular strength, further concluding, there is sufficient evidence that exercise may improve mobility, fatigue, and health-related quality of life in patients with multiple sclerosis (Latimer-Cheung et al., 2013). An earlier review concluded that progressive resistance training improved muscle strength, meanwhile, the evidence around fatigue, balance, functional capacity was not as strong (Kjølhed et al., 2012). One review reported a strong rationale for a multifaceted exercise prescription rather than a wholly aerobic-based programme (Thom and Clare, 2011). Emergent findings of their search concluded that aerobic exercise appears to be more effective in increasing cognitive function in older people than other exercise types (Thom and Clare, 2011). However, progressive resistance and balance training is more effective in improving physical function and decreasing falls risk in older people than aerobic training (Thom and Clare, 2011). Exercise sessions should be conducted more than once per week, preferably, three times a week and continue for at least three months (Thom and Clare, 2011). High-intensity resistance exercise is as

safe as low-intensity exercise, and considerably more effective in increasing physiological and functional measures and possibly more beneficial for cognitive function (Thom and Clare, 2011).

Based on the evidence above, exercise of any intensity is safe for those with neurological condition, performed multiple times per week with greater improvements being achieved when both aerobic and resistance exercises are prescribed. No systematic review or primary study of ERS refers to clinical outcomes of participants with neurological conditions.

To summarise, PA or exercise is an important component of self-management or treatment programmes for those at risk or managing NCD (Grady and Gough, 2014). From evidence presented, a combination of aerobic and resistance-based activities is recommended for most NCD. However, dependant on the type of outcome desired, for instance improving balance and reducing risk of falls vs. lowering blood pressure, targeted types of exercise may have a greater impact. Exercise Intensity levels are recommended to start at a low or moderate level and should be progressed, with higher intensities being safe and more effective. Sessions are recommended to occur as a minimum 2-3 times per week, preferably more, and last between 30-60 minutes per session. Dependant on outcomes desired, interventions should last for six months. The evidence base upon what is prescribed in ERS is limited and lacking across some NCD. This lack of evidence prevents research and practice to assign causality to outcomes and fails to acknowledge best practice.

1.3. Summary

To summarise, this introductory chapter so far has provided an overview of the current level of reporting on three key components of the ERS pathway, namely referral from a HCPs, an individual's choice to uptake ERS and continue attending sessions and the FITT of the exercise prescription and adherence to the prescription. Presently, the reported literature suggests HCPs lack confidence in

their knowledge of prescribing exercise and referring patients to ERS. Furthermore, there is a lack of information about decision-making processes and any facilitators and barriers HCPs face when referring to ERS. Of those referred, there is a lack of published data upon the sub-population of participants who choose not to uptake ERS. Of those who take up ERS, the reported literature suggests there is a high dropout; however, there is a lack of information upon when these participants stop attending. Lastly, those who attend ERS, there is a lack of detailed information upon the FITT of the prescribed exercise and their adherence to the prescribed exercise.

Subsequently, this thesis will aim to address these gaps and in doing so, provide new evidence about these three key components of the ERS pathway. The research therefore aims to contribute towards understanding factors that influence the effectiveness of ERS for preventing and self-managing NCD.

1.4. Contextual development and presentation of thesis

The initial design of the research for this PhD was to establish the feasibility of co-locating an exercise specialist within a primary care setting. My supervisory team and I planned to set out to explore patient preferences and barriers to performing exercise within a health centre. Following on, the task was to establish if take up, attendance and adherence would improve within this new location and therefore optimise effectiveness of exercise for the prevention and self-management of NCD. Last, the aim was to establish the feasibility of such a service across multiple health centres.

However, in reviewing the current evidence base and gaps within the literature (e.g. lack of reporting upon the prescribed exercise dose) it was evident that evidence about the referral by HCPs, who attended ERS, adherence and the exercise prescription in ERS was unclear. Subsequently the focus of the research for the PhD shifted to key components of the ERS pathway. In this thesis I refer to myself as 'the researcher'; initials in parenthesis are used to identify members of the PhD supervisory team. The chapters of this thesis are presented in a chronological order and are reflective of each study's findings informing the next study, rather than being in the order of the

three key consecutive components of the ERS pathway i.e. referral, uptake and attendance, exercise prescription and adherence to the prescription:

- Chapter two presents study one – a systematic review of reviews of ERS to investigate all three key components of the ERS pathway
- Chapter three presents study two – secondary data analysis of an ERS database to investigate uptake and attendance
- Chapter four presents part 1 of study three – secondary data analysis of an ERS database to investigate exercise prescription
- Chapter five presents part 2 of study three – interviews with exercise instructors to explore their perceptions of motivating people to attend and adhere the exercise prescription
- Chapter six presents study four – focus groups with primary care health professionals to explore promotion of PA in primary care
- Chapter seven summarise key findings of the research for the thesis, draws practical implications and makes recommendations for ERS

The framing of this thesis is that of a pragmatic approach. Pragmatism is a philosophy of knowledge construction emphasising practical solutions to applied research questions (Giacobbi, Poczwardowski, Hager, 2005). The philosophical movement of pragmatism began because of the fundamental agreement over the rejection of traditional assumptions about the nature of reality, knowledge, and inquiry. Pragmatists deny there is single reality and human actions can never be separated from the past experiences and from the beliefs that have originated from those experiences (Giacobbi, Poczwardowski, Hager, 2005; Kaushik and Walsh, 2019). The pragmatist view helps in bringing together scientific and humanistic domains of understanding. Therefore, pragmatism rejects the notion that social science inquiry can access the reality solely by using a single scientific method or view (Kaushik and Walsh, 2019). Put simply, pragmatists opt for methods

and theories that are more useful to within specific contexts, not those that reveal underlying truths about the nature of reality (Giacobbi, Poczwardowski, Hager, 2005).

Pragmatism does have its opponents, for example, Allmark and Machaczek (2018) favour realism over pragmatism, arguing that the latter views scientific inquiry as the attempt to find theories that work. However, in contrast, realism posits that scientific theories are true if they correctly describe the world we experience (Allmark and Machaczek, 2018). However, such a view can be flawed, for example, more than one theory may explain a set of data; meanwhile pragmatism accepts that there are singular and multiple realities that are open to empirical inquiry (Feilzer 2010). This is important in ERS due to the number of interactions and pathways present and the heterogenous nature of ERS. Expecting one theory to provide an answer may be unrealistic. Furthermore, as further evidence is gathered, some theories change over time and are thus rejected. Previous research has argued that realism provides a more valuable perspective for many aspects of mixed-methods research over pragmatism (Kaushik and Walsh, 2019). However, pragmatism does not necessarily require a particular method or mixing of methods and definitely does not exclude other methods. Rather, it aims to simply address the research question (Feilzer 2010). However, it is important to note that, the philosophy of pragmatism posits the best method is the one that is most effective in producing the desired consequences of the inquiry.

Therefore, pragmatic research methodology is designed to answer the question of whether an intervention works under usual conditions, rather than explanatory trials that answer the question if an intervention works under 'ideal conditions' (Glasgow, 2013). In the context of ERS, a pragmatic methodological approach suits examining the key consecutive components of the ERS pathway in a real-world environment to produce results that are relevant to stakeholders and research community, whilst being rigorously sound (Glasgow & Chambers, 2012). This is important for the following three reasons, which are given against examples from this thesis: 1) the questions and perspectives drawn are important to researchers and stakeholders; in the case of **Chapter 3**, this

provides understanding which sub-populations are not taking up ERS which may aid understanding inclusivity of ERS; 2) the research is conducted in multiple, heterogeneous settings similar to those in practice; in the case of **Chapter 4**, evidence is presented from four different ERS sites describing exercise prescriptions prescribed to participants; and 3) characteristics of participants resemble those seen in typical practice; in the case of **Chapter 5** and **6**, interviews were conducted with HCPs who see patients and promote PA and exercise referral instructors who deliver prescribed programmes to participants. A pragmatic methodology further aims to increase the transparency of this thesis, making it easier for practitioners and policy makers to determine the breadth and local applicability of the results (Glasgow, 2012).

1.5. Research aims

The overall purpose of the research was to open the 'black box' and provide a rich description of key components of the ERS pathway. The research was designed to contribute towards answering a crucial question: Is ERS fit for purpose in preventing and managing NCD?

The thesis objectives were to:

1. Explore current reporting and definitions of critical components ERS referral, uptake, attendance and adherence (study 1)
2. Investigate the socio-demographic characteristics of those who do not attend and those who do attend ERS and associations between attendee characteristics and attendance (study 2)
3. Describe the FITT of prescribed exercise within ERS (part 1 study 3)
4. Explore exercise instructors' perceptions about motivating people to adhere to the prescribed exercise within ERS (part 2 study 3)
5. Explore primary HCPs' perceptions of their role as promoters and referrers of PA and referrers to ERS (study 4)

Chapter 2. INSUFFICIENT REPORTING OF FACTORS ASSOCIATED WITH EXERCISE REFERRAL SCHEME UPTAKE, ATTENDANCE, AND ADHERENCE: A SYSTEMATIC REVIEW OF REVIEWS.

<https://doi.org/10.1123/jpah.2018-0341>

2.1 Introduction

The benefits of regular PA are well established for those individuals who meet PA guidelines, (DoH, 2011; Morgan et al., 2016; Din et al., 2015; NICE, 2012; NICE, 2014) and have been discussed previously (**see section 1.2.2**). However, PiA is now the fourth leading risk factor for global mortality (WHO, 2010) (**see section 1.2.1**), despite the mounting evidence of a relationship between achieving PA guidelines and health outcomes (DoH, 2011). As previously discussed, ERS are tailored attempts to manage prevent primary and secondary NCD (**see section 1.1**). However, limited evidence is available upon what works, why, and for whom.

Since 1998, a combination of systematic reviews, meta-analyses, or narrative reviews of ERS has been published focusing on different constructs surrounding the effectiveness of ERS (Morgan et al., 2016; Gidlow et al., 2005; Williams et al., 2007; Pavey et al., 2011a, Pavey et al., 2011b, Pavey et al., 2012; Campbell et al., 2015; Arsenijevic and Groot, 2017; Morgan, 2005; Riddoch et al., 1998; Orow et al., 2012; Sorensen et al., 2006). It is evident from this body of work that ERS is considered an important element in the armoury to tackle chronic disease (Jones et al., 2005). However, the UKs National Institute for Health and Care Excellence has indicated that the varying nature of ERS programmes makes it impossible to differentiate between the effectiveness and acceptability of different schemes (NICE, 2014) in addressing physical inactivity and associated NCD disease. This conclusion is largely due to little evidence of any effectiveness of specific schemes (NICE, 2014). It is crucial therefore, that clear reporting of key ERS components is available to allow for components associated with effectiveness to be replicated in future schemes. Factors such as reporting of referral uptake, attendance, and adherence, and the BCT underpinning ERS uptake and adherence are key components to understand for the following reasons:

2.1.1. Referral uptake

Knowledge of who does or does not uptake an ERS referral is imperative for improving the degree of take-up (Pavey et al., 2012). Whether participant characteristics influence the proportion of ERS uptake is uncertain, it is important to know what referral demographics are consistently reported, or unreported, and how they relate to uptake and to gain an understanding of what and how these are influencing scale of ERS uptake. In particular, it is not clear whether those with certain medical conditions have a greater uptake, and whether socioeconomic or demographic characteristics influence an individual's uptake (Dinan et al., 2006). Unless uptake and characteristics of people using ERS are known, then it is difficult to interpret the extent of generalisability of effect to groups of the population; that is, understand what works, why, and for whom.

2.1.2. Attendance and adherence

Slade et al (2016) described adherence as the extent to which a person's behaviour corresponds to the agreed referral. It is important within the context of the present review to distinguish the difference between adherence and attendance. Presently, adherence to ERS refers to the percentage of sessions attended (Pavey et al., 2012; Arsenijevic and Groot, 2017), which may be more appropriately classified as attendance. Adherence then would refer to the participant's behaviour in completing the prescribed PA. Attendance alone does not signify a suitable level of exercise intensity undertaken to benefit from the prescribed PA. For those who complete ERS, promising results were reported for reduced skinfolds, systolic blood pressure, and body mass index (Taylor et al., 1998), greater self-efficacy to overcoming PA barriers (Edmunds et al., 2007) and higher self-reported PA levels (Leijon et al., 2009). However, failure to attend and adhere to the prescribed programme reduces the opportunity a participant has for achieving these benefits. As such, it is important to understand what characteristics influence participants' attendance and

adherence levels. A valid and reliable assessment of both attendance and adherence is essential for drawing valid conclusions about ERS (Slade et al., 20016).

2.1.3. Behaviour change theories and techniques

In evaluating a complex intervention such as ERS, there is a requirement to understand the theoretical underpinning at every stage of the intervention, what it is based on, and the mechanisms through which behaviour change is achieved (Littlecott et al., 2014; Moore et al., 2014). In the same way that the PA content of ERS schemes varies and is determined between service provider and participant (Woods et al., 2016) no single explicit behaviour change theory or technique is embedded within ERS (Littlecott et al., 2014). The explicit reporting of the components within a complex intervention such as ERS, including its contextual factors such as BCTs utilised, is imperative in understanding; what facilitates uptake, attendance, and adherence to ERS and further implementation of ERS (Slade et al., 2016).

2.2 Aims

The current review of reviews aims to systematically collate and evaluate the evidence base of review-level findings around ERS. The study addresses objective one of the thesis; to explore current reporting and definitions of critical components ERS – referral, uptake, attendance and adherence (see section 1.5). It will address what is reported and the consistent and contradictory observations at both a theoretical (i.e. behaviour change theories) and practical (i.e. who attends ERS) level. The review aims (1) to describe definitions and rates of participant characteristics associated with ERS uptake, (2) to describe definitions and rates of participant characteristics associated with attendance at and adherence to ERS schemes, and (3) to describe theoretically informed approaches and associated BCTs that influence ERS uptake and attendance. Furthermore, this review will establish

what key features of ERS reporting go relatively underreported with a view to improving the reporting of future studies of ERS. This review may help to inform the development of a consensus about reporting of ERS that will positively affect both research and practice in a critical area that could improve the health and well-being of individuals with NCD referred to ERS.

2.3 Methods

2.3.1. Data sources and search strategy

The Preferred Reporting Items for Systematic Reviews and Meta- Analyses statement guided the conduct of this narrative review of reviews (Moher et al., 2009). Studies were identified by structured electronic database searches. A librarian and information specialist (R.P.), searched 16 electronic databases (CINAHL, MEDLINE, Embase, Cochrane Library, SPORTDiscus, PsycINFO, Scopus, HMIC, AMED, Public Health Database, ASSIA, CRD databases, PROSPERO, Web of Knowledge, Campbell Collaboration Library, and PubMed) in November 2016 for systematic reviews and meta-analysis of ERS in adults published in English language with no date restrictions. Additional reviews were searched until June 2017, via reference lists of included literature, alongside searches of UpToDate, BMJ Best Practice, and Dynamed Plus. Search strategies were constructed and then amended and agreed by group consultation of all those involved in this research project. As an example, search terms used for MEDLINE are available within the appendix (Appendix 1).

2.3.2. Review Selection

Review inclusion and exclusion criteria were constructed by the researcher (C.S) and then amended and agreed by group consultation and described in Table 2.1. The researcher (C.S.) independently examined titles and abstracts against the inclusion and exclusion criteria. Three members of the supervisory research team (G.H., T.G., and S.G.) independently assessed a randomized subsample of

articles, amounting to 20% of the total title and abstract sample. A group (C.S., G.H., T.G., and S.G.) consensus conferred on which articles were progressed further to full-text review and which excluded. Full-text review articles were then obtained and assessed by the researcher and a member of the supervision team (C.S. and S.G.) against the inclusion and exclusion criteria described in Table 2.1. Figure 2.1 describes the justification of excluding articles at multiple stages of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol. Any discrepancies were discussed until a consensus was reached.

Table 2.1. Inclusion and exclusion criteria used in collating Systematic reviews inclusion.

1. Not in English language	Due to lack of translation facilities, all non-English papers were excluded.
2. Type of study	Systematic reviews (which included RCTs, observational studies, case-controlled or other quasi-experimental studies within them) and meta-analysis were included for review.
3. Type of Intervention	Interventions promoting changes in physical activity behaviour via a direct referral from a health practitioner within primary care to a recognised exercise programme (e.g. local leisure centre, local walking scheme). Interventions initiated from secondary care and beyond were excluded alongside any health screening programmes.
4. Type of Participants	Adults (16 years and over) of any gender who had been diagnosed or placed at risk of non-communicable disease (e.g. type 2 diabetes, hypertension, cardiovascular disease) from their primary care practitioner. Interventions where participants were sedentary but had no further risk factors but were used as a control groups where included if reported separately.
5. Outcomes	Reviews were selected where the primary outcome measures reported were increase in physical activity (e.g. frequency, intensity) uptake and adherence to schemes, physiological and psychological (e.g. changes in Body Mass Index or Short Form (36) health survey). Outcomes could be measured objectively (e.g. with accelerometers) or by self-reported means (e.g. questionnaires). Where reported the cost effectiveness of schemes was included.

2.3.3. Data Extraction

Data were extracted by the researcher (C.S.) against a data extraction template and verified by one member of the supervisory team (S.G.), with any discrepancies discussed until resolution. Eleven

predefined constructs relating to the effectiveness of interventions were used (Appendix 2) taking guidance from work conducted by Greaves et al (2011).

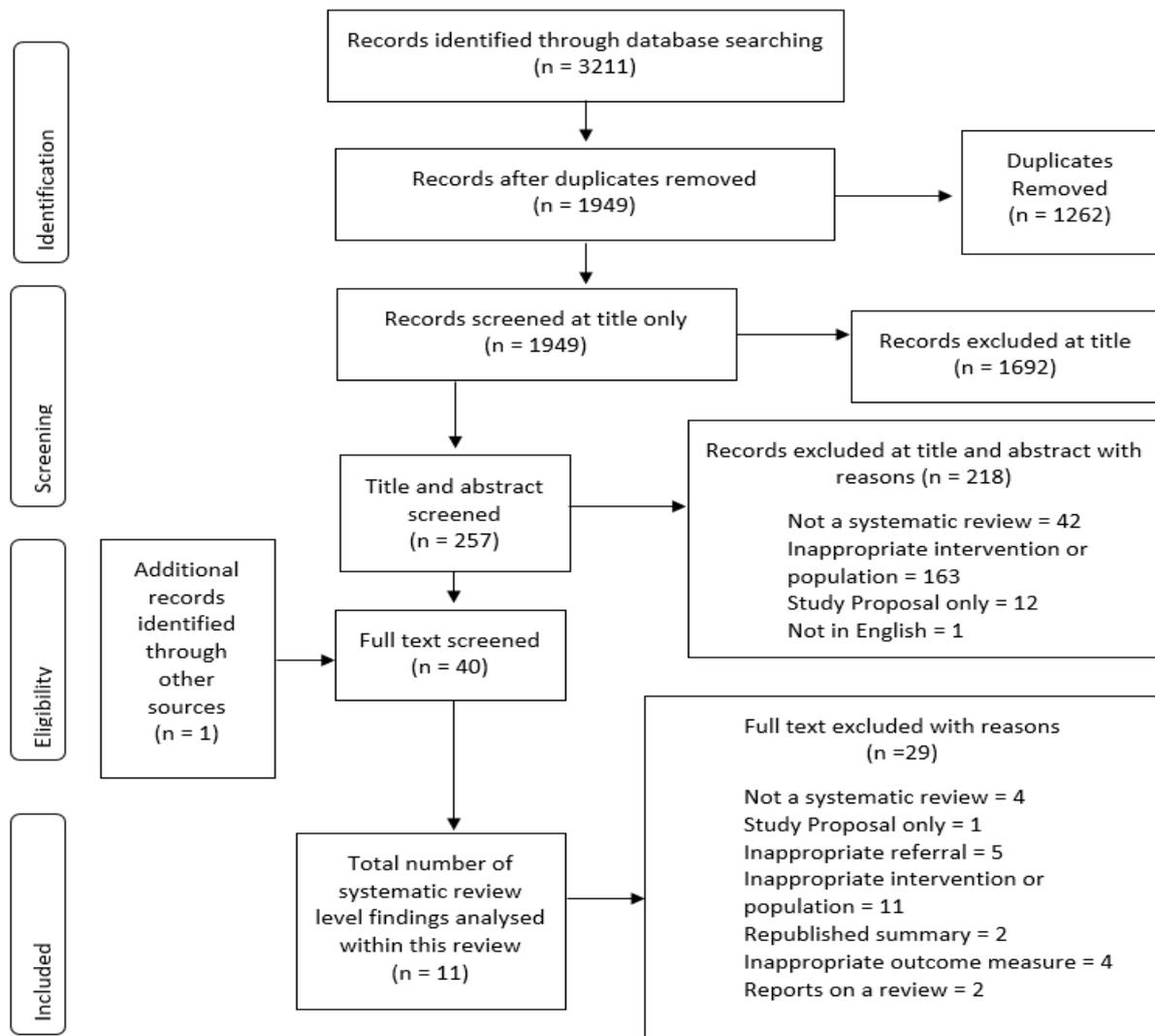


Figure 2.1. PRISMA flow diagram depicting study selection, screening, eligibility for inclusion and analysis.

2.3.4. Grading of Evidence

Each review was graded independently and empirically in duplicate (by C.S. and S.G.) with any discrepancies discussed. A Measurement Tool to Assess Systematic Reviews (AMSTAR) criteria was used to grade reviews. AMSTAR grades score as low (0–3), medium (4–7), and high (8–11) quality (Shea et al., 2007). Although the AMSTAR tool was developed to assess reviews of randomized controlled trials (RCTs) only, it has been shown to be applicable to reviews of nonrandomized studies, demonstrating good psychometric properties (Pieper et al., 2014). Cohen kappa was calculated as a measure of reliability for each AMSTAR item. Kappa values less than zero were rated as less than chance agreement; 0.01 to 0.20, slight agreement; 0.21 to 0.40, fair agreement; 0.41 to 0.60, moderate agreement; 0.61 to 0.80, substantial agreement; and 0.81 to 0.99, almost perfect agreement (Pieper et al., 2014). In addition, reviews were graded on the type of evidence they were reviewing, such as RCTs (see Table 2.2). The classification of AMSTAR (e.g. 9) was then combined with the type of evidence (e.g. A). For example, high-quality systematic reviews of RCTs were coded as 9A.

Table 2.2. Classification of strength based upon evidence included within reviews.

A	Systematic Reviews of RCTs
B	Systematic reviews of individual, non-RCTs, case-control studies, cohort studies, controlled before-and-after (CBA), correlation studies or similar.
C	Systematic reviews of both RCTs and non-RCTs, case-control studies, cohort studies, controlled before-and-after (CBA), correlation studies or similar.

2.3.5. Analysis

A narrative synthesis of the results indicating the quality of the evidence was more appropriate for a review of reviews than for example, a meta-analysis, and was considered for the following reasons: a lack of consistency within reporting of results to undertake a meta-meta-analysis and the variety of study interventions examined within the reviews. Furthermore, the present review aimed to

understand the “how and why” of ERS in order to gain an insight into the manner that ERS is reported. In accordance with reporting guidelines for systematic reviews, a Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist was conducted.

2.4 Results

A systematic search identified 3211 potentially relevant articles (see Figure 2.1). Following exclusion of duplicates and non-relevant articles, 39 articles were retrieved in full and assessed. One additional article was identified in March 2017 via a database alert that was initially set up from the original database search. Eleven reviews met the pre-established inclusion criteria (see Table 2.1).

2.4.1. Review Characteristics

All 11 reviews reported on an aspect of effectiveness within ERS; seven reviews examined referral to, uptake, and attendance at ERS (Morgan et al., 2016; Gidlow et al., 2005; Williams et al., 2007; Pavey et al., 2012; Pavey et al., 2011a; Campbell et al., 2015; Arsenijevic and Groot, 2017) with eight reporting for whom ERS is successful (Gidlow et al., 2005; Pavey et al., 2011a; Pavey et al., 2011b, Pavey et al., 2012; Campbell et al., 2015; Arsenijevic and Groot, 2017, Morgan, 2005; Orrow et al., 2012). Eleven reviews make comment on the theoretical underpinnings or BCTs within ERS (Morgan et al., 2016; Gidlow et al., 2005; Williams et al., 2007; Pavey et al., 2011a, Pavey et al., 2011b; Campbell et al., 2015; Arsenijevic and Groot, 2017; Morgan, 2005; Orrow et al., 2012; Sorensen et al., 2006). Eight reviews reported on changes of PA levels (Williams et al., 2007; Pavey et al., 2011a; Pavey et al., 2011b; Campbell et al., 2015; Arsenijevic and Groot, 2017; Morgan, 2005; Orrow et al., 2012; Sorensen et al., 2006) (Appendix 3). Reviews included data from a range of referral populations (e.g. hypertension, diabetes, raised cholesterol, mental health, and obesity) and delivery settings (e.g. leisure centre, primary care, green settings, such as community outdoor walks or

community gardening). Dates of published studies included within the reviews ranged from 1966 to 2015 and incorporated 221 cited articles of which 98 were duplicated across reviews. The researcher draws attention to three linked reviews resulting from our search by Pavey and colleagues (Pavey et al., 2011a; Pavey et al., 2011b; Pavey et al., 2012) who report different aspects of the same systematic search, and one by Campbell *et al.* (2015) whose initial search was based on that of the Pavey articles and built upon it. Where appropriate, unique items are reported separately.

2.4.2. Review Quality

The methodological quality of included reviews was generally of a medium standard (median AMSTAR score = 7.50 and mean AMSTAR = 7.00). Only three systematic reviews examined evidence adjudged to be of high strength (see Table 2.2). Table 2.3 illustrates the combined duplicate reviewer AMSTAR scoring and strength of evidence within the reviews. The mean interrater reliability (kappa) for applying agreement on review quality was .67 (95% confidence interval [CI], .87–.48). The most common methodological weaknesses adjudged via AMSTAR were the lack of lists indicating the included and excluded studies and the assessment of potential bias within the selection of articles (e.g. in meta-analysis assessment of publication bias should include a combination of graphical aids such as funnel plot and/or statistical tests such as Egger regression test or Hedges–Olken). The greatest methodological strengths were the comprehensive nature of the literature searches performed and the assessment and documentation of the scientific quality of the included studies. Table 2.4 highlights the reported uptake and attendance figures across reviews. Some reviews were able to pool results in order to conduct meta-analysis. Other reviews were not able to achieve this due to the lack of consistent reporting within the original articles. Recording and reporting methods of uptake, attendance, adherence, and theory varied within reviews and are detailed in the following sections.

Table 2.3. Total and mean AMSTAR scoring, classification of strength based upon evidence included within reviews and Cohen’s Kappa for inter-rate reliability.

Review lead author and year	Reviewer	Total AMSTAR score	Mean AMSTAR score	Evidence classification	Inter-rate reliability
Arsenijevic et al., 2017	CS	6	7	C	0.62
	SG	8			
Campbell et al., 2015	CS	9	9	C	0.39
	SG	9			
Gidlow et al., 2005	CS	3	2.5	C	0.74
	SG	2			
Morgan et al., 2016	CS	9	9	C	1
	SG	9			
Morgan, 2005	CS	6	6	A	1
	SG	6			
Orrow et al., 2012	CS	9	9	A	1
	SG	9			
Pavey et al., 2011a	CS	11	11	C	0
	SG	11			
Pavey et al., 2012	CS	4	5	C	0.49
	SG	6			
Pavey et al., 2011b	CS	9	8.5	A	0.74
	SG	8			
Sorensen et al., 2006	CS	2	3.5	C	0.42
	SG	5			
Williams et al., 2007	CS	7	7	C	1
	SG	7			

Narrative of Results

2.4.3. Referral Uptake

Uptake was defined within three linked reviews as attending the initial consultation (Pavey et al., 2012; Pavey et al., 2011a; Campbell et al., 2015). Two reviews did not provide a definition for uptake (Williams et al., 2007; Arsenijevic and Groot, 2017), whereas one review indicated that, it struggled to define uptake due to differences reported within evaluations (Gidlow et al., 2005). Table 2.4 highlights the reported uptake across reviews, demonstrating a range of uptake values between 35% and 85%. Three of the five reviews (Gidlow et al., 2005; Williams et al., 2007 and Pavey et al., 2011a), which report on uptake highlight similar values around 65%. Importantly, no review reported characteristics for a participant who failed to take-up ERS representing around 30% to 40%

of participants referred. Where reviews have reported characteristics relating to take-up, these figures are derived from participants present within the scheme.

Table 2.4. Reported uptake and attendance figures for Observational studies and RCT's where reported within reviews.

Review lead author and year	Strength of study	Reported uptake	Reported attendance
Campbell et al., 2015	9C	35-85%	25 - 86% for final assessment only
Gidlow et al., 2005	2.5C	< 67%	12 - 25%
Pavey et al., 2011a	11C	Observational studies 66% (95% CI = 57-75%) RCTs 80% (95% CI = 61-98%)	Observational studies 49% (95% CI = 40-59%) RCTs 37% (95% CI = 20-54%)
Pavey et al., 2012	5C	Observational studies 66% (95% CI = 57-75%) RCTs 81% (95% CI = 68-94%)	Observational studies 43% (95% CI = 32-54%) RCTs 80% (95% CI = 61-98%)
Williams et al., 2007	7C	66%	12 – 42%

One high-quality review reported that two studies demonstrated women were more likely to take up ERS than men (Pavey et al., 2011a). However, two studies within that review showed no association between gender and uptake of ERS. Pavey et al (2012) concluded that being female and of increasing age were a positive predictor of uptake. A low-quality review summarized that uptake was greater within females (60%– 40% for females' vs males, respectively) (Gidlow et al., 2005). Their review importantly highlighted that reporting of characteristics was poor and only reported within five primary studies (Gidlow et al., 2005). Pavey et al (2012) reported that participants who were more deprived and suffered from a respiratory diagnosis were more likely to take up ERS than those with the same diagnoses who were least deprived (odds ratio [OR] 1.45; 95% CI, 1.06–1.99; P < .05).

A high-quality review reported that pre-existing medical diagnoses were not separately reported, which prevented conclusions being drawn within these subgroups (Pavey et al., 2011a). One medium-quality review reported that participants referred with mental health problems were more

likely to participate in ERS than those with no medical referral (OR 1.79; 95% CI, 1.24–2.39; $P < .01$) (Pavey et al., 2012). However, participants with cardiovascular disease were more likely to engage than participants with mental health problems (OR 0.33; 95% CI, 0.27–0.57; $P < .01$), musculoskeletal problems (OR 0.75; 95% CI, 0.58–0.99; $P < .05$), or overweight/ obesity problems (OR 0.63; 95% CI, 0.50–0.81; $P < .01$). Overweight or obese participants were more likely to take up ERS than smokers (Pavey et al., 2012). Referral uptake to ERS was greater for participants referred from a cardiac nurse over those referred from either a GP or practice nurse (Pavey et al., 2012).

2.4.4. Attendance and Adherence

The most important finding from the reviews was a lack of reporting on exercise prescription adherence. No review detailed the type of exercise prescribed or the extent to which the participant adhered to the prescription. Reviews did report the term adherence; however, it must be understood that this term was a reference to attendance at the programme. As such, the term adherence from the original reviews is replaced by the more appropriate term of attendance in the current article. Large inconsistencies were observed surrounding attendance figures. Four studies failed to define attendance by determining a threshold, instead acknowledging the term as, “duration of participation within ERS” (Gidlow et al., 2005; Williams et al., 2007; Campbell et al., 2015; Arsenijevic and Groot, 2017). Pavey et al (2011a & 2012) used a threshold of $\geq 75\%$ attendance of available sessions within ERS programmes as its inclusion criteria for studies. Objective measures, such as the use of leisure centre records, were underutilized (Gidlow et al., 2005).

One high quality and one medium-quality review, based on the same initial systematic search, reported that males were more likely to attend from two studies, whereas three further studies within the reviews found no such association with attendance (Pavey et al., 2012; Pavey et al., 2011b). A further low-quality review reported attendance was higher in males (Gidlow et al., 2005).

Their review did report that one primary study citing higher attendance in women and two RCTs suggesting no relationship between sexes (Gidlow et al., 2005). Increasing age was positively associated with attendance to ERS from five studies in one review; however, in addition, it reported two studies suggesting no such relationship (Pavey et al., 2012). Gidlow et al (2005) reported two evaluations indicating increasing age and being retired were associated with better attendance. However, increasing age was found to reduce participation in PA from one RCT and one evaluation, whereas one RCT reported no relationship (Gidlow et al., 2005). One medium-quality review adds to these mixed views surrounding increasing age by reporting that attendance appeared to be higher in older participants (Morgan, 2005). Increasing attendance was more prevalent in participants who had higher baseline activity levels and were overweight (Morgan, 2005). Gidlow et al (2005) reported one study, which indicated that socioeconomic characteristics were unrelated to attendance. One high- and one medium-quality review indicated that socioeconomic characteristics were poorly reported, preventing any clear conclusions on the impact of different socioeconomic characteristics (Morgan, 2005; Orrow et al., 2012).

One review acknowledged that a medical diagnosis was a factor that could affect attendance; however, they reported it was not consistently demonstrated throughout their included studies (Gidlow et al., 2005). Participants with cardiovascular disease were more likely to attend than participants with pulmonary disease (Pavey et al., 2012). Physical health problems were a greater predictor of attendance than mental health issues (22% vs 34%, $P < .001$); however, it was not reported what was defined as a physical health problem (Pavey et al., 2012). Diabetic participants were less likely to attend ERS (OR 0.76; 95% CI, 0.63–0.93; $P < .01$) than those with cardiovascular disease (Pavey et al., 2012). Conversely, a medium-quality review reported that participants referred with sedentary lifestyles or diabetes demonstrated a higher adherence than those with cardiovascular disease or obesity (Arsenijevic and Groot, 2017). A high-quality review reported no consistent difference in attendance rates between participants within 1-of-3 at-risk groups: smoking, obesity, and hypertension (Campbell et al., 2015).

One high-quality review identified 17 studies that highlighted peer support and supervision support from staff as a facilitator for attendance to the referral programme (Morgan et al., 2016). Barriers to attendance were noted as follows: the location (distance to travel), difficulties reaching the activities by public transport, perceived safety of the location, timings of sessions, and cost (Morgan et al., 2016). A medium-quality review indicated that European programmes had greater attendance over American, Australian, or Canadian programmes (Arsenijevic and Groot, 2017). A meta-regression shows the duration of an ERS programme is not correlated with the attendance rate (Arsenijevic and Groot, 2017). However, a follow-up period greater than six-months, after the cessation of the programme, did have a positive effect on attendance when the scheme was running (Arsenijevic and Groot, 2017).

2.4.5. Behaviour Change Theories and Techniques

High-quality evidence from two reviews of RCTs (Pavey et al., 2011a; Orrow et al., 2012) showed that the transtheoretical model of behaviour change was the most frequently utilized underlying theory of intervention design, whereas social cognitive theory, theory of planned behaviour, and health belief model were used less. One low quality review (Sorensen et al., 2006) that did not directly report on any theoretical underpinnings suggested that schemes should consider implementing theory-driven approaches to behaviour change. One medium (Williams et al., 2007) and one high-quality (Pavey et al., 2012) review commented that the greatest challenge for ERS was in increasing uptake and improving attendance (Williams et al., 2007; Pavey et al., 2012). One review reported directly on how attendance was affected by theoretical techniques (Morgan, 2005).

Four reviews reported on theoretical techniques to increase PA time or change clinical markers (Pavey et al., 2011a; Pavey et al., 2011b; Campbell et al., 2015; Orrow et al., 2012). With the exception of a few primary studies, reviews reported little reference to the delivery, fidelity, or BCTs of health behaviour change (Williams et al., 2007; Pavey et al., 2011a; Pavey et al., 2011b; Campbell

et al., 2015; Orrow et al., 2012). Motivational interviewing was the most frequently utilized BCT, cited within eight reviews, (Gidlow et al., 2005; Williams et al., 2007; Pavey et al., 2011a; Pavey et al., 2011b; Campbell et al., 2015; Morgan, 2005; Orrow et al., 2012; Sorensen et al., 2006) with only one review indicating the fidelity of the technique (Campbell et al., 2015). One medium-quality review reporting on a primary study indicated that participants who received motivational interviewing combined with free vouchers had a greater self-reported PA score at 12-weeks than a control group given advice alone (all groups combined, $P < .001$) (Morgan, 2005).

The greatest increase in PA was observed in the intensive motivational interviewing and free vouchers group that offered six motivational interviewing sessions (55%, $P < .001$). No difference was evident at 1-year post-intervention between groups (Morgan, 2005). Morgan (2005) further reported that exercise-plus motivation versus exercise-only elicited a greater attendance over a 20-week programme (62% vs 38%, $P < .05$). A further primary study reported that there was no significant difference between three groups attending sessions when comparing, exercise alone, instructions based on the “relapse prevention” model, or sessions that included re-enforcement methods (prizes for high attendance). Attendance attrition was reported at 30% and 72% for all groups at 9 and 18 weeks, respectively (Morgan, 2005).

One high-quality review indicated that motivational interviewing was utilized predominantly by different practitioners but provides no indication of its impact (Orrow et al., 2012). A high-quality review reported two contrasting studies; one indicated that attendance was positively influenced by participant levels of self-determination, and one study found no association between these parameters (Pavey et al., 2011a). A medium-quality review reported participant dissatisfaction when lacking social support, or with an exercise leader lacking motivational skills (Williams et al., 2007).

2.5 Discussion

This review is the first to systematically identify, collate, and grade the evidence from review-level findings on ERS. The creation of this review highlights and summarizes the consistent and contradictory findings surrounding the reporting of, (1) uptake to ERS, (2) attendance and adherence to ERS, and (3) BCTs relating to attendance and adherence. The researcher will discuss the characteristics of studies and definitions used within them and how they affect uptake, attendance, and adherence. This review of reviews highlights how a lack of reporting and knowledge of what is delivered within ERS limits insight into both attendance rates and adherence to the prescribed programme. Where reported, considerations are made as to why participants with certain characteristics (e.g., medical referral) are more likely to take up and attend schemes. Finally, the researcher discusses the reporting of theoretical constructs and BCTs, proposing reporting tools that could be considered to help improve uptake and attendance.

2.5.1. Referral Uptake

Historically, through the reviews, it is reported that uptake of ERS sits around 60% to 70% of those referred. This suggests that no improvements have been made in increasing the number of participants starting a scheme over the years examined. Uptake to ERS was greater in RCTs than observational evaluations, as reported in Table 2.4. Explanation for this could centre on participants offering full consent, coupled with more stringent recruitment processes often excluding participants, which might have elicited higher commitment to the programme (Martin and Sinden, 2001; Benson and Hartz, 2000). Importantly, no review reported detailed characteristics of participants who are referred but fail to make contact with an ERS. Instead, reviews have commented on uptake figures from those who start a scheme. Although this review cannot comment on the research priorities of previous reviews or individual studies, the researcher suggests that this reflects a crucial gap in understanding within the primary data. It is important to

this review to question why this gap exists because if large subgroups of the population are not taking up a referral, they cannot benefit from the programme.

Reviews have attempted to unpick participant referral characteristics; for example, there have been suggestions that participants referred for a medical reason may show greater referral uptake compared with those with no specific referral (Pavey et al., 2012); however, most reviews are less clear on which demographics influence take-up. Referral to ERS from a cardiac nurse appears more effective than referral from any other health professional (Pavey et al., 2012), from which it could be inferred that the hospitalization surrounding the condition has served as a teachable moment.

“Teachable moments” have been described within health behaviour as a noticeable feature of a patient’s circumstance, which prompts a change of behaviour (Flocke et al., 2014). These opportunities are utilized within the patient–clinician interaction or by patients alone to foster positive health behaviours, such as increasing PA levels (Flocke et al., 2014; Lawson and Flocke, 2009). It is important to acknowledge that teachable moments do not occur within isolated situations. Systemic features, such as the expectations of those involved, communication skills of the health practitioner, and medical practice setting will influence the situation (Lawson and Flocke, 2009).

Reviews have indicated participant profiling is varied, and this lack of information on subgroups prevents any inference being drawn about whose ERS is best suited for. Pampel et al (2010) comment that low socioeconomic status groups have fewer opportunities to engage in services that promote good health, yet the picture is not clear in ERS. For example, Pavey et al (2012) have shown participants who had a medical referral coupled with a low socioeconomic status were more likely to take up ERS over participants with a higher economic status, but this was only within participants with a respiratory diagnosis. Further reviews (Morgan, 2005; Orrow et al., 2012) suggest that insufficient reporting of socioeconomic status within ERS prevents any conclusions being reached. The complexity of uptake of ERS, insufficient reporting within ERS (Morgan, 2005; Orrow et al., 2012)

coupled with a lack of clear guidance within the socioeconomic and health behaviour literature (Pampel, Krueger and Denney, 2010) means it is very difficult to produce generalizable statements surrounding the socioeconomic status and take-up of ERS.

2.5.2. Attendance and Adherence

In contrast to uptake, attendance figures across reviews appear greater within observational studies. Interpretation of attendance and completion rates should be treated cautiously due to a lack of a standardised protocol (i.e. objective, standardised, universally consistent measure of attendance) for reporting these figures across the literature. The lack of a standardised measure-surrounding attendance could see participants being classified as completing a scheme (Pavey et al., 2011a), although the reality may be attendance at a couple of sessions and attendance at the final exit session of the scheme. This invites questions as to why there is no standardized use of an objective count for attendance, as all outcomes of ERS are dependent on attendance at and adherence to the programme (Gidlow et al., 2005). The review by Pavey et al (2012) concluded that the number of exercise sessions made available within a scheme might elicit higher rates of attendance.

Meanwhile, Arsenijevic and Groot (2017) reported that attendance rates were not correlated with the duration of the programme. In addition, they report that a prolonged follow-up with increased contact time with researchers and exercise practitioners post-ERS could offer explanations to why attendance was greater during the programme (Arsenijevic and Groot, 2017). This in itself is suggestive that observational studies may reflect the true nature of ERS (Pavey et al., 2012).

Although uptake to ERS was reported to be slightly higher in females, overall, males were more likely to participate within a programme (Gidlow et al., 2005; Pavey et al., 2012; Pavey et al., 2011a).

However, various primary studies within these reviews found no association between gender and attendance. This review questions why there is such a poor base level of reporting with only three reviews, of which two reviews are based on the same study search criteria (Pavey et al, 2012; Pavey

et al., 2011a), reporting on gender characteristics and referral uptake (Gidlow et al., 2005; Pavey et al., 2012; Pavey et al., 2011a). The present review does highlight a greater number of reviews reporting on medical conditions and the impact they have on attendance. Despite this greater breadth of reporting, no clear consensus can be reached, with reviews reporting no difference in attendance between at-risk groups (Campbell et al., 2015); either participants with cardiovascular disease were more likely to attend (Pavey et al., 2012); or conversely, participants with cardiovascular disease were less likely to attend (Arsenijevic and Groot, 2017).

Inference on reporting of attendance figures could be suggestive of at least two aspects of ERS. First, it could suggest a referral process where the wrong participants are being referred into the system. Resolution of this could be gained through a clearer and more robust understanding of who is referred to ERS (Gidlow et al., 2005). Second, it could reflect a lack of knowledge of what participants adhere to within the programme. With no understanding of what is delivered within a programme, from an exercise prescription standpoint, and no reporting on the extent to which individuals adhere to the prescription, few conclusions can be drawn about the effectiveness of the scheme. It is important to question why this gap exists because if subgroups of the population are not completing the prescribed programme, then they clearly cannot benefit from the programme. It is important to acknowledge that participants will stand to benefit from any episode of PA completed, regardless of meeting the prescribed dose.

However, it is important to know and understand the FITT of prescribed exercise in these programmes, but this is not commonly recorded or reported. Knowledge of the prescribed dose could help to understand if it is too demanding, thus leading to participant drop out, or insufficiently demanding to engage participants or provide a clinical benefit. Development of the Consensus on Exercise Reporting Template allows detailed and explicit reporting of the delivery of ERS for policy makers and practitioners alike (Slade et al., 2016). Implementation of the Consensus on Exercise Reporting Template will further enhance the knowledge base and understanding for whom

prescribed exercise is beneficial. Ultimately, it must be understood that both attendance and adherence are multidimensional constructs affected by the relationship between participant and practitioner intertwined with participant centric factors (e.g. mood state, self-efficacy, time, and forgetfulness) (Slade et al., 2016) and potentially exercise prescription centric factors (e.g. frequency, intensity, time, and type of prescription).

2.5.3. Behaviour Change Theories and Techniques

Development of ERS was based on policy recommendations rather than theoretical guidelines developed for health promotion interventions (Arsenijevic and Groot, 2017). Riddoch et al (1998) reported that early ERS were not based on any behaviour change model. Failure to acknowledge, deliver, or evaluate behaviour change models during a programme prevents clear evaluation of the ERS. More often, the end point (e.g. PA levels, blood glucose concentration, attendance, and adherence levels) is the result of behaviour change. Evaluating and reporting interventions on outcomes alone is problematic with an array of influences that could determine the path between behaviour and outcome (Michie and Johnson, 2012). This is evident within the literature where success of ERS is judged as the outcome evaluation without taking into consideration the methods underpinning it, such as BCT utilized to motivate uptake or increase attendance levels to ERS or the quality of those delivering these BCTs.

Theories of behaviour change provide a validated framework to understand not only how behaviour changed, but also importantly why behaviour changed (Dombrowski et al., 2012). A review by Dombrowski et al (2012) found that the delivery and features of behaviour change techniques was heterogeneous in nature. In addition, a later review reported 44% of interventions did not report use of a theoretical framework (Prestwich et al., 2014). This lack of reporting within both reviews of ERS and the wider field of health behaviour prevents any clear guidance on which theory or BCT, or

how it is operationalized, is most effective to understand health behaviour and health behaviour change (Prestwich et al., 2014).

In the present review, the researcher has highlighted how uptake of ERS and attendance at ERS could be influenced by participant characteristics or external factors. Although factors such as that of socioeconomic status and teachable moments have been discussed, a further consideration would be the theoretical perceived risk. The health belief model and the common-sense model hypothesise that perceived severity combined with perceived susceptibility and external cues to actions are strong contributing factors within an individual's perception of threat (Jones, Smith and Llewellyn, 2014; Leventhal et al., 1980). Although this review of reviews cannot comment on direct causality to why individuals with certain medical conditions have a greater uptake or attendance rate, the researcher can stress the importance of trying to understand these factors. This understanding comes from the ability to record, report, and evaluate these perceptions. Tools such as the Illness Perception Questionnaire allow for a greater understanding of what an individual perceives of their condition (Broadbent et al., 2006). The brief Illness Perception Questionnaire has been shown as a valid and reliable measure of illness perception distinguishing between various illness groups and importantly for ERS is a predictor of attendance at cardiac rehabilitation classes (Broadbent et al., 2006). Incorporation of tools such as the Illness Perception Questionnaire seems essential to trying to understand theoretical factors or BCTs impacting on ERS uptake or attendance.

In line with Prestwich et al. (2014) this review of reviews reports that the transtheoretical model of behaviour change and social cognitive theory, alongside BCTs such as motivational interviewing, are used, but ultimately are underutilized tools. Fundamentally, the lack of theoretical reporting within ERS generates more questions than it solves. Is the lack of reporting due to there being a lack of delivery or, more an inability to efficiently test and report its delivery? Without assessing any possible association between the BCTs in conjunction with the theory they are based within, it is difficult to further our understanding of possible effects (Dombrowski et al., 2012). The reporting of

an intervention's BCT and delivery (e.g. duration, intensity, setting, group vs individual, verbal vs written, and the skill level of the practitioner deliverers) (Dombrowski et al., 2012) is imperative to improve understanding about which techniques are appropriate within ERS for improving uptake and attendance.

2.6 Implications for Practice and Policy

This review highlights the need for consistent reporting methods to be implemented within ERS. The ability to robustly detail participant characteristics from the point of referral to exiting the scheme (at any stage) will only enhance the understanding of the ERS process. The ability to gain an understanding of what is being delivered at a theoretical level (e.g. BCTs, such as goal setting or relapse prevention and the delivery process of these BCTs) and PA level (e.g. frequency, intensity, type and time) would allow strong associations to be attributed, or not, to these features, notably for understanding levels of attendance and adherence. Failure to have these fundamentals in order places increased pressure on ERS, notably when NICE is highlighting the scarce evidence of effectiveness for ERS schemes (NICE, 2014). The use of tools such as the Consensus on Exercise Reporting Template, Illness Perception Questionnaire, or behaviour change taxonomies will further help to understand how and why behaviour changed within programmes. Greater understanding at any level will benefit stakeholders, health practitioners, and participants alike, by providing individualized care pathways, in achieving the most effective results from stretched resources and improving programme implementation and viability.

2.7 Strengths and Limitations

This is the first systematic review of reviews focusing on ERS. By taking an overarching view of all the reviews, the researcher has been able to highlight key areas that require exploration to inform

future evaluation of ERS. However, due to the nature of reviewing systematic reviews, the researcher is unable to explore and provide detailed in-depth mechanistic knowledge surrounding ERS effectiveness. Additional problems arise for evidence reporting namely around AMSTAR grading. Although AMSTAR has been shown to demonstrate good psychometric properties, it was developed after four of the included reviews had been published. Subsequently, two of these reviews were classified as low quality, yet they provide vital insights into ERS. Although this review of reviews examined 11 systematic reviews, which in turn sourced 221 citations, 44% of citations were duplicated across reviews reducing the breadth of data available. Although this review draws attention to tools such as the Illness Perception Questionnaire to assess a participant's perception toward their illness, this review is unable to address participant's perspectives toward ERS, this is in part due to the scope of this review. The researcher acknowledges primary studies that have provided qualitative insight toward participant perspectives of ERS (Din et al., 2015; Eynon et al., 2016); however, there exists a knowledge gap in utilizing this for implementation refinement of ERS.

2.8 Directions for Future Research

Research should work hand in hand with practice and policymakers, in the first instance, to facilitate robust participant profiling: (1) to capture data on individuals referred but not taking up the referral to help reduce health inequalities widening as a consequence of not taking up the offer of a referral, (2) to generate a consensus on monitoring attendance and adherence to ERS with clearly agreed definitions and objective measures for reporting it, and (3) to incorporate explicit reporting of BCTs and what they are being used for. With a consistent and coherent basis for reporting, future evaluations and RCT interventions will be able to explore a multitude of potential interventions, safe in the knowledge they are grounded within consistent reporting, allowing for direct comparison between schemes. More research is needed surrounding ERS programme content. The very nature of ERS referral is for participants with lifestyle-related disease, yet, only small to moderate clinical

improvements have been shown within the literature. Perhaps it is because ERS are not fit for purpose; that is, ERSs may not include BCTs that relate to ill-health such as ‘information about health consequences’ and may not prescribe exercises that are relevant to a specific condition for example aerobic exercises to reduce risk of cardiovascular disease, resistance exercises to reduce risk of falls. The use of tools such as the Consensus on Exercise Reporting Template will help drive research on frequency, intensity, and type of PA delivered within programmes. Tools such as the Illness Perception Questionnaire have the potential to build greater understanding of whether individuals are potential candidates for referral to ERS or not and perhaps leading to a more efficient uptake process. These tools may help in understanding who and what specifically, contributes to each part of the complexity surrounding ERS.

Further research is required to establish methods that address the challenging nature of measuring BCT within real life interventions, such as ERS. Other research may be able to track participants over the long term, reporting on future primary care or hospital admissions with the ability to link it back to ERS data (Appendix 4). Although the potential for future research is hypothesised here, it is fundamentally reliant on robust, clear, standardized, and explicit reporting.

2.9 Conclusions

ERS benefit from not being constrained within a rigid framework, allowing a varied spectrum of delivery. However, it would appear that this, currently, may also be detrimental in understanding what works, why, and for whom. Complex interventions such as ERS, which involves multiple input from various health practitioners, requires robust and consistent recording and reporting of all its facets at every stage of the process. ERS outcomes, which are often judged in terms of increased PA, are subject to multiple, separate, and complex constructs along the way. We have reported that uptake levels to schemes have not changed and are potentially influenced by a variety of participant characteristics. Importantly, there is a requirement to know whom the people are those are not

taking up referral and thus missing the opportunity to potentially benefit from ERS. We have identified that attendance within schemes is potentially influenced by both participant characteristics and scheme definition. Critically, there is no knowledge or reporting to date on what participants adhere to within ERS. This systematic review of reviews has also highlighted that BCTs are poorly reported, preventing any knowledge of how and why change may have occurred. Given that ERS is for people at risk or with a medical condition, it seems intuitive that ERSs should include general BCTs shown to change PA (e.g. goal setting) but also BCTs that relate to ill-health (e.g. information about health consequences). Failure to robustly produce effective-reporting methods or have a clear scheme-wide consensus prevents any firm conclusions on causal effect. Ultimately, a lack of reporting prevents any research from accurately validating its hypothesis (Resnick et al., 2005) and within the construct of this review, assigning a true reflection on the effectiveness of ERS.

Chapter 3. SOCIO-DEMOGRAPHIC PATTERNING OF NON-ENGAGEMENT, ATTENDANCE AND SESSION COUNT WITHIN A SCOTTISH EXERCISE REFERRAL SCHEME.

3.1. Introduction

As extensively discussed in **Chapter 1**, ERS is a popular non-pharmacological PC-based PA intervention aimed at tackling NCD (**see section 1.1**). However, ERSs are under scrutiny for overall effectiveness (**see section 1.1**), due to a lack of evidence upon outcome effectiveness such as improvements in PA, or improvements in clinical health markers. Importantly, these outcomes are directly reliant upon an individual taking up an ERS referral, attending the designated number of prescribed sessions and adhering to the prescribed exercises within the programme (Pavey et al., 2012).

As extensively discussed in (**see section 1.1.3**), there exists a body of research examining the relationship between population demographics and ERS uptake and attendance (Pavey et al., 2012; Kelly et al., 2017; James et al., 2009, Hanson et al., 2013). Reviews by Gidlow et al. (2005) and Pavey et al. (2012) cited uptake in primary studies ranging between 23-60% and 28-100% respectively. Where studies have profiled participants, it appears they focus upon participants starting ERS (Harrison, McNair and Dugdill, 2005; Crone et al., 2008), however, very little focus is upon explicitly detailing the subgroups that do not take up referral. As previously commented in **Chapter 2**, failing to identify subgroups that are not taking up a referral (~30% of referrals) reflects a crucial gap of reporting within ERS, as those not taking up referral cannot benefit from the programme (Shore et al., 2019).

It is a widely established that dropout from ERS is an issue (Kelly et al., 2017), with attendance completion between from 12% and 50% being reported (Williams, et al., 2007; Kelly et al., 2017). As previously discussed, the heterogeneous nature of measuring attendance becomes problematic when comparing schemes (**see section 1.1.3**). Where it is possible to compare previous reporting, studies have shown that increasing age and being male are positive predictors of completing a

programme (Hanson et al., 2013; Gidlow et al., 2007; James et al., 2009). Where research has examined ethnicity, deprivation index, referral reason, employment status, or referring health practitioner, in relation to 'adherence' or as we suggest, session count, results become equivocal or non-predictive (Hanson et al., 2013; Gidlow et al., 2007; James et al., 2009; James et al., 2008; Lee et al., 2009; Kelly et al., 2017). Additionally, Hanson and colleagues (2013) explored the possibility of ERS site location influencing attendance. However, despite indicating that leisure sites are a significant predictor of attendance at 12 and 24-weeks, there was no reported objective distinction between either the sites or providers (Hanson et al., 2013). Therefore, it is not clear what within these sites, if anything, influenced attendance.

It is important to understand the relative importance of different variables in predicting uptake and maintenance of healthy behaviours and PA, furthermore, why they are important. One review reported men from lower socio-economic backgrounds were consistently found to be less likely to engage across a range of health checks than women or people from a higher socio-economic status (Dryden et al., 2012). This is important as these variables are well established risk factors for a range of clinical conditions. Similarly, one review and one primary study found that younger adults and those from lower socio-economic status were less likely to attend health checks (Attwood, Morton and Sutton, 2016; Koopmans et al., 2012). Measures of risk or presence of a health condition differ across the literature which may explain why uptake or a lack of uptake of health checks varies depending on the measure (Bunten, et al., 2020). Within the context of ERS it is important to measure socio-demographic factors appropriately in order to rectify any potential inequity. That is, if lower socio-economic background, older age and gender are associated with poorer health and these populations are less likely to engage with health behaviours; ERS without adaptation or increased efforts to increase uptake from these more "needy" populations, there is the possibility that ERS risks exacerbating rather than narrowing health inequalities.

As highlighted in **Chapter 2 (see section 2.4.4)**, when taken in a prescriptive medical context, adherence is usually described as the extent the patient's behaviour matches the agreed recommendations from the HCPs (Horne et al., 2005). Slade et al. (2016) employ a similar definition when dealing with clinical exercise reporting. Applying these definitions (Horne et al., 2005; Slade et al., 2016), adherence within the context of ERS, should investigate the FITT of prescribed 'medicine', in this case, exercise, and the level to which the patient follows the prescribed exercise programme. However, as previous established (**see section 2.5.2**), this is not standard practice within ERS (Shore et al., 2019). For example, in previous reviews adherence has been defined as, percent participation of the total number of available sessions (Pavey et al., 2012; Arsenijevic and Groot, 2017). This approach fails to take into account that ERS often have different durations; meaning one referral programme's 80% threshold may not represent the same number of sessions as another ERS. Adherence has also been defined as, attending the mid-or-end-programme consultation (Hanson et al., 2013). This definition fails to acknowledge attendance across the whole programme. Importantly, none of these definitions actually examine 'adherence' to the prescribed exercise, but instead examine attendance at ERS.

As extensively discussed, inconsistency around reporting leads to a potential myriad of problems. With this inconsistency surrounding definitions of adherence within the literature, it might be pertinent to reconsider the use of the term adherence when referring to completing sessions. It might be better to refer to objective counts of sessions completed as, session count. As such, and defined earlier (**see section 1.1.3**), this thesis will present the term, session count, defining it as the number of exercise sessions attended. Further, session count represents one aspect of FITT, that of frequency. This bears further importance if ERS is to be utilised as a non-pharmacological intervention to manage NCD, as session count is one component of adherence. To be able to draw strong conclusions about ERS, research needs to examine session count in relation to the FITT of a

programme. Notwithstanding this limitation, knowledge of how many times a participant takes their 'medication' (session count), irrespective of its type (mode) or strength (intensity), is important, in order to be able to compare participants' 'treatment' (exercise) prescription.

3.1.1. Aims

In order to start to understand if ERS is a suitable non-pharmacological therapy for NCD, there is a requirement to know of those referred, who is not taking up their medication (prescribed exercise), and of those that are, how long is their engagement (session count). The study addresses objective two of the thesis; investigate the socio-demographic characteristics of those who do not attend and those who do attend ERS and associations between attendee characteristics and attendance (**see section 1.5**). Subsequently, the study aimed to examine routinely collected data from an ERS in Southern Scotland. Secondary analysis of an ERS database was used to 1) profile participants' not taking up ERS; 2) describe any differences between those who do and do not take up referral; and 3) report session count of attenders and explore any relationship between attender demographics and session count.

3.2. Methods

3.2.1. Study Design

Anonymised historical data was retrieved on participants who were referred to an ERS within a Scottish local authority, between October 2016 and October 2017 and January 2018 and June 2018. A retrospective cross-sectional analysis allowed the exploration of participant characteristics (i.e. age, gender etc.) and scheme characteristics (i.e. quality of ERS site facilities) and their association with uptake and subsequent session count. The University of Stirling general university ethics panel granted ethics approval (GUEP 212) for the study.

3.2.2. Participants

The scheme accepts referral for adults aged 18 years or above, who are judged by a HCPs as not meeting PA guidelines and/or are suffering from a medical condition that could potentially benefit from increased PA. Referrals are accepted from HCPs (doctors, nurses and allied health professionals) in both primary and secondary care. Paper referrals are made from HCPs and sent to the ERS, where upon participants are contacted by staff from the ERS, briefed about the ERS and invited to attend their local facility to register onto the scheme and obtaining memberships cards. Data were available for people who took up the referral offer and attended the ERS between Oct 2016-Oct 2017 and those who did not take up the scheme between Jan 2018 – June 2018.

3.2.3. Exercise referral scheme

Administration of the ERS is by a Trust, registered as a Scottish charity, on behalf of the local council. The scheme operates out of 10 different leisure facilities and is free to attend for participants. Participants enrol in a 10-week programme; however, the Trust does not stipulate that the 10 weeks must run consecutively or when the programme must start. If participants are unable to make, or fail to attend specified exercise referral sessions, the Trust allows extension of the membership to allow participants to attend on an ad hoc basis. The nature of this approach allows for potentially large time (days) gaps between obtaining exercise referral membership and undertaking specified exercise sessions alongside potentially long gaps between exercise sessions. Facilitation of referral session is by an exercise referral instructor who holds a minimum of Register of Exercise Professionals (REPS) level 3 qualification commonly referred to as 'GP referral' or 'exercise referral' qualification, enabling them to work with patients with a range of medical conditions. Participants are enrolled on to one of three different weekly sessions, internally named as cardio-1, cardio-2 and, strength and balance.

Which session participants undertake is based upon their referral condition and discussion with the exercise referral instructors. Instructors may move participants between sessions to suit the ability and needs of the participant. Thus, participants could potentially attend one, two or three classes per week. These sessions sit within an over-arching long-term health referral programme. The sessions themselves are a mixture of aerobic and resistance style exercises, taken in a group setting. Sessions last between 50 and 60 minutes and consist of 15 minutes warm up and cool down, positioned either side of a 20 or 30-minute exercise period. Intensity of the session is on a self-monitored basis.

3.2.4. Data recording

An in-house routine service database captured data on participants. This study uses two different sets of data, captured at two different time points. First, data captured between October 2016 and October 2017 relates to participants registering for an exercise referral membership, obtaining a leisure facility card (which granted access to the facility) and presenting at the leisure facility and performing a minimum of one exercise referral session. This group of participants are classified as attenders. Second, between January 2018 and June 2018 data was captured about participants who were referred to the ERS but chose not to take up referral; that is, they did not present at the leisure facility. This group are classified as non-attenders. These are mutually exclusive categories (attenders/non-attenders). Historically within the ERS, data on non-attenders was never retained. As part of this research study, the ERS retained these data to provide an insight into who was not taking up ERS. Subsequently, data capture of attenders and non-attenders do not overlap. During data capture of non-attenders, (January 2018 and June 2018) data relating to attenders was unavailable. Recorded variables within the database at the time of referral include; name, gender, personal address, personal contact details, ethnicity, medical referral reason, referring HCPs job title, referring HCPs address, date of obtaining exercise referral membership card, site and type of session

attended, and number of exercise referral sessions attended. The count of exercise sessions came via the membership card acting as a measure to record when a participant entered into the facility to attend the exercise referral sessions. Data extraction was completed by one staff member (Health Development Officer) employed at the ERS. Data protection regulations from within the Trust, prevented all routinely collected variables from the scheme becoming available to the researcher. Routinely collected data excluded from this research amounts to name, personal address, personal contact details, ethnicity, referring HCPs job title and referring HCPs address. Detailed description of data made available to the researcher is presented below. Additionally, time lag is used as a variable of analysis of high and low attendance (defined below). Subsequently, a dichotomous time lag criterion of six-months and below or seven-months and above was used.

3.2.5. Independent variables

The study included six independent variables: gender, age, indices of deprivation, reason for referral to ERS and time lag (calculated as the sum of the number of days between obtaining ERS membership and date of first ERS session) and ERS leisure facility quality. Gender (male and female) was extracted from referral forms, which were pre-populated by referring HCPs. Age was recorded in years on the day of obtaining exercise referral membership and grouped into the following year bands: 16-24, 25-34, 35-44, 45-54, 55-64, 65-74 and 75+. Grouping of age bands allowed for direct comparison with previous research (Kelly et al., 2017). The Scottish Index of Multiple Deprivation (SIMD) 2016 is the Scottish Government's official tool for identifying areas of deprivation in Scotland. One staff member from the ERS transcribed participants' home postcodes into the 'postcode to SIMD rank tool' supplied by the Scottish Government (Scottish Government, 2016). Quintiles were measured between one = living in most deprived areas to five = living in least deprived areas. Referral reason was extracted from referral forms and were grouped into six health conditions, following James et al. (2009): cancers, respiratory, neurological, frailty and mobility, MSK

and cardiovascular. As described above, HCPs send referrals direct the ERS, who call participants to inform about the ERS and invite them to take up ERS membership. ERS membership is defined as a participant agreeing to enrol in the scheme and collecting a leisure centre membership card. Time lag was the sum of days between signing membership agreement and swiping their membership card to enter the facility in order to undertake their first exercise session. Additionally, analysis of high and low attendance (described below), a dichotomous criterion of six-months and below or seven-months and above were used.

Site location represented where a participant was referred too, and if appropriate, where they undertook their exercise referral sessions. James and colleagues grouped leisure sites via their funding source (James et al., 2008); however, all sites within this research study came from one funding source. Therefore, an alternative method of grouping was undertaken. All exercise referral sessions were in local leisure centres; hence, site location was graded using the following method: VisitScotland operates a Quality Assurance Grading Scheme for Visitor Attractions that also covers leisure centres. Facilities are graded on 43 different criteria elements (VisitScotland, 2014), with grades of 5* Exceptional, 4* Excellent, 3* Very Good, 2* Good, 1* Acceptable (VisitScotland, 2014). There is no legal requirement for facilities to sign up for this Quality Assurance Grading Scheme therefore; it is possible that VisitScotland does not have a record of the leisure facility (VisitScotland, 2014). Based upon this, site locations were grouped into the following categories: VisitScotland Quality Assurance star grade (e.g. 4*) or no record of assessment made of site by VisitScotland.

3.2.6. Dependant variables

The study included two dependant outcome variables, which were (i) non-attendance vs attendance and (ii) session count of attenders. This chapter profiles attenders and non-attenders according to the above-mentioned classification. As previously established, exercise referral membership allows access to specific exercise referral classes over a 10-week period, however the scheme often allows

ad hoc attendance if participants miss sessions. Session count was recorded via membership swipe card entry into the facility. Following Taylor and colleagues (1998), a median split of session count acted as a threshold for high or low session count. Those attending median count of sessions or below are classified as low attenders. Participants completing above the median threshold are classified as high attenders.

3.2.7. Statistical Analysis

Analyses were performed using Statistical Package for the Social Sciences (SPSS) version 23 (SPSS Inc., Chicago, IL, USA). Exploratory analyses were undertaken to establish descriptive measures of all independent variables; age, gender, SIMD, referral reason, site location and time duration between signing membership agreement and exercise commencement. In keeping with previous work (Kelly et al., 2017; Crone et al., 2008; Gidlow et al., 2007; Hanson et al., 2013) and where appropriate, Chi-squared (χ^2) analysis was used to investigate differences between high and low attendance and attenders and non-attenders. Where appropriate, data is shown as mean (range: minimum-maximum) or in pre-defined age bandings. Where data is skewed both mean and median (range: minimum-maximum) is presented. Where appropriate statistical significance is set at $p \leq 0.05$. A Generalised Linear Model (GLM) Poisson regression model, which met known assumptions, was used to compute 95% confidence intervals (CIs) for the association average session count to potential covariates. Main effects of the GLM assume all else being kept equal and no interaction. Where data was unreported on the referral form (referral reason, SIMD, and gender) for covariate stratification of GLM or χ^2 , individuals were excluded from analyses.

3.3. Results

3.3.1. Total study cohort

The total study cohort comprised 498 participants. Data was unpopulated on some referral forms and therefore missing from the ERS database (full data: referral reason; N = 496, SIMD; N= 483 and gender; N = 470). Fifty-seven percent of these participants were female, 70% over 65 years of age, and mostly referred for cardiovascular (31%), musculoskeletal (25%), or frailty and mobility (24%) conditions. Referrals were split evenly across ERS sites (see Table 3.1). Mean age of participants was 69 (20-93) years, with males and females being 69 (20-91) and 70 (32-93) years respectively.

3.3.2. Non-attenders

During a six-month period (January 2018 – June 2018) 93 participants chose not to take up the exercise referral programme. Data on attenders were not available during this period (January 2018 – June 2018), thus concurrent comparison between attenders and non-attenders is not possible. Table 3.1 describes the characteristics of non-attenders. Non-attenders were predominately female (55%), referred for cardiovascular or MSK conditions, above 65 years of age, classified as being from a SIMD 1 and 2 catchment areas. Referrals were spread evenly across the VisitScotland quality assurance-grading scheme of referral sites. Mean age of non-attenders was 68 (31-89) years, with males and females being 68 (31-89) and 69 (42-85) years respectively.

3.3.3. Attenders

During a one-year period (October 2016 – October 2017), 405 participants were recorded as presenting at the leisure facility to undertake an exercise referral session. Data on non-attenders were not available during this period (October 2016 – October 2017), thus concurrent comparison between attenders and non-attenders was not possible. Attenders were predominately female (58% vs 42%, N= 384), referred with a cardiovascular condition, over 65 years of age, classified as being

from a SIMD 2 catchment area with referrals spread evenly across the VisitScotland quality assurance-grading scheme of referral sites (see Table 3.1). Mean age of attenders was 70 (20-93) years, with males and females being 69 (20-91) and 70 (32-93) years respectively.

3.3.4. Attender's vs non-attenders

As previously established, the study draws on data that does not overlap (non-attenders vs attenders) and as such being able to make a concurrent comparison is not possible. However, it is important that research does begin to draw comparison between these mutually exclusive groups. Therefore, this study will present comparison data, while acknowledging an inability to draw strong conclusions from it. Chi-squared (χ^2) analysis revealed no statistical significant differences between participants classified as non-attenders or attenders for SIMD ($\chi^2(4) = 3.195$, $p = .526$), grouped age ($\chi^2(6) = 10.815$, $p = .094$), grouped site ($\chi^2(3) = 4.006$, $p = .261$), grouped referral reason ($\chi^2(5) = 7.70$, $p = .169$) or gender ($\chi^2(1) = 0.248$, $p = .619$).

3.3.5. Session count of attenders

Mean time lag between signing contract and presenting at the leisure facility for their first exercise referral session was 46 (0-427) days, however, median time lag was 14 days (see Figure 3.1). Eighteen percent (N = 73) of participants presented and scanned their membership card to enter the leisure facility for their first exercise referral session on the same day as signing the contract. Thirty-seven percent (N = 149) of the participants presented at the leisure facility for their first session within seven days and 52% (N = 201) of the sample within 14 days. Mean and median session count was five and four (1-25), respectively, (see Figure 3.2). Sixty-one percent (N = 248) of ERS participants completed five-exercise sessions or less, with one person attending 25 exercise referral sessions (see Figure 3.2).

Table 3.1. Descriptive count and percent of total participant count of participant demographics, and VisitScotland quality assurance grading scheme of referral site, for non-attenders, attenders, and total study cohort.

Referral reason	Non-attenders		Attenders		Total study cohort
	Frequency count (N)	Percent of total participant count (%)	Frequency count (N)	Percent of total participant count (%)	Percent of total participant count (%)
Cancers	1	1	8	2	2
Respiratory	4	5	15	4	4
Neurological	5	5	60	15	14
Frailty and mobility	18	19	99	25	24
Musculoskeletal	32	34	92	23	25
Cardiovascular	33	36	129	32	31
Total	93	100	403	100	100
SIMD quintiles					
SIMD 1	17	18	56	14	15
SIMD 2	24	26	109	28	28
SIMD 3	22	24	73	19	19
SIMD 4	17	18	75	19	19
SIMD 5	13	14	77	20	19
Total	93	100	390	100	100
Age Banding (yrs)					
16-24	0	0	2	0	<0
25-34	1	1	4	1	1
35-44	4	5	4	1	1
45-54	5	5	30	7	7
55-64	18	19	84	21	20
65-74	32	34	136	34	34
75+	33	36	145	36	36
Total	93	100	405	100	100
VisitScotland quality assurance-grading scheme					
3 Star	32	35	120	30	31
4 Star	28	30	144	35	35
No Record or assessment	33	35	141	35	34
Total	93	100	405	100	100

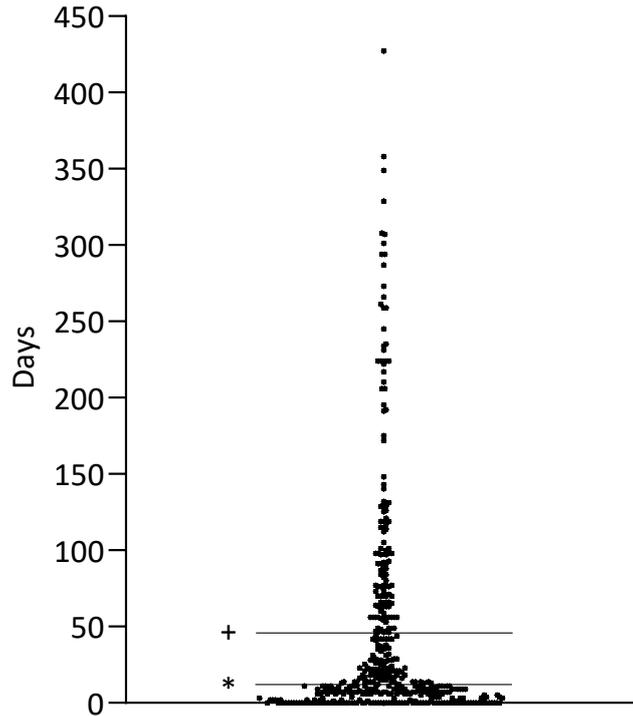


Figure 3.1. Time lag in days between signing contract and presenting at the leisure facility for first exercise session with + and * representing mean and median time delay, respectively.

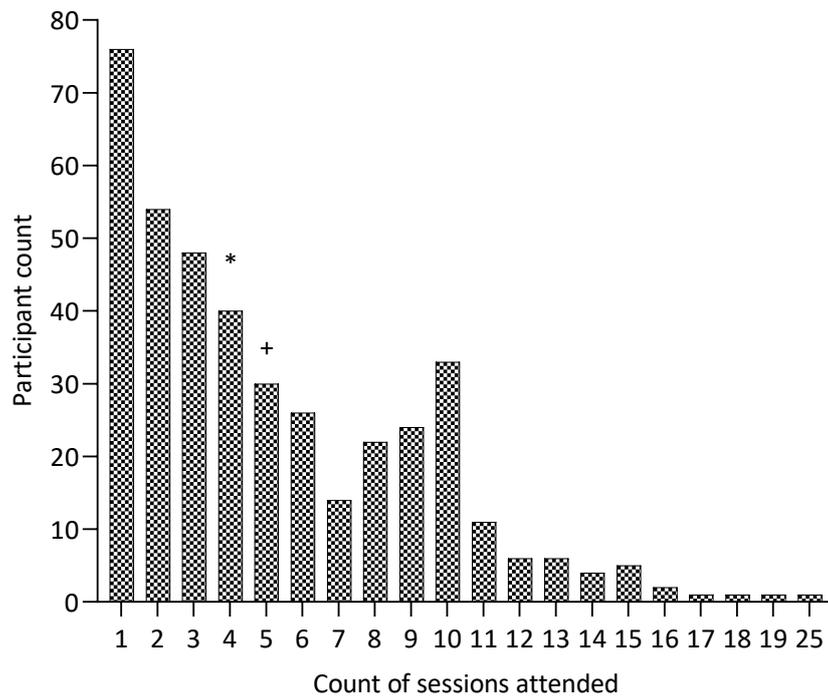


Figure 3.2. Count of participants exiting scheme with + and * representing mean and median session count across ERS, respectively.

The median value of four exercise sessions completed was the threshold used in this study to classify high or low attendance. Similar percentages were observed across variables either below or above median session count (see Figure 3.3). A comparison of high and low attenders was conducted; chi-squared (χ^2) analysis revealed no statistical significance for SIMD ($\chi^2(4) = 2.442, p = .655$), grouped age ($\chi^2(6) = 5.273, p = .509$), grouped site ($\chi^2(2) = 1.572, p = .456$), grouped referral reason ($\chi^2(5) = 9.270, p = .099$); gender ($\chi^2(1) = 0.150, p = .699$) or time lag, when grouped by above or below six-month threshold, ($\chi^2(1) = 1.910, p = .167$).

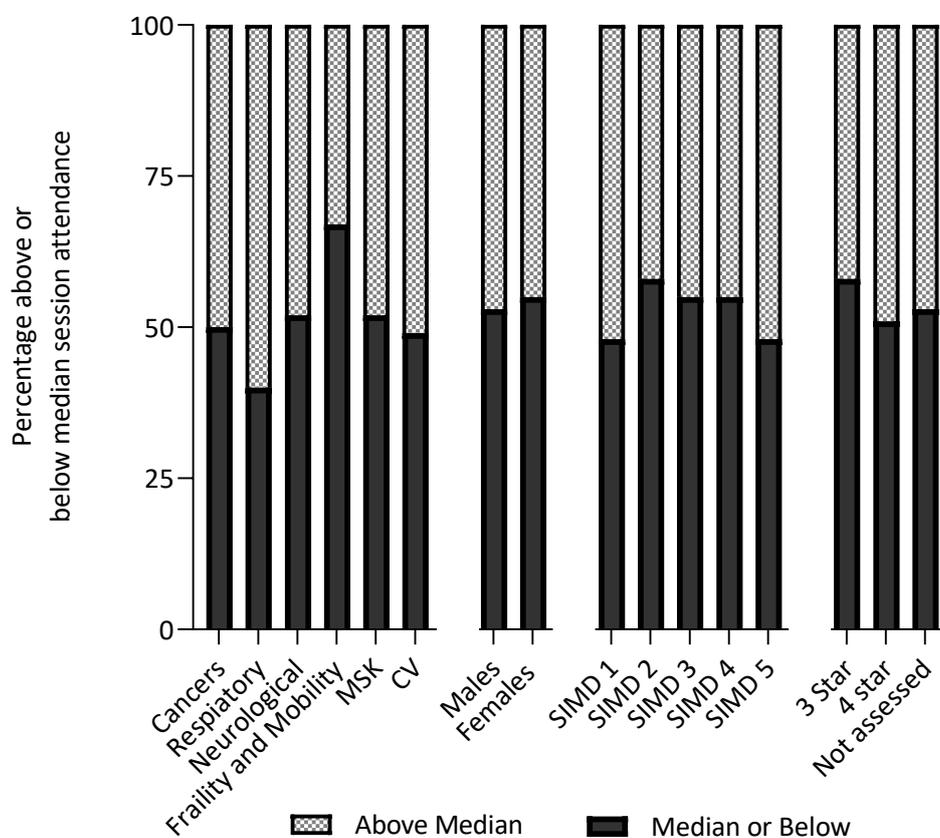


Figure 3.3. Participant demographics and ERS site quality percentage above or below median session count.

Model results presented in Table 3.2 include parameter estimates from GLM Poisson regression.

There is insufficient evidence suggesting males perform more sessions than females. Statistical significance was observed between the SIMD 2, 3, and 4 when compared to reference value of SIMD

5, meaning those from lower SIMD areas performed fewer sessions. However, such a small difference is indistinguishable from chance fluctuations. Statistical significance was observed in those referred with frailty and mobility compared to reference value of referral with a cardiovascular condition (.801, 95% CI, .698 to .918, $p = .001$). A Lack of participants present in the younger age bandings reflect uncertainty in the data reflected by wide confidence intervals for those aged 16-24 (.750, 95% CI .353 to 1.592, $p = .454$) and 25-34 (.958, 95% CI .561 to 1.727, $p = .985$). Statistical significance was observed with those grouped in 55-64 years of age performing 25% fewer sessions than reference value of above 75 years of age (.753, 95% CI .658 to .862, $p = <.001$). Statistical significance was observed for sites graded as being 3 stars completing less sessions, compared to the reference value of no grading (.855, 95% CI .759 to .964, $p = <.010$). Last, evidence is extremely limited to suggest a time lag in starting ERS has an impact upon session count (1.001, 95% CI 1.001 to 1.002).

Table 3.2. Generalized Linear Model Poisson regression with 95% confidence intervals linking known variables to mean session count of attenders.

	Parameter (Intercept)	B	Sig.	Exp(B)	95% Wald Confidence Interval for Exp(B)	
		1.834	0.000	6.261	Lower	Upper
Gender	Male	0.049	0.329	1.051	0.951	1.160
	Female	0 ^a		1		
Deprivation	SIMD 1	0.005	0.952	1.005	0.864	1.168
	SIMD 2	-0.162	0.015	0.851	0.747	0.969
	SIMD 3	-0.202	0.007	0.817	0.706	0.946
	SIMD 4	-0.161	0.027	0.851	0.738	0.982
	SIMD 5	0 ^a		1		
Referral reason	Cancers	0.088	0.599	1.092	0.786	1.519
	Respiratory	0.166	0.206	1.181	0.913	1.528
	Neurological	-0.011	0.875	0.989	0.861	1.136
	Frailty and mobility	-0.222	0.001	0.801	0.698	0.918
	Musculoskeletal	-0.026	0.686	0.974	0.857	1.107
	Cardiovascular	0 ^a		1		
Grouped age	16-24	-0.288	0.454	0.750	0.353	1.592
	25-34	-0.015	0.957	0.985	0.561	1.727
	35-44	-0.840	0.063	0.432	0.178	1.048
	45-54	-0.146	0.155	0.864	0.707	1.057
	55-64	-0.284	0.000	0.753	0.658	0.862
	65-74	0.001	0.985	1.001	0.898	1.115
	75+	0 ^a		1		
Starting ERS	Time duration starting ERS	0.001	0.000	1.001	1.001	1.002
Rating of ERS facility	3 Star	-0.156	0.010	0.855	0.759	0.964
	4 Star	0.052	0.357	1.053	0.943	1.177
	No Record or assessment (Scale)	0 ^a 1 ^b		1		

Dependent Variable: Sessions frequency Model: (Intercept), gender, SIMD, grouped medical, grouped age, time duration starting ERS, Grouped site

a. Set to zero because this parameter is redundant

b. Fixed at the displayed value.

3.4. Discussion

3.4.1. Main findings of this study

The aim of this study was to; 1) profile participants' not taking up ERS; 2) describe any differences between those who do and do not take up referral; and 3) report session count of attenders and explore any relationship between attender demographics and session count. Non-attenders were predominately female, aged 65 years of age and above, classified as living in areas of greater deprivation and experiencing cardiovascular disease or MSK condition. Concurrent comparison between non-attenders and attenders was not possible, however, demographics of participants classified as attenders of ERS appear similar to that of non-attenders. Attenders were mostly female, aged 65 years or above, living in areas of greater deprivation and experiencing cardiovascular disease. Session count of attenders was low, with a median and mean session count of four and five sessions respectively. In comparing high and low session count, there was statistical evidence to suggest that participant demographics or ERS site quality influenced engagement.

3.4.2. Participant profiling of non-attenders

As previously highlighted (**see sections 1.1.3 and 2.5.1**), participant demographics from past studies are generated directly from those who start ERS (Harrison, McNair and Dugdill, 2005; Crone et al., 2008), with little focus on the subgroup that do not take up referral. Previous studies have suggested that females and older adults (Pavey et al., 2012; James et al., 2008; Gidlow et al. 2007) are more likely to take up referral. Establishing if certain demographics influence uptake of ERS is unclear, however, cardiovascular and MSK condition are prominent conditions cited for those taking up ERS (Kelly et al., 2017; Pavey et al., 2012), but this may be due to more people with these conditions being referred. Data from this study reports female, older adults, those residing in areas of greater deprivation and experiencing a cardiovascular or MSK condition, as being the prominent demographics for non-attenders, which may reflect greater primary care use in these groups.

Over a 10-year period, Scottish primary care has seen a 20% increase in patients aged 65 years and over (ISD, 2018). Consultation rates increase with age, are more common in females than males, and more common in lower quintiles of deprivation (ISD, 2013). Cardiovascular disease is the most common cause of death globally (Townsend et al., 2015). While mortality in the UK is declining, prevalence of cardiovascular disease appears to have increased in Scotland (Bhatnagar et al., 2016), with further data suggesting the largest increases were in men and women aged over 65 years (Bhatnagar et al., 2016). This may explain why a greater proportion of non-attenders are older, female, and experiencing a cardiovascular condition; a reflection of primary care use. None the less, this study is unable to report concurrent rates between non-attenders and attenders to establish if rates are reflective of primary care use or another factor.

3.4.3. Participant profile of attenders

This study reports participants who attended at least one exercise session as being predominately female, aged above 65 years of age, living in areas of greater deprivation and experiencing a cardiovascular condition. While it was not possible to undertake concurrent comparison between attenders and non-attenders, a non-concurrent comparison was performed. It revealed that there was no evidence of statistical difference between groups. Previously discussed, published data on ERS uptake reflects those who start a programme (**see sections 1.1.3 and 2.5.1**). Previous studies report that being female and of older age (Pavey et al., 2011a; Gidlow et al., 2005) to be the most consistent predictor of starting an ERS, which this study data reflects. Previous data is unable to infer further upon referral condition or deprivation level influencing starting ERS (Pavey et al., 2011a). Data from this study adds to the body of evidence in providing further evidence. However, as this study reports no difference between non-attenders and attenders, it may well be that HCPs refer more females, who are older and have a cardiovascular condition, as discussed above.

3.4.4. Session count of attenders

The present study reports a low session count and is in keeping with previous studies and reviews who have reported high dropout (reported as adherence in their studies) (Hanson et al., 2013; Gidlow et al., 2007, Kelly et al., 2017). However, limited studies have reported data directly upon session count (Hanson et al., 2013, Taylor, Doust and Webborn, 1998). Hanson and colleagues (2013) report mean session attendance as four sessions for participants who stopped attending before the 12-week midpoint of ERS. For those participants who did attend the 12-week midpoint, the mean session count was 13 sessions. Those who attended the 24-week exit assessment, mean session count was 22. The present study reports a lower session count than a 10-week RCT (Taylor, Doust and Webborn, 1998) which reported a mean of nine sessions. Acknowledging the heterogeneity of ERS (e.g. scheme duration), it is important to start drawing comparisons, where possible, between schemes to determine what might be influencing session count.

Previous studies report that being male and of an older age is a greater predictor of staying in the programme (Pavey et al., 2011a; Pavey et al., 2012; Gidlow et al., 2005). This present study found no statistical evidence when using χ^2 analysing attendance above or below median threshold (see Figure 3.3), to suggest that demographics had an influence. The present study did find some statistical significances between session count and attender's demographics, within the GLM model (see Table 3.2). In practical terms, this represents a limited real-world change. For instance, this study reports those grouped in 55-64 years of age perform 25% less sessions than reference value group, those above 75 years of age (.753, 95% CI .658 to .862, $p = <.001$). This represents those aged 55-64 years departing from the mean session count of four by 0.6 and 0.8 of a session less.

The present study was able to explore if site location, since all ERS participants undertake their exercise prescription at a set location, influenced session count. Only one other study has considered site location as an independent variable (Hanson et al., 2013). Hanson presented a mean range across sites (min-max, 15-31 sessions completed), for participants who attended the 24-week follow

exit interview (Hanson et al., 2013). Direct comparison against this study is difficult, due to their inability to distinguish any objective difference between referral sites (Hanson et al., 2013).

Meanwhile the present study attributed a quality standard across sites. However, the VisitScotland quality assurance-grading scheme does not account for provision of ERS. In addition, this study reports the quality of the site is not an influencing factor in session count. Therefore, we must consider additional factors that might influence session count.

Additionally, there is a lack of evidence upon what happens to those who choose to exit ERS early. For example, do they go on and become independent exercisers. This may have an impact on both the participant and the scheme. The current evidence does suggest that schemes with a longer length (20+ weeks) have a positive impact on health and improving PA levels (Rowley et al., 2018; Edwards et al., 2013). Furthermore, in more traditional schemes of 10-12 weeks (NICE, 2014), there has been no consistent evidence of an increase in PA following participation in an ERS (Campbell et al., 2015). This suggests that those who exit early are unlikely to become independent exercisers, however, this is a summation of the researcher, rather than backed by evidence. Early exit by participants may also have an impact upon the cost-effectiveness of the programme. That is, if participants exit early, should this allow ERS stakeholders to redeploy ERS instructors when they are not being used or reduce their hours?

3.5. Directions for Future Research

Knowledge of who is referred to ERS, in conjunction with when they stop attending provides critical information in understanding who may be at risk and not be in a position to benefit from completing their prescription. This study highlights that non-attenders and attenders appear very similar as a sub-population and session count, which is low, appears not influenced by demographic factors. Therefore, there is a need to investigate beyond demographic factors.

Akin to factors contributing to poor pharmacotherapy adherence, future research has to consider an exercise prescription from both the patient's point of view and that of the prescribers (HCPs and exercise referral instructor). One reason an individual might not complete a course of medication may involve suboptimal health literacy (Brown and Bussell, 2011). Research from the Scottish Health survey (2017) indicates that 73% of adults considered their health as good or very good. Their self-perception may render ERS prescription, from the participant's point of view, an unwarranted need and choose not to take up the referral. Another patient focused consideration is the lack of involvement in the treatment decision-making (Brown and Bussell, 2011). This current study does not know if patients requested a referral to ERS or not.

Support from ERS instructors or fellow attendees has been shown to contribute to maintenance of ERS (Morgan et al., 2016). Additionally, psychological need satisfaction, intrinsic motivation, social support, and self-efficacy are notable factors in contributing to ERS attendance (Eynon et al., 2019). ERS instructors may be able to foster intrinsic motivation and autonomy through providing exercise choices to participants (Eynon et al., 2019). Participants in the present study completed a pre-planned circuit session, and it is not clear what level of modification participants have around the types of exercise, which may have influenced a lower session count. Conversely, the group nature of the session may have allowed participants to feel related to others and help to improve participants' attendance and competence to exercise (Eynon et al., 2019). Therefore, it is recommended that future studies exam what role participants have in designing their treatment course (i.e. FITT of prescribed exercise) and what support referral instructors offer to help increase attendance.

ERS referral is from an HCPs to a third-party site to work with an exercise specialist. Any inconsistencies between these two parties including ineffective communication may further complicate matters for the patient (Brown and Bussell, 2011). Therefore, further recommendations of future research would be to explore the level of information from HCPs to patient. Why patients

might not start or stop taking their 'exercise medication' early are likely to complex and multifactorial.

Furthermore, there is a need to investigate what happens to participants after exiting early from the scheme and any potential impact this may have on the participant or the scheme. That is, those who exit early, do they become independent exercisers. There is also a need to understand the impact upon ERS. If participant exit early, if this a cost-effective for the scheme or is the a potentially negative impact on ERS instructors if they are redeployed or have their hours reduced.

3.6. Strengths and Limitations

Although the study examined participant's engagement with the scheme, it is unable to identify barriers and facilitators of uptake or attendance. Qualitative methodology would provide examination of the experiences of participants and instructors within the scheme. It is important to acknowledge that periods of data collection do not directly overlap. With no previous figures of non-uptake available, a true reflection of differences between non-attenders vs attender's demographics factors cannot be inferred. As such, the researcher acknowledges the potential for the confounding effects of seasonal variation, referrer habits or staff developments that are beyond control.

Variables collected by the ERS, but not made available (e.g. ethnicity) reduce the number of variables on which to explore. Exercise instructors running referral classes could allow participants into the facility without the need to swipe the membership card. Subsequently, there may be potential over-or-underestimation that may present from using entrance cards into the leisure site as a proxy of session count. However, with no registers taken within sessions, this was the only means available to track number of sessions completed. Despite these limitations, this study benefits from strong ecological validity, which is important in determining and reporting real life factors that may play a role within the success of ERS.

3.7. Conclusion

This study provides socio-demographic patterning of attenders and non-attenders referred to a Scottish ERS. This study reports no discernible differences between the sub-population choosing not to take up their prescription and those who chose to attend. During the period assessed, session count at this ERS was low, with nearly 61% of the cohort stopping their prescription at five sessions or fewer. Those who choose to exit the scheme earlier are not in a position to benefit fully. Exercise prescription will not work for patients who do not take part. Thus, there is a need to investigate factors that may influence how participants engage with their exercise prescription and how to increase session count. In order to compare ERS programmes and advance the evaluation of clinical effectiveness of exercise prescription, this study advocates a sustained and coordinated effort from ERS and future evaluations, to produce, as a minimum, objective counts of sessions completed. However, session count is just one aspect of a broader picture, where it is vital to know what an individual completes within ERS.

Chapter 4. REPORTING OF PRESCRIBED DOSAGE OF EXERCISE WITHIN EXERCISE REFERRAL SCHEMES IN SCOTTISH COMMUNITIES.

4.1. Introduction

Previous research, alongside findings from **Chapter 2**, highlights that ERS are highly heterogeneous (Pavey et al., 2011a; Graham, Dugdill and Cable, 2005) and descriptions of the prescribed exercise dosage are often suboptimal, prompting a lack of clarity about the content (FITT) of programmes (Slade et al., 2016). Resistance training, outdoor walking, swimming, aerobics and gym sessions are all forms of PA or structured exercise that have been reported within ERS schemes (Arsenijevic and Groot, 2017, Orrow et al., 2012, Webb et al, 2016). However, the level of description of these in published studies of ERS varies dramatically. How ERS are variously described is presented in **Chapter 1**, hence, only a few examples are provided here.

Webb et al. (2016) investigated a three-arm intervention between laboratory based exercise vs. community walking exercise, vs. attendance at the National Exercise Referral Scheme of Wales (NERS), where the description of the NERS programme amounted to, reporting of the number of sessions per week and how long the session lasted (Webb et al., 2016). Moore (2013) reporting of NERS was, supervised activities, for at least four weeks for safety reasons, participants were primarily offered group-based patient-only exercise opportunities. While allowing local definition of exact form, however, the programme was to involve a variety of activities (Moore et al., 2013). One systematic review attempted to extract the type and mode of PA offered in primary studies (Rowley et al., 2018). The review went as far as reporting generic results: one-to-one supervised gymnasium-based exercise sessions, prescribed both cardiovascular, and resistance exercises, chair-based exercise sessions, group aerobic classes and swimming (Rowley et al., 2018). Hence, ERS descriptions are very brief, variable and described by number of weekly sessions and duration of each session and/or type of exercise. Missing therefore is a detailed description of the FITT of prescribed exercise.

While journal word restrictions may limit detailed reporting, such ambiguity upon the level of intervention delivered (FITT) leads to a myriad of potential problems for interpreting the efficacy of ERS. Moreover, without this level of detail upon design, there is an inability to replicate the study; failure to establish which aspect may or may not have a positive or negative influence; and failure to establish a dose response or threshold that a participant must achieve to reap any clinical benefit. This latter consideration is imperative if exercise is to be used as an adjunct therapy or replacement to medication for NCD's.

4.1.1. Aims

Therefore, the overall aim of this study was to describe the FITT of prescribed exercise in ERS, which addresses objective three of the thesis (**see section 1.5**). The study will report prescribed frequency of exercises, prescribed intensity as classified by low moderate or vigorous, the type or prescribed exercise (i.e. running, weights, aerobic, resistance) and the prescribed time duration of the exercise. Further, exploring if the prescribed exercises changes over time. The study will also explore any relationship between referral condition and the FITT of prescribed exercise.

4.2. Methods

4.2.1. Study Design

The study employed a cross-sectional analysis of routine participant data and exercise prescription cards, of individuals attending a rural ERS. The University of Stirling NHS, Invasive or Clinical Research Panel granted ethics' approval (NICR (17/18) Paper No.004).

4.2.2. Exercise referral scheme

At the time of the study, the ERS investigated in the study reported in this chapter operated in four different sites spread across a rural part of Western Scotland. All four ERS sites came under the control of one Trust, established by the local council and operated as a charitable company. The ERS were located within small towns, 47% of catchment area served by the ERS resided within rural areas, and there was no settlement of 10,000 people or more within a 60-minute drive (Scottish Government Urban-Rural Classification 2018). Participants enrolled in a 12-week programme, which allowed access for two sessions per week, held on Tuesdays and Thursdays. The current cost of the programme was £3.90 per session. Participants who completed all referral sessions and progressed from the programme were offered the opportunity to join the leisure centre via a concessionary membership. Similar to the ERS described in **Chapter 3 (see section 3.2.3)**; instructors who held the REPS level 3 GP referral qualification led exercise referral sessions.

Participants were responsible for making contact with the ERS and subsequently presenting themselves at the site with their paper referral from the HCPs. They undertook an introductory interview with the referral instructor, during which, the instructor explained the programme, timings, and price, gave a tour of the facility, and reviewed the referral condition and any potential co-morbidities. Within this interview, instructors established any potential barriers or facilitators to undertaking the programme and discussed with the participant any exercises they would like to partake in, or any goals from participation in the scheme. The exercise referral session was held in a gymnasium setting, making use of cardiovascular machines, resistance machines, and free weights or using bodyweight as a means of resistance. Subsequent sessions comprised an aerobic warm up, followed by a combination of further aerobic exercise, or resistance exercise, and a cool down period. Each participant received a personalised prescription card; performed the exercises independently, whilst being closely monitored by the instructor. Participants were encouraged to interact with other participants within the scheme who were also present in the session. Physical

capacity of the various gymnasiums restricted the number of ERS participants able to attend to between 8-15 participants per session. The gymnasiums were open to the public at the same time that ERS sessions were held.

4.2.3. Participant recruitment

As is common with other ERS (see sections 1.1 and 3.2.3), participants within the scheme were adults aged 18 years or above, who were not meeting PA guidelines as judged by HCPs and/or are suffering from a medical condition that could potentially benefit from targeted exercise and increasing levels of PA. In addition to the standard introductory interview conducted by instructors, described above, participants were made aware of the study being conducted. Two meets were previously conducted with exercise referral instructors, detailing the rationale behind the study, and the level of data required. Across these two meetings, instructors were given the opportunity to ask any questions. Contact details were made available if the need for further questions arose. At the introductory interview, exercise referral instructors talked through the participant information sheet explaining the study and allowed time for any questions the participant might of had. Participants were given a minimum of 48-hours to provide informed consent to release data. It was made explicitly clear; participants choosing not to be part of the study would receive the same level of 'care' (in this case, exercise prescription) of those who did. Those who chose to be a part of the study signed informed consent forms; counter signed by an exercise instructor. The nature of the study-required no new data to be collected and made use of data routinely held by the scheme to be released. Participants who were referred to and took the referral between June 2018 and December 2018 were invited to take part in the study.

4.2.4. Data extraction

Data was extracted from two documents held by the ERS: 1) referral forms that were pre-populated by the HCPs to the ERS, 2) prescription cards that included free text information detailing the prescribed exercises for participants to follow. The following procedure was used to extract data. An exercise referral instructor at the relevant referral site collected pre-populated referral forms. Referral forms were photocopied and participants' name, address, date of birth, referring HCPs details and any data unrelated to the study, were redacted, off the photocopy. Prior to removing the address, postcodes were converted into SIMD quintiles via the Scottish Government's official deprivation tool, as described in **Chapter 3 (see section 3.2.5)**. Commonly age was pre-populated on the referral form, if not; date of birth was used to calculate age in years before it was removed. A list of extracted data is presented below. The same process was completed for exercise prescription cards, where the researcher and one instructor from each referral site anonymised photocopies. The researcher went through handwritten prescription cards with the referral instructors to ensure clarity and understanding of free text writing. Free text data on the prescription cards amounted to the following: date(s) of session, prescribed type of exercise (i.e. treadmill running), prescribed time duration (minutes) of aerobic exercises, prescribed speed at which to complete aerobic exercise, prescribed mass (kg) to lift of resistances exercises, and prescribed number of repetitions and sets of each resistance exercise. An example of a prescription card is available in the thesis appendix (Appendix 5).

4.2.5. Independent variables

Five descriptive independent variables: gender, age, indices of deprivation, reason for referral to ERS and comorbidities. Extensively discussed in **Chapter 3** of this thesis, these four variables (gender, age, indices of deprivation, reason for referral) follow the same methodological process (**see section 3.2.5**), for example the use of the SIMD tool to capture deprivation level. Where there was a

departure to this process, it was reported. Reason for referral were grouped into seven categories: neurological, frailty and mobility, musculoskeletal, cardiovascular, general fitness, mental health and obesity. While general fitness is not a medical condition, it was a term listed by HCPs as a reason for referral. Co-morbidities were defined as the number of additional medical conditions participants made referral instructors aware of during the introductory interview before commencing the prescribed programme.

4.2.6. Objective measures

Table 4.1 provides definitions of FITT that are used to report prescribed exercise, extracted from prescription cards. Date(s) acted as a measure of when the referral session occurred and used as an objective measure of the number of referral sessions completed or session count. Where available, the prescribed speed of aerobic exercise was matched against compendium of physical activities, providing METS as a reference value. Light-intensity aerobic activity was an activity done at 1.1 to 2.9 METs, moderate-intensity activity was 3 to 5.9 METs while vigorous activity was an activity done at ≥ 6 METs (HSS, 2008). Subsequently, light intensity, moderate and vigorous activity were assigned values of one, two and three respectively and used as a measure of exercise intensity. Further, intensity, 1, 2 or 3, was multiplied by the duration in minutes to create a measure of aerobic load.

The same process was used to create a resistance-training exercise load, which was the multiplication of weight lifted (kg), sets and repetitions. For example; chest press 10kg x 10 repetitions x 2 sets = resistance training load of 200 kg. Furthermore, total lifted load (kg) was the sum of all resistance-training loads completed per session. Magnitude of change was expressed as difference between first recorded exercise session and last recorded exercise session. Magnitude of change was reported as increases or decrease of the following measures: frequency count of total number of exercises completed per session, frequency count of either resistance or aerobic exercises completed per session, time duration (minutes) of aerobic exercises completed, and total

lifted load per session. Magnitude of change was used as a measure of an instructor prescribing more exercise, not a measure of performance.

Table 4.1. Definitions of FITT used to report the prescribed exercises extracted from ERS prescription cards.

Component	
Frequency	The number of exercises completed within each exercise session.
Intensity	Predetermined value matched against compendium of physical activities and respective MET's indicating effort to perform activity.
Time	The length of time the participant performs an exercise. Expressed in minutes.
Type	The category of exercise performed. Expressed as aerobic or resistance.
Aerobic	Predominant focus of the exercise performed is to improve cardiovascular conditioning. Examples of such exercises can include treadmill walking, running, recumbent cycle or up-right cycle bike.
Resistance	Predominant focus of the exercise performed is to improve muscular strength via the use of free weights, resistance machines or body weight. Examples of such exercises can include chest press, bicep curl, and sit-to-stand.
Repetition	One complete motion of a resistance exercise, measured as a whole number.
Sets	A group of consecutive repetitions measured as a whole number.

4.2.7. Statistical Analysis

Analyses were performed using Statistical Package for the Social Sciences (SPSS) version 23 (SPSS Inc., Chicago, IL, USA). Exploratory analyses were undertaken to establish descriptive measures of all variables; age, gender, SIMD, referral reason, co-morbidities, FITT of prescribed exercise, magnitude of exercise prescription change. Aggregate data is expressed as median (range: minimum-maximum) across all participants at the four referral sites within the one ERS. Descriptive measures were reported across four individual sites for distribution of participants, referral condition, count of sessions and time and lift load. Last, Moods Median allows for a statistical analysis of any relationship between referral condition and the prescribed exercise. Moods Median allows analyses of two or more categories within nominal independent variables. In this instance, it allowed the seven-referral conditions to be examined. Statistical significance was set at $p \leq 0.05$.

4.3. Results

4.3.1. Participant characteristics

Over a six-month period, 50 participants agreed to participate in the study. Just over half of the participants were female (52%), median age of 70 years (26-83) and predominately over 55 years of age (76%). Participants broadly resided in areas classified as deprived (36% SIMD 1-2 combined, 36% SIMD 3, 28% SIMD 4-5). General fitness and cardiovascular disease were the two most common reasons for referral (see Table 4.2) to the scheme; participants presented with two comorbidities (0-5).

Table 4.2. Frequency count and percentages of participant variables across all four ERS sites.

		Frequency (N)	Percentage (%)
Participants		50	
Gender	Female	26	52
	25_34	3	6
	35_44	2	4
	45_54	7	14
Grouped age	55_64	9	18
	64_74	20	40
	75+	9	18
	Neurological	2	4
	Frailty and mobility	2	4
	Musculoskeletal	6	12
Referral reason	Cardiovascular	15	30
	General Fitness	18	36
	Mental Health	4	8
	Obesity	3	6
	Most Deprived	7	14
	More Deprived	11	22
Scottish index of multiple deprivation	Deprived	18	36
	Less Deprived	12	24
	Least Deprived	2	4

4.3.2. Frequency, intensity, type and time of prescribed exercise

Across all sites, participants attended a median of eight (1-25) sessions, with males undertaking slightly more referral exercise sessions than females: 10 (1-25) and eight (1-21) referral sessions,

respectively. Across the programme, thirty-eight different types of exercises were prescribed, of which eight were aerobically focused and thirty resistance-based (see Table 4.3).

Instructors prescribed a median of 4 (1-11) exercises per referral session. This was further broken down into sub-categorises, where participants were prescribed a median of 1 (0-9) resistance-based exercise per session and 2 (0-5) aerobic based exercises per session.

Table 4.3. Classification and type of exercise prescribed across referral scheme.

	Targeted area	Exercises as described on prescription card
Aerobic	Cardiovascular system	Walking, Cross trainer, Rower, Treadmill, Recumbent bike, Hydro, Up-Right bike, Unspecified / Exercising alone
	Upper-body musculature	Arm raises, Fly, Chest press, Bicep curl, Lateral pull down, Upper back, Shoulder press, Barbell curl, Dumbbell front raise, Cable pull down, Triceps dumbbell kickbacks, Bent over row, Seated row, Lateral raises, Wall press
Resistance	Trunk musculature	Torso rotation, Hip Hinge, Crunch, Donkey kicks
	Legs musculature	Sit to stand, Heel taps, Weighted step ups, Hamstring curl, Lunge and lateral raise, Calf raises, Deadlift, Leg extension, Leg curl, Leg press
	Other	Unspecified circuit

Tables 10 provides a detailed breakdown of median intensity, type and time of aerobic based exercise and aerobic load prescribed. Frequency presented is the total count of prescribed exercise across all sites and participants, of which treadmill and up right bike were the two most common exercises. Across all sites, participants and aerobic-based activities, individuals were prescribed 35 (5-70) minutes of aerobic exercise per session. The ability to determine intensity for aerobic exercises was classified for six exercises, all of which were prescribed to be performed at a moderate intensity; only running on the treadmill was prescribed and performed at light or vigorous intensity levels. The prescribed median aerobic load across the programme was 70 (10-140) and was calculated for six exercises (see Table 4.4). Data upon intensity, time and aerobic load was unavailable for two exercises, unspecified / exercising alone and hydro.

Table 4.4. Total frequency count and median (min-max) of intensity, time and aerobic training load values, of aerobic exercises prescribed across four ERS sites.

Type	Frequency	Intensity	Time	Aerobic training load
Unspecified / exercising alone	2	*	*	*
Hydro	5	*	*	*
Treadmill	380	2 (1-3)	15 (1-35)	30 (2-70)
Up right bike	339	3 (2-2)	15 (5-45)	30 (10-90)
Recumbent bike	246	2 (2-2)	15 (5-30)	30 (10-60)
Rower	207	2 (2-2)	10 (3-20)	20 (6-40)
Cross trainer	68	2 (2-2)	7 (5-11)	14 (10-22)
Walking	8	2 (2-2)	5 (5-10)	10 (10-20)

*Data unavailable

Table 4.5 provides a detailed breakdown of the frequency of resistance exercises prescribed, median sets, reps, weight (kg) lifted and lift load per session across all sites and participants. Intensity of resistance exercises was not evident on prescription cards. Chest press and lateral pull down were the two most commonly prescribed resistance-based exercises, accounting for 15% and 12% respectively, of total prescribed resistance exercises. Exercises focusing on the musculature of the upper body accounted for 59% of total resistance prescription; legs musculature exercises comprised of 35% of total resistance exercises and trunk musculature and other (circuits) were 3% each. Participants were prescribed a median of 10 (1-20) repetitions and 2 (1-7) sets, per exercise, per session. The prescribed median total lifted load (kg) across all sites, participants and resistance was 1224 (60-4728) kg.

Table 4.5. Total frequency count and median (min-max) values of sets, repetitions, weight and lift load per session, of resistance focused exercises prescribed across four ERS sites.

Type	Frequency	Sets	Repetitions	Weight (kg)	Lift load
Unspecified circuit	44	*	*	*	*
Arm raises	8	4 (3-4)	9.5 (8-12)	*	*
Fly	2	1.5 (1-2)	10 (10-10)	10 (10-10)	150 (100-200)
Chest press	202	2 (1-4)	10 (1-15)	12.5 (5-30)	300 (10-1440)
Bicep curl	90	2 (1-7)	10 (8-12)	4 (2-8)	98 (20-384)
Lateral pull down	165	2 (1-4)	10 (7-15)	20 (10-35)	500 (100-1540)
Upper back	4	2.5 (2-3)	11 (10-12)	16.25 (15-18)	442.5 (360-525)
Shoulder press	65	3 (2-4)	10 (8-12)	6 (2-15)	192 (40-500)
Barbell curl	17	*	*	*	*
Dumbbell front raise	36	2 (2-3)	12 (10-12)	1.5 (2-5)	36 (30-120)
Cable pull down	12	2.5 (2-4)	10 (10-15)	11.25 (7-16)	303.75 (135-780)
Triceps dumbbell kickback	23	2 (2-1)	10 (10-10)	7.5 (8-10)	150 (100-150)
Bent over row	23	2 (1-3)	10 (10-12)	10 (1-20)	300 (30-720)
Seated row	42	2 (1-2)	10 (1-15)	15 (10-20)	300 (20-480)
Torso rotation	11	1 (1-1)	10 (10-10)	1 (1-3)	10 (10-25)
Lateral raises	86	2 (1-3)	10 (6-12)	2 (1-12)	48 (10-144)
Leg press	72	2 (1-3)	10 (10-15)	25 (1-40)	450 (10-1200)
Leg curl	44	2 (1-2)	15 (10-20)	15 (5-25)	400 (77-600)
Leg extension	72	2 (1-4)	12 (10-20)	10 (5-35)	360 (75-750)
Dead lift	24	2 (1-4)	12 (10-12)	15 (10-20)	360 (150-720)
Calf raise	45	2 (1-2)	16 (10-20)	*	*
Lunge lateral raise	16	2 (2-3)	11 (1-12)	2 (1-12)	60 (24-360)
Hamstring curl ball	30	2 (1-3)	12 (1-15)	*	*
Step up	72	2 (1-4)	12 (1-24)	4 (4-5)	96 (5-120)
Heel taps	9	1 (1-1)	10 (10-10)	*	*
Crunch	15	1 (-2)	15 (10-15)	*	*
Sit-to-stand	81	2 (1-4)	10 (1-15)	5 (1-10)	120 (10-336)
Wall press	10	1.5 (1-2)	12 (10-15)	*	*
Hip hinge	6	3 (1-3)	10 (1-12)	12 (8-16)	360 (8-432)
Donkey kicks	7	1 (1-3)	16 (12-20)	*	*

*Data unavailable

As participants progressed through the programme, magnitude of prescription change is reported accordingly, between first and last session completed. Median change across aerobic load (see Figure 4.1) and total lifted load (kg) of resistance (see Figure 4.2) were 0 (-60-58) and 0 (-1240-4181) kg, respectively.

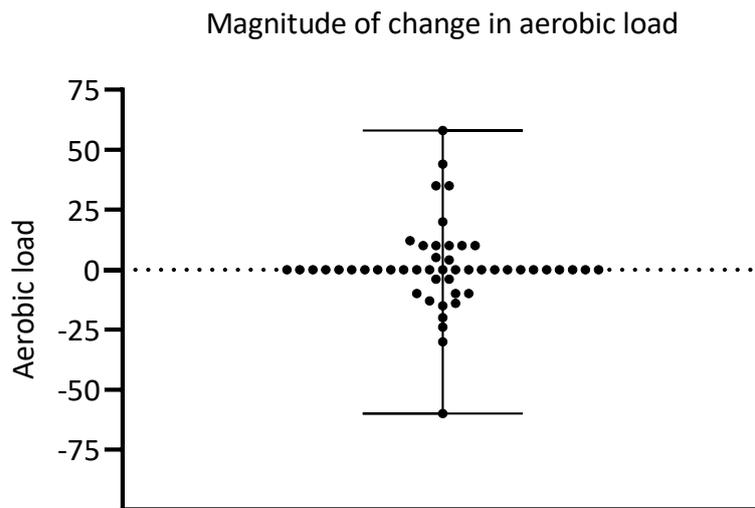


Figure 4.1. Magnitude of change of prescribed aerobic load between first and last recorded exercise session.

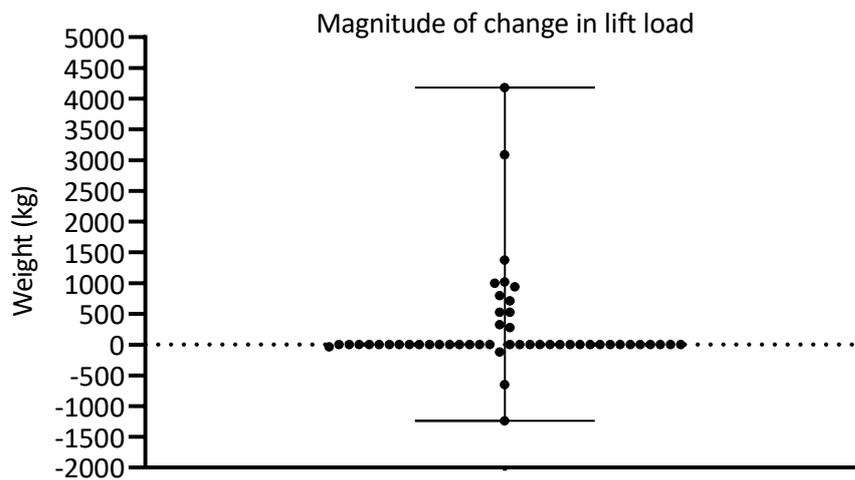


Figure 4.2. Magnitude of change of prescribed lift load between first and last recorded exercise session.

Zero median changes are reported in total exercise count (see Figure 4.3) across participants (0, -4-7). Further, zero change in median count value of aerobic exercises performed 0 (-2-2) are shown in Figure 4.4, with count of resistance exercises performed 0 (-4-7) in Figure 4.5. However, as seen in Figure 4.6, in participants who performed more referral sessions, the number of exercises prescribed does increase somewhat over time.

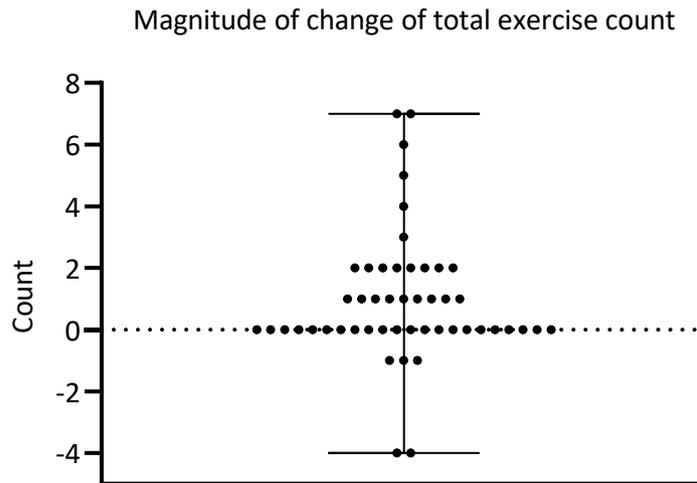


Figure 4.3. Magnitude of change of prescribed count of total exercises per session between first and last recorded exercise session.

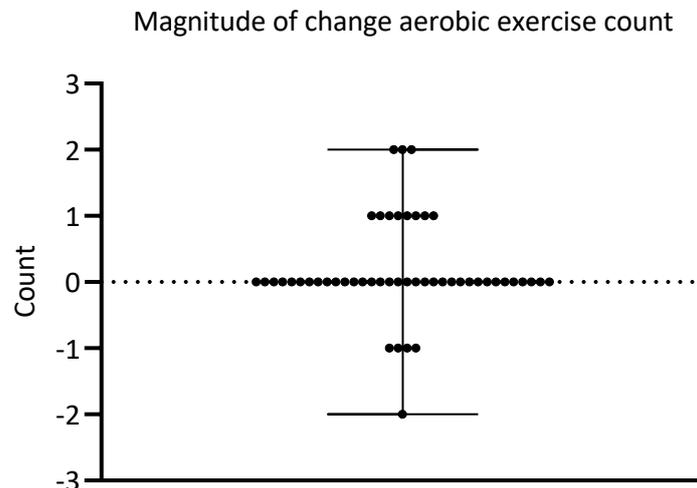


Figure 4.4. Magnitude of change of prescribed count of total aerobic exercises per session between first and last recorded exercise session.

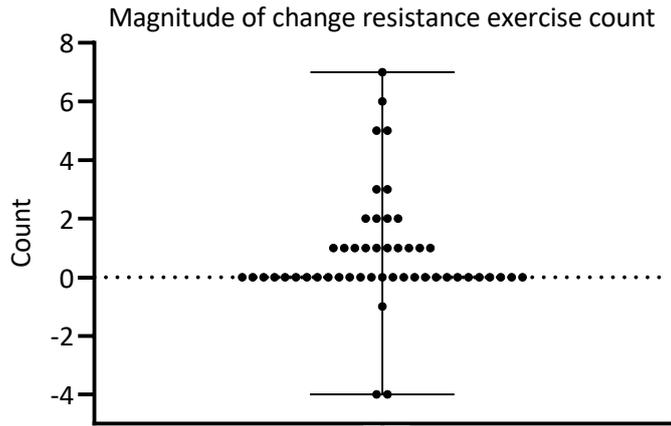


Figure 4.5. Magnitude of change of prescribed count of total resistance exercises per session between first and last recorded exercise session.

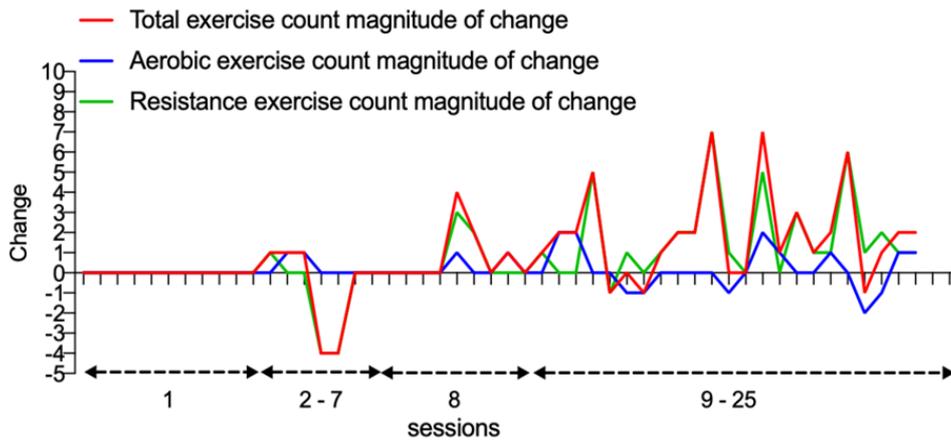


Figure 4.6. Linear representation of magnitude of prescribed exercise change expressed as difference between prescription at first recorded exercise session and prescription at last recorded session.

Table 4.6 reports data within individual referral sites. Site D (N = 32) was the busiest site for participants, compared with sites C (N = 9), A (N = 5) and B (N = 4). Site D had the largest number of participants whose primary referral reason was for a cardiovascular condition (86%). Site D saw participants being prescribed the greatest number of aerobic based exercises (3, 1-7); prescribed more time on aerobic activities (43, 18-54), and prescribed the fewest number of resistance exercises per session (1, 1-4) and lowest total lifted load (736 kg, 190-1442) per session. Participants

at sites B and C performed greater total number of exercises per session. The two sites with highest prescribed lifted loads (A and C) prescribed almost less than half the time in aerobic activities than site D.

Moods Median revealed no significant difference between referral condition and count of prescribed exercise per session ($\chi^2 (6) = 3.70, p=.71$), number of prescribed resistance exercises per session ($\chi^2 (6) = 7.28, p=.29$) and prescribed total lifted load per session ($\chi^2 (5) = 7.54, p=.18$).

Statistical significance was observed for referral condition and time spent performing aerobic activity ($\chi^2 (6) = 14.80, p=.02$) and between referral reason and number of aerobic exercises performed ($\chi^2 (6) = 20.01, p=.003$).

Table 4.6. Percent of participants based on referral condition and median (min-max) total exercise count, count or aerobic and resistance exercise, time spent in aerobic exercise and lift load of resistance exercises, prescribed at four different referral sites.

	Site A	Site B	Site C	Site D
Neurological	50%		50%	
Frailty and mobility		50%	50%	
Musculoskeletal			50%	50%
Cardiovascular		7%	7%	86%
General Fitness	17%	11%	11%	61%
Mental Health	25%			75%
Obesity			33%	67%
Number of exercises per session	5 (4-10)	7 (5-8)	7 (4-8)	3 (1-7)
Number of aerobic exercises per session	1 (1-2)	2 (1-2)	2 (1-2)	3 (1-7)
Number of resistance exercises per session	4 (2-8)	5 (3-7)	5 (2-7)	1 (1-4)
Time spent performing aerobic activities (min)	25 (5-30)	39.5 (23-45)	20 (14-24)	43 (18-54)
Total lift load per session (kg)	1799 (765-2833)	936 (830-1078)	1727 (515-3318)	736 (190-1442)

*figures in parenthesis = range

4.4. Discussion

The aim of the study was to describe the FITT of prescribed exercise in ERS, reporting prescribed frequency, intensity, type and time duration exercise. Further, exploring if the FITT of prescribed exercises changed over time and explore any relationship between referral condition and the FITT of prescribed exercise.

4.4.1. Main findings of the study

The present study reported that 38 different types of exercises were prescribed across the ERS sites. Eight exercises were aerobically focused, and 30 resistance based. Participants completed a median of eight sessions across the whole programme. Of those eight sessions, participants were prescribed four different exercises per referral session, further broken down as one (0-9) resistance-based exercise per session and two (0-5) aerobic based exercises per session. Prescription of aerobic exercises was at a moderate intensity; however, there is no reporting of intensity for resistance-based exercises.

Participants were prescribed aerobic exercise for just over half of the one-hour referral session (35 minutes), of which, use of the treadmill was the most commonly prescribed. Of the 30 resistance-based exercises, 15 different exercises were prescribed that predominantly targeted the upper body alone, subsequently, two of those exercises, chest press and lateral pull down, were the two most common, accounting for 27% (15% and 12% respectively) of total resistance exercises prescriptions. From the start of the ERS programme to the point that participants stopped exercising, there was no reported median change of exercise prescription (See Figures 6, 7, 8, 9 and 10).

4.4.2. FITT of prescribed exercise

The present study did not set out to explore if the FITT of prescribed exercise would have an impact on clinical outcomes. However, as established in **Chapter 1 (see section 1.1.4)** the FITT of prescribed exercise should target the referral condition. Therefore, in theory, the prescribed FITT should match exercise prescription recommendations. For example, as presented in **Chapter 1 (see section 1.2.1.1)**, to prevent primary and secondary cardiovascular disease, the strongest evidence is in favour an exercise prescription that includes aerobic and resistance exercises, performed 3-5 times per week. However, there are no recommendations on the frequency of exercises per session.

This present study reports that participants had the opportunity to attend two times per week as part of their ERS membership. This study reports that Site D received the largest number of participants whose primary referral reason was for a cardiovascular condition (86%). Subsequently, Site D saw participants being prescribed the greatest number of aerobic based exercises (3, 1-7); prescribed more time on aerobic activities (43, 18-54), and prescribed the fewest number of resistance exercises per session (1, 1-4). This suggest that the prescription does not fully match recommendations for cardiovascular disease, as it places more focus on one type of exercise: aerobic exercise.

A review by Bray *et al.* (2016) recommended a mixture of aerobic, resistance, balance and flexibility training per session for those presenting with frailty and mobility related issues. The present study reported no evidence of exercise designed solely to target balance or mobility. The prescribed exercise did cover a broad range, however four exercises (treadmill, up right bike, chest press and lateral pull down) accounted for 42% of the total exercise prescription. Exercises within the prescription may have challenged balance, such as use of using the cross-trainer or sit to stand. However, these types of exercises were prescribed very infrequently. Previous meta-analyses indicate moderate-to-high weekly resistance training volumes may elicit marginally greater strength gains than low weekly resistance volume, and that increasing frequency of resistance training is one

way to achieve this stimulus (Grgic et al., 2018). However, the reported data in the present study indicate participants were prescribed low sets of resistance-based exercises and there was no median change in prescription over time.

Recommendation for at risk populations indicate that exercise intensity levels are to start at a low or moderate level and should be progressed, with higher intensities being safe and more effective.

Training impulse (TRIMP) is a strategy for integrating the components of exercise into a single term (Banister et al., 1975). Further, this method allows understanding of responses to exercise (Borresen and Lambert, 2008; Foster et al., 2001). However, there are practical and theoretical limitations to the TRIMP concept (Foster et al., 2001). The ability to provide, monitor and record heart rate was not available within the ERS, therefore ruling out this opportunity for data capture. Foster and colleagues (2001) simplified training load quantification by substituting a session rating-of-perceived-exertion (RPE), a measure of intensity, for the measure for heart-rate data. It was concluded, RPE was a valid method of quantitating exercise training during a wide variety of types of exercise (Borresen and Lambert, 2008; Foster et al., 2001). RPE was not collected the ERS. As such, RPE was substituted for the measure of intensity (e.g. moderate = 2) derived from the exercise card, as previously discussed, and multiplied with time (minutes) to create a training load. However, the present study reports that prescribed intensity was moderate and there was no median change in prescription between first and last session a participant attended. Furthermore, there was no reported measure of intensity in resistance-based exercise, thus reducing the level of understanding the prescription. Notably, session count was low across the programme, so it unknown that if more participant completed a greater number of sessions if a change in prescription would be evidenced in the data.

4.5. Directions for Future Research

Clear reporting is required of the dose of exercise prescribed and performed. However, there is a need to explore the rationale for the prescription - What decision-making process led to the FITT of the prescription? Exercise referral instructors are well positioned to offer insights into the reasons for prescribing exercise, delivering the prescription and ensuring participants adhere to the prescription. Furthermore, instructors possess the ability to reflect and consider how these practices have been refined through their own experience. Therefore, it is a recommendation that future research should undertake qualitative exploration into the rationale for the prescription, exploring links to the medical condition that the referral was made.

4.6. Strengths and limitations

The present study benefitted from a naturalistic approach by extracting handwritten data from prescription cards. Prescription card data supports the validity of the study, in that it provides a realistic account of FITT of prescribed exercise. The frequency, intensity, type and time of exercise prescription is rarely reported. Hence, a strength of this study is a description of FITT. There are, however, a number of limitations. First, data were collected in just one ERS programme therefore limiting the ability to generalise to other ERS programmes. The present study lacked the methodology and logistics to explore adherence to the prescribed exercise. Referral cards did not capture any objective markers of completion rates. However, due to the low number of participants per sessions, instructor supervision ensured adherence; therefore, it can be considered that participants completed close to 100% of the prescription.

4.7. Conclusion

The FITT of an exercise prescription is dependent on the type of outcome desired, for instance improving balance and reducing risk of falls vs. lowering blood pressure. Therefore, targeting exercise prescription to the condition will have a greater impact. Broadly, FITT of an exercise prescription should contain a combination of aerobic and resistance-based activities. Exercise Intensity levels should progress from low or moderate to higher intensities. Session should occur as a minimum 2-3 times per week, preferably more, and last between 30-60 minutes per session. Dependant on outcomes desires, interventions should last for six months. This study has shown that FITT of prescribed exercise in this ERS does match certain aspects of the recommendations; for instance, sessions last 60 minutes and incorporate a combination of aerobic and resistance-based exercises. There are no recommendations on the frequency of exercises that are to be prescribed, aside from including aerobic and resistance-based activities; the median number of exercises prescribed is four. However, the FITT of the prescribed exercise in this ERS does not show evidence of prescribing exercise specifically to the condition. Furthermore, opportunities for participants are limited to two session per week and the scheme duration falls short of the recommended minimum six-months (dependant on outcomes desires, **see section 1.2.2.7**) for effects in NCD. Additionally, there is no evidence to suggest that the prescription is progressed. Knowledge of the dose of exercise prescribed and performed within referral schemes provides critical information, in understanding if ERS is tailoring exercise prescription towards tackling NCD.

Chapter 5. EXERCISE REFERRAL INSTRUCTORS PERSPECTIVES ON PRESCRIBING EXERCISE TO INCREASE UPTAKE, ATTENDANCE AND ADHERENCE TO EXERCISE PRESCRIPTION: A QUALITATIVE STUDY.

5.1. Introduction

As discussed in **Chapter 1**, PA does have the ability to help reduce the risk of many chronic diseases (see **section 1.2.2**). However, the evidence within published findings of ERS on the influence that exercise has upon people's health who have an existing NCD is limited and short-term (Pavey et al., 2011a). Findings from the published literature and results from chapters within this thesis reveal that uptake to ERS is low, session count is low with participant's exiting the scheme early (**Chapter 3**). Findings in this thesis reflect that the FITT of ERS, in part matches aspects of recommended exercise treatment protocols for example, aerobic exercises are a common prescription in ERS (see **section 1.2.1.7**). However, overall, exercise prescription appears generic in nature rather than linked to address a specific existing NCD (see **Chapter 4**).

The prescription of 'exercise as medicine' is often presented as being this linear and predictable process towards health benefits (Henderson et al., 2018). However, delivery of 'exercise as medicine' through ERS is reliant on participants' uptake, attendance and adherence to the scheme. Therefore, health benefits are also additionally reliant on referral instructor ability to motivate participants to uptake, attend and adhere to the prescribed prescription. Subsequently there is a need for a good partnership or relationship between participant and referral instructor. However, partnership work between instructors and participants is rarely linear. Further, whether instructors' behaviour is standardised and typical across ERS or highly variable is unclear. Partnerships can encounter challenges as relationships fluctuate according to balances between personal objectives, organisational objectives and cooperation and reflexivity inherent within the relationship (Henderson et al., 2018; Mansfield, 2016).

The current evidence suggests that the role of an exercise referral instructor is to provide various types of support. To date, the majority of research has focused on attributes that participants' value in instructors, such as professional supervision and guidance in supporting needs to engage with ERS. Hardcastle and Taylor (2005) reported support from exercise instructors helped older women integrate exercise into their identities. Participants' who perceived instructors to be supportive reported higher identified motivation (Markland and Tobin, 2010). Commonly across studies, access to an instructor who is knowledgeable and effective at providing interpersonal support is a key determinant of increased attendance within ERS (Hardcastle and Taylor, 2005; Singh 1997; Wormald and Ingle 2004). A mixed-methods process evaluation reported that comprehensive professional contact (from instructors) provided motivational support, enabling participants to build confidence in becoming more active, from a practical standpoint. That is, they felt confident to perform the exercise (Moore et al., 2013).

Research has explored referral instructors' perspective; one study examined exercise professionals' experiences of engaging diverse clinical populations in an ERS and emerging practices to support uptake and attendance (Moore, Moore and Murphy, 2011). The authors conclude that exercise professionals viewed their role as helping patients to overcome anxieties about the exercise environment and providing educational and interpersonal support (Moore, Moore and Murphy, 2011). Guidance on exercising safely is crucial in providing participants skills to become autonomous. However, guidance (i.e. safety) is viewed by referral instructors as secondary to mentoring roles (Moore, Moore and Murphy, 2011). Previous work has shown that successful exercise instructors are able to create, represent, advance, and embed a shared sense of identity among group members (Stevens et al., 2017). This is suggestive that exercise instructors can influence (both positively and negatively) members' exercise experiences and intentions to continue engaging in ERS (Stevens et al., 2019; Ntoumanis et al., 2016).

However, there is paucity of evidence surrounding the justification and process that exercise referral instructors place on prescribing exercise, and supporting participants to uptake, attend and adhere to the scheme. Exercise referral instructors are well placed to offer insights into reasons for prescribing certain exercises and ensure participants' uptake, attend and adhere to the prescription. Therefore, there is a need to understand why exercise referral instructors prescribe certain exercise and how they help participants engage with ERS. This may further our understanding of the role of ERS for primary and secondary prevention and self-management of NCDs.

5.1.1. Aims

The aim of the study was to explore exercise referral instructors' perceptions and experiences of prescribing and delivering exercise, within a contextual framework of improving uptake, attendance and adherence to the prescribed exercise. The study addresses objective four of the thesis; explore exercise instructors' perceptions about motivating people to adhere to the prescribed exercise within ERS (**see section 1.5**). This chapter reports the findings of a qualitative analysis of interview data about instructors' perceptions of what influences uptake, attendance and adherence to the prescription and perceptions of the purpose of the exercise prescription.

5.2. Methods

5.2.1. Study Design

The study employed a qualitative methodology that involved conducting a thematic analysis of semi-structured interviews with exercise referral instructors. The University of Stirling NHS, Invasive or Clinical Research Panel granted ethics' approval (NICR (17/18) Paper No.004).

5.2.2. Participants

The present study was conducted in the same ERS described in **Chapter 4 (see section 4.2.2)**.

Inclusion criteria were adults, 18 years old and above, employed either part-or-full-time as exercise referral instructors. Instructors had to hold a minimum of REPS level 3 qualification and be working towards or possess a level 3 GP referral qualification. One instructor within the programme was undergoing the GP referral qualification. Subsequently, they were included within the interviews as they delivered the programme in conjunction with a qualified instructor.

5.2.3. Recruitment

During instructor-researcher meetings, described in **Chapter 4 (see section 4.2.3)**, ERS instructors were made aware of the qualitative research project. Participant information sheets were distributed to ERS instructors at research meetings and instructors were able to ask questions surrounding the project. Instructors were provided with email and phone contact details of the researcher, if they had further questions. Instructors were invited to participate in the study; if they agreed, a suitable time and date was set for the researcher to visit the referral site to conduct the interview. Before commencement of interviews, ERS instructors were provided with a brief verbal recap of the purpose and format of the interview, alongside assurances of confidentiality and a further opportunity to withdraw if required. All ERS instructors provided verbal and written informed consent for digital audio (Olympus VN-731PC) recording and use of anonymised quotations. One hundred percent (N=6) of referral instructors employed at the time of the study agreed to participate.

5.2.4. Qualitative data collection

Given the exploratory and inductive focus of the research on exercise professionals' perceptions of ERS, face-to-face, semi-structured interviews were undertaken. Interviews were conducted at ERS sites where instructors worked, in a meeting room at the leisure facility. The interviews were guided by a semi-structured schedule (Appendix 6). The schedule was developed using a literature search and collaborative discussions within the PhD supervisory team. Initial pilot testing of the questions was conducted with an exercise instructor who was not a study participant but had experience of prescribing exercise to clinical populations. The guide was not designed to have questions posed chronologically but rather, in an order that seemed to follow the natural flow of the conversation. The schedule used open-ended questions, probing topics of interest to the researcher, whilst allowing discussion of issues of importance to the interviewee. Use of open-ended questions allowed instructors the opportunity to express their experiences, providing deeper and detailed insights into their experiences. Interviews lasted approximately 45 minutes.

5.2.5. Rigor

Debate surrounds qualitative research and the confidence we can draw upon conclusions and subsequently the ability to extrapolate or generalise to the population. This often manifests itself via sample sizes and 'how many interviews is enough' to declare confidence in the findings (Saunders et al. 2018). Commonly, research views saturation as the methodological principle to indicate that further data collection and/or analysis are unnecessary (Saunders et al. 2018). However, the definition of saturation is variable within the literature, and used within different models, for example, theoretical saturation, inductive thematic saturation, a-priori thematic saturation and data saturation (Saunders et al., 2018). Each of these models lay focus upon a threshold where development of new codes or themes cease. In the current study, one-hundred (N=6) percent of ERS instructors employed within the scheme participated in the study. This sample may appear

numerically small; however, it can be assumed that emergent themes are representative of exercise referral instructors within this referral scheme. Extrapolating beyond the sample in this study to suggest referral instructors employed within Scotland or the United Kingdom hold the same views may be problematic. Further, this study conducted a naturalistic inquiry that sought to understand ERS instructors within context-specific settings (Cypress, 2017).

As a concept, rigor is best understood in terms of the quality of the research process. Rigor in qualitative research can be expressed through a number of features, such as: credibility, transferability, dependability, confirmability, maximal validity or credibility, maximal reliability or dependability, comparativeness, and reflexivity (Cypress, 2017; Saumure and Given, 2012).

Understanding of rigor within this study is via the criteria of credibility, transferability, dependability, and confirmability (Cypress, 2017). Demonstration of credibility is through the accurate and truthful depiction of referral instructor's answers and perceptions about their experiences of ERS. As described above, generalisability from this study may be problematic and is context specific.

Dependability was achieved through triangulation between three researchers (two members of the PhD supervisory team and the researcher), reviewing transcribed material at different stages to validate findings. In this study, the PhD supervisory team read raw data and discussed coding and interpretations of these data with the researcher thereby establishing some degree of rigor. Similar, confirmability refers to the degree to which others could corroborate the results via examination of the audit trail of data collection, data analysis, and interpretation. Transferability is viewed as providing and building upon the database of evidence that allows judgements possible (Lincoln and Guba, 1985). Self-awareness as the sole researcher collecting data brings into question any potential biases, assumptions, beliefs, that might be present. However, complete removal of the researcher from data collecting was not possible (Cypress, 2017). Furthermore, the above criteria are detailed throughout the qualitative analysis below, allowing for transparency.

5.2.6. Qualitative analysis

Data were transcribed verbatim. Transcripts and sound files were stored in an encrypted research drive, held at the University of Stirling. A realist approach to the analysis was undertaken; that is, the researcher sees the analysis and interpretation as a representation of participants' perceptions of their experiences. Given the exploratory nature of the research, an inductive thematic approach to analysis was adopted (Bruan and Clarke, 2006). Thematic analysis is a method for identifying, analysing and reporting patterns within data (Braun and Clarke, 2006). Thematic analysis benefits by allowing the researcher to exam the perspectives of different research participants while highlighting similarities and differences (Braun and Clarke, 2006). An Inductive approach means the themes identified are strongly linked and driven by the data. A latent approach to the themes generated was undertaken. This allows the researcher to identify or examine the underlying ideas, assumptions, and conceptualisations and go beyond just descriptive measures (Braun and Clarke, 2006). This is important in the context of understanding 'what and why' around exercise instructors' perceptions about motivating people to adhere to the prescribed exercise within ERS. Analysis were performed using three-steps (Figure 5.1).

First, an initial set of codes were set by identifying recurring words within the dataset, for example, 'motivation', 'encouragement', 'communication', 'autonomy'. Additional codes were generated from words of interest to the researcher. Once an initial list of codes were generated, they were cross-referenced against each other and where appropriate, combined. For example, 'welcoming', 'friendly' 'comforting' were grouped together to create the code 'Interpersonal support'. Within this step, codes were worded appropriately to allow contextual understanding of the code. For example, 'motivation' became 'provide motivation', thus it became clear that providing motivation came from the instructor. Generated codes related to take-up to ERS, attendance and adherence at ERS and the prescription of exercise. Transcripts were coded by hand, constantly revisited and cross-referenced,

throughout this first iterative step by the researcher and two members of the PhD supervisory team (GH and TG).

Second, coded data were grouped into six descriptive themes. First, instructor intentions within ERS, which is defined as the role that instructors perceive they have. Second, communication approaches from ERS instructor, which is defined as approaches that instructors make to motivate the participant to uptake, attend and adhere to ERS. Third, behaviour change approaches, which is defined as instructors' use of BCT's. Fourth, instructors' perceptions of participants' views of ERS, which is generated from a combination of views and emotions that a participant might directly or indirectly say or demonstrate to an ERS instructor. Fifth, barriers towards providing ERS, which is defined as any situation that might hinder delivery of ERS. Last, success of ERS, which is defined as what instructors valued as an outcome for participants, or instructors' perceptions of what participants valued. For example, under the overarching theme 'Barriers towards providing ERS' were codes such as, 'restrictive gym size', 'lack of equipment', 'external distractions (e.g. having to run gym floor at same time)'. Third, all codes under the six descriptive themes were analysed in the context of the researchers' understandings of the topics of, uptake to, attendance at and adherence to prescribed exercises. The researcher and one of the PhD supervisors (GH) developed the following conceptual framework, basing it upon the six descriptive themes and codes and previous research (Shore et al., 2019). The conceptual framework comprises three interpretative themes: 1) perceived influences on take up of ERS; 2) perceived influences on attendance and adherence at ERS; and 3) purpose of exercise prescription. The six descriptive themes were not exclusive to one particular interpretative theme. For example, the descriptive theme 'barriers towards providing ERS' under the interpretative theme 'perceived influences on take up of ERS' refers to, but is not limited to, the lack of knowledge that a participant has on why they are attending the scheme. Whereas the same descriptive theme under the interpretative theme 'Perceived influences on attendance and adherence at ERS' refers to, but is not limited to, infrastructure restrictions at the gym (e.g. lack of space). Throughout all three-stages described above, draft analyses were circulated between the

researcher and two of the PhD supervisors (GH, TG). Face-to-face meetings allowed discussions about initial coding, descriptive themes and thereby reaching consensus on descriptive thematic analysis and interpretation.

STEP 1: Codes

- 1.Improve participants health
- 2.Improve participants ADL
- 3.Participants personal goals (e.g. weight loss)
- 4.Creating personalised realistic and achievable prescriptions and targets
- 5.Provide motivation
- 6.Provide Interpersonal support (comforting / welcoming / friendly / encouragement / reassurance / enthusiastic)
- 7.Participant finds gym Intimidating
- 8.Referring health professionals lack knowledge about the scheme
- 9.Provide gold standard customer service
- 10.Creating a positive first impression
- 11.Provide appropriate level of care for the condition (e.g. Cardiac patients)
- 12.Encourage autonomy and independence of participant
- 13.Instilling a foundation to create lifelong habits. Building blocks.
- 14.Participant centred
- 15.Provide feedback (e.g. showing progression)
- 16.Poor communication from HP to participant
- 17.Time of session tricky for some participants
- 18.Providing knowledge and benefits to becoming active
- 19.Restrictive gym size
- 20.Being able to manage people through the programme (e.g. reining people back in)
- 21.Instructors frustrated when patients drop out
- 22.Instilling a level of education for participants
- 23.Clinical improvements as a reinforcement tool
- 24.Instructors want people to return
- 25.Instructors need to have problem solving skills
- 26.Building relationships with participants
- 27.Success is viewed as improvements in ADL > health > fitness
- 28.Participants express fear at exercising
- 29.Success is participants continuing to exercise (e.g. getting a membership)
- 30.Instructors want to create replicable exercises of ADL
- 31.Instructors justify why they prescribed an exercise
- 32.Instructors create variety to keep people motivated
- 33.Referral system creates bottle neck which can hamper service delivery
- 34.Participants view exercise as too much hard work
- 35.Participants have an epiphany, a realisation that exercise is positive
- 36.Participants lack knowledge about the scheme
- 37.Instructors try to group people to create friendship, show they are not alone
- 38.Lack of equipment
- 39.External distractions (e.g. having to run gym floor at same time)
- 40.Participant acceptance they are there and get on with things
- 41.Goal setting

STEP 2: Descriptive themes

Instructor intention within ERS

Codes: 1, 2, 4, 5, 6, 9, 10-14, 18, 22, 25, 29, 30, 31, 32.

Communication approaches from ERS instructor

Codes: 6, 10, 13, 14, 18, 20, 22, 24, 26, 31, 35.

Behaviour change approaches

Codes: 5, 6, 9, 10, 12, 15, 18, 22, 23, 26, 32, 35, 37, 41.

Instructors perceptions of participants views of ERS

Codes: 3, 7, 17, 28, 34, 36, 40.

Barriers towards providing ERS

Codes: 7, 8, 16, 17, 19, 21, 33, 36, 38, 39.

Success of ERS

Codes: 1, 2, 21, 24, 27, 29, 35.

STEP 3: Interpretative themes

Perceived influences on take up of ERS

Descriptive theme: Barriers towards providing ERS

Codes: 8, 16, 17, 33, 36.

Descriptive theme: Instructors perceptions of participants views of ERS

Codes: 7, 17, 28, 34, 36.

Descriptive theme: Communication approaches from ERS instructor

Codes: 10, 26,

Perceived influences on attendance and adherence at ERS

Descriptive theme: Instructor intentions within ERS

Codes: 4, 11-14, 25, 30, 31, 32.

Descriptive theme: Communication approaches from ERS instructor

Codes: 6, 10, 18, 20, 22, 26.

Descriptive theme: Behaviour change approaches

Codes: 5, 6, 9, 12, 15, 18, 22, 23, 26, 32, 35, 37, 41.

Descriptive theme: Instructors perceptions of participants views of ERS

Codes: 3, 17, 28, 34, 36.

Descriptive theme: Barriers towards providing ERS

Codes: 7, 19, 21, 38, 39.

Purpose of exercises prescription

Descriptive theme: Instructor intentions within ERS

Codes: 1, 2, 4, 11-14, 18, 25, 30.

Descriptive theme: Communication approaches from ERS instructor

Codes: 6, 13, 14, 18, 20, 22, 24, 31,

Descriptive theme: Behaviour change approaches

Codes: 6, 15, 18, 22, 32.

Descriptive theme: : Instructors perceptions of participants views of ERS

Codes: 3, 28, 34, 40

Descriptive theme: Success of ERS

Codes: 1, 2, 24, 27, 29, 35.

Figure 5.1. Three step coding framework of semi-structured interviews of exercise referral instructor's experiences or delivering exercise prescription.

5.3. Results

In total six interviews of 44 (37-53) minutes in length were conducted. Fifty percent were female instructors, and across instructors, a median of 3 (1-12) years of experience working as an exercise referral instructor was reported. Six instructors held REPS level 3 personal trainer qualifications, while five instructors held REPS level 3 GP referral qualification. One instructor was currently completing the level 3 GP referral qualification at the time of study; however, they were included as they delivered the referral programme in conjunction with a qualified instructor. Forty-one initial codes were created. These codes were grouped into six descriptive themes. Descriptive themes are understood via three conceptual themes (see Figure 12). The following results section is organised to represent the three conceptual themes with representative quotations from participants.

5.3.1. Perceived influences on take up of ERS

A common barrier to a referred ERS participant taking up the referral expressed by all instructors was that HCPs lacked knowledge about the scheme. Instructors described that a lack communication from the HCPs to the participant about ERS made their job trickier in terms of motivating participants to take up the ERS referral. So much so, some participants lacked sufficient information on their referral and why attending the scheme was likely to be of benefit to them.

“I don’t think most GPs are particularly interested in what they [the participant they referred to ERS] will be doing here [...] thought to myself, I reckon you’ve just been at the doctor on a regular basis and the GP’s thought, we’ll just send you to the gym and see if that helps. Sometimes they don’t even get the patient to sign or date the form, they sometimes don’t put who is referring them [...] from what they’ve told us (participants), it’s just the doctor hasn’t really said why they would benefit from using the gym, they’ve just said, I think this would work” (In1).

Instructors highlight that providing clear information about what the ERS entails and the likely benefit is key to tackling the lack of information provided by HCPs.

“I see that as part of my job, sit the client down at the point of consultation to say, right, well this is what we’re gonna do with you, and this is what you’ll hopefully see the benefits is” (In2).

Instructors believed that it is vital that participants have a good experience the first time that they attend since this will encourage uptake.

“Getting people into the gym, I think if they get that good experience especially in the first time, because first impressions, if they have a good first impression” (In5).

5.3.2. Perceived influences on attendance and adherence at ERS

Instructor intentions were to help participants attend ERS, ultimately staying active after ERS irrespective of whether they took out leisure centre membership or exercised elsewhere. However, an intention of the leisure centre is to make profit. Upon asking if there was external pressure to keep participants attending and coming back to the leisure centre, there was a mixed response. Those instructors who expressed external pressures conceptualised it from a business perspective.

“I mean, obviously we’re in to make money but people that actually adhere to the programme and then not necessarily taking a membership but staying active. Maybe not through us. I want to get people, as I said, to maintain what they’re doing or actually increase what they’re doing.” (In4).

All instructors acknowledged that drop out of ERS is high. The biggest challenge that instructors encountered in keeping participants in the programme, is participant motivation. Communication was perceived as key to building rapport, which in turn, was crucial to encouraging attendance and

adherence. Instructors' commented that a strong rapport between themselves and participants is key to ensuring that participants stay motivated.

"Keeping people motivated the hardest part,...if you interact with them, even if it's just a case of... but two or three times, just 'til they get comfortable with it, but you're touching base to say how it's feeling?" (In5).

Instructors declared that there was no formal behaviour change theory embedded within the programme that would improve uptake, attendance and adherence. However, as illustrated by the quotations below, instructors appeared to make use of a variety of BCTs in order to improve attendance and adherence; for instance, problem solving, self-monitoring, social support (practical and emotional), identification of self (Michie et al., 2015). Instructors expressed the importance of creating an environment that is welcoming and appropriate for the participant, elevating any fears they might have about exercising or being judged. As the quotations below suggest, different BCTs are used by different instructors; In5 uses self-monitoring by encouraging participants to reflect on their previous exercise ability so that they could see how far they had progressed, In3 uses humour within verbal encouragement. In2 and In6 use social support, to achieve different outcomes. In2 uses social support by encouraging participants to give each other lifts to attend ERS. In6 uses social support to group people together so that they would support one another to engage and adhere to the exercise's prescription.

"we just try and push them past the barriers and just try and say, look, where did you come from, if you can think back when you started phase three, for instance" (In5).

"I think I probably have a bit of a jokey, kind of, sense with them and say, come on, let's get this done, let's get that done and egg them on [...] just stay really upbeat with them" (In3).

"there's almost a social side of the class, as well [...] if they're in that group environment, they'll know that their pal, Jessie, is coming in with them [...] couple of occasions where

they're car-pooling [...] because they're coming in at the same time as Billy, and they can have a chat about whatever, so yeah, so that side of it as well that's a good retention" (In2).

"try and maybe group a couple together with the same [...] I think it kind of gets them talking, gets them to open up a bit more, and I think it gets them to motivate one another as well" (In6).

Instructors described how participants expressed emotions about ERS such as being scared or anxious, which they perceived was likely to influence attendance and adherence. Therefore, the role of the instructor becomes more mentoring the participant and providing reassurance, providing guidance to help ease concerns and trying to educate participants on benefits of continued attendance and adherence to the programme.

"Some of the clients know they're coming into the gym, and they're like, oh, I don't really want to do this. We also see that about, when we take their blood pressure, their heart rate is through the roof before they even come in, it's like 100 plus, and I'm like, right, are you a bit nervous? and they are nervous. Because they're coming into an environment, they're unaware of, they don't know what it's all about, they might have a misconception in their head in regards to what a gym is" (In2).

Instructors perceived that they were a key source of social support. One instructor for instance, would make sure that the participant did not feel that they were on his or her own but that they (instructor) were there for that participant.

"Just reassure them that I'm there with them and we're going to go through it together and that everybody started somewhere" (In3).

Another BCT used was shaping knowledge, where the instructor would encourage attendance by informing participants of the benefits of exercise.

“Just talk them through it, as long as you tell them the benefits it’s hopefully going to bring them back and make them realise that it’s going to be beneficial for me” (In6).

“I’ve got one that was a PE teacher and you know they’ve done exercise in the past and they understand why it’s important” (In3).

The physical infrastructure of the ERS setting and the timings of ERS sessions were perceived as a barrier towards providing ERS and encouraging attendance and adherence. Across all ERS sites, the gymnasium where ERS participants exercised is open to the general public, which could be off-putting.

“I think the people not coming back is more to do with the environment more than the session, they all say, was great, thank you, loved it, come in one time and it’s not very quiet, people dropping weights and things like that and you can see their heads starting to go and it’s out of my control unfortunately” (In4).

Further, the physical capacity of the gymnasium was perceived as restricting the number of ERS sessions available

“it would be nice to get more participants in, but I think you would need to disperse it over the whole week rather than having them in the two-hour slots and the two days” (In6).

Instructors expressed that extending the length of ERS and increasing the availability of equipment in order to increase the range of types of exercise helped to increase attendance to the scheme.

“Well, we did make a change there [...] it used to only be an eight week block, so we increased that to 12 just to try and improve the adherence of the participants , so I think that’s been one good improvement [...] I try and base my programme round obviously you need to base it round what they’ve been referred for, but as well take into consideration their likes and dislikes on equipment, so try and avoid any equipment that they don’t like, because they’re probably not going to come if they’re not enjoying their session” (In6).

Referral instructors described using a variety of BCTs to increase attendance and adherence to the exercise prescription. Instructors did not distinguish between using BCTs to increasing attendance and increasing adherence. Rather, they were packaged as a whole. Common techniques used by instructors to improve attendance and adherence to the exercise prescription included: distraction, social support, and providing a level of education upon the benefits of PA by shaping knowledge. One instructor used a mixture of social support (emotional) and distraction to help encourage participants to work a little longer and not give up if it was hard work.

“I know they're ultimately there to have a work-out, if we can give them a social side to it, a wee bit of interaction, a wee bit of chat, then I think that goes a long way, if it means distracting them when they're on a treadmill, so they can do 15 as opposed to 10, then it might serve its purpose” (In2).

One Instructor used shaping knowledge to help participants understand why they were performing a certain behaviour.

“I try and give them the reason behind why we give them stuff, so I like to let them actively know, this is why we're doing this I want them to know the reason why we do things, it is important to do” (In5).

Another instructor endeavoured to optimise adherence to specific exercises through use of humour and banter.

“I mean, they'll call me the devil and things like that which is that fun part of it and I'll have a wee joke with them. But it's trying to keep it interesting” (In4).

5.3.3. Purpose of exercises prescription

Instructors provided a mixed response when asked if the objective of ERS was to improve health or fitness. Acknowledging that participants were referred for a health condition, instructors described that fitness and health go hand-in-hand with each other.

“Yeah, I would say a bit of both. [...] being a health and fitness professional is you want to get people more active, regardless of what condition they may have at the time, but yeah, just I would say just in general, get a bit more active” (In5).

“I think with the people that we work with, the majority of them, health is the motivation for referring them, and you can see that through from whatever reason [...] some of them will say that, oh, I feel much fitter for it, but the majority of them just want to feel better” (In1).

Unanimously, instructors said that supporting participants to be independent and be able to carry out activities of daily living such as, tying their own shoelaces was the main goal of ERS. Therefore, instructors prescribed exercises that either mirrored activities of daily living or would have a positive influence on activities of daily living; ultimately providing holistic benefits for the participant.

Instructors described how participants expressed success of ERS as improvements in their (participants) activities of daily living. Instructors continued to describe that prescribing exercises that were simple, easily attainable and replicable at home, gives autonomy and independence back to participants.

“I’ve managed to do this, tie my shoelace. Things like that. I mean, you can see the look on their faces to actually get a bit of independence back in their lives which is my main goal for it. To give them back that independence and maintain it” (In4).

“I can climb the stairs with shopping bags, it’s just so much easier, I can’t believe the difference it’s made” (In1).

“we want them to be independent, because it’s a lifestyle change, it’s not just [...] well done, see you later” (In5).

Instructors described they need a degree of flexibility when prescribing an exercise programme. For instance, having to deal with participants who are negative, working around clinical limitations of referral condition and co-morbidities, participant’s likes and dislikes and availability of exercise equipment.

“what do you fancy starting on today, so it’s not always just us telling them what they’re going to do, so we try and be quite laidback, quite flexible. We’re quite positive, because some of them are very negative, so we will always try and put a positive slant on things” (In1).

“depends on again the individual, what they’ve been referred for, what their previous activity is like as well, take all those sort of things into consideration. But I always tend to start off low rather than starting off too high and maybe having to regress it, it can demotivate them” (In6).

Instructors described that having a good rapport with participants’ means they are able to provide practical support on how to complete exercise, or emotional support to reduce any fear or anxiety (participants) they might show.

“put their mind at rest in that regard to say, right, well we’re just gonna do a wee bit of cycling here, it's just gonna be 10 minutes, you go at your own level, we’ll keep it at level one. If we do level one for 10 minutes, that’ll do me, because I'm not gonna tell you to go up to level ten” (In2).

“Yes, I’ve had loads of people come in and be like; I don’t know what to do. I say, well, that’s okay because that’s why I’m here. I do know what to do and we’ll do it together” (In3).

One instructor used shaping knowledge in an attempt to educate the participant on the purpose of the exercise and what benefit it will have.

“I think it makes it more interesting to them if you give it as a real-life scenario instead of just saying, carry that weight. Why? Because I want you to. Carry that weight because you might be doing shopping. Then they think, do you know what, that’s actually beneficial”
(In4).

5.4. Discussion

5.4.1. Main findings

The present study offers a number of insights in how exercise referral instructors faced various situations in their roles when it came to facilitating take up to ERS, increasing attendance at ERS, ensuring adherence to their prescribed exercise and prescribing exercise. For instance, correcting misinformation provided to participants from HCPs and explaining to participants why HCPs had referred them. Furthermore, the role included easing patient’s anxieties towards exercise.

Instructors make use of a variety of BCT’s to tackle patients concerns and help increase attendance at ERS and adherence to the prescription. However, instructors stated that there is no theoretical framework embedded in the ERS. When prescribing exercise, the primary referral condition is at the forefront of instructors’ mind. Instructors described that the purpose of ERS was to instil independence and autonomy in their (participants) activities of daily living. Instructors perceived that participants also viewed improving activities of daily living as a successful outcome or ERS.

5.4.2. Perceived influences on take up of ERS

This present study reported that instructors perceived HCPs lacked information about ERS, leading to participants lacking the required knowledge about the scheme. This is consistent with previous

work (Henderson et al., 2018), and suggest that HCPs do not possess the relevant information, or if they do, according to the perceptions of referral instructors, communication to the participant about ERS is typically lacking. Considering, the present study findings are consistent with previous studies regarding the intimidating nature of leisure centre environments and anxiety held by participants towards exercising (Moore, Moore and Murphy, 2011; Wormald and Ingle, 2004), a lack of communication to the participant may not help ease any anxiety towards exercising. Subsequently, referral instructors expressed that it is key that they can communicate with participants, forge a relationship with them to provide a strong positive impression of ERS, reduce any fears, with the view of motivating the participant to take up the referral. Previous work has shown that participants' who received support from, and perceived instructors to be supportive have reported higher identified motivation to uptake ERS (Markland and Tobin, 2010). Previous work has shown that exercise referral instructors demonstrated a strong sense of professional affiliation, which is they felt 'ultimately responsible' for ERS delivery (Henderson et al., 2018). This is evident in the present study, where instructors were committed to motivating participants to attend and adhere to the exercise prescription and benefit from ERS.

5.4.3. Perceived influences on attendance and adherence at ERS

Instructors describe providing greater levels of support and communication at the start of the programme to help foster attendance and adherence to the programme. Consistent with previous research (Wormald et al., 2006, Stevens et al., 2017), providing social interactions and developing self-identity has been shown as effective behaviour changes approaches to help maintain attendance in the programme (Stevens et al., 2019; Ntoumanis et al., 2016).

Henderson (2018) described service provision and the strategic management of ERS to be at odds with each other. The present study's findings appear to reflect such barriers to ERS delivery that ultimately influenced attendance and adherence. Instructors described two key barriers, out with

their control, which they perceived to have a negative impact on attendance: size of the gymnasium and timings of the programme. Previous qualitative research reported that participants were more likely to exit a scheme early due to a lack of ERS staff availability, support and timings of ERS (Wormald and Ingle, 2004). Instructors in the present study described that sessions ran during a quieter period of the day; however, the gymnasium was open to the public. If physical space were at a premium, alongside non-ERS exercisers creating noise, or the referral instructor having to divert attention away from ERS participants, this would often put participants off from attending. Additionally, instructors felt that participants were limited with programme timings, wishing they could offer more support and more opportunities to attend.

Instructors described offering practical guidance on supporting participants to exercise. Consistent with previous findings (Moore, Moore, Murphy, 2011), practical support was inseparable from discussion of the need to provide interpersonal support to build confidence and to motivate participants to attend and adhere. Moreover, such support was often used as a tool to help distract participants, for example, worrying about how long participants had left on the treadmill, to help aid adherence to the prescription. Distractions have been shown to increase tolerance of high intensity exercise, suggestive that a change in attentional processing from internal (physical sensations) to external perspective (distractions) may have facilitated this improvement (Barwood et al., 2009).

5.4.4. Purpose of exercises prescription

The present study reports that instructor's value and are aware of trying to improve patients' clinical condition. However, creating independence, autonomy and supporting daily activities is the purpose of the prescription. Instructors actively prescribe exercises that would resonate with participants, due to the perceived perceptions that participants value the associated outcomes of improvements in their daily activities (i.e. tying shoelaces, carrying shopping or walking up the stairs without being

out of breath). Moore and colleagues (2011) stated that participants performing exercise or PA that participant related to help participants engage with their exercise prescription.

Instructors justified that while the FITT of prescribed exercise may not appear demanding; however, the aim is to encourage participants to adopt a long-term physically active lifestyle. In providing a prescription, co-created with the participant, that is achievable and fun, instructors perceived this as having a greater long-term impact. This may provide clarity to previous findings (**Chapter 4**) in this thesis that intensity prescribed across the ERS was moderate with no statistical evidence to suggest that the prescription changed over time.

Instructors described how they aimed to improve participants' activities of daily living and they perceived exercise as a way to meet this aim. However, it was expressed that the ERS programme was not a high priority from a business perspective. So much so, instructors expressed the need to encourage leisure centre membership because ERS needed to generate profit for the facility. ERS has previously been seen as a non-essential service by public health commissioners, being deemed too costly a 'medicine' to fund from the public purse (Henderson et al., 2018). However, at a policy level, schemes like ERS are promoted as a potential panacea to the problem of rising inactivity levels and associated increased prevalence of NCD. This disconnect between ERS as a panacea for health and being viewed as a non-essential service may be reflective of different perspectives held of ERS. Those delivering the programme are acutely aware of their role to help the individual. Meanwhile, it has been reported that commissioners often see ERS as a scheme that will have influence at a population level (Henderson et al., 2018). Therefore, it unsurprising that there is no national policy (Oliver et al., 2016) or best practice on what should be prescribed within ERS.

5.5. Directions for future research

Future research should continue to explore the consistency of the findings described in this chapter across multiple schemes. Findings from this chapter suggest that HCPs lack or appear not to deliver appropriate information upon ERS to participants. Future research should consider exploring perceptions of HCPs preference to using PA and exercise as medium to help manage NCD. Research should explore what views HCPs hold of ERS referral, exploring how HCPs decided to refer participants to ERS, who they refer and on what basis. Furthermore, exploring barriers and facilitators HCPs face when referring participants to ERS. Outcome effectiveness of ERS is commonly viewed as improvement to clinical markers of the associated referral condition. However, in the present study referral instructors described prescribing exercises to improve participant's activities of daily living. Considering this, future research may consider pre-and-post measures of daily activities as an alternative outcome measure of ERS effectiveness.

5.6. Strengths and limitations

Strengths of the present study include a high response rate with 100% of referral instructors employed at the sites participating the study. Subsequently, views expressed reflect those of all the exercise referral instructors, not just a proportion. The present study adds to the body of evidence, reporting similar findings as previous research on instructor's actions in influencing uptake and attendance. The present study goes further to add new evidence on lived experiences of instructors prescribing exercise. Moreover, the present study provides depth, value and context to findings presented in **Chapter 4**. Despite obtaining 100% of referral instructors employed in this ERS, the cohort is representative of a small ERS with limited facilities. Subsequently, the present study is limited in conferring such findings on to larger ERS's, which may have more facilities and opportunities. The present study only explored instructors' views, as such; views of participants are limited to perceived perceptions from instructors. Last, consideration of reliability related to the researcher as the sole instrument who conducted the data collection and analysis is a limitation of

any study. Due to logistical restraints around funding of an independent researcher to conduct the interviews, it was not possible to mitigate for any researcher bias.

5.7. Conclusion

The present study offers several insights of lived experiences of exercise referral instructor's perceptions of facilitating uptake of ERS, increasing attendance at ERS, prescribing and ensuring adherence to the prescribed exercise. Perceived perceptions from instructors are that referring HCPs do not communicate to participants, why they are referring them or what to expect in the scheme. Lack of HCPs communication may have a negative impact upon uptake and attendance. The ERS in this study does not have an embedded behaviour change theory in place designed to aid uptake or increase attendance or adherence. However, referral instructors make use of a variety of BCTs to facilitate uptake, attendance and adherence. Referral instructors acknowledge that ERS has the potential to provide health and fitness benefits for the participant. However, the purpose of ERS and the prescribed exercise is driven to improve activities of daily living, promoting independence and autonomy with the participants. Knowledge of how exercise instructors support uptake, attendance, and prescribed exercise within ERS provides critical information, in understanding if ERS is fit for purpose, i.e. what approaches are currently in place to help tackle NCD via ERS?

Chapter 6. EXPLORING HEALTHCARE PROFESSIONALS PERSPECTIVES ON PHYSICAL ACTIVITY PROMOTION AND REFERRAL IN PRIMARY CARE: A QUALITATIVE STUDY.

6.1. Introduction

PA promotion is a public health priority and there is a need for effective strategies to increase PA levels across the population (Lowe et al., 2017). Integrating PA promotion into healthcare has been proposed as one of the seven 'best investments' for reducing inactivity levels (Lowe et al., 2017; GAPA, 2011). HCPs in primary care can play an important role in encouraging and facilitating lifestyle change among their patient group, in part, due to a high level of contact opportunities (Douglas et al., 2005; PHE, 2016). As previously established, ERS are one of the most popular PA interventions available within primary care (**see section 1.1**).

The underpinning premise of ERS is that participants will make positive changes, which then impact positively on their clinical outcomes. These positive impacts may then lead to a reduction in medication or reliance on medical care. **Chapter 2** of this thesis recommended that future work should explore the feasibility of examining ERS' potential impact on a patient's use of medical services (**see section 2.8**). As part of this thesis, an attempt was made to link attendance data of ERS participants to their medical records, however, as explained in Appendix 4 this project did not take place. A key reason why the data-linkage study did not take place was a lack of engagement from HCPs in releasing medical record data. No clear rationale was cited by the HCPs that explained their choice not to engage with the data-linkage. However, supposition may be a lack of time, capacity or interest. Previous findings from this thesis (**Chapter 5**), consistent with previous research (Henderson et al., 2018) highlight referral instructors' perceptions that HCPs do not engage with ERS. This suggests a need to understand HCPs perceptions of ERS.

Earlier arguments presented in this thesis (**see section 1.1.2**) identified several barriers to HCPs referral to ERS across studies (Din et al., 2015; Graham, Dugdill and Cable, 2005; Persson et al., 2013;

Singh 1997). For example, perceptions of patient likelihood to exercise, and concerns around giving advice that is not associated with the primary reason of the GP appointment (Din et al., 2015; Graham, Dugdill and Cable, 2005). Other barriers included concerns around their own expertise and whether it was within their remit, time constraints, and a lack of perceived importance or priority, relative to other health promotion activities (e.g. smoking cessation) (Din et al., 2015; Graham, Dugdill and Cable, 2005; Persson et al., 2013; Singh 1997). Such findings suggest that HCPs are apprehensive about their expertise in PA, priority setting and time constraints. One study suggested future work ought to examine and understand the decision-making process of HCPs relating to PA advice and referral to ERS (Din et al., 2015).

The studies presented in the paragraphs above are conducted where ERS schemes are currently available for HCPs to refer into. However, if HCPs in primary care do not have an ERS to refer to, what processes are happening instead? In Scotland, the National Physical Activity Pathway (NPAP) is a set of steps for HCPs to follow to encourage patients in their care to be more physically active. The NPAP should be used by all HCPs in primary care and involves 5 steps: 1) Raising the issue of PA; 2) screening for PA levels; 3) giving person-centred PA advice; 4) signposting or referring to external support; and 5) follow up review (and screen again) (NHS Scotland, 2018). The Scottish government's 2016 Health and Social Care Delivery Plan published, described plans that would have NPAP embedded in all appropriate clinical settings by 2019, and provide resources and training for HCPs to make use of the pathway (ScotGov, 2016). Therefore, it would be expected that HCPs are likely to be aware of and making use of NPAP. However, it is currently unknown to what extent this has happened and the level of engagement from HCPs. Part four of NPAP recommends that HCPs signpost or refer patients towards PA opportunities, one of which is ERS.

A 2010 audit of ERS provisions in Scotland, highlighted that within NHS Highland health board there are no large ERS, one medium size ERS and eight small ERS (large schemes were defined as covering a health board area; medium schemes were defined as covering a local authority area or most of a

local authority area; and small schemes were defined as a single practice schemes; schemes in one town) (Jepson, Robertson and Doi, 2010). However, the geographical location of these ERS were predominately in the southwest and western fringes of the NHS Highland health board catchment area. A follow up audit in 2018 revealed that there was no ERS provision in NHS Highland health board (Buxton and McGeorge, 2018). Notable limitations are present in the 2018 audit, for instance, there is no central register of ERS in Scotland, thus, there is no guarantee that the survey reached all relevant parties. Further, mapping ERS's based upon the reliance of schemes self-reporting may fail to capture the true knowledge of ERS provision. Despite these potential limitations, there is no ERS provision in the north of the NHS Highland health board catchment area for HCPs to refer patients towards, where this present study was conducted.

It is critical to understand the perspectives of HCPs role in promoting PA, given that HCPs show apprehension towards their own expertise and priority setting and work within restrictive time barriers. Therefore, there is need to understand decision-making process of HCPs relating to promotion of PA and referring to ERS, i.e. what they promote, to whom and why. Furthermore, if HCPs are wanting to promote ERS, yet no schemes are available, it is crucial to understand what a PA referral scheme might look like and how it could operate, where currently one does not exist.

6.1.1. Aims

The aim of this study was to explore HCPs perceptions and experiences in promoting PA in primary care. The study addresses objective five of the thesis; to explore primary HCPs' perceptions of their role as promoters and referrers of PA and referrers to ERS (**see section 1.5**). Reporting and description focused on the following objectives: 1) perception of HCPs role in promoting PA; 2) barriers and facilitators of promoting PA; 3) what might influence the decision-making process of promoting PA; 4) knowledge of what PA is promoted and to whom; and 5) what any future ERS might look like, where one does not exist.

6.2. Methods

6.2.1. Study design

The study employed a qualitative methodology that involved conducting a thematic analysis of semi-structured focus group interviews with general medical practice staff. University of Highlands and Islands Ethics Committee (OL-ETH-SHE_1056) and NHS Highland Research and Development (ID: 1437) approved the study.

6.2.2. Study development

Emergent findings from **Chapter 5** highlighted that exercise referral instructors expressed that they felt HCPs lacked information in referring participants to ERS. Therefore, to forward our understanding about whether ERS is fit for purpose, it was key to explore the perspectives of those who initiated the referral, HCPs. Initially, a local GP, with an interest in PA, approached a member of the PhD supervisory team (TG), looking to explore the implementation of a cycling or walking group from general medical practice. As part of this, and prior to implementation of any initiatives, the researcher decided the need to explore current processes to promote PA across general medical practice. Subsequently, the researcher worked in conjunction with one member of the PhD supervisory team (TG) and the local GP to develop a qualitative study to explore HCPs experiences of promoting PA and ERS.

6.2.3. Recruitment and participants

Focus group interviews were conducted with employees of general medical practices (GP, Nurse, administration staff such as Practice Managers) recruited from seven general medical practices across National Health Service Highland, UK. Throughout this thesis, 'HCPs' has referred to medical staff who refer participants into ERS. For the purpose of this study, HCPs will also include

administration staff. Recruitment of a general medical practice was via a combination of two approaches. First, the GP working with the researcher and one member of the PhD supervisory team (TG), provided contact details of practices within their practice cluster, who had expressed an interest in the project. These practices were invited to participate via an email invitation to the practice manager. Second, NHS Highland Research and Development contacted practices on behalf of the research team, and when a practice agreed to take part in the study, their details were passed on to the researcher, and an email invitation was sent to the practice manager. Participating practices were asked to nominate five to eight staff to take part in the focus group interview (up to one hour). Practices were encouraged to open invites to any staff within the practice who may have a role in the promotion of PA. Participating staff received a Participant Information Sheet in advance. Written and verbal assurances were given that their participation was voluntary; they were free to withdraw at any time and of anonymity.

6.2.4. Focus group interviews

Focus group interviews were conducted in general medical practices. Informed consent was taken prior to the start of the interview and included consent to digitally record interviews (Olympus VN-731PC). The researcher and one member of the PhD supervisory team (TG) facilitated interviews. The initial topic guide was produced in conjunction with the GP. The guide was not designed to have questions asked chronologically but rather, in an order that seemed to follow the natural flow of the conversation. Topic areas, semi-structured questions and prompts relating to the research questions (Appendix 7) included perspectives on PA; previous experience of promoting and prescribing PA; current efforts in promoting PA; who PA is promoted to; facilitators and barriers to promoting PA; and ideas on what a future ERS might look like. The use of focus group interviews is common practice in health research (Tausch and Menold, 2016). The group dynamic helps promote synergy and spontaneity by encouraging the participants to comment, explain, disagree, and share their

views. Thus, experiences voiced might not surface during individual interviews (Tausch and Menold, 2016). Focus group interviews were conducted within practices at a time convenient to the practice.

6.2.5. Rigor

As previously discussed (**see section 5.2.5**), debate surrounds qualitative research analysis sample sizes and the number of interviews needed to be able to declare confidence in the findings. This study made use of the concept, data saturation, where the methodological principle indicates that no further data collection is necessary, because the researcher begins to hear the same comments repeatedly; therefore, reaching data saturation (Saunders et al. 2018). Similar to the qualitative research presented in **Chapter 5**, this research benefited from being a naturalistic study. That is, the study sought to understand HCPs views within a context-specific setting (Cypress, 2017).

Furthermore, understanding of rigor within this study is via the criteria of credibility, transferability, dependability, and confirmability (Cypress, 2017). Demonstration of credibility is through the accurate and truthful depiction of HCPs answers and lived experiences. Transferability is viewed as providing the database of evidence that allows judgements possible (Lincoln and Guba, 1985).

Dependability was achieved through triangulation, having multiple researchers (one researcher and one member of the PhD supervisory team) review transcribed material at different stages to validate findings. Confirmability was achieved through an audit trail of data collection, data analysis, and interpretation. (Cypress, 2017). Self-awareness as the researcher collecting data brings into question any potential biases, assumptions, beliefs, that might be present (Cypress, 2017). That is the researcher tried not to let any personal perceptions influence the analysis. However, complete removal of the researcher from data collecting was not possible. Further, the above criteria are detailed throughout the qualitative analysis below, allowing for transparency.

6.2.6. Qualitative analysis

Data were transcribed verbatim, with transcripts and sound files stored in an encrypted research drive, held at the University of Highlands and Islands. Similar to the methods described in **Chapter 5** (see section 5.2.6) transcripts were analysed using inductive latent thematic analysis (Braun and Clarke, 2006). The researcher and one member of the PhD supervisory team (TG) familiarised themselves with the transcripts and coded the data into emerging categories, themes and sub-themes. Coded data were indexed and summarised thematically, retaining the context and semantic in which it was expressed, (Gale et al., 2013; Ritchie and Spencer, 1994). Thematic analysis is widely used in healthcare research. Thematic analysis provides a flexible but structured way of performing analysis, with the advantage of systematically reducing data to categories, themes and sub-themes, while retaining links to raw data (Gale et al., 2013; Din et al., 2015). Analysis was an iterative process with disagreements discussed, resolved and the analysis amended accordingly. This process helped to improve rigour and reduce bias in data analysis and interpretation (Cohen and Crabtree, 2008).

Similar to the process carried out in **Chapter 5**, an initial set of codes were set by identifying recurring words within the dataset, alongside additional codes of interest to the researcher. Once an initial list of codes were generated, they were cross-referenced against each other and where appropriate, combined. Generated codes related to promotion of PA; perception of role; barriers and challenges to promoting PA; and current promotion of PA (see Table 6.1). Transcripts were coded by hand, constantly revisited, and cross-referenced, throughout the first iterative step, by the research and one members of the PhD supervisory team (TG). Second, coded data were grouped into five descriptive themes, as reported and defined in Table 6.1. Unlike **Chapter 5**, the present study did not develop a conceptual framework in which to understand the descriptive themes. The aim of the present study was descriptive exploration, for example, what are the barriers and facilitators to HCPs promoting PA. During the analysis, it became evident that some of the

descriptive processes could explain the actions of HCPs, i.e. barriers and facilitators that the HCPs encountered influenced the decision-making process on who they promoted PA.

Last, a realist approach to the analysis was undertaken; that is, the researcher sees the analysis as a true representation of HCPs experiences. Face-to-face meetings between the researcher and one member of the PhD supervisory team (TG) allowed discussions about initial coding and descriptive themes, thereby reaching consensus upon analysis and interpretation. Quotes were selected to represent the range of views relating to descriptive themes.

Table 6.1. Codes and definitions of descriptive themes of HCPs perceptions of promoting PA

Codes	Descriptive theme and appropriate code	Descriptive theme definition
1. HCPs perceived patients' challenges	Job role perception	Perceptions that HCPs hold of their role and perceived perceptions by patients of HCPs role.
2. HCPs challenges	Codes 15, 20	
3. External challenges		
4. Clinical challenges	Decision-making process	Relates to challenges and facilitators a HCPs may experience in their role and how these factors influence any decision-making process.
5. Practice challenges	Codes 1,2,3,4,10,11,12,13,14,18	
6. Referral process		
7. ERS structure		
8. ERS location		
9. ERS solutions	Physical activity promotion	After making the decision to promote PA, HCPs have to consider, what to promote to whom and how.
10. Practice facilitator	Codes 16,17	
11. HCPs relations with patient and perceived perception of patient facilitators		
12. Clinical facilitator	What will help current practice?	Relates to process or solutions that may enhance HCPs current working practices and ability to promote PA.
13. Facilitator HCPs knowledge and belief	Codes 5,9	
14. Facilitator peer encouragement		
15. Why promote PA	How a future ERS will best work	When referring a patient to ERS, what certain features, based on previous experiences and current working practices, are required in order to offer the patient the best opportunity to take up, make use of, and benefit from ERS.
16. How PA is promoted	Codes 6,7,8,19	
17. What PA is promoted		
18. Who PA is promoted to		
19. Previous promotion		
20. Patient expectations		

6.3. Results

Mean duration of interviews was 49 min, (range= 42 to 60 min). A total of 29 HCPs participated in the semi-structured focus group interviews representing seven practices; mean group size was 4 (range = 2 to7). This included 19 GPs, five practice nurses, one medical student and four practice administration staff (2 practice managers and 2 reception staff). Practices were located in areas across the socio-economic spectrum (Scottish Government, 2016). Four practices had patient population lists above 5,000 (see Table 6.2) (ISD, 2019). Twenty codes and five descriptive themes emerged across focus group interviews (see Table 6.1).

Table 6.2. Descriptive of general medical practices patient list size, SIMD quintile and interview length of seven anonymised general medical practices.

Anonymised practice code	Practice population size, above or below 5000*	Practice SIMD	Interview duration (minutes)
P1	above	4	44
P2	above	1	47
P3	above	5	45
P4	below	3	52
P5	below	3	60
P6	below	2	42
P7	above	2	48

*as of 03/12/2019

The following results section is organised to represent the five descriptive themes with representative quotations.

6.3.1. Job role perception

HCPs described how keen they are to promote PA, and how they see PA promotion as a key aspect of their role. Furthermore, HCPs are aware of the evidence base supporting PA and that PA is a key component of a holistic package of self-care management. However, HCPs describe how they are mindful of over medicalising PA, expressing that PA is a life-long practice.

“So, it would definitely be to promote it, as part of a holistic package of care for everybody’s wellbeing, mental and physical health” (P2).

“I have to say there’s enough that’s been medicalised that doesn’t need to be. But I think it’s useful to have as an additional thing...the doctor referring in. But I wouldn’t want to overly medicalise physical activity. It should be something that’s encouraged and they do” (P7).

HCPs appear to be in conflict with themselves regarding their role. HCPs described how although promoting PA was an important role of theirs, they are not public health promoters; their job as medical professionals is to prescribe medicine to treat the condition. However, HCPs are aware that this is changing slowly, with a shift in the training for medical professionals. This conflict may arise from the structure of the health service in the United Kingdom. That is the service is a reactive service and as such, the perception is that you get medication to cure a problem rather than advice to prevent or self-manage.

“The NHS has always been a bit of a reactive service, so it’s definitely, someone comes in to see us when they’re ill. Though, we’re better with long term conditions...GPs, doctors, are not good, we know we’re probably not very good at it, because we end up seeing people when they’re unwell. And that’s not often the time, when we’re promoting stuff” (P2).

“Personally, I think yeah, two things, we have a very, very important role, we’re well-placed, promoting this to people who come to us, but also, we’re medics, we’re not public health employees. This is not our...the only thing we do” (P3).

“fundamentally we are doctors and we go to medical school and we’re trained as doctors and we think medically and, you know, it’s part of our own self-affirmation about who we are and what we do and being powerful and clever and all the rest of it. You know, we prescribe drugs and we do high tech medical interventions and that’s what we’re about and that’s what we come into work to do and that’s very much kind of in our personalities and

what's been bred into us. So, medical students are getting much more focus on the importance of lifestyle intervention, I think, in a more structured formalised way during their training." (P4).

HCPs additionally described how patients might view the primary care practitioner role. HCPs held concerns that patients might feel stigmatised if the HCPs suggested PA as a treatment option. For example, many HCPs felt they were active often cycling into work, but they were mindful that patients might not relate to this. Additionally, HCPs felt that patients might hold concerns of being misunderstood or that PA was not a relevant treatment for their condition. Lack of PA relevant was especially if patients were dealing with a multitude of complexities in their lives.

"And I think the thing that I'm aware of in our practice is that we all look like we exercise and so, for our patients who perhaps have never exercised, they might think it's easy for us" (P4).

"life is so chaotic and,...it would almost seem, I think, like he would think I was having a laugh, speaking to him about, why don't you go for a run. You know, it...like, he might stand up and go, have you listened to anything I've said for the past 45 minutes" (P1).

6.3.2. Decision-making process

The present study set out to describe 'what' barriers and facilitators HCPs encounter to promoting PA. However, it emerged that barriers and facilitators played a role in the decision-making process of the HCPs. Therefore, the narrative of this results section will first describe 'what' barriers and facilitators HCPs encounter to promoting PA. The narrative will then describe how these barriers and facilitators influence HCPs decision-making process when choosing to promote PA.

HCPs described a variety of challenges to promoting PA, some that they have control over and some they do not. Challenges inherent within the practice or service delivery process often prevent

promotion of PA. For example, patients may not see the same clinical staff member, or dependant on their condition, might not present at the practice on a regular basis that would enable HCPs the opportunity to follow up and reinforce positive PA messages. It is unknown if patients seen other medical professionals if there is consistency in the advice given.

“If someone had a heart attack, you would see them once, maybe, after they’ve come out of hospital, and you’ve had a bit of chat about rehab, and lifestyles, and stuff. But then they would get followed up by nursing staff” (P2).

HCPs also described that the lack of time they get to spend with the patient in consultations is very limiting and they do not have time or frequency to follow up patients. Administration staff express that it is out with their job remit and has never been requested of them to proactively recommend local PA opportunities. However, they were happy to discuss this if asked.

“as an administrator, because we’ve not really been told that we should promote it, as such, because it’s not something that we’ve been told to” (P2).

“I could give them good running advice, you know, and tailoring it to what their life is. But you just need time. But I don’t think you can do that as a GP, [...], you need follow-up for that, [...] we’re not set up for that.” (P2).

There are some facilitators inherent within practice that enable PA to be brought up. Nurses express that they do have a bit more time with patients as part of annual reviews and this enables them to spend more time discussing PA. Nurses also described clinical facilitators such as, clinical protocols (e.g. diabetes annual review) that include PA questions. Moreover, the nature of the nursing in general medical practices favours health promotion. Doctors describe how they tend to see patients with mental health conditions, more than nurses do and the nature of the consultation is more conversational, meaning it is easier to bring up PA.

“probably the nurses don’t see as much, you know, they wouldn’t see as much mental health as we would [...], you know, they’ve got their tick boxes of what they need to be talking about at all these reviews. You know, you’ve got to check the blood pressure, you’ve got to do this, you’ve got to talk about diet, you’ve got to talk about exercise, so they’ve got a good formula that they go through, so it is talked about every time” (P6).

“all chronic disease monitoring appointments should ask about exercise. Yeah, nurses would have quite a different approach. They’d look more at lifestyle measures and they have those kinds of appointments that are geared towards promoting” (P3).

“think it maybe comes up quite naturally as well in these consultations because you almost kind of open the floor for what are we going to do to help things” (P4).

HCPs described external challenges that restricted opportunities to promote PA. For example, local PA facilities closing down or changing their remit (e.g., who they accept), or cumbersome referral processes. Furthermore, the infrastructure supporting patient’s access to PA opportunities are limited and restrictive in the local area.

“these triplicate forms that we had to fill in. It was a real hassle and we didn’t use them very much. And whilst I thought the idea was great, I think it... And then it was pulled presumably for funding reasons or perhaps it wasn’t being adequately utilised. I’m not too sure and I’m not aware of anything similar that’s come in to replace it” (P4).

HCPs described a variety of situations that help to facilitate promotion of PA. general medical practices that align themselves to community programmes, such as park run, aid HCPs in becoming more aware of local PA opportunities. Additionally, some practices have developed a directory of local social prescribing opportunities, which is circulated among colleagues and general medical practices clusters. Similarly, HCPs described the benefit of having colleagues and peers that recommend or champion local PA services or local PA success. HCPs also described that this builds a

positive image of PA and if HCPs have used a local PA service and it has been a successful experience, it makes discussing PA easier based on their beliefs and experiences.

“it's quite nice to say to people, to give some concrete options. So, I'm going to be at Park Run on Saturday, will I see you there? ...both times I've been, I met a bunch of GPs there, and a bunch of their patients. So, there must be a bit of a contract, if you know, like, if you say to your doctor, I'm going to meet you on Saturday, you should maybe turn up” (P2).

HCPs described barriers that are associated with the patient. For example, conditions patients present with in primary care are becoming more complex, patients want an easy fix, and HCPs perceive that patients want to leave a consultation with something. Furthermore, the effort to begin such conversations about PA is time consuming and often pointless because it can often lead the conversation in an un-productive direction. HCPs also described that they lack the ability to provide structured advice, other than patients should exercise more which often prevents them from discussing PA matters with the patient.

“when you see somebody when they come in. But it's the same. It's difficult not having...I think people like going away with something, you know, like a prescription for something. So just saying, oh, it would be good if you could exercise more, I sometimes feel doesn't really...” (P6).

“patients generally all want a simple fix” (P2).

“it is a challenging conversation to bring in and it can take the conversation in another kind of direction which is time-consuming and energy sapping” (P4).

However, HCPs perceive patients to be increasingly aware of PA, so will often ask advice or steer conversations themselves, which aids the HCPs in promoting PA. HCPs described knowledge around health behaviours changing over time.

“first started as a GP a lot of people didn’t seem to really know about weight and exercise and smoking. This is back in the nineties, now, everybody knows they shouldn’t be smoking, so it’s a different conversation” (P5).

HCPs suggest that PA should be promoted to everyone, certain conditions or situations are seen as more appropriate, for example, diabetes. Therefore, the primary condition is foremost in the clinical decision-making process. Perceptions of the patient, internal and external barriers and facilitators play into the decision of whether PA is discussed with a particular patient. For example, awareness of local opportunities, such as park run, encouraged HCPs to talk to patients because they had something to offer. Furthermore, only if the HCPs perceived that the patient was in a position to take up PA, and that the conversation was not going to be wasteful, and that time was available, and that PA is an appropriate treatment for the patient’s condition would they be proactive in promoting PA. Patients presenting with long term conditions for annual reviews and patients at risk of long-term medication were targeted as potential avenues of PA promotion.

“And I think often because we know our patients well these are conversations that may have happened before. So, it seems to me you’re going to have most success with lower hanging fruit because then we might have a sense of our patients where you know you’re not going to get anywhere at all. So, even bringing it up... I mean, they’re not even in their pre-contemplative phase. You know, it’s so not on their radar. Or you might have mentioned it before but haven’t gotten anywhere. And so, sometimes it might be... Even if it’s a patient that you might have mentioned it before or, in the past, it’s not been suitable, but something happens that then makes it more suitable. So, it’s kind of picking your moments” (P4).

“prediabetes being quite a big thing that we’re trying to pick up and code and diagnose a lot better and hopefully reverse if we can. I certainly seem to be having a lot more

conversations with prediabetics about how we got to that point, how much they're doing physical-way" (P1).

HCPs described how important their relationship with the patient is. HCPs describe how they often caveat complex conversations, in order to maintain a functional relationship with the patient. HCPs described that due to the nature of some patient's chaotic lives, how hard it was to pitch advice to patients, fearful of offending or tarnishing their relationship with patients. HCPs appear to plant seeds in order that patients become autonomous, taking control of their condition.

"Yes, I sometimes try and shift the focus away from myself and say, well, unfortunately, you know, I may have an opinion but what I'm telling you is based on some sort of objective advice. This is not actually my opinion; I'm just telling you what I know. So, you know, we might both agree that it's hard to do this, or it's rubbish that we're in this situation" (P5).

6.3.3. Physical activity promotion

After making the decision to promote PA, HCPs must consider, what to promote and how.

Therefore, this section will first address what HCPs promote, i.e. FITT, before addressing how HCPs promote PA.

HCPs knowledge of what to promote appeared generic. HCPs did not promote specific frequency, intensity or times in relation to PA or exercise. A variety of activities were promoted including walking, cycling, gardening, and wild swimming. HCPs described avoiding promoting gymnasiums, for fear of not engaging the patient, unless they gymnasium ran appropriate classes, such as OTAGO classes (OTAGO Exercise Programme was developed at the University of Otago Medical School, New Zealand; it is a programme of set leg muscle strengthening and balance retraining exercises and a walking plan designed specifically to prevent falls (Campbell et al., 1997)). The nature of what was

promoted was based on previous use of a service, and if they knew, a service was still running. HCPs described generic promotion of PA and felt they lacked the skills to provide structured advice.

“My favourite one at the moment is, once they’ve got over the, gosh you’re going to talk to me about exercise, is to say have you ever considered wild swimming because of the mental health benefits” (P4).

“That said, OTAGO classes for the older folk are very popular, I mean, I certainly recommend them primarily, I guess, for people who their balance isn’t too good” (P5).

“I think, if you're going to do something that’s going to be effective for a person, it would not be just a trip to the gym” (P2).

HCPs described the language they used when encouraging patients to be more active, which tend to focus on very simple phrases. HCPs described that they did not carry out a formal assessment of patients PA levels; therefore, simple generic advice appears to be more appropriate.

“If it’s the little old lady who wants to be steady on their feet, it’s usually, well, just either try and keep doing what you’re doing, or just a little bit more, because if you don’t use it you lose it [...] you need to find something, you need to fit it into your day, walking is the best as anything. You don’t have to buy Lycra, just walk and try and get slightly out of breath and that’s all you need to do” (P5).

HCPs described a number of approaches to PA promotion. For example, they employed prompts, which were not always designed to engage patients directly with PA, but led patients to starting conversations, enabling HCPs to capitalise upon this opening. For example, a HCPs had left their cycling helmet on the door, which prompted a patient to ask about cycling. HCPs described walking to house visits locally, sending out newsletters describing HCPs PA habits, or having posters about PA opportunities in the practice.

“Well it’s funny, the days that I...on the days I do cycle in, I’ve started changing in my room and I put my cycle helmet on the back of my door. And the number of people that comment is amazing. You know, do you cycle to work? You know, I don’t do that every day like lots of folk do, but it...it’s interesting ‘cause that has promoted discussion about cycling.” (P1).

“And so another way we do try to influence our patients to a degree is we have a newsletter that goes out quarterly and we try to put some of the information in, you know, if a partner’s running a marathon or partners are doing the Etape, we will...we’ll put that in. And patients do love to know what any of their doctors, nurses and practice team are doing” (P1).

HCPs commonly described clinical benefits to patients, describing how increasing activity and reducing weight will have a knock-on effect on blood biomarkers. Where appropriate, HCPs are presenting PA as equal to medication. HCPs described offering up opportunities, asking patients what they would like, in order to promote an opportunity that is relevant to the patient.

“I would try and ask them, what kind of exercise are you in to? if it’s nothing, I might ask about, what did they do when they were younger? And try and make a connection with it and fun...And also in terms of motivation, try and make that connection with the social element or a fun element like for example parkrun. It might be...they’re going to parkrun but they’re joining it with a coffee, which will make them more likely perhaps to stick with it” (P1).

“in depression I tend to speak about three areas, medicine, psychology and lifestyle, of which activity is part. And if you...I think if you present it as a...on a, kind of, level playing field with all the options for whatever that particular condition is, it gets to that stage where it feels like a natural thing to do” (P1).

“if you can tell them...hypertension...if you lose some weight, it will knock on your blood pressure, it will bring that down, and you might be able to lose some medications, they’re much more likely to engage with it.” (P7).

Some administration staff described how they use social media to promote the general medical practices. Such a service was not proactively used to promote PA; however, it was suggested that there is no reason why it shouldn’t be used to promote PA. Additionally, HCPs described the changing role of primary care and it would not be a surprise if administration staff became more involved in promoting health.

“this is the stuff that’s slowly changing, and it will change even more. The signposting idea, and how much you guys know already about what pharmacy does. And patients are having more conversations with you about, I don't know, stuff that might, would never...so just four years ago, if a patient called, admin would not ask anything, and they would just be booked into this GP” (P2).

6.3.4. What will help current practice

HCPs offered some solutions that may aid efforts to promote PA. HCPs described that knowledge of the local PA services (timings, locations, what it offered) was key; not having such information to hand was described as a disservice to patients. It was suggested that a centralised system, be it a web portal, sign posting directory or a person, may aid in offering a comprehensive service to patients. Overwhelmingly, time with patients was viewed as the key area, however, as primary care was so busy this would not be easy to overcome as there is unlikely to be an increase in consultation times.

“I think the difficulty is that if you sat everyone in a room, they could say, I know about this, I know about that. But actually, they don’t...each of us don’t know about all of them. So if things were centralised, that we either said, this is the person you go to speak to, or, this is where you have a look, or, this is the leaflet that’s got everything listed, you know” (P1).

“It almost needs to be someone, a different person, with more time. Not only for that initial bit, but for the follow-up, for promoting whatever exercise. And there needs to be goals set, and who’s monitoring with you” (P2).

6.3.5. How a future ERS will best work

The present study was conducted in an area where a formal ERS does not exist. Many of the HCPs interviewed were aware of or had previous experiences of ERS. This previous experience ranged from referring into local ERS services, an in-house ERS based in the general medical practice and signing exercise referral prescriptions. Mixed views were expressed by HCPs on the referral process. Some described that referral needed to be from the HCPs to hold gravitas or felt that the patient might lack the motivation to do it themselves. Others preferred a self-referral process that reduced the workload burden on HCPs and handed autonomy to the patient. HCPs described how other services made use of self-referral process, such as physiotherapy or a smoking cessation clinic, so there is no reason why ERS could not be the same. Irrespective of the process, HCPs described that it needed to be simple and efficient.

“From our point of view, it would be better if they just all self-referred, but I think some patients would find that more difficult” (P7).

“That’s what happens with the health improvement advisor, which is mainly smoking cessation, they have to refer themselves, so we just give them the card, it seems to work” (P5).

“I guess to make the change the motivation has to be there but – yeah, I don’t know – to make that first step it would make things easier if somebody does it for you” (P6).

“We’ve got enough admin stuff to do at the best of times, so something definitely quick and easy” (P7).

HCPs commonly described the need for a centralised ERS, which offered patients a variety of PA opportunities to suit their patient’s needs. Furthermore, schemes need to be consistent. It was vital that the staff within the ERS were knowledgeable, up to date, with dedicated time for the patient and importantly, followed up the patient, which was not possible from primary care.

“So I would think it would be a personal trainer, or somebody who would spend that time finding out about them, and what they want to do, and working out a plan, and giving them a personalised individual something, for six, 12 weeks, or something. Like CBT for mental health, some kind of...and then, follow-up. So that might, the personal trainer might be the specialist bit at the beginning” (P2).

Last, HCPs presented contrasting views on where the ERS should be located. The majority of HCPs felt that ERS should not be that closely tied to the general medical practices, for fear of over medicalising PA, which should be part of a long-term healthy lifestyle. Furthermore, HCPs describe that patients must go to different locations for different referrals, therefore ERS should be no different.

“Yes, that’s why I want them to do it, because I don’t think it is a medical issue, really, I mean, it impacts on their...that’s why I would like it to be outside here, give the advice” (P5).

“Well yeah, I think we should be moving away from it being a treatment and a therapy. It should be part of good healthy lifestyles, so, starting from young kids, and stuff, and just making it...and I suppose, that’s why I would be, I suppose I'd be unkeen to have it, really, in a doctor’s surgery, or really associated with it.” (P2).

“I think for patients, they probably are well aware they’re going to be two separate things. They’re used to going up to the hospital to get X or Y done, or to the pharmacy. So, it’s just another referral” (P7).

Those HCPs who felt ERS could be closely linked to the practice, described potential psychological benefits for patients, such as social interaction of walking with HCPs. Furthermore, they felt that as the practice represents a place of health, and physical activity is part of a health, it is a natural fit.

“Well, we’re keen for it to be very much linked to the health centre [...] Well, that’s then I guess why walking from the health centre is maybe psychologically a good...you know, because if the GPs are coming with us and the nurses are coming with us” (P6).

“They’re thinking about their health ‘cause they’re in the building. They’re either thinking about their health because they’re coming for a health promotion clinic or they’re coming ‘cause they’re not feeling well” (P1).

6.4. Discussion

6.4.1. Main findings

The aim of this study was to explore and report HCPs perceptions and experiences of promoting PA in primary care. HCPs value PA as an important tool that contributes towards health, however, they are mindful of over medicalising PA. Furthermore, HCPs appear to be in conflict with their role, in that they see it is important for them to promote healthy behaviours; however, the structure of the NHS is not set up for such a process. Furthermore, their training is to prescribe medicines. HCPs described a variety of barriers and facilitators when promoting PA. Barriers and facilitators played into whether a HCPs would discuss PA with a patient. FITT of PA promotion was limited and generic in nature. HCPs expressed contrasting views whether any future ERS or PA scheme should be associated with general medical practice. However, there was a consistent call for any new ERS or PA

scheme to be easy for HCPs to refer to, centralised, easily accessible by patients, and able to provide multiple choices for patients.

6.4.2. Job role perception

Findings from the present study suggest that HCPs accept their role in health promotion. However, conflict lies in where their role starts and stops. HCPs described that they are trained as medics and it is their job to prescribe, it is bred into them; therefore, their remit is not as public health professionals. HCPs described that PA should be part of a healthy lifestyle; however, they do not have the capacity to provide such PA advice. The conflict felt by HCPs may in-part be due to their training. Despite it being an established idea that PA is beneficial to health, training for HCPs on non-pharmacological and lifestyle methods has been previously reported as inadequate (Womersley and Ripullone, 2017; Lion et al., 2019). HCPs in the present study acknowledge that training in lifestyle is getting better for doctors. However, there is a call for the new generation of doctors to avoid prescribing “preventive” drugs as a first response to diseases of inactivity (Khan, Weiler and Blair, 2011). Khan argues that clinicians need to contribute to the PA message since counselling in clinical settings provides exceptional value for money (Khan, Weiler and Blair, 2011). Understandably, as with any health promotion activity, there is a requirement for convincing evidence that the interventions work, that is what interventions work for whom and why (Donaldson, 2000).

HCPs in the present study described concerns that their role should not over medicalise exercise. As defined by the World Health Organisation, health is “a state of complete, physical, mental, and social well-being”. By definition, then every aspect of individual and collective life can be seen as a health problem (Kaczmarek, 2018). Therefore, PA could be medicalised and be part of a medical model used to treat certain conditions if appropriate. It is possible that HCPs views of over medicalising lies in the lack of training on PA, addressed above.

6.4.3. Decision-making process

Previous research has reported that despite viewing PA as an important component of health, many HCPs expressed reluctance to promote PA via primary care (Lawlor et al., 2000; Laws et al., 2008). Additionally, it has been reported that prescribing PA was a task that doctors did not feel comfortable performing (Persson et al., 2013). The findings from the present study suggest that HCPs are willing to prescribe PA in some clinical cases (i.e. pre-diabetes and mental health). However, the decision-making process leading to choosing PA was multi-factorial, heavily influenced by a variety of facilitators and barriers. One key aspect within the decision-making process was the relationship between HCPs and patient. The doctor-patient relationship is an integral part of a medical consultation and can alter health outcomes for patients (Chipidza, Wallwork and Stern, 2015). There are four key elements to the relationship: mutual knowledge, trust, loyalty, and regard (Chipidza, Wallwork and Stern, 2015). Knowledge refers to the doctor's and patient knowledge of each other. Trust involves the patient's faith in the doctor's competence and caring, as well as the doctor's trust in the patient to report accurately on their symptoms. Loyalty refers to the patient's willingness to forgive a doctor for any inconvenience or unintended errors. Regard implies that the patients feel as though the doctor likes them as individuals and is on the side of the patient (Chipidza, Wallwork and Stern, 2015; Ridd et al., 2009). HCPs described the need to maintain a relationship with the patient, describing how they may actively avoid conversations with patients about PA if they felt it might damage their relationship. This suggest that in order to maintain long-term trust, short-term attempts to address PA are put aside. HCPs in the present study described uncertainty on how to bring up conversations, especially in patients whose lives appear chaotic. HCPs further held perceptions that patients might feel stigmatised if lifestyle change advice was offered, which is consistent to previous studies (Lobel, Duperly and Frank, 2009). The talk in the present study suggest that HCPs may opt for a path of less resistance, in order to maintain a relationship with the patient.

HCPs in the present study and previous studies (Din et al., 2015) have cited time to see patients as a key barrier. Therefore, HCPs often have to make quick decisions because they need to see many patients in a limited time (Klein, 2005). Aiding rapid decision-making are heuristics, defined as mental shortcuts, allowing judgments quickly and efficiently. Klein (2005) describes five types of pitfalls that HCPs might fall into in decision-making. First, the representativeness heuristic, defined as an assumption that something that seems similar to other things in a certain category is itself a member of that category. Second, the availability heuristic, defined as placing particular emphasis on examples of things that come to mind easily, perhaps because they were recently encountered. Third, overconfidence, defined as poorly assessing the gaps in our knowledge, overestimating how much we know and how reliably we know it. Fourth, confirmatory bias, defined as the tendency to look for information that fits with our pre-existing expectations. Last, illusory correlation defined as a tendency to view two events as causally related, when in fact the connection is coincidental or non-existent (Klein, 2005). The present study did not seek to answer how HCPs were making certain decision-making processes. Rather, it emerged that HCPs were basing decisions on barriers or facilitators they encountered. Subsequently, the present study cannot comment directly upon any biases that HCPs might have held or pitfalls within their decision-making. However, investigation upon unpicking decision-making in HCPs is a recommendation of further investigation.

6.4.4. Physical activity promotion

HCPs described a variety of promotional approaches related to PA. Prompts include sending newsletters to patients, posters promoting PA, leaving cycling apparel on doors. HCPs describe how these cues can lead patients to bring up conversations, which allows HCPs to follow up. For example, HCPs are trying to enable discussion, spin perceived negative thoughts of the patient, and negotiate approaches with patients. More overt PA promotion methods, such as HCPs describing how

becoming more active can have a knock-on effect on blood measures appear similar to brief interventions (Lion et al., 2019).

HCPs in the present study described time as a barrier to bringing up PA conversations. One approach to combat time constraints are brief interventions. Previous studies have shown that brief interventions can help to increase PA in the short-term; however, there remains uncertainty if brief interventions have a long-term impact (Lamming et al., 2017; Pears et al., 2016). Consistent with previous research (Din et al., 2015; Osborn et al., 2015), consultation time was cited as a key barrier from HCPs in the present study. Furthermore, recent research has reported consultation rates in the United Kingdom have risen to close to 10 minutes (Irving et al., 2017). Lamming argues that future research should develop and evaluate very brief interventions (of 5 min or less) (Lamming et al., 2017). However, as previously discussed, within Scotland (**see section 6.1**), HCPs should be making use NPAP. Point two of the NAPA involves the screening for PA levels, via the Scottish Physical Activity Screening Questionnaire (Scot-PASQ), consisting of three questions, which should lead into conversations and act as a brief intervention. However, HCPs in the present study described that they do not formally assess PA levels.

There is a lack of evidence of FITT in the PA, which HCPs chose to promote, and therefore promotion is very generic in nature. While the present study did not set out to assess knowledge of PA guidelines, talk from HCPs generally focused on the aerobic component of PA guidelines. Effective PA promotion in primary care relies on HCPs having the appropriate knowledge and skillset to assess, promote and support their patient (Lion et al., 2019). However, the evidence described by HCPs appears to suggest that this might not be the case, and this may be reflective of HCPs training (Lion et al., 2019). Previous evidence presented by Bull (1997) and Jørgensen (2012) suggest HCPs are confident at providing generic PA advice rather than specific advice to patients, consistent with findings from this present study. Walking was the form of PA most frequently recommended by Australian doctors, where around three-quarters self-reported providing patients with details of the

frequency, intensity, and duration of PA (Bull et al., 1997). A study on Danish GP's reported that when they did promote PA (around 60% of the time); they would recommend the type of exercise, duration, frequency, and intensity on at least 70% of those occasions (Jørgensen, Nordentoft and Krogh, 2012). Neither study was able to provide greater clarity on the specific FITT of PA, other than GP's reported that they promoted FITT. Furthermore, the evidence from the Danish cohort suggest findings are contradictory to reality; direct observation of GP's reported PA counselling in 22% of consultation (Podl et al., 1999). The evidence presented in previous studies and the present study suggest that HCPs only promote generic activities. Therefore, there is either a need for HCPs to upskill and have the confidence and ability to offer more personalised PA promotion, or HCPs need to refer patients on sooner.

6.4.5. What will help current practice?

As previously discussed, HCPs describe challenges and barriers that are present in the infrastructure of the health service. Solutions to solve such issues might require synergy between stakeholders and policy changes. For example, HCPs described a lack of time as a key barrier when seeing patients. However, increasing consultation lengths will have an impact on patient lists and waiting time. HCPs further described that society has changed to extent that PA is no longer viewed as the norm. However, little is known about patient perspectives of being prescribed exercise or PA, or referred to ERS as a treatment method, in primary care. One study that might offer insight examined attitudes of patients toward complementary and alternative medicine in primary care and reported that patients supported the option of receiving complementary and alternative medicine in a primary care setting (Ben-Ayre et al., 2008). Furthermore, patients expected HCPs to be more proactive in prescribing alternative therapies (Ben-Ayre et al., 2008). Contextually, complementary and alternative medicine is included, but not limited to folk and traditional medicine, diet/nutritional therapy, chiropractic and movement/manual healing therapies (massage, reflexology, yoga, etc.).

While PA is not usually considered a complementary therapy or alternative medicine, the findings suggest that patients may be more supportive of PA than HCPs believe. However, further research is required to understand patients' preferences for their treatment.

6.4.6. How a future ERS will best work

Previous research demonstrated HCPs did not consider that involvement of HCPs in referral was necessary and that self-referral should be allowed (Din et al., 2015). Furthermore, a previous review has questioned the need for a referral direct from the HCPs where an automated referral could be an option (Clarke et al., 2012). In the present study, HCPs presented mixed views about referral.

Concurrent with a previous study, there was some consensus towards self-referral to remove the workload burden HCPs are under (Din et al., 2015). However, others still felt GP's were required, either to give gravitas to the referral or help motivate patients who would struggle on their own.

Lion et al (2019) suggested that PA should be tailored to the individuals' health and social needs and interests, varying from personal home-based exercises to community-based activities. HCPs in the present study expressed similar views, and that any future ERS needs to be easily accessed (i.e. referral process and patient access), centralised and tailored. HCPs described the importance of sustainable schemes that they could be confident referring to. Findings from **Chapter 5** of this thesis suggest that ERS instructors perceived HCPs to lack knowledge of their local ERS. HCPs in the present study described the need for close communication between HCPs and any future ERS, to help keep HCPs up to date to opportunities. This is suggestive that communication between HCPs and ERS is important to the success of the programme and it could perhaps be enhanced by outreach or educational means or collaborative working between ERS and HCPs. This might help draw all stakeholders together in having a strong, consistent consensus on what ERS offers. Something that is currently not in existence (Henderson et al., 2018).

6.5. Direction for future research

If PA promotion is to be integrated into routine primary care consultations, concerns regarding HCPs knowledge and skills-sets, need to be considered. Exploration of educational approaches of trainee HCPs might be one way to influence future practices. This could include guidance for professionals on how to prescribe beyond generic recommendations. Conversely, as HCPs cite workload burden, future researcher may examine the capacity to aid HCPs around PA promotion. One approach could explore referral instructors acting as link workers between general medical practice, with a view to increase HCPs knowledge of PA benefits and PA or ERS opportunities. This could be extended further by revisiting the initial PhD plan, examining exercise specialist co-located in primary care.

6.6. Strengths and limitations

The present study benefits from reporting views from a diverse range of staff members employed within general medical practice. Additionally, participants were representative of the target population from mixed geographic areas (urban vs. rural) with a range of practice sizes. However, more senior HCPs appeared to contribute the most, with nurses or administration staff speaking less despite facilitators efforts to include. Data saturation refers to the point in the research process when no new information is discovered, and this redundancy signals the termination of data collection. In this study, saturation was achieved, however, as the practice staff described themselves as active people, this may have led to greater uniformity in views. It is unknown if additional practices with staff who labelled themselves as less active or non-active would have meant a different range of viewpoints were expressed with saturation being reached at a later point. This study was performed where no current ERS service exists. Such insights presented in this study may aid any future ERS understand the relationship required between stakeholders (i.e. HCPs, patient and ERS). For example, a recommendation may be to establish a working relationship

between HCPs and the ERS that would keep HCPs up to date on PA opportunities. Additionally, such collaboration might lead to an appropriate referral process that reduces HCPs burden.

6.7. Conclusion

HCPs in primary care have enormous potential to promote PA. However, HCPs express conflict in their role as promoters of PA. Acknowledging the importance of PA as a tool to help tackle NCD over the life course, HCPs express concerns whether they are best placed to assess, promote or follow up patients from primary care. Furthermore, HCPs express concerns on medicalising PA. Previously identified barriers to PA promotion in primary care such as time and lack of knowledge, appear to still be problematic. It is evident that barriers and facilitators discussed in the present study influence HCPs decision-making process. The nature of PA promotion from HCPs appears generic and reflective of personal knowledge and experiences. It is imperative that any future ERS needs to be easily accessed, sustainable and provide tailored opportunities to patients. Evidence suggest that HCPs have a vested interest in integrating PA promotion into primary care consultations, however, there is still an urgent need to forward progress toward this goal, specifically advancing opportunities that allow HCPs to promote PA beyond generic suggestions.

Chapter 7. GENERAL DISCUSSION.

Mounting evidence has shown that exercise can act as an adjunct therapy or replacement to medication for prevention, control and self-management of NCD (Mikklesen et al., 2019).

Traditionally, ERS evaluation has focused on the end, i.e. has the participant significantly improved upon an objective measure since the start. However, currently, there is a lack of evidence for ERS effectiveness at improving NCD risk factors in the long-term (Pavey et al., 2011a; Morgan et al., 2016). Laying judgement of ERS solely on the endpoint without truly understanding the multiple processes preceding, and any potential influence they might have, is problematic. Consequently, a thorough appreciation of the value and quality of referral to, uptake of, attendance at, and the prescription delivered within ERS is required.

7.1. Aims

The overall aim of this thesis was to open the 'black box' and provide a rich and thorough understanding of key components of the ERS Pathway. Developing a better understanding of these key components contributes towards answering a crucial question: Is ERS fit for purpose in preventing and managing NCD?

The thesis objectives were to:

1. Explore current reporting and definitions of critical components of ERS uptake, attendance and adherence (study 1 / **Chapter 2**)
2. Investigate the socio-demographic characteristics of those who do not attend and those who do attend ERS and associations between attendee characteristics and attendance (study 2 / **Chapter 3**)
3. Describe the frequency, intensity, type and time of prescribed exercise within ERS (study 3 / **Chapter 4**)

4. Explore exercise instructors' perceptions about motivating people to exercise within ERS
(study 3 / **Chapter 5**)
5. Explore primary HCPS perceptions of their role as promoters and referrers of PA and
referrers to ERS (study 4 / **Chapter 6**)

The experimental studies within this thesis were conducted to fulfil the presented aim and objectives. The pragmatic methodical approach undertaken (**see section 1.4**) has produced results from real-world environment rather than ideal conditions. This is beneficial because it has provided findings that are directly relevant to ERS stakeholders and researchers. However, such a pragmatic approach may make it tricky to generalise the findings to different ERS. It is important that the findings are understood in the context they are within, that is they are bound to the ERS in question, or ERSs within a similar context. For example, in **Chapter 5**, one challenge to delivering an ERS prescription highlighted by referral instructors is the physically small size of the gymnasium. Such a factor might not be highlighted by referral instructors operating in large gymnasiums. Whilst a lack of generalisability may be deemed problematic, this pragmatic approach has reinforced how heterogeneous ERS are and context they operate within must be considered. The purpose of this final chapter is to summarise, synthesise and collectively discuss the outcomes. Furthermore, this chapter will provide practical implications of the findings towards ERS effectiveness. Discussion will focus on suggestions for future research within ERS, based upon the findings presented in this thesis. Last, the chapter will conclude the key take away messages from the findings.

7.2. Summary of main findings

As presented throughout this thesis, the current level of reporting of ERS is limited and inconsistent. Ultimately, a lack of reporting prevents assigning a true reflection on ERS effectiveness. **Chapter 2** provided a review of evidence of reporting, referral, attendance and prescription within ERS. Novel contributions included systematically collating and evaluating the evidence base of review-level

findings. The main findings presented in **Chapter 2** included the following: First, lack of robust and consistent recording within the existing literature upon reporting of all facets of ERS; second, lack of reporting upon participants choosing not to take-up their referral and; last, lack of reporting upon prescriptions delivered to participants in the programme. Therefore, it seems there is a failure to provide a concrete evidence base for ERS. This failure is partly due to the heterogeneous nature of ERS and the lack of reporting prevents researchers, ERS stakeholders and policy makers from commenting on what works for whom and why. Thus, leading to an inability to recommend what ERS should comprise. Crucially, it makes it almost impossible to assess if ERS is fit for purpose i.e. addresses the needs of individuals being referred who will have a range of different conditions that require different prescriptions.

Chapter 3 presents data on the socio-demographic patterning of ERS participants. Novel findings presented in this thesis suggest there is no discernible demographic difference between the sub-population choosing not to take up their referral and those who chose to attend ERS. That is, those not taking up a referral were also older and female, referred with a cardiovascular condition and living within an area of higher deprivation. Existing literature is unable to provide clarity about socio-demographic influence on ERS uptake, attendance or adherence. The literature is consistent in suggesting that older females are more likely to uptake ERS; meanwhile older males are more likely to complete the duration of the scheme (Pavey et al., 2012). Findings presented in **Chapter 3** suggest that participants within ERS actually reflect those more likely to attend primary care, i.e. older, females, with a cardiovascular condition, which may explain why no statistical difference was observed between non-attenders and attenders. Unique findings presented in **Chapter 3** reveal that attenders exit ERS within the first few sessions. Participants who remove themselves from the scheme early reduce the opportunity to benefit from the scheme. Previous research acknowledges a high drop out from ERS (Hanson et al., 2013). However, previous research has not documented when participants exited ERS. Novel findings presented in this thesis show that 61% of ERS cohort exiting on or before their fifth exercise session. Critically, this highlights the need to investigate

factors that may influence how participants engage with their exercise prescriptions and how to increase session count and retain participants in the scheme.

Chapter 4 described the FITT of the prescribed exercise. The FITT of any exercise prescription is dependent on the type of outcome desired (e.g. specificity of exercise adaptations); however, targeting exercise prescription to the condition will have a greater impact on the condition. The prescribed exercise dosage observed in **Chapter 4** was a generic exercise package as all participants were prescribed components of aerobic and resistance focused exercises. The prescription contained a large variety of exercises prescribed; however, there was a large focus on prescribing either treadmill or upright bicycle for aerobic-based exercise. Chest press and lateral pull down were the two most common resistance-based exercises prescribed. ERS sites that received a greater number of cardiovascular referrals did prescribe more time in aerobic exercise. Across all sites and exercise types (aerobic and resistance), there was little evidence to suggest progression overload, or that participants were prescribed more exercises or asked to perform exercises for a greater time duration as the scheme progressed. For improvements to occur, the prescription must be systematically altered so that the body adapts to the changing stimuli. The adaptive processes will only respond if continually required to. Therefore, a lack of progressive overload or variation within the exercise prescription restricts any potential physiological benefits. Knowledge of exercise dose prescribed within referral schemes provides critical information, in understanding if ERS is tailoring exercise prescription towards tackling NCD or referral condition.

The main findings from **Chapter 5** helped provide understanding towards conclusions drawn in **Chapter 4**, that is, instructors indicated that the primary design of exercise prescription was not to target the specific referral condition. Rather, referral instructors described how the co-created exercise prescription, in conjunction with the participant, was primarily designed to have an influence on activities of daily living. Instructors' perceived perception of participants indicated that holistic improvements in daily living were valued more than clinical improvements. This is suggestive

that ERS may not be fit for purpose i.e. rather than addressing the clinical needs of the patient, rather they are addressing holistic, personal needs preferences of the patient. Data presented in **Chapter 5** further offers insights of lived experiences of exercise referral instructor's perceptions of facilitating uptake of ERS, increasing attendance at ERS, prescribing and ensuring adherence to the prescribed exercise. Part of this insight included instructors desire to instil levels of autonomy into participants via a variety of BCT, based on their relationship with the participant. Therefore, knowledge of how exercise instructors support uptake, attendance, and prescribed exercise within referral schemes provides critical information, in understanding if ERS is fit for purpose, i.e. what approaches may work in tackling NCDs via ERS.

Findings from **Chapter 5** described how exercise referral instructors perceive that HCPs lack knowledge about ERS and fail to provide sufficient information to the participant regarding their referral and **Chapter 6** data concur with referral instructor's perceived perception. In **Chapter 6**, HCPs described how they lack information regarding local PA or ERS opportunities. Furthermore, they lack specific knowledge on what PA they should be promoting to patients. This suggests that further work is required to advance HCPs knowledge of PA and exercise promotion. Comparative literature in the late 1990's and more recent work in 2012 recommended the need to advance HCPs knowledge (Bull et al., 1997; Jørgensen, Nordentoft and Krogh, 2012). The current evidence presented in **Chapter 6** suggests such progress may not be present. However, is this the most appropriate route to follow? If the National Health Service invested more in prevention, then primary care may have fewer GP's and more health specialists. Traditional reported barriers and facilitators experienced by HCPs when promoting PA also influence their decision-making process on whether PA is promoted. Findings also suggested that in order to maintain a working relationship with the patient, HCPs might avoid promoting PA altogether, or wait for a more appropriate time. Therefore, HCPs choosing not to promote PA or to refer a patient to ERS, instantly removes those who may be in need of ERS.

Based on the findings from the primary studies of this thesis, this thesis can conclude that ERS does not seem to be fit purpose. However, further research is required on how the findings presented across this thesis directly impact outcome measures. However, considering the evidence presented in this thesis, in order for ERS to be effective in its role of primary and secondary prevention and self-management of NCD, there is certainly a need to advance current practice. The following subsections will consider the practical implications in considering that ERS does not seem to be fit for purpose.

7.3. Practical implications

7.3.1. Uptake, attendance and adherence to ERS

Based on findings from **Chapter 2** there is a need to create a minimum data set of what is reported within ERS. Building upon this, there is a requirement to standardise definitions on the key constructs associated with reporting, i.e. session count rather than adherence to measure attendance (Shore et al., 2019). This allows different schemes to be assessed against each other, whilst still allowing schemes to have autonomy in what they choose to offer (i.e. types of exercise programme available). A recent editorial has reinforced this idea calling for the need to establish meaningful ERS classifications, which may lead to improvements in the interpretation and evidence base of ERS (Hanson et al., 2019). However, as evidence in this thesis, succinct reporting around ERS on many facets is lacking. To advance knowledge and practice on ERS, to be able to truly compare, judge and confer ERS as fit for purpose, there is a need to have consistent reporting, which may lead to improvements in the interpretation and understanding of the evidence base for policy makers and ERS practitioners.

There is a need to know referral rates from HCPs to establish the true extent of which factors (e.g. demographics or socio-economic) may be influencing scale of ERS take-up. Previous published data reported females as being more likely to commence ERS (Pavey et al., 2011a); however, the data

more accurately reflects the proportion of females to males that start a scheme, which makes it difficult to interpret the extent of generalisability of effect to groups of the population. Data presented in **Chapter 3** of this thesis, in part agrees with previous literature in that there are more females present. Females represent a higher proportion of both non-attenders and attenders within the ERS examined. Therefore, a more accurate reflection of who does or does not uptake ERS should be assessed at the point of referral from HCPs; these data presented in **Chapter 3** (attenders vs non-attenders), while not concurrent, reports that the demographics of non-attenders vs attenders appears similar. This finding is likely due to older females with cardiovascular disease presenting at primary care more often.

Once within ERS there is a need to distinguish between attendance and adherence. Knowledge of when participants stop ERS is vital, also important is why they stop. Commonly rates of attendance within ERS are reported as percentage of sessions completed (Pavey et al., 2012) or attendance at set points of the programme, for example, at the six-week mark (Hanson et al., 2013). This prevents any comparison between schemes of different lengths. Furthermore, it provides no clarity if the participant attended sessions before this threshold or just the required 'threshold session'. Data presented in **Chapter 3** concurred with previous research (Pavey et al. 2011a) in that drop out was high. However, these data presented in **Chapter 3** reveals the actual sessions when participants dropped out, thus providing a key driver for researchers and ERS providers to explore opportunities to combat such an early exit. Exiting the schemes early reduces any opportunity that a participant may have of benefitting physiological or psychologically. Therefore, ERS currently does not seem to be fit for purpose since the majority of participants exit the scheme prematurely.

Data presented in **Chapter 5** reveal insights into how ERS instructors try to manage participant attendance. This thesis did not set out to explore if certain factors were having a greater impact on drop out, however, referral instructors highlighted multiple factors they address to aid participant attendance (**Chapter 5**). For example, lack of information provided by HCPs to participant,

competing job interests of sports centre staff restricting time with participants, limited infrastructure (i.e. small gyms, sessions times). Instructors did describe attempts to motivate participants to continue attending, which were personalised to each participant. Therefore, there are multiple factors that may influence a participant's choice to continue attending ERS. However, it seems that the greatest opportunity for ERS instructors to have an impact on participants attendance would be to afford them more time with participants, facilities that allowed staged integration, so as not to scare those less active off from exercising with regular members, and greater choice of times to attend. Currently, ERS is not facilitating such a service, which may be influencing attendance, which is then affecting ERS ability as a fit for purpose model.

7.3.2. Exercise referral prescription

Attendance alone is just one component of a bigger picture of the ERS prescription. While implied, attendance does not signify exercise was completed. Moreover, within previous studies, reporting on attendance, it has been unclear the precise FITT of the exercise prescribed and performed (Slade et al., 2016; Slade and Keating, 2012). Data presented in **Chapter 4** provided a detailed description of the prescribed exercise. However, in presenting these data, two debates arise; first, would the FITT of the prescription confer a clinically meaningful change? Second, would ERS benefit from standardisation or differentiation by context?

To address the first debate, it might be worth reconsidering the context of the referral from the HCPs. Within this thesis, (**Chapter 3 and 4**) referral condition was categorised based on the referral condition stipulated by the HCPs, e.g. cardiovascular disease or mental health. Whilst mental health is a medical condition, that in itself is a not an explicit referral. If the referral stated, help combat feelings of self-worth and loneliness via improve improved leg strength, enabling improved function for patient who is uneasy on their feet but would benefit from being able to visit friends. This gives

referral instructors a clear objective. It further provides a base target for ERS to be judged as effective.

Findings presented in **Chapter 5**, suggest that clinical improvements are not the focus of the prescription. This is in part due to the co-creation of the prescription based on the referral instructor's introductory assessment. Furthermore, the co-creation takes into account any co-morbidities that might influence the prescription. A key conclusion for practice would be that HCPs provide a detailed referral and instructors provide a rationale for their prescription that is explicitly linked to the medical condition. As discussed above, ERS may not be fit for purpose in managing NCD. However, instructors describe prescribing for meaningful improvements in quality of life, which is perceived by instructors to be valued more importantly than the referral condition as an outcome.

Referral instructors prescribe towards holistic wellbeing versus condition specific FITT prescription, matches that of patient centred care. The principles of patient centred care espouse the qualities of respecting individual beliefs and values, open communication and support (Fazio et al., 2018). This is all evidenced in the approach referral instructors taken in prescribing an exercise programme (**Chapter 5**). The benefits of patient centred care are supporting individuals with a greater emphasis on communication, rather than viewing them as a passive component of the process (Rygiel, 2017). This is particularly important for individuals with multiple co-morbidities, which is reported in **Chapter 4**. The alternative approach, and one that currently ERS is judged upon is that of a disease centred approach, focusing on a clinical outcome. One disadvantage of a disease centred approach in clinical care on individuals with multiple comorbidities include the treatment burden, relevant to often contradictory recommendations for different conditions (e.g. treatments that are beneficial for one disease can worsen the condition of another) (Rygiel, 2017). However, ERS does not operate in such a manner. Therefore, if evaluations continue to assess on broad clinical referral or a disease centred approach, i.e. manage mental health, based on the evidence in **Chapter 4** and **5**, they may well be judged as ineffective and appear not fit for purpose. Therefore, there might be a desire to

suggest additional measures of impact, such as measures of quality of life or activities of daily living (Linton, Dieppe and Medina-Lara, 2016), which would bring ERS in line with the health service in following a patient centred approach and be a truer reflection of what is prescribed and why.

To address the debate that surrounds standardisation or differentiation of ERS by context it is important to understand what is and should be standardised. It was addressed above (see 7.3.1) that ERS would benefit from standardised reporting (e.g. session count). However, as discussed, the FITT of ERS may not be appropriate or accommodate standardisation in order to be patient centred. Standardised FITT approach reduces opportunities for individual tailoring. Furthermore, it may be unrealistic to expect one unique intervention fits into all participants' profiles and needs. ERS may take guidance from The British Association for Cardiovascular Prevention and Rehabilitation who recommend minimum standards for cardiac rehabilitation programmes to ensure that routine provision of cardiac rehabilitation closely resembles the effective clinical trials it is based upon (Doherty et al., 2017). The standards set focus predominately upon, cardiac rehabilitation being offered to patient priority groups (myocardial infarction, percutaneous coronary intervention, coronary artery bypass, heart failure), how quickly participants need to be admitted (within 40 days) and pre and post assessments (Doherty et al., 2017). However, despite warnings of statistically significant differences in programmes meeting the minimum standards of delivery, cardiac rehabilitation is a highly effective programme (Doherty et al., 2017; Dalal, Doherty and Taylor, 2015). A non-standardised approach may encourage innovation, new ideas and approaches to provide a greater range of choice for participants (Morgan, 2017). However, it important that clear standardised reporting of what is delivered is undertaken to monitor and benchmark the FITT of ERS.

7.3.3. Referral process from healthcare professional

This thesis has shown HCPs do value the contribution that PA plays towards a healthy lifestyle, although, there is a fear and unease of medicalising exercise (see section 6.3.1). HCPs are well placed to contribute towards changing patients' attitudes towards PA health benefits. Previous

research has highlighted needs for address training needs of HCPs (Womersley and Ripullone, 2017; Lion et al., 2019). Evidence presented in **Chapter 6** indicates that there is a need for increased training around PA for HCPs. However, it may not be the panacea to improving PA promotion from primary care, rather one aspect of a much bigger picture for the following reason: continued professional development training of HCPs to promote PA may include motivational interviewing techniques, brief interventions, communication skills and risk assessments. Training would need to include the theoretical context of the evidence base that supports PA interventions, and practical application of this in the context of motivational interviewing and brief interventions. To support this, explicit policy and protocols would need to be written and implemented, therefore providing a coherent guide for HCPs to follow.

Evidence highlighted in **Chapter 6** reported that HCPs expressed confidence to engage patients in conversation around PA. However, more often than not, there was insufficient time. Chronic underfunding and workforce shortages has the potential to compromise quality of care and place patient safety at risk. This means that HCPs are working in a system under immense pressure to meet rising patient demand, in a service unable to recruit and retain the necessary staff required to deliver services (BMA, 2018). This suggests that HCPs will priorities conversations in order to provide a level of care that is safe and time efficient. As such, conversations around PA may be viewed as less important and do not fit into the time scale afforded to HCPs. Therefore, while training HCPs is vital, if HCPs consultation lengths are not accommodating, HCPs may not be able to implement any such training. Modifying consultation lengths would require HCPs, general medical practices and health boards to take joint responsibility for implementing such a change. Where change is underway, an opportunity exists to implement integrated primary care and ensuring continuity of care through greater team working (Baird et al., 2016). New models of primary care, specially, the vanguard programme of multispecialty community providers (MCPs), fully integrates community services with primary care. Any new model must enable delivery of integrated care for the increasing numbers of patients with chronic conditions (Baird et al., 2016). This means patients will get care

from co-ordinated teams of professionals from across the health and care spectrum (Baird et al., 2016).

This suggestion of integrated care brings this discussion full circle, back to the initial proposal of this PhD thesis (section 1.4). The initial research design for this PhD was to establish feasibility of co-locating an exercise specialist within a primary care setting. One previous study that might shed some light on such a concept reported the effectiveness of individualised advice from an exercise specialist in a general medical practice setting on changing PA levels and cardiovascular risk factors (Halbert et al., 2000). This study observed that PA advice was effective at increasing the intention to exercise and self-reported PA levels. Critically, the study had a high retention rate (88%), potentially reinforced by the participants' strong association with their GPs, who were aware and possibly encouraging of their participation, and the fact that all visits were conducted at their (participants) general medical practices (Halbert et al., 2000). What is unknown from this study was if it reduced the workload burden on the GP's. Whether it is appropriate and helpful to house ERS as a medical intervention is an important consideration. Australia might provide some guidance towards this; Accredited Exercise Physiologists are professionals with specialised training in the prescription of exercise and physical activity for NCD (Soan et al., 2014). Since 2006, the Australian government has recognised Accredited Exercise Physiologists as one of the allied health professions and therefore can provide services within the national Medicare system (Zhou et al., 2019). Since 2006, the number of referrals to Accredited Exercise Physiologists has increased significantly, 80 000 services were delivered in 2010 through to 620 000 services in 2013 (Gillam, 2015). Furthermore, at the end of 2012 there were 2327 Accredited Exercise Physiologists qualified to provide Medicare-funded services, an increase of approximately 563 % since 2006 (Cheema, Robergs & Askew, 2014). Such trends suggest that Accredited Exercise Physiologists are well integrated and have taken up a vital and important position within allied healthcare in Australia (Cheema, Robergs & Askew, 2014). Accredited Exercise Physiologists are still underutilised (Stanton, 2013), however, interventions delivered by Accredited Exercise Physiologists have found to benefit in terms of avoided health

system costs and wellbeing gains from lifestyle (Deloitte Access Economics, 2015). This suggests that the integration of ERS into a healthcare is possible and may prove helpful. Such proposals to embed an exercise specialist within primary care, to act as a link worker or stepping-stone to ERS, may positively influence the reach and benefits of ERS referral. Furthermore, it might help referral of appropriate participants to ERS. **Chapter 6** provides insight into the HCPs decision-making process and what factors may influence HCPs promotion of PA. **Chapter 6** described HCPs overriding need to maintain a relationship with patients. Therefore, those patients who are prepared to change, or are actively in the process of wanting to improve their lifestyle are actively targeted. However, those patients who may be dealing with situations that are more complex in life, HCPs are mindful of stigmatising or offending patients by raising PA with them. However, these people may well be in need of a PA intervention and would benefit the most. The observation that those most in need get the least resources is termed the inverse care law (Baird et al., 2008). This raises a debate whether ERS should be targeted to those more in need to help reduce such inequalities or should be a more universal scheme. The reality is that ERS operates in a grey area in-between universalism and selectivism. Status enhancement policies are those which change the environment for everyone. That is, they provide a subsidised service for all people with a defined need irrespective of material assets (Wolff, 2009). Such an approach is argued to be successful due to the lack of stigma attached to interventions which universally improve people's opportunities. ERS provide an example of a successful application of this approach. Furthermore, based on findings presented in **Chapter 3** and **4**, there is evidence to suggest that ERS does not adhere to the inverse care law, as those from lower SIMDs are well represented. However, when put in the context of HCPs referral process sits at odds with this idea. This thesis therefore suggests that ERS should remain universally accessible, however, greater efforts should be made to reach out and target patients who may be dealing with situations that are more complex in life. Therefore, the current process of promoting and referring patients to ERS is not fit for purpose, in that those most in need of behaviour change are not targeted appropriately.

To summarise, ERS does not seem to be fit for purpose for the following reasons. There is a lack of reporting of many facets of ERS. This prevents ERS from being truly evaluated across schemes in order to establish what works, for whom, and why. Exiting a scheme early prevents any opportunity to benefit from the scheme. However, those who do stay in the scheme there is a lack of evidence to suggest that they receive an exercise prescription that demonstrates progression overload that would illicit physiological adaptations. Last, HCPs are mindful of medicalising PA, however, they currently do not have the time or knowledge to promote PA and are mindful of damaging any relationship with those patients who might benefit from PA behaviour change.

7.4. Theoretical and philosophical advancements

This chapter has discussed the applied implications across the findings; this next summary will consider the main theoretical and philosophical advancements made by the thesis. The choice to adopt a pragmatic approach is deemed an appropriate approach as the focus of the research is on which methods can answer the research questions at hand, providing “how” and “why” to the research question (Glasgow, 2013; Glasgow and Chambers, 2012, Feilzer 2010). ERS is a real-world intervention developed for and participated in by members of the community. Therefore, the impact of this thesis may help dictate a philosophical and theoretical change amongst some researchers, stakeholders and commissioners of ERS. That is, previous research has tended to be realist in nature, concerned with generating a singular truth on the impact or outcome of ERS, without truly considering the process that led to them. Therefore, this thesis has shown the importance of understanding the ‘black box’ that underpins ERS. The findings of this thesis are valuable to the stakeholders of the ERS who took part in the research, and similar ERSs in communities with a similar local context. However, the learnings from this thesis have led me as a researcher to question the generalisations that can be made about the impact of highly heterogeneous programme. Therefore, it is important that this thesis draws attention to this further, advancing and challenging

researchers, stakeholders and commissions of ERS to consider the philosophy of pragmatism and contextualism of the research undertaken on ERS.

7.5. Recommendations for future research

The findings from this thesis provide a number of potential directions for further research. These are detailed below:

It is well established that drop out from ERS is high. Novel findings presented in **Chapter 3** highlight that not only is drop out high, participants exit the scheme very early on. Therefore, there is need to address this. Exiting the scheme early reduces any potential chance a participant might have of benefitting. Qualitative work should address patient perspectives of why participants drop out early. Further exploration could examine if dropping out early acted as a catalyst for participants to become physically active elsewhere. This would represent an early exit from ERS, however it served its purpose in helping a person become active to self-manage their condition; it's just the gymnasium was not a preferred preference. To be able to unpick if this was the situation, data-linkage would be a powerful tool. Current ERS practice requires referral from a HCPs professional based on a risk or need to manage an NCD. Therefore, future research should explore the impact that ERS has on that referral condition. Whilst attempted for this thesis (Appendix 4), data-linkage may help provide evidence on the realistic impact that ERS has upon a participant's ability to self-manage their NCD beyond the ERS referral duration by indicating access of NHS services for treatment.

Building on suggestions from **Chapter 2** and the call for standardisation of definitions It is recognised that ERS is heterogeneous in offerings (length, FITT), based on the service providers choice (staffing, service infrastructure, i.e. pool access, gym size). Therefore, trying to compare schemes effectiveness across a heterogeneous spectrum of schemes where the outcomes are reliant on the same delivery is problematic and leads to schemes labelled ineffective. Referral instructors in **Chapter 5** described perceptions that participants valued holistic improvements to their daily living.

Furthermore, referral instructors provide a prescription (**Chapter 4**) that aims to address the patient's daily living. Therefore, it is a recommendation to explore alternative methods to judge ERS effectiveness. It is a recommendation that qualitative methods explore patient perspectives of what patients deem as success of referral to and attendance at ERS. There is a plethora of quantitative self-report measures for assessing well-being in adults (Linton, Dieppe and Medina-Lara, 2016). The variability between measures supports the need to pay close attention to what is being assessed under the umbrella of 'well-being' (Linton, Dieppe and Medina-Lara, 2016). If referral instructor prescribes a prescription that aims to influence a patient's activities of daily living, based on perceptions that participants value such an outcome, alternative measures provide scope for ERS to report impact beyond generic marker, such as reduction in body mass.

HCPs in primary care are working within an underfunded and understaffed service; facing an ever-increasing workload burden, limited consultation time, requirement to maintain patient relationships while dealing with increasingly complex patient problems. Therefore, it would not be expecting of HCPs to become experts in PA, due to the current pressures. Therefore, there is a need to streamline such a service to provide the most effective and efficient model for patients in primary care. Future researcher should investigate the opportunity of placing an exercise specialist into primary care. Qualitative work would explore patient preferences and barriers to performing exercise within a health centre. Quantitative methods could be used to establish if take up and attendance would improve within this healthcare location and therefore optimise effectiveness of exercise for the prevention and self-management of NCD. Mixed methods could be used to establish the feasibility of such a service across multiple health centres.

7.6. Conclusion

This thesis aimed to unpack the 'black box' and provide a rich description of key components of the ERS pathway. In order to consider the evidence that referral to ERS is fit for purpose in managing NCD. The studies within this thesis have explored the following: first, reporting of factors associated with ERS uptake, attendance, and adherence; second, sociodemographic and socio-economic profiles of non-attenders and session count of attenders; third, the FITT of prescribed exercise with ERS; fourth, perceptions and experiences of referral instructors prescribing and delivering exercise, within a contextual framework of improving uptake, attendance and adherence to the prescribed exercise; and last, HCPs perceptions of promoting PA in primary care. The studies within this thesis will allow researchers and stakeholders within ERS to make more educated and informed decision on ERS ability as a tool in combating NCD. Furthermore, this thesis considerably adds to the body of research in the area and provides suggestions for future research to help forward our understanding that ERS is fit for purpose in managing NCD. Based on the evidence present in the thesis, the current model of ERS as a tool to help patients self-manage their NCD is not fit for purpose; HCPs are mindful of over medicalising PA and do not bring up the conversation of PA with those who might need it most. Participants drop out within a few sessions whilst undertaking a prescription that is not designed to target the broad reason for referral. All of which suggest that a re-assessment of ERS purpose and approach to entry into ERS is required.

This thesis concludes with the following:

1. There is insufficient and inconsistent reporting on the factors associated with uptake, attendance and adherence within ERS, which prevents assigning a true reflection on the effectiveness of ERS. Subsequently, there is a need for structured and consistent taxonomy of such reporting factors. Without recording the 'how's', we may fail to identify best or current practice and judge effectiveness inappropriately.

2. Sociodemographic profiles of non-attenders appear very similar to those who attend, and attenders drop out of ERS early; there is no statistical evidence to suggest that sociodemographic profile influences uptake or attendance at the scheme. Subsequently, there is a need for qualitative evidence to understand why participants dropout of ERS within the first few sessions. Furthermore, there is a need to encourage a greater diversity of participant referrals from HCPs.
3. The FITT of prescribed exercise appears generic in nature and tailored to the participants' activities of daily living. Subsequently, the FITT of exercise delivered in ERS is not prescribed to directly target the medical condition participant were referred for, targeted towards holistic benefits. Therefore, there may be a need to diversify outcome measures to include more appropriate markers, such as quality of life. HCPs could provide a more explicit referral for instructors to work towards and instructors to align their prescription to a specific outcome, but it seems that HCPs do not have the expertise nor time to undertake this type of work.
4. HCPs face multi-factorial competing pressures in promoting PA and lack appropriate knowledge of PA opportunities, therefore reducing HCPs capacity to provide PA promotion beyond generic advice, in primary care. Subsequently, there is a need to identify strategies that integrate PA appropriately and effectively into primary health care, which will benefit all patients, such as using exercise specialists within primary care.

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APPENDICES

Appendix 1: Search strategy terms and protocol steps used within Medline database

Step	Search term
1	exp Exercise/
2	exp Exercise Movement Techniques/ or exp Exercise Therapy/
3	exp Sports/
4	exp Motor Activity/
5	exp Physical Exertion/
6	exercis* refer*.af.
7	refer* exer*.af.
8	exerc* prescr*.af.
9	prescr* exerci*.af.
10	(activ* refer* or refer* activ*).af.
11	(presc* activ* or activ* precri*).af.
12	6 or 7 or 8 or 9 or 10 or 11
13	exp Prescriptions/
14	(prescribing or prescribe or prescriptions).af.
15	13 or 14
16	or/1-5
17	15 and 16
18	12 or 17
19	limit 18 to english language
20	(metaanal: or meta-anal:).af.
21	exp Meta-Analysis/
22	20 or 21
23	limit 19 to meta analysis
24	19 and 22
25	23 or 24
26	(systematic* review* or review* systematic*).af.
27	limit 19 to systematic reviews
28	19 and 26
29	27 or 28
30	systematic review*.af.
31	19 and 30
32	27 and 31
33	29 not 25
34	25 or 29 or 33

Appendix 2: Eleven predefined constructs used as an extraction tool and relating to the reporting effectiveness of reviews

1	Aim of Review
2	Theoretical basis (any stated theory)
3	Behaviour change technique (goal setting, problem solving)
4	location(s) or setting where the intervention occurred (local leisure centre, green spaces)
5	Intervention provider (should always be 3 rd party exercise provider as part of ERS)
6	Frequency of intervention (period of time including the number of sessions, their schedule, and their duration, intensity (if mentioned in initial studies or current review))
7	Mode of delivery (group, individual, supervised)
8	Characteristics of the participants (sex, disease or risk state)
9	Amount of studies within the review
10	Number of participants within the review / Sample sizes
11	Cost effectiveness if mentioned

Appendix 3: Key characteristics of included systematic reviews

Review lead author and year											
Characteristics of reviews	Arsenijevic et al., 2017	Campbell et al., 2015	Gidlow et al., 2005	Morgan et al., 2016	Morgan, 2005	Orow et al., 2012	Pavey et al., 2011a	Pavey et al., 2012	Pavey et al., 2011b	Sorensen et al., 2006	Williams et al., 2007
Type of review performed and its search period											
Descriptive	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Meta-analysis	✓	✓				✓	✓	✓	✓		✓
Economic Evaluation		✓					✓				
Date period searched	2000 onwards	October 2009 – June 2013	Origin - 2003	1995 – June 2015	1966 - 2002	Origin - May 2009	1990 – October 2009	Origin - October 2009	Origin - October 2009	1980 – June 2005	Origin – March 2007
Objectives and outcomes markers of review											
Overall effectiveness (increase of PA levels)	✓			✓	✓	✓			✓	✓	✓
Clinical effectiveness		✓					✓		✓		
Cost effectiveness		✓					✓			✓	

Uptake to ERS						✓	✓		
Attendance or completion of ERS	✓	✓				✓	✓		✓
Implementation / design ERS	✓							✓	
Reported inclusion criteria of reviews									
Any study design considered	✓			✓		✓	✓	✓	✓
RCT only						✓			
Males and females ≥ 18	✓	✓		19 ≥		16 ≥			
Peer reviewed and published in English	✓			✓				✓	
Referral from primary care to improve clinical outcomes or physical activity levels		✓	✓	✓	✓		✓	✓	✓
Programme designs more intensive than advice alone		✓				✓		✓	
UK based studies		✓							

Appendix 4: Data-linkage reflection

THE LONG-TERM EFFECTS OF EXERCISE REFERRAL SCHEMES ON LONG-TERM HEALTH: A NARRATIVE REFLECTION ON THE FEASIBILITY OF DATA-LINKAGE BETWEEN EXERCISE REFERRAL AND NATIONAL HEALTH SERVICE RECORDS.

Introduction

In order to obtain health-enhancing benefits from PA, adults are to perform at least 150 minutes of moderate intensity or 75 minutes of vigorous PA during the week. Furthermore, adults should develop or maintain strength in the major muscle groups by performing muscle-strengthening activities on at least two days a week. Adults should further minimise prolonged bouts of sedentary behaviour (DoH, 2019). Evidence has shown a positive association between achieving these recommendations and the management of conditions such as CHD, mental health problems, stroke, type 2 diabetes, MSK conditions and some cancers (NICE, 2013).

Many evaluations have shown that ERS elicits small to moderate short-term improvements in PA levels (Williams et al., 2007; Campbell et al., 2015). However, it is unclear whether ERS contributes towards long-term improvements in the prevention or self-management of NCD. One systematic review found no evidence that objective measures of health were improved by ERS (Campbell et al., 2015). However, recently published primary studies have found short-term improvements in objective health markers (Webb et al., 2016; Stewart et al., 2017). However, such improvements may not achieve clinically meaningful levels (Wade et al., 2019). The fundamental referral aspect from HCPs to ERS is reliant on the presence or risk, and subsequent need to prevent or self-manage, NCD (Din et al., 2015). Therefore, a long-term evaluation of ERS should focus on the management of NCD, i.e. is the patient reliant on National Health Service (NHS) services.

Increasing availability of routinely, collected 'big' data allows research to linking data from multiple sources (Sayers et al., 2016). All interactions with the healthcare system generate individual files containing both personal and health data (Xafis, 2015). Typically, such data are used to facilitate the

provision of healthcare. However, beyond such use, combining such data, e.g. medical records, primary care appointments, prescriptions, into a single de-identified data set provides researchers with rich data of potentially great medical or epidemiological significance (Holman et al., 2008; Xafis, 2015). Through bringing together multiple sources of data, researchers can identify factors and associations that would otherwise be difficult or impossible to determine or go unnoticed (Green et al., 2015). Currently, there is no published research on the long-term effects of ERS on participant NHS data (e.g. general medical practices admissions, hospital admissions, prescription). It is unknown if this is due to a gap within the primary data or a lack of feasibility. Therefore, the aim of this study was to establish the feasibility of linking patient data between ERS participants and their subsequent NHS medical records.

Aim & research questions

There were two aims for this project: (1) to explore the feasibility of linking anonymised patient data between ERS and routinely collected medical records; and, (2) to determine the impact, if any, of ERS on long-term health and use of NHS resources. Specifically, the research questions were:

1. Is it feasible to link ERS participant data with available NHS medical records?
2. What is the relationship between ERS attendance and use of NHS services?

Outcome

Data-linkage is increasing in popularity and conceptual frameworks and statistical methods are well established. However, data-linkage studies may encounter significant practical challenges (Green et al., 2015). First, technical and operational issues. This may include gaining permission to access and use datasets held by multiple organisations. Second, institutional issues that may include, legal, ethical and cultural considerations, which may constrain attempts to link data in practice. This may include

uncertainties over what is permissible or concerns over consent (Green et al., 2015). It is a combination of these two challenges, which meant the present study was unable to link ERS and NHS data. The following narrative reflection will describe the steps, hurdles and termination of this study.

Narrative methodology

Study design

Secondary analysis of a locally representative ERS data set linked against primary and secondary care NHS datasets.

Participant sampling

The ERS researched in study 3 (**Chapters 4 and 5**) were able to provide patient-identifiers of participants who were referred to the scheme and subsequently made contact with the ERS with interest to uptake ERS during 2016. The ERS was able to provide the following: 1) if the participant never attended an ERS session; 2) if a participant attended ERS and still currently held an active membership with the leisure provider; and 3) if a participant attended ERS but chose not to take up an offer to become a leisure centre member. The ERS was not able to provide data on the number of sessions the participants completed. Personal identifiable information held by the ERS included gender, name, date of birth, postcode and The Community Health Index number (CHI; a population register, which is used in Scotland for healthcare purposes). Personal identifiers would act as criteria to ensure a match with NHS datasets. Referral forms were pre-populated by the referring HCPs; therefore, some data was missing.

Data-linkage providers

The Administrative Data Research Network (ADRN) was a UK-wide partnership between universities, government departments and agencies, national statistics authorities, the third sector, funders and researchers. ADRN consisted of a network including the Administrative Data Research Centres, for England, Northern Ireland, Scotland and Wales. The network helped researchers carry out research using linked, de-identified administrative data routinely collected by government organisations, for example, the NHS.

Albasoft are a private company that works in conjunction with NHS Scotland and the Administrative Data Research Centre – Scotland (ADRC-S) to provide EScro (Enhanced Service contract reporting options), a suite of software that provides an integrated solution to primary care reporting. EScro combines a clinical system independent data mining suite with an automated audit and claim submission system. Albasoft are the only company currently providing clinical audit facilities for Enhanced Services to NHS Scotland.

Data-extraction approval process

In principle, the conceptual framework of linking data is simple. The designated ERS provides patient-identifiers directly to linkage partner or the linkage partners trusted third party. The linkage partner would provide two data sets of NHS use, which matches patient-identifiers. The first data set will be for a period pre ERS referral, the second, post ERS referral (see Figure A-4.1). Pre and post period would be 12-18months.

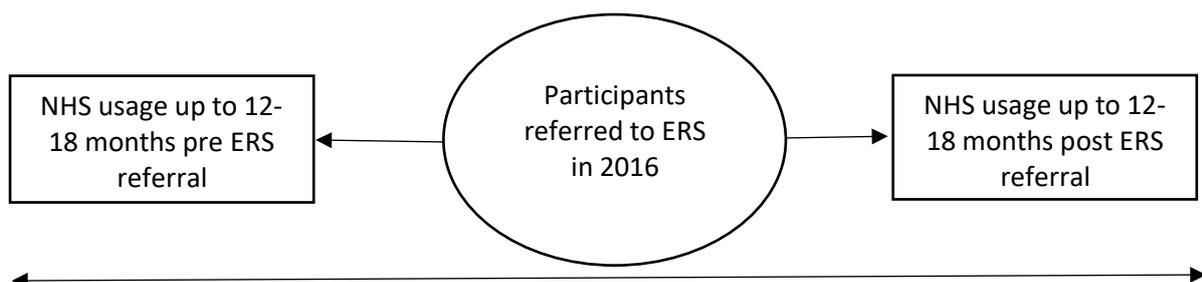


Figure A-4.1. Proposed data-linkage time period pre-post ERS referral.

The concept of data-linkage appears simple, but initial project discussion with ADRC-S highlighted the complex steps within the process. Initial hurdles were identifying who had attended ERS and obtaining the patient data from the ERS. ADRC-S advised approaching the NHS board in which the ERS were based, and applying for Caldicott approval. The 1997 Caldicott report made a number of recommendations regulating the use and transfer of patient-identifiable information between NHS organisations and between NHS organisations and non-NHS bodies. The aim of Caldicott approval is to ensure that only the minimum necessary patient-identifiable information is shared and for justified purposes (NHSScotland Caldicott Guardian's Principles into Practice, 2012). Caldicott approval is required for the use of patient identifiable data for health research, audit purposes or service improvement and enabling direct access to patient information.

Caldicott Approval was granted on the basis that ADRC-S could not fulfil the requirement of saying who has been referred to an exercise scheme. Data might be recorded within primary care records, indicating a patient was referred to ERS; however, ADRC-S could not indicate if the patient took up ERS, as such data is not nationally recorded. Furthermore, the Caldicott approval obtained prevented the ERS contacting historical participants requesting permission for the researcher to be able to make contact to request that identifiable information be released.

Approval was further needed from the ERS board, as data controllers of participant-identifiable information. In addition to Caldicott approval and ERS approval, approval was required from the Public Benefit and Privacy Panel for Health and Social Care (PBPP). PBPP streamlines governance processes for the scrutiny of requests for access to NHS Scotland originated data to benefit the citizens of Scotland for purposes other than direct care. University of Stirling, NHS, Invasive and Clinical Research Ethics panel (NICR) (17/18) Paper No.005), NHS West of Scotland NHS research Ethics service (17/WS/0243) and NHS Highland Research and Development all provided ethical approval.

Research timeline

Figure A-4.2 depicts the timeline undertaken by the researcher. Initial discussions with ADRC-S were promising. The link analyst described the project as, “an easily accessible project”, where ADRC-S was able to provide linkage to an array of NHS data that might be relevant. After initial ADRC-S project proposal drafts, it became evident that the level of data available might not be as widespread as first thought. Initially, primary and secondary care NHS data were proposed, however, ADRC-S declared it challenging to obtain GP data. ADRC-S made the researcher aware of organisation entitled SPIRE (Scottish Primary Care Information Resource). SPIRE is a service that will allow small amounts of information from GP practice records to be used by doctors’ surgeries, NHS Scotland and the Scottish Government to improve care and plan services. However, it would be some time before any primary care data is available for research via that route. Therefore, making it a service not available to the researcher. This meant that primary care-data were not available from ADRC-S; however, secondary care data would still be available along with some components of prescription data. Therefore, the application continued with ADNR-S.

Enquires were then made with NHS Highland on potential alternative approaches to access primary care data. NHS Highland Research and Development indicated that general medical practices facilities fall out with Caldicott. Therefore, it is not possible to force them to release data or allow a researcher to access their database to extract it manually. ADRC-S and NHS Highland suggested approaching Albasoft as they are able to extract primary care data and act as a data linkage facilitator. Therefore, an approach to Albasoft was made, to see if they would be able to extract the info for you using their EScro software. Albasoft confirmed that they were able to conduct data-linkage; however, at a cost, circa £5,000. It was fortunate the ERS was located in the NHS Highland catchment area, allowing the researcher to approach Albasoft. Currently, there are no organisations, which the researcher is aware of, operating as service similar to Albasoft.

Concurrently, the link analyst assigned to the linkage project at ADRC-S notified the researcher that they were moving jobs. Therefore, a new analyst would be assigned, however, due to ADRC-S work commitments and proposed data-linkage project classified as small-medium priority, this may take time. The newly assigned link-analyst notified the researcher that the ADRC-S application process had changed; therefore, the previous application required amending and submission to an interim panel for approval. However, the panel did not sit for the following reasons. First, the ADRN is a programme funded by the Economic and Social Research Council (ESRC) that ran from October 2013 to July 2018 and ADRC-S was funded until October 2018. Second, ADRC-S will be taken forward as part of a new ESRC administrative data research initiative. However, the new initiative will be launched later in 2018 with an undetermined transition period as they move to the new phase. During the transition period, no new proposals were accepted. ADRN did offer the opportunity to continue the project; however, this would be at a cost of circa £17,000 - £20,000. This represented key issue for the researcher, for following two reasons. First, the level of funding required to fund the project was unavailable. Secondly, July 2018 represented the 21st month of the researcher's PhD journey. Not knowing when the ESRC administrative data research initiative may start accepting projects represented an unknown delay that could negatively influence the timely completion of the PhD by the researcher. Subsequently, the researcher withdrew the application from ADRC-S on cost and logistics grounds. Therefore, at this point, the study was reduced to explore primary care and the proposal was taken forward with Albasoft acting as the linkage partner.

Due to the similar nature of work conducted by Albasoft, the application process was swift and an initial payment of £2,000 was made to facilitate linkage. Amendments to the project and data-linkage partner were submitted and approved by the following: Caldicott; NHS Highland Research and Development; West of Scotland NHS ethics panel; and University of Stirling Ethics panel. As previously indicated by NHS Highland Research and Development, general medical practices fall out with Caldicott and act as their own data controllers. During initial discussions, Albasoft highlighted that general medical practices may refuse to release data however it is rare. Therefore, it came as a

surprise to both the researcher and Albasoft when none of the general medical practices that had referred patients to the ERS responded to the recruitment call. As part of the cost associated with linkage via Albasoft, a £50 fee is paid to the general medical practices for allowing Albasoft to mine the data. Aside from approving Albasoft to extract data, there is no additional workload expected of the practice. Continued efforts from Albasoft and the researcher, including phone calls and offers to visit the practice failed to encourage any of the practices to allow data extraction to occur. After 22 months from the initial project proposal, developed by the researcher and PhD supervisory team, notifications were sent to all ethic boards involved indicating the termination of the project.

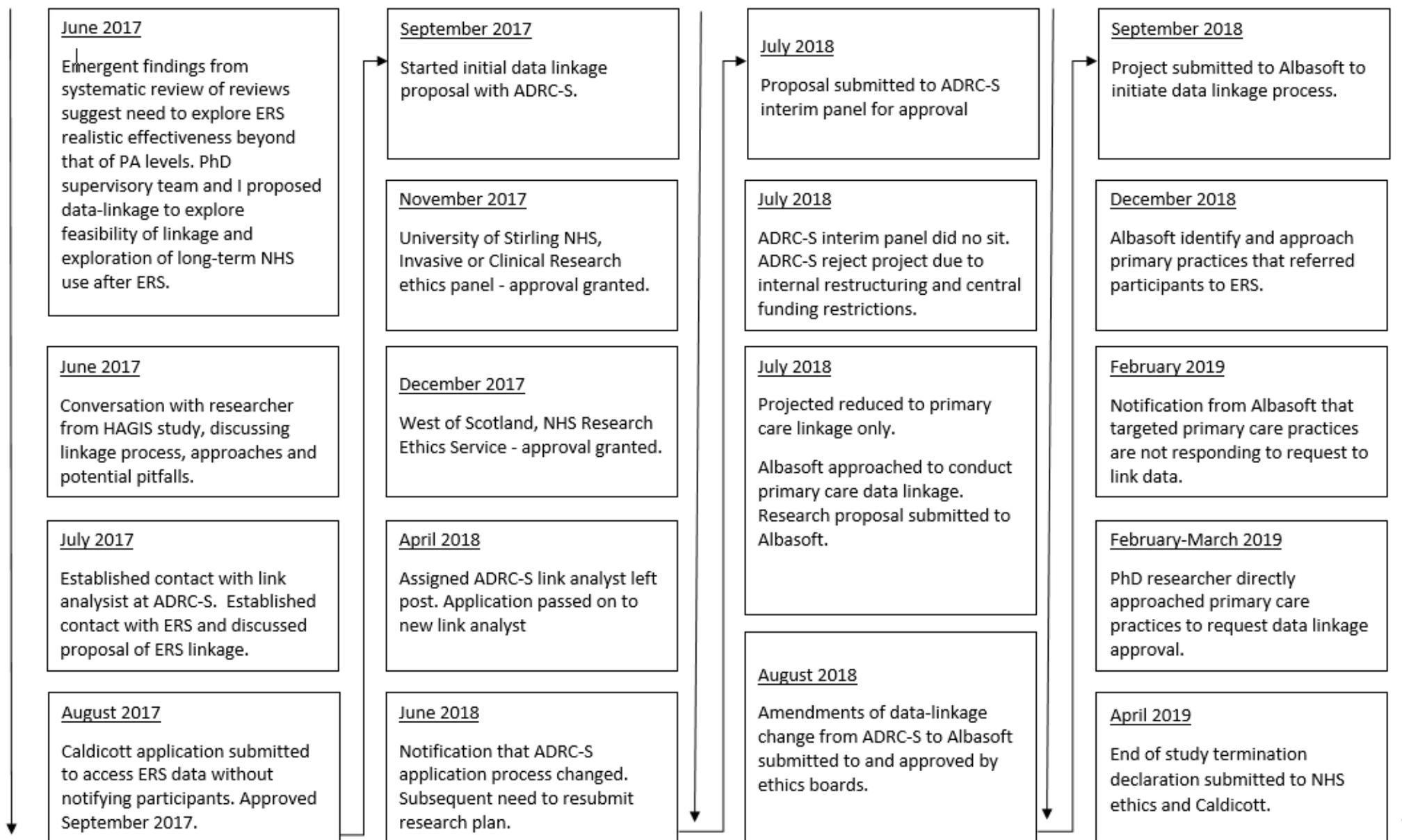


Figure A-4.2. Data-linkage timeline flow chart.

Reasons for general medical practices refusal

During attempts made by the researcher to encourage general medical practices to agree to the linkage, two common themes emerged for not wanting to take part in the study. First, General Data Protection Regulation (GDPR). Albasoft were shocked that this was given as a reason not to take part in the study. Notably, as part of the linkage process Albasoft set up legal contracts between the practice and Albasoft and the researcher stating the following:

“GDPR Compliance statement: The legal basis for the special permission to process and store personal data for ‘Long term effects of exercise referral schemes upon NHS usage’ is that it is 'a task in the public interest' (article 6(e)) and that sensitive personal data is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes (article 9 (2) (j), based on Article 89 (1)). This is particularly pertinent to the use of personal identifiers for the linkage with Albasoft as the trusted third party working within NHS Highland. The dataset released to the research team for analysis is 'pseudonymised', meaning that we have no access to personal/sensitive personal data such as name, date of birth or CHI number”

Secondly, practices stated fear of extra effort or additional workload on their behalf. From the researchers understanding, aside from signing the consent form, there is no other workload expected. An approach was made to NHS Highland Local Medical Committee, to enquire if such issues are commonplace in general medical practices when asked to conduct research projects. The following response was received.

“Plenty of practices are willing to work with Albasoft to answer questions that they think are important: they know that the work involved is minimal and that GDPR isn't an issue in anonymised studies of this type. My guess is that the practices that have been approached just aren't particularly interested in the research question. Certainly, practices in Argyll have been under enormous pressure recently in relation to the new GP contract and I suspect

that some are feeling quite overwhelmed with workload and are not wanting to take on any new work, however minimal. It is not really correct to say that there is no work for practices involved in administrative data projects like this. They do need to consider the pros and cons of all research being conducted with their patients' data: despite REC and PBBP approval, they still need to consider the potential impact on their patients and there may be particular concerns about potential breaches of anonymity in very small practices. In my practice, for example, all the partners discuss every potential research study for half an hour at a weekly meeting and that is quite a costly exercise"

The NHS Highland Local Medical Committee suggested that finding a local GP champion, or having a GP on the project steering group, may have helped, but there would be no guarantee.

Reflective discussion

The initial aim of the project was to explore the feasibility to link anonymised patient data between ERS and routinely collected medical records. In part, the study was able to establish that linking data between ERS and NHS is challenging. However, this is not to say that linkage is not feasible. The termination of funding and subsequent termination of this present study and many others by the ADRC-S was disappointing. Arguments may suggest that link-analysts at ADRC-s were aware of the timelines of projects and future funding scope and potentially may have made the researcher aware of this within early discussions. However, if there was no funding shortfall, or the researcher and the PhD supervisory team were able to provide funds for the project, secondary data would be available.

Similarly, Albasoft had access to the data within primary care. However, without consent from the GP's who are their own data custodians, the data was not accessible for linkage. Furthermore, the present study was fortunate that Albasoft operated within the NHS health board, where the study was being conducted. It is unknown if such a service exists within other NHS health boards in

Scotland. It is further unknown if SPIRE is able to provide the same level of primary care data that Albasoft can.

The failure to link data between ERS and NHS meant it was not possible to undertake exploratory research, exploring any relationship between ERS attendance and use of NHS services.

Understandably, this is a disappointment to the researcher from a time and cost perspective, but ultimately is also a lack of research progression. With the project targeted to a small catchment area, the researcher was of the belief that general medical practices would be keen to buy in to the project, to help understand locally what was happening to their patients. Any future attempts of data-linkage might learn from the suggestion provided by the NHS Highland Local Medical Committee; that is having a GP on the project steering committee. Recruiting a GP champion onto the project may have provided insights into the best recruitment approaches required to engage general medical practices. However, this may come at additional cost. As suggested, the choice of a general medical practices not to engage may reflect general medical practices perceptions of the research questions, coupled with an overwhelming workload. Therefore, there is a need to understand GP views about PA promotion and ERS (see **Chapter 6**). Since referral of a participant to ERS is from a HCPs in primary care, it is imperative to understand views and perceptions of those HCPs. In the context of this thesis, the termination of the present data-linkage study opened up a new avenue of research, which was explored in study 4 (**Chapter 6**).

Conclusion

The present study set out to examine the feasibility of linking data between ERS and the NHS.

However, the study faced many setbacks, many out with the control of the researcher. The nature of the initial setbacks shows that data-linkage between ERS and NHS may be feasible. An alternative approach may have yielded different response from GP, who act as their own data custodians, choosing not to engage in the release of data. However, due to the nature of the work conducted by

the linkage partner, such problems were not anticipated to an extent that suggested a different approach was required. Based on supposition, the lack of engagement from general medical practices in releasing data has driven the need to understand HCPs views and perceptions of PA promotion and ERS referral. The failure to link ERS and NHS data is not a reflection on the data-linkage process; moreover, termination was victim of funding restrictions and a lack of engagement from data custodians.

Appendix 5: Example exercise prescription card

HR Overview					Instructor Checklist								
40%	50%	60%	70%	80%	Advantage	PAR Q	Risk Stratification	Referral Notice					
Week	Heart Rate			RPE	Circuit/Equipment Feedback			Comments					
	Before	During	After	Ave									
12/3/18 1	1 set of 12 reps Measurements: Waist 109cm	Hips 113cm	Biceps 41cm		RECLINE BIKE LVL 5 10mins	lat pull M-20kg (BW)	sit to stand (BW)	chest press M 7.5kg	step-ups (BW)	seated shoulder press 2kg	leg ext m 10kg	marching lateral to front raise Treadmill 10mins 3.5kph 2% incl	
15/2/18 3	2 sets of 10 reps				TREADMILL 3.5kph 2.0%	lat pull M-20kg (BW)	sit to stand (BW)	chest press M 7.5kg	step-ups (BW)	bag 10kg	farmer walk holding 5kg DB's	seated shoulder press 2kg	
17/2/18 4	2 sets of 10 reps	Waist 108	Hips 128	Biceps 41cm	RECLINE BIKE LVL 5 10mins	lat pull 20kg (BW)	SIT TO STAND (BW)	CHEST PRESS 7.5kg	step-ups (BW)	Bag 10kg	FARMERS WALK HOLDING 5kg DB's	seated shoulder press 2kg	
5					CROSS TRAINER 2mins	TREADMILL 3.0%							
22/2/18 6	2 set of 12 reps				recliner bike 10mins	chest press M 7.5kg	Farmers walk 5kg DB's	lat pull machine 20kg	leg ext 5kg	single leg 10kg	marching shoulder press 2kg	cross-trainer 8 mins L-1	Treadmill 10mins
20/3/18 8	2 sets of 15 reps				RECLINE BIKE LVL 7 11mins	sit to stand with shoulder press 5kg	Farmers walk with 5kg DB's	step-ups 5kg DB's	leg ext machine 10kg	chest press 2.5kg	lat pull M-20kg 15 reps	seated shoulder press 2kg	Continuing to Exercise
After Course Checks					<input type="checkbox"/> Gym Induction Completed <input type="checkbox"/> Tutor Return form <input type="checkbox"/> follow up <input type="checkbox"/> Membership advice				<input type="checkbox"/> Yes <input type="checkbox"/> No				

June 2012
Rowler - 10mins L-6

Detailed Programme

Cardio	Measure	1	2	3	4	5	6	7	8
27/2/18 2x15 reps	Time	RECLINE BIKE LVL 6	Marching Shoulder press	Farmers walk	Lat pull M - 20kg	leg ext M J 10kg	bag pick-up 15kg	chest press 7.5kg	STEP UPS
	Level	10 MINS	3kg	5kg DB 3 times up/down gym					TREADMILL 4% L-4 10 MINS
	HR/RPE								
6/3/18	Time	recline bike 10 mins L-6	sit to stand with shoulder press	Farmers walk 5kg DB's	LAT pull M - 22.5kg	leg ext M 10kg	chest press Machine 7.5kg - 10kg	chest press up 15kg	TREADMILL
	Level								
	HR/RPE								
8/3/18	Time	recline bike L-8	sit to stand shoulder press	leg ext M 10kg	Lat pull M 20kg	Farmers walk 5kg with step-ups	bag pick up 15kg	chest press up 15kg	Treadmill 5.5% 4KPH
	Level								
	HR/RPE								

Time
Fitness Levels
HR/RPE

Before				After			
Weight	B/F	BMI	VT/Test	Weight	B/F	BMI	VT/Test

Resistance

Weight/Reps	1	2	3	4	5	6	7	8
22/3/18	bike L-8 12 mins	lat pull 12kg (20kg)	leg ext 12.5kg 2x25	step-ups 15 each leg holding 5kg	sit to stand with DB'S	bag pick up 15kg	chest press M 10kg	Treadmill 7% 4KPH
27/3/18	BIKE 11 MINS L-9	LAT pull 20kg 7.5kg 15 REPS 20 REPS 5 REPS	STEP UPS 2x15 REPS 5kg					

Appendix 6: Semi-structured interview schedule and prompts for exercise referral instructors

Topic area	Questions	Prompts if and when appropriate
Demographics of professional	<ol style="list-style-type: none"> 1. Age 2. How many years of experience do you have as an exercise referral instructor? 3. Can you tell me what qualifications you hold as an ERS instructor? 4. Do you have any additional qualifications that you deem relevant to your job as an exercise referral instructor? 	<p>Can you give me examples of this?</p> <p>Can you share a time that happened?</p> <p>Q2 – years as non-exercise referral instructor</p> <p>Q4 – How does that qualification help you?</p>
Role of an ERS instructor in prescribing exercise	<ol style="list-style-type: none"> 1. Can you explain to me what you see your role as, in regard to exercise referral? 2. Putting yourself in the shoes of the client for a second, can you talk me through what clients might see exercise referral as / see you as 3. Can you tell me how does your role differ between clients? 4. Can you tell me how diverse your role with the client is - Does it expanded away from just the referral? 	<p>Can you give me examples of this?</p> <p>Can you share a time that happened?</p> <p>Q1 – health / increase PA</p> <p>Q2 - Do they value the importance of the programme</p> <p>Q2 – Do they have preconceived goals / ideas</p> <p>Q2 – Do they know what the referral is, are they given much information from the referring health professional</p> <p>Q2 – you say that the clients don't really want to be here, do you have pressure for management to sign them up to long term membership</p> <p>Q3 – you talk about... (Listen to response) for different clients, can you think of examples where it has worked / not worked.</p> <p>Q4 – Do clients ask for advice on other exercise / diet / smoking / lifestyle</p>
Descriptive of ERS sessions	<ol style="list-style-type: none"> 1. Can you walk me through a typical session you might prescribe? 2. Can you describe the typical setting of a session? 3. Can you describe how you like to deliver a prescription session? 4. Can you talk me through the type of support you offer during a session (observation / supervision / technique)? 	<p>Can you give me examples of this?</p> <p>Can you share a time that happened?</p> <p>Q1/2 – You say there is no typical..., can you elaborate why</p> <p>Q1 – What is your thinking in why you have opted for that style of lesson</p> <p>Q1 – You talk about these types of exercise; do you find that the delivery fit in – aerobic / resistance more often – why do you think that might be the case?</p> <p>Q1 /2– You say the client is in control of what they choose.</p> <p>Q3 / 4 – you say you mostly observe, is this because clients are generally happy to get on with things – if so, you can talk me through which groups</p>

	<ol style="list-style-type: none"> 5. Can you talk me through what you see as a perfect / gold standard session? 6. Can you talk me through how you determine when your progress / regress a prescription? 7. Do you feel restricted when prescribing? 8. Do participants come in asking to do certain types of exercise 9. Putting yourself in their shoes, do they know what sort of exercises they will be doing? 	<p>Q 3/4 – you say you offer techniques / greater supervision, do find certain groups of people ask for more or less</p> <p>Q5 – How does that differ to what you deliver? Why do you think that is the case?</p> <p>Q6 – You say you find it hard progressing / regressing. What sort of barriers do you face? - example of how you've overcome those barriers</p> <p>Q7 – how so?</p>
Motivational strategies relating to exercise prescription	<ol style="list-style-type: none"> 1. Can you describe your rationale for the starting level of a prescribed session and how you convince a person this is the best place to start? 2. Can you talk me through what motivational strategies you use with clients (if any)? 3. Putting yourself in the client's shoes, how much anxiety / fear / excitement is there towards the programme. 	<p>Can you give me examples of this?</p> <p>Can you share a time that happened?</p> <p>Q1 – You say there is no typical start point – why so.</p> <p>Q1 – You say the clients work with you; do they pick where they want to start</p> <p>Q2 – you say it is quite diverse, is there a time where it has worked or not worked– can you give me an example?</p> <p>Q2 – which BCT have you found to be the best – why?</p> <p>Q2 – Do certain populations require more support as a case- if so, which?</p> <p>Q2 – you say you don't openly use / discuss BCT, why is this?</p> <p>Q3 – How long does that last for, do certain populations show greater or lesser tendencies?</p>
Your assessment of the situation / measurement / supervisor / delivery	<ol style="list-style-type: none"> 1. Can you described to me what you see as successful? 2. Can you describe how you measure adherence to the prescription? 3. Do you ever face adverse events? If so, what kind, and how do you deal with them? 	<p>Can you give me examples of this?</p> <p>Can you share a time that happened?</p> <p>Q1 – How do you judge that success</p> <p>Q1 – you mention seeing clients maintain exercise as success, are memberships conversion important to you / company?</p> <p>Q3 – e.g. patients just doing their own thing, patients are injured, your choice of activity just not working.</p>
External to ERS	<ol style="list-style-type: none"> 1. Do you prescribe activities away from the programme, such as home activities or refer to other programmes? 2. Is there anything else you would like to bring up that you feel I might have missed, or you want to talk more about? 	<p>Can you give me examples of this?</p> <p>Can you share a time that happened?</p> <p>Q2 – how would you improve the concept exercise referral, what would make your life easier / achieving more with participants?</p>

Exploring health professionals' perspectives on physical activity promotion in primary care: A qualitative study

1. Perspectives on physical activity and its role in health

- (don't ask this, let it emerge)

2. Previous experiences promoting physical activity

- Can you tell me about any experiences you have had with promoting PA or referring patients to PA activities, either here or in past jobs?

3. Perspectives on their role in promoting physical activity

- Can you explain/describe the role of the GP practice in the promotion of PA?
- Can you explain/describe your role as clinical practitioner for PA promotion?
- Can you describe what your usual approach would be to promoting physical activity?
- How often would you discuss PA? refer? How many? To whom? Where?
- What words do you use (e.g. "be more active" "exercise more")?
- Do you talk about car use and Active Travel?
- What has been your experience of talking about Active Travel?
- What do you currently highlight as possibilities (e.g. gym, existing schemes)?

4. Decisions on who they would promote physical activity to

- How would you choose which patients to promote PA to?
- How do you assess current physical activity levels if at all?
- Are there any patient groups or conditions that you would not recommend PA to?
- Are there any target groups that you prioritise for PA?

Probe: why? Why not?

5. Facilitators and challenges to the promotion of physical activity in primary care

- Are there any challenges/barriers to advising people to being more physically active?
- describe, expand, potential solutions
- What would make it easier for you to promote PA?

6. What would an Exercise Referral Scheme based in a GP practice look like to them

- What would an ideal ERS look like for Inverness?
- Are there any barriers to an ERS? Give example, expand etc.
- What would encourage you to refer to ERS?

PUBLICATIONS

Insufficient Reporting of Factors Associated With Exercise Referral Scheme Uptake, Attendance, and Adherence: A Systematic Review of Reviews

Colin B. Shore, Gill Hubbard, Trish Gorely, Robert Polson, Angus Hunter, and Stuart D. Galloway

Background: Exercise referral schemes (ERS) are prescribed programs to tackle physical inactivity and associated non-communicable disease. Inconsistencies in reporting, recording, and delivering ERS make it challenging to identify what works, why, and for whom. **Methods:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses guided this narrative review of reviews. Electronic databases were searched for systematic reviews of ERS. Inclusion criteria and quality assessed through A Measurement Tool to Assess Systematic Reviews (AMSTAR). Data on uptake, attendance, and adherence were extracted. **Results:** Eleven reviews met inclusion criteria. AMSTAR quality was medium. Uptake ranged between 35% and 81%. Groups more likely to take up ERS included (1) females and (2) older adults. Attendance ranged from 12% to 49%. Men were more likely to attend ERS. Effect of medical diagnosis upon uptake and attendance was inconsistent. Exercises prescribed were unreported; therefore, adherence to exercise prescriptions was unreported. The influence of theoretically informed approaches on uptake, attendance, and adherence was generally lacking; however, self-determination, peer support, and supervision were reported as influencing attendance. **Conclusions:** There was insufficient reporting across studies about uptake, attendance, and adherence. Complex interventions such as ERS require consistent definitions, recording, and reporting of these key facets, but this is not evident from the existing literature.

Keywords: PRISMA, compliance, prescription, physical activity

The benefits of regular physical activity (PA) are well established,¹⁻⁴ notably for adults who engage in at least 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity per week, alongside activities that improve muscular strength on at least 2 days of the week.¹ Despite the clear and causal relationship between achieving PA guidelines and health outcomes,¹ physical inactivity is rising.⁵ Inactivity is now the fourth leading risk factor for global mortality (6% of deaths globally), behind high blood pressure (13%), tobacco use (9%), and high blood glucose (6%).⁵ Contextually, it must be acknowledged that although physical inactivity is a standalone risk factor,⁵ PA status is a key determinant in moderating the additional risk factors of high blood pressure and high blood glucose levels.^{4,5}

In recognition of this physical inactivity burden, the UK government has implemented population-wide programs.⁶ In addition, at the individual level, tailored attempts to manage physical inactivity has led to the expansion of exercise referral schemes (ERS). An individual showing evidence of noncommunicable disease coupled with an inactive lifestyle is directly referred by allied health practitioners to independent third-party exercise facilities to undertake a structured and prescriptive exercise program.⁷ The popularity of the ERS model drove a rapid rise in the number of centers offering referral program despite limitations presented

within the literature evaluating the implementation of schemes⁸ and thereby limited evidence of what works, why, and for whom.

Since 1998, a combination of systematic reviews, meta-analyses, or narrative reviews of ERS has been published focusing on different constructs surrounding the effectiveness of ERS.^{2,9-19} It is evident from this body of work that ERS is considered an important element in the armory to increase PA and tackle chronic disease.²⁰ However, the UK's National Institute for Health and Care Excellence has indicated that the varying nature of ERS program makes it impossible to differentiate between the effectiveness and acceptability of different schemes⁴ in addressing physical inactivity and noncommunicable disease. This conclusion is largely due to little evidence of any effectiveness of specific schemes.⁴ It is crucial therefore that clear reporting of key ERS components is available to allow for components associated with effectiveness to be replicated in future schemes. Factors such as reporting of referral uptake, attendance, and adherence, and the behavior change techniques (BCTs) underpinning ERS uptake and adherence are key components to understand for the following reasons.

Referral Uptake

Knowledge of who does or does not take-up an ERS referral is imperative for improving the degree of take-up.¹¹ Whether participant characteristics influence the proportion of ERS uptake is uncertain, it is important to know what referral demographics are consistently reported, or unreported, and how they relate to uptake and to gain an understanding of what and how these are influencing scale of ERS uptake. In particular, it is not clear whether those with certain medical conditions have a greater uptake, and whether socioeconomic or demographic characteristics influence an individual's uptake.²¹ Unless uptake and characteristics of people using

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Abstract accepted for oral E-poster presentation at the 7th International Society for Physical Activity and Health Congress in London, United Kingdom, October 2018.

If you provide it, they still do not go: the reality of attendance frequency within a Scottish exercise referral scheme

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Introduction: Exercise Referral Schemes (ERS) are a common method of tackling physical activity (PA) levels and lifestyle associated non-communicable disease at the individual level. However, attendance frequency is a problematic with many participants dropping out early from the prescribed programme. Demographic characteristics, referral reason, leisure site and delay time in commencing exercise referral were investigated in relation to attendance frequency.

Methods: Retrospective cross-sectional analysis was undertaken of a Scottish exercise referral scheme. ERS data from 2016 to 2017 were retrieved for analysis. Chi-squared analysis investigated differences between referral characteristics, and logistic regression investigated increased attendance from predictors.

Results: 405 participants registered onto an ERS, undertaking a minimum of one session. Females (58%) presented a larger proportion, with cardiovascular disease being the most referred condition (32%). Median and mode attendance was four and one sessions respectively. 37% of participants presented at the leisure facility for their first session within seven days of membership commencement. No significant differences overserved within: SIMD ($\chi^2(4) = 2.442, p = .655$), grouped age ($\chi^2(6) = 5.273, p = .509$), grouped site ($\chi^2(3) = 1.587, p = .662$), grouped referral reason ($\chi^2(5) = 9.270, p = .099$) or gender ($\chi^2(1) = 0.150, p = .699$). Logistic model showed increased attendance was only predicted by age related referral ($p = .007, 95\% \text{ CI} = 0.21-0.78$).

Conclusion: In spite of age related referral predicting increased session frequency, session frequency remains low. Simply providing a service such as ERS does not address the complex factors associated with attendance.

Abstract accepted for oral presentation at the 15th Annual meeting and 10th conference of Health Enhancing Physical Activity Europe in Odense, Denmark, August 2019.

What is the prescribed exercise dosage within referral schemes in rural Scottish communities?

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Purpose: Mounting evidence has shown exercise can act as an adjunct therapy or replacement to medication for non-communicable diseases. However, exercise referral schemes have shown limited success in achieving favourable clinical outcomes. Therefore, it is imperative to understand prescribed and completed exercise dosage by participants. The aim of this study was to explore, and report frequency, intensity, time and type of exercise prescribed to and completed by participants within community-based exercise referral schemes.

Methods: Retrospective cross-sectional analysis of participants attending four rural, Scottish, referral schemes. Data were extracted from exercise prescription cards issued to participants. Instructors confirmed completion matched prescription in all cases. Frequency data accounted for number of exercises within the prescription. If reported and applicable, intensity was classified against standardised thresholds of low, moderate and vigorous exercise. Weight lifted (sets x repetitions x weight) was reported for resistance exercises. Time was reported as minutes spent completing aerobic exercises. Type of exercise was classified as aerobic or resistance. Descriptive data expressed as median (minimum-maximum) is supported by Chi-squared analysis.

Results: Fifty participants (52% female), 70 (26-83) years of age, presenting with one-of-seven referral conditions (36% general fitness, 30% cardiovascular, 12% musculoskeletal, 8% mental health, 6% obesity, 4% frailty, 4% neurological), undertook thirty-eight different exercises, eight aerobic and thirty resistance-based. Participants completed 8 (1-25) referral sessions and 4 (1-11) exercises per session. Participants completed 1 (0-9) resistance-based exercise comprising, 2 (1-7) sets and 10 (1-20) repetitions. Participants performed 2 (0-5) aerobic exercises at 35 (5-70) minutes, at moderate intensity. Cardiovascular referrals (50, 6-70 minutes) spent a greater time performing aerobic activities than referrals for other conditions ($\chi^2(6) = 135.22, p < .001$). Participants at site four (45, 5-70 minutes) spent more time performing aerobic activities than at other sites ($\chi^2(3) = 198.43, p < .001$). Site four received 86% of cardiovascular referrals made to the scheme.

Conclusion: This is the first study to detail the dosage of exercise completed within a referral programme. Sites receiving greater numbers of cardiovascular referrals see participants accumulate more minutes performing aerobic activities. Acknowledging any increase of exercise is beneficial, it is unknown if reported dose of exercise would address the clinical needs of referred participants. Knowledge of the dose of exercise prescribed and performed within referral schemes provides critical information, in understanding and subsequently tailoring exercise prescription towards tackling non-communicable diseases.

Support/Funding: This study forms part of a PhD impact studentship funded by University of Stirling.