

**Development and testing of a school-based multi-component
walking intervention for children with intellectual disabilities**

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I confirm that the word count of this thesis is less than a 100,000 words

This thesis is dedicated to my family

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List of abbreviations

BCT	Behaviour change technique
BMI	Body mass index
CASP	Critical Appraisal Skills Programme
DoH	Department of Health
ID	Intellectual disability
MRC	Medical Research Council
MVPA	Moderate to vigorous physical activity
6MWT	6 minute walk test
Non-ID	People without intellectual disability
PA	Physical activity
PIS	Participant information sheet
RCT	Randomised controlled trial
SDQ	Strengths and difficulties questionnaire
SEM	Socio-ecological model
COM-B	Capability, opportunity, motivation and behaviour
T1	Time point 1 of data collection
T2	Time point 2 of data collection
T3	Time point 3 of data collection
UK	United Kingdom
UUREC	Ulster University Research Ethics Committee
USA	United States of America
WHO	World Health Organisation

Declaration

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Abstract

Background: It is established that people with intellectual disabilities (ID) have an increased risk of poorer health than the general population. This population are more likely to experience obesity, type 2 diabetes, coronary heart disease and premature death. The risks of obesity and associated co-morbidities can be alleviated by meeting the recommended physical activity guidelines. People with ID, and especially children and adolescents with ID are not sufficiently physically active to produce health enhancing benefits. It is well reported that walking is the most natural form of physical activity and the most common type of physical activity among people with ID. Given that children and adolescents with ID spend the majority of their day either travelling to or in school, this setting may provide the best opportunity for sustainable behaviour change in this population.

Aim: The aim of this doctoral thesis was to develop and test a school-based multi-component walking intervention for children with ID.

Method: There were 5 phases involved in this thesis. Phase 1 involved a systematic review of interventions aimed at increasing physical activity in children and adolescents with ID to synthesise the evidence base. Phase 2 involved conducting focus groups and interviews with children with ID, adolescents with ID, teachers, classroom assistants and principals to identify themes to aid in the development of the intervention. Phase 3 involved co-production of the walking intervention with stakeholders through a series of workshops. Individual and systems change theories were used to form a coherent theoretical underpinning to the intervention. During phase 4, the feasibility trial was conducted to assess the appropriateness and the acceptability of the intervention for this population and setting. Finally, phase 5 involved the process evaluation to determine the acceptability of the intervention from the perspective of the participants.

Results: The results from the systematic review highlighted the dearth of physical activity interventions aimed at increasing physical activity in children and adolescents with ID and the poor quality and design of existing interventions. Four core themes were identified from focus groups (social support, organisational structure, rewards and incentives and reasons for participation/non-participation). These themes were mapped to COM-B (Capability, opportunity, motivation and behaviour) and the socio-ecological model to develop the

intervention. The iterative process of workshops allowed stakeholders to tailor the intervention for their school, this involved making changes to walk routes, frequency and duration of walks, pairing of participants and walk diaries. The feasibility trial showed that attrition rate was low (6.7%) and drop outs were within the intervention group. Adherence to the prescribed frequency and duration of walks across the 12-week intervention was acceptable. Compliance to accelerometer wear time was low and declined from baseline to end of intervention. In relation to the effect of the intervention, there were consistent trends for decreases in sedentary behaviour and increases in moderate and vigorous physical activity in the intervention group, whilst the control group showed consistent trends for increases in sedentary behaviour and decreases in light and moderate physical activity. There was a consistent trend for improvement in physical fitness in the children with ID and peer role models with ID intervention group and a decrease in physical fitness in both the children and peer role model control groups. Strengths and difficulties questionnaire (SDQ) scores showed a reduction in total difficulties in both children and peer role model groups in the intervention group and in the control group. Findings from the process evaluation showed the school setting is an appropriate environment for physical activity interventions aimed at this population however challenges exist with logistics, staffing, objective measurement of physical activity and engagement of parents.

Conclusion: The work comprised in this thesis demonstrates that it is feasible to develop and test a school-based walking intervention for children with ID. This work contributes to the evidence base for physical activity interventions in this population and highlights key intervention components, methodological challenges and recommendations to inform future research in this field.

Chapter 1

Introduction

1.1 Introduction

This chapter will present an overview of the background, rationale, aims and objectives, contribution to knowledge and layout of this doctoral thesis. The content of each of the subsequent chapters will also be discussed.

1.2 Background

People with intellectual disabilities (ID) are more likely to have significantly poorer health when compared to the general population (Emerson and Hatton, 2014). According to Emerson and Baines (2010) the ID population is predisposed to a range of co-morbidities including obesity, coronary heart disease and type 2 diabetes. The risks of these non-communicable diseases are known to be increased by poor diet, low levels of physical activity (PA) and high levels of uninterrupted sedentary behaviour. In relation to young people, Bartlo and Klein (2011) stated that over 80% of children and adolescents with ID engage in levels of physical activity below the recommended guidelines of 60 minutes moderate to vigorous physical activity per day (Department of Health, 2011). Young people with ID consistently demonstrate lower levels of cardiovascular fitness and higher levels of obesity than their non-disabled peers (Gillespie, 2003; Stanish et al., 2006; Lotan, 2007). Physical activity can promote physical and mental health benefits for young people including cardiovascular and musculoskeletal health, improved concentration and maintenance of healthy weight (Janssen and LeBlanc, 2010; Ness et al, 2007). Despite the known benefits of physical activity and the low levels of physical activity among people with ID, there is a dearth of research on how to encourage physical activity among this population, and more specifically in young people with ID. Further robust research on the best methods to encourage physical activity among young people with ID is required (Einarsson et al., 2014).

Young people with ID face many barriers to physical activity (Bossink et al., 2017). Downs et al. (2013) reported that barriers to physical activity for young people with ID included a lack of support, not wanting to participate in physical activity and physiological factors. A qualitative study by Temple and Walkley (2007) of individuals with ID found that staff and parents remarked that individuals with ID preferred sedentary activities, were unmotivated and lacked persistence. In direct contrast to this, individuals with ID reported that their enthusiasm for physical activity was undermined by others, further highlighting the need for social support in this population. Three key themes have been identified for facilitating PA including 1) social support, 2) enjoyable or purposeful and 3) a familiar routine (Mayh et al., 2010). Enablers and barriers to physical activity for young people with ID were similar to those of adults with ID, including influence of family on physical activity and social support from peers or family (Barr and Shields, 2011). A study of 18 individuals with ID and their

parents/carers by Mayh et al. (2010) found that support plays a crucial role, both as an enabler and a barrier. Parents were found to be the main influence for a child with ID to engage in physical activity, although difficulties exist in engaging with parents (Downs et al., 2013).

There have been few studies that have investigated physical activity interventions for young people with ID, however from the available literature it is evident that there are numerous physical and psychosocial health benefits for young people with ID (Heller et al., 2011) including improvements in aerobic capacity and gross motor function, high levels of satisfaction for participants, improved balance, improved quality of life and decrease in inactivity (Johnson, 2009; Bartlo and Klein, 2011; Bergstrom et al., 2013). Although the numerous health benefits of physical activity for young people with ID are evident, low levels of physical activity are persistent in this population, with young people with ID being 40% less active and 9% more sedentary than their non-disabled peers (Einarsson et al., 2014).

Story (2009) suggested that school is the ideal setting for physical activity interventions as this setting has the most influence on young people during the early stages of life as this environment provides good reach at population level and overcomes potential barriers as it is compulsory. Research also suggests that school based interventions may be most effective in increasing physical activity levels of children that can be tracked into adulthood with physically active children becoming physically active adults (Smith et al., 2015). A systematic review by Dobbins et al. (2013) suggested that, given young people spend a significant amount of their day either travelling to or in school, school based physical activity programmes could potentially reduce population wide chronic diseases by increasing knowledge and producing behaviour change conducive to a healthier lifestyle. Schools can play a key role in increasing physical activity of young people with ID (Pitetti et al., 2009; Haney et al., 2014; Davis et al., 2011; Ozmen et al., 2007; Golubovic et al., 2012). Dobbins et al. (2009) also stated that school-based interventions aimed at promoting physical activity in young people positively impact on the duration of physical activity, indicators of physical fitness and reduced time spent watching television. Schools can make a significant contribution to the physical, mental and social wellbeing of young people (Taggart and Cousins, 2014), however organisational barriers must be overcome in order for school-based physical activity interventions to be effective. Dobbins et al (2009) state that the minimum changes required to produce benefits are educational materials and changes to the school curricula.

There are many modes of PA which can be categorised into aerobic or muscle-strengthening activities, however walking is considered one of the most natural forms of

physical activity. The benefits of walking are well reported (Lee and Buchner, 2008; Johansson et al, 2011; Hanson and Jones, 2015). Walking is a convenient, accessible and free form of exercise (Ogilvie et al, 2007); it can not only produce health benefits and an increase in physical activity but can also be used as a form of active travel. Furthermore, walking requires little or no skill and there is a low risk of injury (Murphy et al, 2007; Lee and Buchner, 2008). Walking can also take place indoors or outdoors, with no specific facility requirements and no need for specialised equipment. Walking can be accumulated throughout the day and in short bouts, which may suit the sporadic nature of childrens' physical activity and can help to reach recommended daily physical activity guidelines (Whitehead et al, 2009). Walking may also encompass some of the aforementioned key facilitators of physical activity for young people with ID, including support from others, a fun activity and a familiar routine (Mayh et al, 2010). Although evidence suggests that walking is the most commonly participated in type of physical activity for adults with ID (Barnes et al, 2013), there are no studies of walking in young people with ID. However, studies of walking interventions in mainstream schools report that school based multi-component walking interventions may be effective in increasing physical activity levels of young people (5-18 years) (McKee et al, 2007; Ford et al, 2013; Mendoza et al, 2011).

1.3 Rationale for the study

It is evident from the available literature that there exists a need to promote physical activity and behaviour change in young people with ID to increase physical activity, decrease sedentary behaviour, alleviate co-morbid conditions and decrease obesity levels. Despite the known benefits of physical activity for young people with ID, there remains a lack of physical activity interventions for this population. The key facilitators and motivators of physical activity for young people with ID are well reported. Peer support has been identified as a key facilitator in influencing the physical activity levels of young people with ID (Shields et al, 2012; Klavina and Block, 2008; Vashdi et al, 2008; Halle et al, 1999). Pedometers have also been shown to be effective as a motivational tool to increase physical activity levels of young people (Butcher et al, 2007; Schofield et al, 2005; Vanda et al, 2013). It is also clear from the literature that school presents the ideal environment for influencing young people's physical activity levels and this could be tracked through into adulthood (Story, 2009; Pitetti et al, 2013). Despite evidence that behaviour change interventions should be underpinned by theory (Michie et al., 2011), physical activity interventions for the ID population often lack a theoretical underpinning. Thus, a need exists to develop and test a school-based multi-component physical activity intervention with a coherent theoretical framework aimed at increasing physical activity in young people with ID.

The aim of this doctoral thesis was to develop and test a school-based multi-component walking intervention for children with ID (9-13 years). Following a systematic review in phase 1 (chapter 3) of existing interventions aimed at increasing PA among young people with ID, which highlighted the poor quality and lack of theory in PA interventions for this population, appropriate theory was identified as recommended by the Medical Research Council (MRC, 2008). COM-B and the socio-ecological model (SEM) were applied to develop the intervention. The subsequent two phases were concerned with the development of the walking intervention. Firstly focus groups were conducted with stakeholders to explore the enablers, motivators and barriers to a school-based walking intervention for young people with ID (chapter 5) and secondly workshops were conducted with teachers and classroom assistants to identify intervention components and refine the intervention prior to testing (chapter 6). The fourth phase tested the feasibility of a school-based multi-component walking intervention for this population (chapter 7) and the final phase conducted a process evaluation of the walking intervention (chapter 8).

1.4 Aims and objectives

The overarching aim of this thesis was to develop and test a school-based multi-component walking intervention for children with ID. The objectives were to:

1. Undertake a systematic review of the existing interventions aimed at increasing objectively measured physical activity among young people with ID.
2. Explore the barriers, enablers and motivators of a school-based multi-component walking intervention from a range of perspectives including children with ID, adolescents with ID, teachers, classroom assistants and principals.
3. Develop a school-based multi-component walking intervention through co-production with stakeholders.
4. Test the feasibility of a school-based multi-component walking intervention for young people with ID to increase physical activity levels.
5. Conduct a process evaluation of the school-based multi-component walking intervention.

1.5 Contribution to knowledge

This thesis makes a number of novel contributions to an understanding of interventions to increase PA in young people with ID, the key areas of contribution are:

- The first systematic review of interventions aimed at increasing PA in this population.

- The development of a structured walking intervention targeted at children with ID.
- The first study to apply a coherent theoretical framework to a school-based multi-component walking intervention using individual and systems change theories.
- The co-production of the intervention with stakeholders through the iterative process of workshops.
- The finding that a school-based multi-component walking intervention for children with ID is feasible and the identification of the methodological challenges that must be overcome.

1.6 Thesis layout

This thesis is comprised of nine chapters. Following this introductory chapter, chapter 2 reviews the background literature in relation to health and physical activity of people with ID. Chapter 3 is the systematic review of interventions aimed at increasing objectively measured PA among young people with ID. Chapter 4 describes the research design of the study including the 5 phases and the use of individual and systems change theories. Chapter 5 comprises the qualitative phase and presents themes from focus groups and interviews. Chapter 6 describes the intervention development via a series of workshops with stakeholders. Chapter 7 presents the results of the feasibility study and chapter 8 describes the process evaluation conducted post-intervention. Chapter 9 concludes this thesis with discussion and recommendations.

Chapter 2

Background: Health and physical activity among people with intellectual disabilities

2.1 Introduction

This chapter will review the literature in relation to health and PA among people with intellectual disabilities with specific focus on children and adolescents with ID. For the purposes of this review, the definition and prevalence of ID will be discussed. Following this the health inequalities and co-morbidities experienced by this population will be discussed. Physical activity levels and the mediating role of PA in alleviating some of the key health concerns for people with ID will also be discussed. This is intended to be a review of the literature in relation to the contents of thesis, thus literature that falls outside the scope of this thesis is not included in this review.

2.2 Defining Intellectual Disability

There is no definitive and finite definition of ID due to the wide range of aetiologies, however most definitions consider a person's intellectual ability and adaptive behaviour, which includes conceptual, social and practical skills (Luckasson and Schalock, 2015). The level of intellectual disability can be assessed by the use of standardised measures such as IQ testing, where an IQ of less than 70 would indicate significant impairment, or can be measured in relation to adaptive behaviour including conceptual, social and practical skills (Fig 2.1).

Table 2.1 Skills comprised in adaptive behaviour (British Psychological Society, 2015).

Adaptive Behaviour	Skills Comprised
Conceptual skills	Reading and writing, language, handling money, managing time and number concepts.
Social skills	Interpersonal skills, self-esteem and social responsibility.
Practical skills	Daily living and personal care, schedules and routines, safety, occupational skills.

The World Health Organisation (WHO) defines ID as a significantly reduced ability to understand new or complicated information and apply new skills, which results in a reduced ability to be independent, begins before the onset of adulthood and has a longterm effect on development. The WHO also states that ID can be categorised into 4 main categories; mild, moderate, severe and profound. Mild being the ability to communicate effectively and live relatively independently with minimal support from family, carers or the community. Moderate being individuals who, with lifelong support from others, will be able to have positive relationships, will be able to communicate, manage money, travel on public transport, can make and understand their own daily schedules and make choices and decisions for themselves. Severe or profound being individuals who are totally dependent on those around them and will require lifelong help and support with personal care, communication and accessing community facilities, services and activities.

Table 2.2 Level of intellectual disability, corresponding IQ score and abilities.

Mild	IQ between 50-70
	85% of ID population
	Can learn to read and write
	Can have jobs and live independently without support
Moderate	IQ between 35-50
	10% of ID population
	May be able to learn to read and write
	May be able to learn functional skills such as safety and self-help
Severe	Will require support from family, carers or community
	IQ between 20-35
	5% of ID population
	May learn self-help skills
	Will need daily schedules and pictures of routines
Profound	Require support with daily activities and living environment
	IQ below 20
	1% of ID population
	May have little or no speech and rely on other means for communication

Will require significant support with daily activities

The definitions of ID and the standardised measures to diagnose it appear to be straightforward methods of identifying people who are considered to have an ID, however Emerson and Hatton (2014) argue that the methods of identifying people with ID often rests upon assumptions about the nature of their ID, which can be debated. Intellectual disability is a social construct (Stalker, 2012), it is what a society has allowed a person to make of their own internal capabilities in the environment or setting which they inhabit. It is entirely possible that these internal capabilities could vary if a person was to inhabit a different environment or setting, therefore a person could move backwards and forwards between being classified as having an ID or not having an ID (Emerson and Hatton, 2014). This highlights the significant influence environments and settings in which a person with an ID inhabits, can have on their own potential. It is clear that defining ID is difficult as it can present in many forms and the standardised measures by which it is diagnosed do not take into consideration the environment that one inhabits and how this may affect their capabilities.

2.3 Prevalence of Intellectual Disability

It can be difficult to determine the incidence of ID due to the methodological difficulties of completing studies including use of different terms for ID (learning disability and developmental disability), stigma attached to having an ID and different measures used to assess prevalence (Durkin, 2002; Smiley, 2005). Prevalence rates of ID can vary according to definitions and the classification system being used. Maulik et al. (2011) stated that using only one criterion for diagnosing ID, for example IQ testing, can inflate prevalence rates. King et al. (2009) found that by using only IQ testing, it was estimated that the prevalence of intellectual disability was 3% in the USA. However, by using additional measures such as adaptive behaviour, this estimate was reduced to 1%.

In the UK, people with ID make up approximately 2% of the population. Approximately 1.5 million people in the UK have a learning disability, of which 280,000 are children aged 0-17 years. In Northern Ireland, there are approximately 40,177 people with learning disabilities, of which 8,150 are children and adolescents aged between 0-19 years (NI Assembly, 2011). Emerson and Hatton (2014) stated that 65,000 children and young people in the UK can be classified as having a severe or profound ID.

Studies across the USA and Northern Europe suggest that the incidence of ID at age 8 years of 4.9 children with severe intellectual disabilities per 1000 births and 4.3 children with mild ID per 1000 births (Emerson and Hatton, 2014). These studies, however, do not independently assess entire populations and tend to rely on people identified as having intellectual disabilities by various service systems.

A study by Leonard et al. (2003) ascertained the number of children born with ID over a period of nine years in Western Australia and found the prevalence to be 14.3 per 1000 births, 10.6 per 1000 of those were children born with mild to moderate intellectual disabilities and 1.4 per 1000 were children born with severe intellectual disabilities.

A meta-analysis by Maulik et al. (2011) found the prevalence of ID to be 10.37/1000 population across 52 studies. The prevalence was also found to be two times higher in low and middle income countries compared to high income countries, this could be attributed to lack of resources in low income countries and poor antenatal, maternal and child health care. Furthermore, methodological challenges in diagnosis of ID in low income countries and use of non-standardised assessment tools may contribute to an inflated prevalence rate. Prevalence was also higher among studies based on children and young people with ID, compared to those based on adults with ID.

2.4 Health Inequalities

Health is a broad concept (Naidoo and Wills, 2000), and can encompass various dimensions. The World Health Organisation (1946) defined health as 'a state of complete physical, mental and social well being, not merely the absence of disease or infirmity'. There are a number of interacting factors that contribute to the health of individuals and communities. Health is largely determined by an individual's environment and their circumstances (WHO, 2015). This is corroborated by findings from Emerson and Hatton (2014) and may be of particular importance for the ID population. The social determinants of health include biological factors, lifestyle factors, social environment, physical environment and access to health services (Marmot and Wilkinson, 2005).

People with ID, when compared to their non-disabled peers, are more likely to have significantly poorer health (Emerson and Hatton, 2014) and be disadvantaged across all indicators of health (Bollard et al., 2018). This could be because people with ID are also more likely to be exposed to social conditions detrimental to positive health and engage in more hazardous health behaviours (Snell and Luckasson, 2009). People with ID have a higher level of health need, however these needs appear largely unmet (Cooper et al, 2006). People with ID also experience a number of health disparities including a higher prevalence

of adverse conditions, inadequate attention to care needs, inadequate focus on health promotion and inadequate access to quality health care (Krahn et al, 2006). Despite living longer than ever before, people with ID have increased mortality rates across all ages when compared to the non-disabled population (Glover and Ayub, 2010); and the average age of death for people with ID remains significantly younger than that of the general population (Heslop et al, 2013). Recent research suggests that mortality rates of people with ID remain three times higher than that of the non-disabled population (Emerson and Hatton, 2014).

People with ID can often be exposed to inadequate access to health care, despite their range of health needs. This can be due to different developmental trajectories and limitations in communication and cognitive skills (Davis et al, 2011). A study by Beange et al (1995) of 202 people with ID aged 20-50 years determined the frequency of medical disorders in this population and results show that healthcare delivery to people with ID is often ineffective or absent and that the provision of health care to individuals with ID must improve. Limitations in adaptive functioning in self-care, communication and literacy can have a significant impact on the ability of people with ID to have the same opportunities to achieve good health and access good health care as the general population (Ouelette-Kuntz, 2005).

A systematic review of 38 studies by Robertson et al (2010) focused on health checks for people with ID. Results show that introduction of health checks for people with ID results in unmet and unrecognized health conditions, which require treatment and can include cancer and cardiovascular disease and targeted actions to address health needs. Health checks should aim to identify treatable conditions in people with ID in order to afford this population equal access to opportunities for health gain that is available to the general population.

2.5 Health Promotion

People with ID are a vulnerable population and their limited access to education, employment and financial resources can marginalise them in society (Davis et al, 2011). Emerson (2010) also states that there are five key determinants of health inequalities that affect people with ID, including; greater risk of exposure to social determinants of poor health, increased risk of health problems, communication difficulties and reduced health literacy, personal health risks and behaviours, and deficiencies relating to access to healthcare provision. Health inequalities are particularly evident for people classed as having severe ID (Krahn et al, 2006).

Health promotion can be defined as the process of enabling people to increase control over and to improve their health (WHO, 2002). Ewles and Simnett (1999) state that health promotion is about supporting, advancing and encouraging people to improve their lives.

Despite the known benefits of health promotion and education in maintaining health and controlling risk factors, there is an inadequate focus on health promotion for people with ID (Taggart and Cousins, 2014). Whilst there have been increasing improvements in health promotion for the general population due to health screening, health promotion programmes and health education, there is still a lack of health promotion targeting individuals with ID. People with ID are likely to experience a different pattern of health needs compared with the general population (Cooper et al, 2006), however people with ID are entitled to access the same health promotion programmes as the general population, and this could be effective in reducing incidence of disease.

2.6 Secondary Conditions

For the purposes of this thesis, co-morbidities can be defined as the occurrence of two distinct diseases in one individual at a rate higher than can be explained by chance. Secondary conditions are defined as the occurrence of additional physical or mental health conditions as a result of a primary condition (Institute of Medicine, 1991). In relation to co-morbidities and secondary conditions, which are often treatable, Woodhouse et al (2004) conducted a study to screen the vision of 505 Special Olympics athletes aged 9-69 years and found that 15% reported never having an optometric eye examination, 40% had ocular abnormalities and 14% could be classified as visually impaired. Kerr et al (2003) found that carers in the UK assessed vision of 49% of their clients as normal, however when tested, it was found that less than 1% were classed as having normal vision. This was also true for hearing where carers reported that 74% of clients had normal hearing, however upon testing, only 11% had normal hearing. This demonstrates the health disparities between individuals with ID and the general population.

A study by Cooper et al (2006) assessed the effectiveness of a health screening programme for people with ID after one year. 50 participants were assigned to an intervention group, whilst 50 were assigned to a control group. Findings show that after one year of the health screening intervention designed to meet the mental and physical health requirements of individuals with ID, participants in the intervention group had sustained health gains (new health needs identified and met, higher level of health promotion needs met) compared with those in the control group who only had access to standard care. This further demonstrates the effectiveness of health promotion and health screening on the health of people with ID.

According to Emerson and Baines (2010) the ID population is predisposed to a range of co-morbidities including obesity, coronary heart disease and type 2 diabetes. As the life expectancy of people with ID increases, there is also greater risk of age related diseases

such as cancer, heart disease, stroke and chronic respiratory disease and the incidence of such diseases is expected to increase in this population (WHO, 2005).

2.6.1 Cardiovascular Disease

Incidence of cardiovascular disease (CVD) is high among the general population in the UK. The British Heart Foundation (2014) states that CVD is responsible for the deaths of 160,000 people in the UK each year and is still the leading cause of mortality in women. It also states that incidence of CVD is almost always higher in Northern Ireland than in England. For the first time in over fifty years, CVD is no longer the leading causes of death in the UK, with 28% of overall deaths being attributed to CVD and 29% being attributed to cancer. CVD, however, remains the leading cause of death in women. Coronary Heart Disease (CHD) accounted for just under half (46%) of CVD deaths in the UK in 2012 and stroke accounted for a quarter (26%).

The incidence of coronary heart disease is also high for individuals with ID however recent research suggests that the prevalence is lower in this population than the general population (Cooper et al., 2017). Despite the lower prevalence of CHD, individuals with intellectual disabilities are more likely to be physically inactive, have high blood pressure and be overweight or obese, all of which are risk factors for CHD (Royal College of Nursing, 2011). A study by Wee et al (2014) identified the prevalence of these risk factors in 227 adults with ID who were receiving services from the Movement for the Intellectually Disabled of Singapore and found that 22.5% had hypertension, 10.6% had diabetes, 10.7% were obese and 90.6% were lacking regular exercise. O'Brien et al (1991) found heart disease to be most prevalent among people with ID who resided in community settings; this could be due to a range of lifestyle factors.

Although cardiovascular disease is associated with older adults, there has been evidence to suggest that the precursors to cardiovascular disease can begin to originate in childhood (McGill et al, 2000). These precursors to cardiovascular disease can track into adulthood (Castro-Pinero et al, 2014), however it is well documented that physical activity and lifestyle factors can reduce the risk of cardiovascular disease in people of all ages.

2.7 Obesity

Obesity can be defined as abnormal or excessive fat accumulation that may impair health (WHO, 2017) and the obesity epidemic is a major public health concern. More than 1.9 billion adults are overweight and 650 million are obese (WHO, 2016). Recent statistics for England showed that 40% of men are classed as overweight whilst 26% are classed as

obese and for women, 30% were overweight whilst 27% were obese (Health Survey for England, 2016). Obesity rates are higher among the ID population compared with their non-ID peers (Hsieh et al., 2014). Data from a 15 year longitudinal national health survey found that 26.5% of males and 44.2% of females with ID were obese (Yamaki, 2005). Roberston et al. (2000) in a sample of 500 adults with ID reported that 13% of males and 24% of females were obese. Emerson (2005) in a sample of 1304 found that 27% of adults with ID were obese. Although the results should be interpreted with caution due to disparities in methods, measurement tools and geographical locations which may limit the generalisability of findings, however it does demonstrate a trend that prevalence of obesity is higher among the ID population than those in the general population (Melville et al., 2005).

A systematic review by Maiano et al. (2016) reviewed 16 studies which examined the prevalence of overweight and obesity among children and adolescents with ID. Findings demonstrated that levels of obesity for males with ID were comparable to those of males without ID, however levels of obesity in females with ID were higher than those observed in the female general population. Findings also showed that levels of obesity increase with age in individuals with ID and obesity poses significant risk of secondary health conditions in this population. Although the lack of homogeneity in these studies mean the results should be interpreted with caution, findings highlight the need for interventions to effect behaviour change in the ID population, specifically among adolescents with ID to reduce risks of co-morbidities.

A recent study of obesity in children with and without ID (Emerson et al., 2016) used data from the UK Millenium Cohort Study to identify the prevalence of obesity in children with and without ID at ages 9 months, 3, 5, 7 and 11 years. Findings show that at age 5, 15.1% of children with ID were obese compared with 11.9% of children without ID. At age 7, 17.5% of children with ID were obese compared with 13.3% of those without ID and at age 11, 31.1% of children with ID were obese compared with 21.2% of those without ID. These findings corroborate previous findings by Maiano et al. (2016) that levels of obesity increase with age among the ID population.

The findings that there are higher levels of obesity among young people with ID and the levels of obesity among this population are increasing with age demonstrate the need for interventions targeted at this population in order to reduce levels of obesity and other associated co-morbidities including type 2 diabetes.

A recent study in Australia (Krause et al., 2016) of 261 adolescents with ID reported that 22.5% of adolescents with ID were obese.

2.7.1 Diabetes

There are currently 3.6 million people living with diabetes in the UK and a further estimated 1.1 million who are yet to be diagnosed (Diabetes UK, 2016). Diabetes UK estimates that 270,000 people with ID have type 2 diabetes (Diabetes UK, 2009) and people with ID are 20% more likely to be diagnosed with diabetes than the non-disabled population (Axmon et al., 2017). The risk of type 2 diabetes among the ID population is confounded by high levels of obesity, lack of physical activity and poor diet (Rimmer et al., 2010). These lifestyle factors are likely to contribute to the prevalence of type 2 diabetes in individuals with ID (McVilly et al., 2014).

It is estimated that one person in 10 worldwide will be affected by diabetes by 2040 (Diabetes UK, 2016), this figure is of particular concern for people with ID who are already at higher risk of developing diabetes. This is corroborated by Imperatore et al. (2012) who predicted a 178% increase in type 2 diabetes diagnosis in young people without ID (11-20 years) by 2050. Morin et al. (2012) in a study of 791 people with ID reported that 8.3% of adults with ID were diagnosed with type 2 diabetes compared with 5.1% in the general population.

Low levels of PA in childhood which tracks through to adulthood can increase the risk of developing type 2 diabetes in adulthood (Petri et al., 2018). Thus, given the low levels of PA in the ID population and the associated health risks, interventions aimed at increasing PA among children with ID have the potential to alleviate the risks of co-morbid conditions in later life in this population.

2.8 Physical activity

Physical activity can be defined as any bodily movement produced by the skeletal muscles that requires energy expenditure (Caspersen et al., 1985). PA can be classified into four intensities; sedentary, light, moderate and vigorous. The Sedentary Behaviour Research Network (SBRN) defined sedentary behaviour as any waking behaviour that has an energy expenditure of less than 1.5 METs whilst sitting or lying down (SBRN, 2012). Exercise is a sub-component of PA, however it differs from PA in that it is planned and structured and involves repetitive bodily movement (Caspersen et al., 1985). Furthermore, the main goal of exercise is often to maintain or improve physical fitness whereas physical activity is often incorporated into daily life activities.

There are many benefits of PA including, lower risk of heart disease, stroke and type 2 diabetes, and improved weight control and concentration, however the majority of the

population are still physically inactive. Physical inactivity is the fourth leading risk factor for global mortality and accounts for 6% of deaths globally (WHO, 2010).

1 in 5 (21%) adults in the USA meet the recommended daily PA requirements of 30 minutes per day (CDC, 2015). Adherence to physical activity guidelines was 49% for boys and 35% for girls aged 6-11 years, which dropped considerably for adolescence, with only 12% of boys and 3% of girls aged 12-15 years achieving the recommended one hour per day of physical activity (Troiano et al, 2007). Physical activity levels are also low in the UK, with 40% of men and 28% of women in England meeting physical activity guidelines, which drops to 32% of boys and 24% of girls aged 2-15 years. Physical activity also decreases as age increases in the general population, this is also true for people with ID (Hilgenkamp et al, 2012).

In relation to Northern Ireland, 33% of men and 28% of women report achieving the recommended physical activity guidelines, whilst only 19% of boys and 10% of girls achieve the recommended 60 minutes of moderate activity per day (DOH, 2011). These figures are based on self report methods, therefore levels of physical inactivity are likely to be much higher than demonstrated in these figures.

There are also low levels of physical activity reported by people with intellectual disabilities. Beange et al (1995) state that physical inactivity is significantly more prevalent in people with intellectual disabilities than in the general population. A study by Draheim et al (2002) of 76 men and 74 women with intellectual disabilities showed that 51% reported participating in little or no physical activity. Given the use of self-report measures in this study, it is difficult to ascertain the accuracy of these results, however findings give an indication of the scale of physical inactivity in adults with ID. Similarly, a study by Phillips and Holland (2011) objectively measured physical activity levels of 152 individuals aged 12-70 years with ID and results showed that none of the participants met the recommended daily guidelines for physical activity.

Barnes et al. (2013) in a study of 294 adults with intellectual disabilities, found that 23.7% of participants met the current recommendations of 150 minutes moderate to vigorous physical activity per week. Self report and objective methods were used for this study. Findings also show that adults with ID who are overweight or obese complete significantly less moderate to vigorous physical activity per week (97.6 minutes) than those who are not overweight or obese (153.3 minutes). This is consistent with findings by Temple et al. (2006) who reported that only 17.5%-33% of adults with ID complete 30 minutes of moderate to vigorous physical activity on at least five days of the week. The variation in this percentage could be due to

differences in measurement of physical activity, for example accelerometer, pedometer or self report methods.

Peterson et al. (2008) also found that only 14.1% of adults with ID meet the recommended 10,000 steps per day. Despite this finding showing the lack of PA in this population, there is little evidence to suggest that completing 10,000 steps per day will be conducive to health-enhancing benefits.

Blick et al. (2014) investigated the impact of physical fitness on quality of life by comparing individuals with intellectual disabilities who maintain a physically active lifestyle and those who are not sufficiently active. The study involved a total of 788 participants aged 11-92 years from three counties in Pennsylvania. Findings show that only 27% of participants reported in engaging in regular physical activity and 42% reported never exercising.

Although a limitation of this study is that it was based on self-report methods, findings by Bodde et al. (2013) corroborate these findings by Blick et al. (2014). Bodde et al. (2013) measured physical activity of 42 adults (aged 19-62 years) with intellectual disability via accelerometer. Results show that, on average, participants completed 7.73 minutes of moderate to vigorous physical activity per day. Results also show that 47.6% of participants averaged zero minutes of moderate to vigorous physical activity per day.

There are also low levels of PA among children with ID. Bartlo and Klein (2011) stated that 80% of children with ID do not achieve the recommended 60 minutes of physical activity per day. Similarly, Einarsson et al. (2014) compared PA levels of 91 children with ID and 93 age matched typically developing children. Findings show that children with ID were 40% less physically active and were 9% more sedentary than children without ID. None of the children with ID met the recommended 60 minutes MVPA per day, compared to 40% of children without ID who met this guideline.

A study by Pitetti et al. (2009) of 15 primary school children with mild ID measured MVPA accumulated throughout the school day. The findings from this study show that children with ID participated in 83 minutes of MVPA, which is significantly more than the recommended 60 minutes per day. These results, however, lack generalization due to the small sample size and being conducted in only one location and one school, with a teacher who had received specialised training in providing PE classes to children with ID. Although it is noted that there are significant limitations to this research, it does highlight that gains can be made in health-enhancing physical activity that children with ID engage in throughout the school day.

In contrast to findings by Pitetti et al. (2009); Sit et al. (2007) assessed physical activity levels of children with ID during physical education and recess in two special schools. SOFIT

was used to assess a total of 24 PE lessons across the two schools and results show that children spent 50.4% of a 35 minute PE lesson either sitting or standing. Participants completed 9.1 minutes of MVPA, which falls significantly below the recommended 60 minutes MVPA.

2.8.1 Physical inactivity and associated problems

Physical inactivity is a global public health issue and is the fourth leading cause of death in the world, with approximately 3.2 million deaths per year attributed to lack of physical activity (WHO, 2010). It is estimated that physical inactivity is a key cause of a number of cancers including breast and colon cancers (21%-25%), diabetes (27%) and heart disease (30%) (WHO, 2011).

The WHO (2010) states that, globally, 23% of adults are insufficiently active. In relation to Northern Ireland, the population is among the least active in the UK, with only 59% of men and 49% meeting recommended guidelines of 150 minutes of moderate intensity physical activity per week (British Heart Foundation, 2015). Physical activity levels are also low in children. Globally, 81% of children and young people (aged 11-17 years) do not achieve the recommended guidelines of 60 minutes moderate to vigorous physical activity per day (WHO, 2010). In England in 2012, only 21% of boys and 16% of girls achieved the recommended physical activity guidelines.

Physical inactivity is also a significant problem for people with intellectual disabilities. Bartlo and Klein (2011) found that over 80% of people with ID engage in levels of physical activity below the minimum recommended level of 60 minutes moderate to vigorous physical activity per day (DoH 2011).

The risks of the non-communicable diseases that are prevalent in people with intellectual disabilities are known to be increased by a lack of physical activity and high levels of uninterrupted sedentary behaviour. Findings by Lee et al. (2012) show that 6%-10% of all deaths from non-communicable diseases worldwide can be attributed to physical inactivity. This figure is also much higher for specific diseases such as heart disease (30%). Kohl et al. (2012) stated that in the year 2007, 5.3-5.7 million deaths globally from non-communicable diseases could have been prevented if people who were inactive were to be sufficiently active, for example meeting recommended physical activity guidelines.

The prevalence of obesity in adults with intellectual disabilities has been shown to be higher than that of the general population, and this is also true for children and adolescents with ID (Melville et al., 2007). Childhood obesity has more than doubled in children and quadrupled

in adolescents in the last 30 years (Ogden et al., 2014). Children with ID consistently demonstrate lower levels of cardiovascular fitness, muscular strength and higher levels of obesity than peers without ID (Gillespie, 2003). Physical activity can promote physical and mental health benefits for children including cardiovascular and musculoskeletal health, improved concentration and maintenance of healthy weight (Janssen and LeBlanc, 2010; Ness et al., 2007). Despite the known benefits of physical activity and the low levels of physical activity among people with ID, there is a dearth of research into physical activity of people with ID, and more specifically in children. Further robust research on promoting physical activity among children with ID is required (Einarsson et al., 2014).

2.9 Physical activity in a school setting

Story (2009) suggests that school is the ideal setting for physical activity interventions as this setting has the most influence on young people during the early stages of life. Research also suggests that school based interventions may be most effective in increasing physical activity levels of children that can be tracked into adulthood with physically active children becoming physically active adults (Smith et al., 2015). A systematic review by Dobbins et al. (2013) suggests that, given young people spend a significant amount of their day either travelling to or in school, school based physical activity programmes could potentially reduce population wide chronic diseases by increasing knowledge and producing behaviour change conducive to a healthier lifestyle. Schools can play a key role in increasing physical activity of young people with ID (Pitetti et al., 2009; Haney et al., 2014; Davis et al., 2011; Ozmen et al., 2007; Golubovic et al., 2012). Dobbins et al. (2009) also stated that school-based interventions aimed at promoting physical activity in young people positively impact on the duration of physical activity, indicators of physical fitness and reduced time spent watching television. Schools can make a significant contribution to the physical, mental and social wellbeing of young people (Taggart and Cousins, 2014), however organisational barriers must be overcome in order for school-based physical activity interventions to be effective. Dobbins et al. (2009) state that the minimum changes required to produce benefits are educational materials and changes to the school curricula. As school is compulsory for children and adolescents, there is less chance of inequality in terms of health enhancing benefits of the intervention compared to a community-based programme.

2.10 Walking as physical activity

The benefits of walking are well reported (Lee and Buchner, 2008; McAuley et al., 2004; Schultz et al., 2011) and the seminal review by Morris and Hardman (1997) identified the role of walking in developing and maintaining physical fitness. Walking is a convenient,

accessible and free form of exercise that be incorporated into daily life and sustained into old age (Ogilvie et al., 2007); it can not only produce health benefits and an increase in physical activity but can also be used as a form of active travel. Furthermore, walking requires little or no skill and there is a low risk of injury (Murphy et al., 2007; Lee and Buchner, 2008).

Walking can also take place indoors or outdoors, with no specific facility requirements and no need for specialised equipment. Walking can be accumulated in short bouts throughout the day, which may suit the sporadic nature of children's physical activity and can help to reach recommended daily physical activity guidelines (Whitehead et al., 2009). Walking may also encompass some of the aforementioned key facilitators of physical activity for young people with ID, including support from others, a fun activity and a familiar routine (Mayh et al., 2010). Although evidence suggests that walking is the most common type of physical activity for adults with ID to take part in (Barnes et al., 2013), there are no studies of walking in young people with ID. However, studies of walking interventions in mainstream schools report that findings indicate school based walking interventions may be effective in increasing physical activity levels of young people (5-18 years) (McKee et al., 2007; Ford et al., 2013; Mendoza et al., 2011).

2.11 Conclusion

This chapter discussed the health and physical activity of people with ID, with particular focus on children and adolescents with ID. It is evident from the available literature that health inequalities exist for people with ID; high rates of co-morbid conditions exacerbated by low levels of physical activity contribute to poor health for this population. Young people with ID experience high levels of obesity and achieve less daily physical activity when compared to their non-disabled peers. As young people with ID spend the majority of their day in school, this provides a teachable setting for behaviour change. Despite the benefits of PA for young people with ID, there is a lack of PA interventions targeted at this population in order to facilitate behaviour change and increase PA levels. Thus it is appropriate to develop and test a school-based physical activity intervention targeted at this population. The following chapter is a systematic review of interventions aimed at increasing objectively measured physical activity in children and adolescents with ID.

Chapter 3

Interventions aimed at increasing objectively measured physical activity among young people with intellectual disabilities: A systematic review

3.1 Introduction

People with ID are more likely to have poorer health compared to their non-disabled peers (Taggart and Cousins, 2014; Emerson and Hatton, 2014). The intellectually disabled population is predisposed to a range of co-morbidities including obesity, coronary heart disease and type 2 diabetes (Emerson & Baines, 2010). The risks of these non-communicable diseases are increased by a lack of physical activity (PA) and high levels of uninterrupted sedentary behavior (Lee et al., 2012).

Current UK guidelines recommend that children and young people (aged 5-18 years) should engage in a minimum of 60 minutes moderate to vigorous PA (MVPA) per day (Department of Health, 2011). Many children and young people fail to meet these guidelines with only 51% of 7 year olds achieving the recommended 60 minutes (Griffiths et al., 2013). A longitudinal study over a period of two years by Basterfield et al. (2011) found that PA reduced by 0.3% and sedentary behaviour increased by 3% in children aged between 7-9 years. Similarly, in adolescence, 80.3% of 13-15 year olds do not achieve the recommended 60 minutes MVPA per day (Hallal et al., 2012). There is a decline in PA as children move into adolescence (Allison et al., 2007) and adulthood (Metcalf et al., 2015).

Children and adolescents with ID are particularly at risk of low levels of PA and high levels of sedentary behaviour (Hinckson and Curtis, 2013; Foley and McCubbin, 2009) and are 40% less active than their typically developing peers (Einarsson et al., 2015). A study by Matute-Llorente et al. (2013) of 42 young people with ID reported that participants completed only 9 minutes of MVPA per day, failing to meet the recommended guidelines. Similarly, Boddy et al. (2015) reported that in a sample of 70 5-15 year old young people with ID, 23% of the children were active enough to have health enhancing benefits. Young people with ID consistently demonstrate lower levels of cardiovascular fitness and muscular strength than peers without ID (Lotan, 2007; Gillespie, 2003). Einarsson et al. (2016) also found that throughout the entire weekday, only 5% of children with ID achieved the recommended 60 minutes MVPA, compared to 42% of their non-disabled peers. There is also a higher prevalence of obesity and obesity-related secondary conditions amongst youths with ID (Rimmer et al., 2010). Stewart et al. (2009) found the prevalence of obesity to be significantly higher in young people with ID than those without ID. Young people with autism and Down syndrome were also two to three times more likely to be obese than their non-disabled peers, whilst (Rimmer et al., 2010). Physical activity can promote physical and mental health benefits for young people including cardiovascular and musculoskeletal health, improved concentration and maintenance of healthy weight (Janssen and LeBlanc, 2010; Ness et al, 2007).

Despite the known benefits of PA and the low levels of PA among people with ID, there is a dearth of research on how to encourage PA among this population, and more specifically in children and adolescents with ID. Further robust research on the best methods to encourage physical activity among young people with ID is required (Einarsson et al., 2014).

For the purposes of this review, an intervention can be defined as a programme aimed at increasing PA of individuals through provision of information and/or participation in PA. In order to aid in the development of effective PA interventions for children and adolescents with ID, it is important to identify the 'active ingredients' (Michie et al., 2011). Michie et al. (2013) developed the behaviour change technique (BCT) taxonomy (Appendix 3) as a method to reliably identify intervention components. Behaviour change techniques (BCTs) have been shown to be effective in interventions in the general population (Bird et al., 2013; Martin et al. 2013). A systematic review of BCTs in lifestyle change interventions for people with ID (Willems et al., 2017) concluded that BCTs were often employed in lifestyle change interventions for this population, however there was a lack of theory-driven BCTs and poor reporting of intervention components.

Previous research has focused on quantifying PA levels in order to inform the development of interventions to increase PA levels (Foley et al., 2009; Frey et al., 2008; Phillips and Holland, 2011). This has led to a focus on the methods of PA measurement (Hinckson and Curtis, 2013).

Physical activity can be quantified using objective (e.g. accelerometers or pedometers) or subjective (e.g. self-report) methods. There are a number of limitations of self-report and proxy reporting of PA including; over-estimation or under-estimation of PA, difficulties in determining intensity of PA and reporting bias (Shephard, 2003; Troiano, 2007). Given the limitations of self-report, objective methods may be particularly suitable for measurement of PA in children and adolescents with ID as they do not depend upon recall or rely on cognitive ability (Beets and Pittedi, 2011; Rowlands and Eston, 2007; Shephard, 2003). Results from previous studies suggest that objective methods of PA measurement are more reliable and valid than subjective methods (Hinckson and Curtis, 2013; Reilly et al., 2008; Warren et al., 2010). Although compliance issues with accelerometers in this population have previously been raised (Whitt-Glover et al., 2006) and problems with validity (McGarty et al., 2014), objective measures may still be more credible than subjective methods in capturing PA (Hinckson and Curtis, 2013) in this population.

An accelerometer is a small device that measures acceleration along multiple axes. The main function of accelerometers is that the sensor converts movements into electrical signals that are proportional to the muscular force producing motion (Melanson and

Freedson, 1996). These electrical signals are then translated into counts using algorithms. The counts are summed over a specific period of time (epoch) to assess PA level. Cut points can be applied to identify intensity of activity. Similarly pedometers are small devices that produce a step count. Electronic pedometers measure step count via a horizontal, spring-suspended lever arm that deflects with vertical acceleration of the hips during ambulation. The electrical circuit opens and closes with each deflection detected and a step count is then displayed on the pedometer screen (Tudor-Locke et al., 2002).

Although PA levels of children and adolescents with ID have been measured and reported (Esposito et al., 2012; Hinckson and Curtis, 2013; Whitt-Glover et al., 2006), no systematic review to date has focused on objectively measured PA interventions designed to increase PA levels and their effectiveness in this population. Although there have been PA interventions for this population, the findings from PA are equivocal and the methods disparate therefore a systematic review of interventions for children and adolescents with ID is required.

This paper aimed to systematically review interventions designed to increase objectively measured PA levels in children and adolescents with ID. The objectives were to; 1) review the types of interventions used to increase levels of PA with an outcome of objectively measured PA and assess the effectiveness of these interventions in increasing objectively measured PA in this population; 2) Identify BCTs employed in these studies and 3) Assess the quality of these studies. To date, interventions to promote PA in this population have included small sample sizes, lack of objective measures, lacked comparison or control groups and have been delivered in a range of settings; therefore synthesizing these studies will aid in developing recommendations for future intervention research in this population.

3.2 Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009) was used as the framework for this review.

3.2.1 Search

Individual literature searches were conducted using five electronic databases, Medline Ovid, Web of Science, CINAHL, PsychInfo and SPORTDiscus. The search terms used were physical activity OR exercise terms AND intellectual disability terms AND population terms. These broad terms were used to ensure a comprehensive search strategy and all studies that met the criteria for inclusion could be identified and screened. Within each database, the following search terms were used; for physical activity, 'physical activity', 'exercise' and 'motor activity'. For intellectual disability; 'learning disability' or 'mental retardation' or

'intellectual disability' or 'developmental disability'. For children and adolescents, 'child' or 'adolescent' or 'adolescence' or 'youth' or 'young person' or 'teenager'. There were no timespan limits imposed on the searches in order to identify all relevant studies. The reference lists of all included studies were also hand searched in order to identify any other relevant studies for inclusion in this review.

3.2.2 Eligibility criteria

Studies were included for review if they met the following criteria; (1) full text and available in English; (2) an intervention in which the main component or one of the main components is aimed at increasing PA levels; (3) one of the main study outcomes is an objective measure of PA and (4) children and adolescents with ID, the mean age of participants is 5-18 years. Studies were excluded if; (1) the mean age of participants was over 18 years; (2) focused on therapy; (3) focused on participants' perception of PA; (4) focused on PA experiences and (5) participants were children with cerebral palsy as although there can be an element of ID, this is a predominantly physical disability. In a study of 176 children, Beckung and Hagberg (2002) found that with only 40% were classed as having an intellectual disability. Similarly, Odding et al. (2006) found that between 23-44% of individuals with cerebral palsy were classed as having an IQ less than 70. Studies of children and adolescents with Prader-Willi Syndrome were included as this syndrome can be defined as a genetically determined disorder which causes the presence of mild to moderate intellectual disability (Whittington et al, 2004). Similarly, a systematic review of measurement of physical activity in children and youth with ID (Hinckson & Curtis, 2013) included studies of children with Prader-Willi syndrome. There were no limits imposed with regard to study design during the search. Although randomised controlled trials (RCTs) are often reported as the gold standard measurement for assessing the effectiveness of interventions (Dugdill et al., 2009), other studies of less methodological quality have been included in this review.

3.2.3 Screening

Papers were identified through database searching and duplicates were removed. Results from each database were screened for eligibility by title and abstract by a single reviewer (AJ) and papers that did not meet the inclusion criteria were excluded at this stage. As a result, 48 full text papers were assessed for eligibility by three reviewers (AJ, LT, MM). There were 5 papers that were deemed eligible for inclusion in this review.

3.2.4 Data extraction and quality assessment

Data from each paper was collated using a pre-designed data extraction form (Cochrane, Effective Practice and Organisation of Care (EPOC), 2015). Data extraction for each

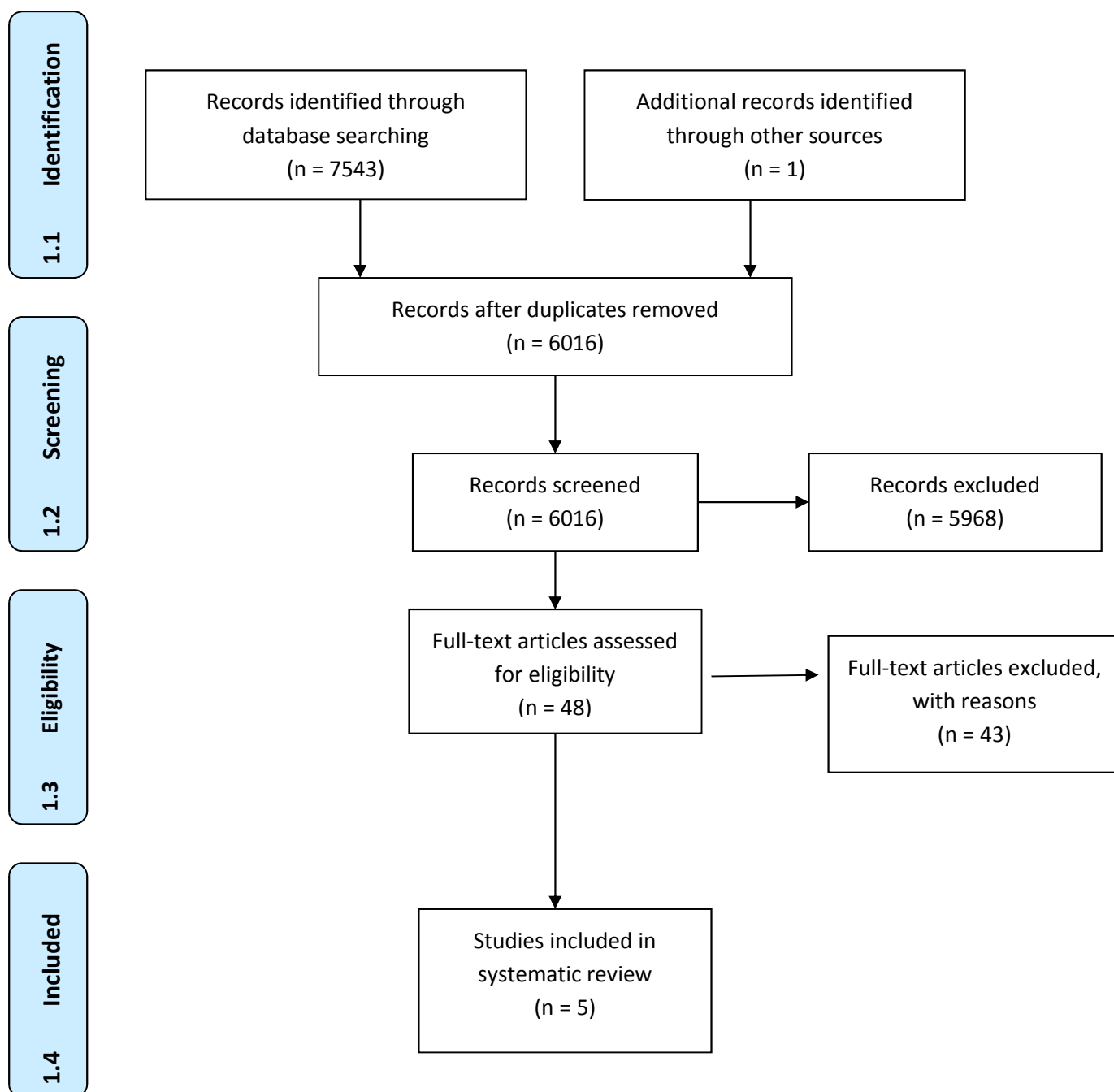
included paper was carried out by a single reviewer (AJ), before being reviewed by the research team. The Critical Appraisal Skills Programme (CASP, 2014) checklist was used to assess the quality of each included paper (Appendix 24). CASP was chosen as the tool for quality assessment as it is a comprehensive checklist for methodological critical appraisal of both qualitative and quantitative studies and it was deemed appropriate for the studies included in this review. The quality of each paper was independently assessed by two reviewers (AJ and LT), with discrepancies being resolved by a third reviewer (MM).

3.3 Results

3.3.1 Included papers

The search identified 7544 papers across all five databases, which were screened against the eligibility criteria. As a result of screening by title and abstract, 7495 papers were excluded, as they did not meet the inclusion criteria. Reasons for exclusion included; (1) not an intervention in which the main component or one of the main components was aimed at increasing PA; (2) objectively measured PA not an outcome measure and (3) not an ID population; (4) not in the age range of 5-18 years. Subsequently, 48 full text papers were assessed for eligibility and 5 studies were deemed to meet the inclusion criteria. As a result, 5 papers were included in this review (Fig 2.)

Fig. 3.1 PRISMA diagram detailing literature search for physical activity interventions in children and adolescents with intellectual disabilities.



3.3.2 Overview of included papers

The main characteristics of included studies are presented in Table 1. Studies included in this review were conducted in the USA ($n = 2$), Switzerland ($n = 2$) and Australia ($n = 1$), with sample sizes ranging from between 19 to 68 participants. The total number of participants across all studies was 203, with a total of 67 female participants and 79 male participants; one study included mixed genders but did not specify the number of males or females. The mean age of participants ranged between 5-18 years across the five studies. All of the studies included mixed genders. The setting for the majority of the studies was in the home ($n = 3$), whilst the other studies were in a community setting (gym or local neighbourhood) ($n = 2$). None of the studies took place in a school setting. As per the inclusion criteria, all of the studies used objective measures (accelerometers and pedometers) to assess PA levels of participants. One study also used a pedometer as a motivational tool for participants (Ptomey et al., 2014).

The interventions in the 5 included studies were muscle strength and endurance training programmes (3), cycling ($n = 1$) and a range of activities including walking, cycling and dancing ($n = 1$). All of the studies included an objective measurement of PA at baseline and at least one other time point. The duration of the interventions varied between 5 days and 6 months and the length of follow up for measurement of PA levels varied between studies from 8 weeks to 12 months across studies. Four of the studies included a control group (Ptomey et al., 2014; Schlumpf et al., 2006; Shields et al., 2013; Ulrich et al., 2011); only one study included a non-ID control group (Eiholzer et al., 2002). One study comprised of two intervention groups and no control group. Three of the studies were RCTs with participants being randomly assigned to intervention or control group, whilst two of the studies were quasi-experimental and did not contain any randomisation. None of the studies included in this review were underpinned by an explicit and coherent theoretical framework for behaviour change.

3.3.3 Effect of interventions on physical activity levels

All of the studies included in this review reported a measure of PA at baseline and at least one other time point. PA data was reported for the whole sample at these measurement points. Four of the studies reported significant increases in PA levels at follow up, whilst one study reported no change in PA levels. Three of the studies, which reported a significant increase in PA levels also reported an increase in physical capacity (Eiholzer et al., 2002), increase in lean mass (Schlumpf et al., 2006) and decrease in sedentary behaviour (Ulrich et al., 2011).

Table 3.1 Intervention characteristics of included studies

Author and Date	Participants	Age	Intervention Type	Setting	Duration	Follow up	Control Group	Outcome Measures	BCTs	Main Findings
Eiholzer et al. (2002) Switzerland	N=35 Mixed gender. Intervention: 8 female, 9 male Control: 8 female and 10 male	Mean 5.3 years, range 3.4-7.2	Muscle strength and endurance training	Home – Supported by parents	3 months	3 months	Same programme as intervention group (non-ID control)	Pedometer (3 day step count)	Social support Repetition and substitution	3 months mean walking distance ↑ (p<0.05)
Schlumpf et al. (2006) Switzerland	N=19 Mixed gender	Mean 8.7 years, range 5.9-11.8	Muscle strength and endurance training	Home – Supported by parents	6 months	6 months	No intervention	Pedometer (3 day step count)	Social support Repetition and substitution	6 months PA ↑ (p<0.05) 6 months Walking distance ↑ (p<0.05)
Shields et al. (2013) Australia	N=68 Mixed gender	Mean 17.9 years	Progressive resistance training	Community (Gym) - Supported by student mentor (non-ID)	10 weeks	11 weeks & 7 months	Social programme with student mentor (non-ID)	Accelerometer (mins/day of MVPA)	Social support Repetition and substitution	11 weeks PA ↔ 7 months PA ↑ MD 58 activity counts/min, 95%, CI 5-112, SMD

										0,8
Ulrich et al. (2011) USA	N=61 Mixed gender	Range 8-15 years	Cycling	Community (Local neighbourhood) – Supported by trained staff	5 days	7 weeks & 12 months	No intervention	Accelerometer (counts per min, time spent in SED)	Shaping knowledge	7 weeks SED ↓ (p=0.001) 12 months SED ↓ (p=0.001) 12 months MVPA ↑ (p=0.004)
Ptomey et al. (2014) USA	N=20 Mixed gender (45% female)	Range 11-18 years	Stop Light Diet education and instructed to engage in 60mins MVPA/day	Home – Supported by parents and weekly Skype calls to a dietician	2 months	2 months	Conventional diet education and instructed to engage in 60 mins MVPA/day	Accelerometer (counts per min, time spent in light, moderate & vigorous activity & time spent SED)	Goals and planning Feedback and monitoring Repetition and substitution Shaping knowledge	2 months MVPA ↔ 2 months SED ↓

3.3.4 Intervention types and effects

Two of the studies included in this review involved children with ID exclusively (Eiholzer et al., 2002; Schlumpf et al., 2006). In these studies the setting for the intervention was in the home. Both of the interventions used muscle strength and endurance training programmes that involved participating in a number of exercises in the home each day. In both of these studies the children completed the exercises themselves, however parents filled out training diaries indicating for each day whether their child had completed the training and how many repetitions were completed. One of these interventions (Eiholzer et al., 2002) measured walking by pedometer and found that there was a significant increase in walking levels in the intervention group compared to the control group at follow up. The other intervention (Schlumpf et al., 2006) found that PA levels had increased in the intervention group at follow up, however this appears to be directly related to the decrease in PA levels of the control group following the intervention.

One study in Australia (Shields et al., 2013) involved only adolescents with ID. This study was an RCT with 68 adolescents (mean age = 17.9 years), which involved a progressive muscle training programme in a local community gym. The programme was led by student mentors without ID who also completed the exercise alongside participants to provide an element of peer support. The authors reported that there was no significant difference in PA levels between the intervention group and the control group at the 11 week immediately post-intervention measurement point, however differences in PA levels between intervention and control group were significant at the 24 week follow up measurement point.

Two studies included in this review conducted interventions with groups consisting of both children and adolescents with ID. The first (Ulrich et al., 2011) conducted a RCT where children and adolescents aged between 8-15 years were trained to ride a bicycle by an instructor. Results found that there was a significant increase in MVPA in the intervention group compared to control group at follow up. The second study was also a RCT (Ptomey et al., 2014) and involved a diet and PA intervention in children and adolescents ranging in age between 11 - 18 years. Participants were instructed to engage in moderate intensity PA and to gradually accumulate a total of 60 minutes per day on at least five days per week. Parental support was a key element of this intervention. Results reported that there were no significant differences in MVPA between groups at follow up (Table 3.1).

All of the studies included in this review used objective methods of PA measurement,

either pedometers (n=2) or accelerometers (n=3). Wear time of pedometers and accelerometers varied between 3 to 8 days across studies, with 3 of these studies stating that compliance was classed as a minimum of 4 days wear (including 1 weekend day) and at least 10 hours of valid data per day (Ptomey et al., 2014; Shields et al., 2013; Ulrich et al., 2011). Two studies reported good compliance with accelerometers for this population, with Shields et al. (2013) reporting that PA data was successfully collected for 65% of participants and Ptomey et al. (2014) reporting a compliance rate of 80%. One study (Ptomey et al., 2014) provided participants with a Fitbit as a motivational tool.

The majority of studies (n=3) accumulated PA in short bouts of between 3 and 10 minutes. One study (Ulrich et al., 2011) accumulated PA in bouts of 75 minutes and another (Shields et al., 2013) accumulated PA in bouts of between 45-60 minutes.

The majority of studies (n=4) included in this review aimed to ensure intervention fidelity through a number of methods. The study by Eiholzer et al. (2002) included an activity diary that was to be filled out by parents each day of the intervention and record details including whether the training had been completed, how many repetitions were completed and if they had not been able to complete the full training programme. Similarly, Schlumpf et al. (2006) also included a daily training diary to be completed by parents indicating how long the exercise was conducted, the number of repetitions achieved and the total training duration.

Another study (Shields et al., 2013) used student mentors without ID who had taken part in training prior to assisting adolescents with ID throughout the intervention. Student mentors completed a log book to record details of each training session including exercises completed, weight lifted, number of repetitions, injuries and any missed sessions. Student mentors were contacted by a member of the research team every 2 weeks to ensure training was consistent and being delivered as planned. Participants in the study by Ptomey et al. (2014) were contacted by a health educator on a weekly basis to monitor progress. Parents were also involved in tracking diet and PA on a computer tablet. The study by Ulrich et al. (2011) did not mention any factors related to ensuring intervention fidelity.

All of the studies included in this review employed BCTs in order to effect behaviour change, however these BCTs did not appear to be derived from a theoretical framework. The BCTs employed included social support (n=4), feedback and monitoring (n= 4), repetition and substitution (n=4), shaping knowledge (n=2) and

goals and planning (n=1). The majority of studies (n=4) which employed BCTs reported an increase in PA levels of participants.

Three of the studies included in this review were RCTs (Ptomey et al, 2014; Shields et al., 2013; Ulrich et al., 2011). The CONSORT (Consolidated Standards of Reporting Trials) checklist (Schulz et al., 2010) provides a tool to ensure the adequate reporting of RCTs. None of the studies included all of the items of information that are recommended for inclusion by CONSORT (Appendix 4) when reporting an RCT.

All 5 studies included had small sample sizes ranging from 19-68 participants. None of the 5 studies included a power calculation or described how sample size was determined.

3.4 Discussion

This is the first review to systematically assess the effects of PA interventions designed to increase PA levels in children and adolescents with ID. Overall results suggest that short to medium term interventions can be effective in increasing objectively measured PA levels of children and adolescents with ID, with 4 of the 5 included studies reporting a significant increase in PA levels between the intervention and control groups at follow up. Of the 4 studies that reported an increase in PA, 2 were home based muscle strength and endurance training programmes and 2 were community based programmes. Of the 2 community based programmes, 1 was a progressive resistance training programme and 1 was a cycling programme. All of the PA interventions were short to medium term ranging from 5 days to 6 months. All 4 of these studies reported significant increases in PA ($P<0.05$, $P<0.05$, $P<0.004$ and 95% CI 5-112).

3.4.1 Behaviour change

Michie et al. (2011) stated that all interventions should be underpinned by a model of behaviour and the influencing factors. None of the studies in this review were underpinned by a coherent theoretical framework of behaviour change. It is well established that theoretically informed interventions are imperative for successful PA promotion (Buchan et al., 2012). The Medical Research Council (MRC, 2008) guidelines for designing and evaluating complex interventions stated that it is best practice to design interventions systematically and to identify appropriate theoretical underpinning. The use of a theoretical framework in the studies included in this

review could help to identify and understand the components of the intervention that worked and may be able to better inform future interventions.

Michie et al. (2013) developed the behaviour change technique (BCT) taxonomy as a method to reliably characterize interventions and to aid in the identification of active components which can then be replicated and implemented in future interventions. All of the studies included in this review employed BCTs in order to effect behaviour change, however these BCTs did not appear to be derived from a theoretical framework. The BCTs employed included social support (n=4), feedback and monitoring (n= 4), repetition and substitution (n=4), shaping knowledge (n=2) and goals and planning (n=1). The majority of studies (n=4) which employed BCTs reported an increase in PA levels of participants.

Ptomey et al. (2014) provided participants with a Fitbit as a motivational tool with the use of BCT's including goals and planning and feedback and monitoring. The use of pedometers as motivational tools in PA interventions for young people is becoming increasingly popular. Pedometers provide a source of feedback for the participant, which can be effective in providing information on physical achievement and can increase PA levels (Tudor-Locke & Lutes, 2009). The use of pedometers as a motivational tool has been shown to be effective in increasing PA levels of school aged young people without ID (Butcher et al., 2007; Schofield et al., 2005; Vanda et al., 2013). Accelerometers have also been used successfully in children without ID (Mattocks et al., 2007; Robertson et al., 2010; Rowlands, 2007; Trost et al., 2003). Similarly, pedometers have been used successfully in studies of young people with ID (Beets et al., 2007; Eiholzer et al., 2003; Pitetti et al., 2009), as have accelerometers (Einarsson et al., 2014; Izquierdo-Gomez et al., 2014; Shields et al., 2013).

Parental support plays a key role in influencing the PA levels of children and adolescents with ID (Barr & Shields, 2011; Downs, Boddy, Knowles, Fairclough & Stratton, 2013; Mayh, Shields, Taylor & Dobb, 2010), as children with ID often have less autonomy than their non-ID peers and have greater reliance on parents. The majority of the studies included in this review (n = 3) took place in the home setting and comprised an element of parental involvement. Parental support is a social support BCT and two of the studies that employed this BCT were effective in increasing the PA levels of participants. Parental support is an important correlate of PA in children without ID (Trost et al., 2003), however parental support plays a particularly important role for children and adolescents with ID and can be a key

facilitator of PA engagement for this population (Downs et al., 2013).

One of the studies in this review employed the BCT of social support via the use of peer support (Shields et al., 2013). Participants who received peer support showed an increase in PA (mean difference 58 activity counts/min). Results show that there were significant differences in PA levels between the intervention and control group in favour of the intervention group at follow up. Peer support can positively influence PA behaviour in young people with ID (Downs et al., 2013; Klavina & Block, 2008; Vashdi, Hutzler & Roth, 2008). Peer support has also proven to be effective in sustaining engagement in PA for young people with ID (Halle, Gabler-Halle & Chung, 1999). Shields, Synnot and Barr (2012) conducted a systematic review of perceived barriers and facilitators to PA for young people with ID and found that one of the key facilitators of PA for these young people was interaction, encouragement and assistance from peers. Social reasons have also been found to be the main motive for children with ID to engage in PA (Menear, 2007).

A familiar routine has been previously identified as a key facilitator of PA for children and adolescents with ID (Mayh et al., 2010). Almost all ($n = 4$) of the studies in this review comprised interventions, which involved repetition of the same routine for a number of weeks. This demonstrates the use of the BCT repetition and substitution. All 4 of these studies reported significant increases in PA levels.

Behaviour change techniques are often employed in lifestyle change interventions for the ID population however studies are of low quality, lack a theoretical framework and BCTs included are not derived from theory. Willems et al. (2017) identified that BCTs can be effective in lifestyle change interventions for people with ID, however detailed reporting of intervention content and inclusion of a theoretical framework could contribute further to effectiveness.

3.4.2 CONSORT

CONSORT is important when conducting RCTs to avoid inaccurate and incomplete reporting and to ensure that the methods and protocol are replicable in order to inform future studies. This would be particularly important to implement in RCTs involving people with ID, given the poor quality and replicability of existing studies in this population. Although the three RCTs involved in this study were conducted after the CONSORT guidelines were produced, none of the studies included all of the items of information that are recommended for inclusion when reporting an RCT. The

use of CONSORT as a guiding framework when reporting RCTs could enhance the replicability of studies to allow for implementation in future interventions.

3.4.3 Bouts

The majority of the studies ($n = 3$) included in this review accumulated PA in short bouts of between 3 and 10 minutes, of which 2 studies reported significant increases in PA levels. There is evidence to suggest that accumulating short bouts of PA may be effective in helping to achieve recommended daily levels (Barr-Anderson et al., 2011). This may be particularly suitable for children due to the sporadic nature of their PA (Welk et al., 2000).

3.4.4 Fidelity

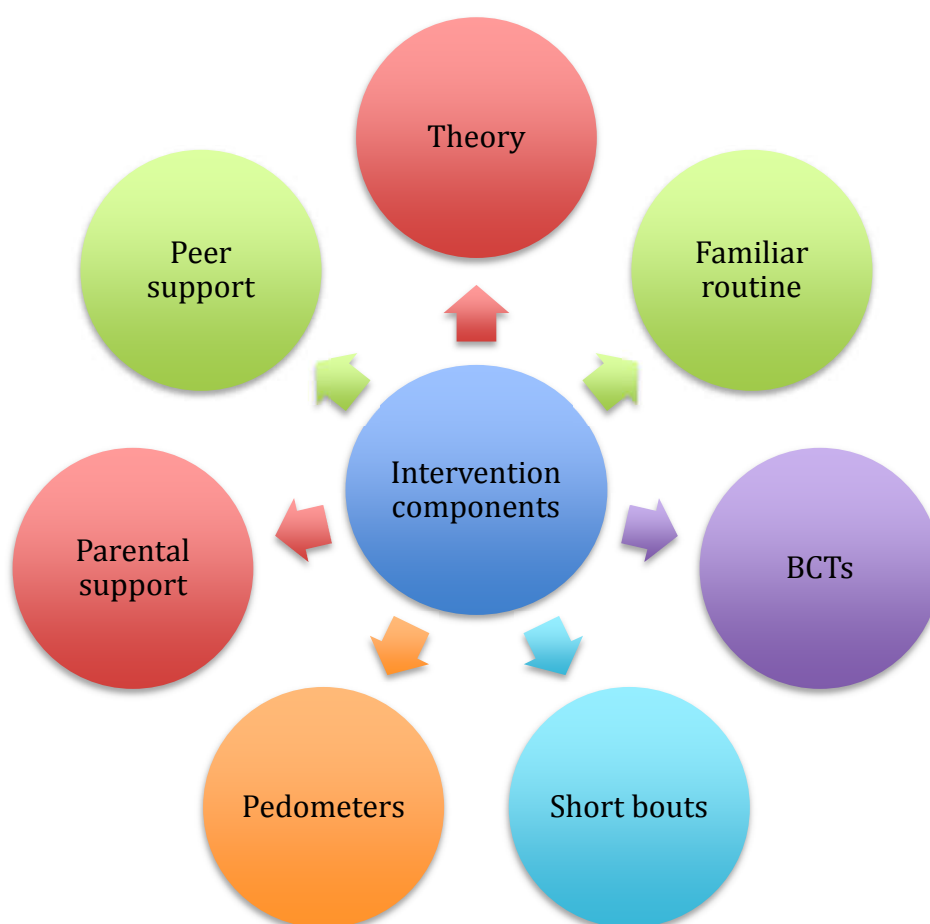
Intervention fidelity is an important aspect to consider when determining the effectiveness of an intervention. Intervention fidelity can be defined as an intervention which is delivered as intended (Breitenstein et al. 2010). It is important to ensure intervention fidelity in order to maintain internal validity and enhance external validity (Horner et al., 2006). The majority of studies ($n=4$) included in this review aimed to ensure intervention validity through a number of methods. Of the four studies that included measures to ensure intervention fidelity, three (Eiholzer et al. 2002; Schlumpf et al. 2006; Shields et al. 2013) reported a significant increase in PA.

3.4.5 Setting

The majority of the studies took place in the home ($n=3$), whilst others took place in a community setting ($n=2$), however the recent Cochrane Review by Dobbins et al. (2013) suggested that, given young people spend a significant amount of their day either travelling to or in school, school based PA programmes could potentially reduce population wide chronic diseases by increasing knowledge and producing behaviour change conducive to a healthier lifestyle. Story et al. (2009) argued that school is the ideal environment for PA interventions as this setting has the most influence on young people during the first two decades of life. Einarsson et al. (2016) stated that children can accumulate between 5-61% of their daily recommended MVPA during school time. Research also suggests that school based interventions may be effective in increasing PA levels of children that can be tracked into adulthood with physically active children becoming physically active adults (Smith et al., 2015).

Schools can play a crucial role in increasing the PA levels of children and adolescents with ID (Davis et al., 2011; Golubovic et al., 2012; Haney et al., 2014; Ozmen et al., 2007; Pitetti et al., 2009). The results indicate that significant gains can be made within the time children and young people with ID spend in health-enhancing PA in the school setting. Children and young people with ID participate in little PA during school (Sit et al., 2007), however they also depend more on the school system to accumulate the recommended levels of moderate to vigorous PA per day than their non-disabled peers (Einarsson et al., 2016). Given that school based PA interventions have been successful in mainstream schools (Dobbins et al., 2009) and that children with ID spend a significant amount of the day in school, it would be appropriate to investigate the effectiveness of a school based PA intervention designed to increase PA levels in this population.

Fig. 3.2 Intervention components of included studies.



3.5 Strengths and limitations

The studies included in this review were systematically searched using electronic databases, data extraction was completed using a pre-designed data extraction form and CASP was used as a framework for quality assessment. Studies were reviewed by two additional reviewers prior to inclusion to ensure rigour. Only full text articles that were in English were eligible for inclusion in this review, therefore potentially relevant articles may have been overlooked or excluded.

3.6 Conclusions and Recommendations

This systematic review has identified interventions to increase objectively measured PA and their effectiveness in increasing PA levels of children and adolescents with ID. Results indicate that short to medium term interventions designed to increase objectively measured PA levels can be successful in this population. Future research should aim to focus on the inclusion of a coherent theoretical framework to underpin the design of further PA interventions in order to effect behaviour change and to aid in the identification of effective intervention components. There should also be clear reporting of BCTs employed to allow for replication and implementation in future interventions. Further research into the settings of PA interventions for children and adolescents with ID, particularly within a school setting, is also warranted. Due to the small number of studies eligible for inclusion, this review has highlighted the need for further research on PA interventions for children and adolescents with ID.

Chapter 4

Research Design

4.1 Introduction

This chapter will present the rationale for the research design, the theoretical underpinning including individual and systems change theories and the justification for this and ethical considerations involved in conducting research with young people with ID. Subsequently, each phase has a dedicated chapter (chapters 5,6,7 and 8), which will detail the methods used.

The work described in this doctoral thesis comprised of five phases. Firstly a systematic review was conducted to identify the evidence base. Secondly, focus groups and interviews were conducted to identify the barriers, facilitators and motivators to physical activity for young people with ID. Subsequently, workshops were conducted with stakeholders to ensure co-production of the intervention. The intervention was then feasibility tested and finally a process evaluation was carried out to identify factors affecting implementation.

4.2 Research design

The overarching aim of this doctoral study was to develop and test a multi-component walking intervention, thus it is necessary to define complex (multi-component) interventions. Complex interventions can be defined as interventions which are comprised of multiple interacting components (Moore et al., 2015). To provide a framework for complex interventions the Medical Research Council (MRC) produced guidelines for developing and evaluating complex interventions (2000), however the shortcomings of these guidelines have previously been identified particularly in relation to limited detail regarding intervention development (Craig et al., 2008). The updated MRC guidelines (2008) provided further guidance on how to approach intervention development and the role of complex systems in the intervention development process.

There has been some debate around the definition of complexity and whether this relates to the intervention itself or the system in which the intervention is implemented (Hawe, 2015) however Petticrew et al. (2011) sought to clarify when an intervention should be defined as simple or complex. Recent thinking has moved towards not only considering the components of an intervention in isolation but also considering the context within which an intervention is implemented (Moore and Evans, 2017). The term complex intervention is widely used, however Shiell et al. (2008) argued that complexity relates to the system within which an intervention is implemented.

As the work comprised in this doctoral thesis involved developing and testing a multi-component intervention within a complex system, the phases were guided by the updated MRC guidelines (2008) whilst also incorporating individual and systems change theories in the intervention development. The MRC guidelines (2008) stated that the first step in developing a complex intervention is to identify the evidence base, therefore the first phase of this research was to conduct a systematic review of interventions aimed at increasing objectively measured physical activity in children and adolescents with ID.

The work comprising this thesis aimed to meet the aims and objectives through five distinct phases within a longitudinal, multi-phase research design culminating in a non-randomised controlled feasibility trial of the walking intervention.

Although a longitudinal design has been employed in studies of physical activity for adults with ID (Harris et al., 2018; Dairo et al., 2016) and young people with ID (Collins et al., 2017; Shields et al., 2013) for measuring variables at two time points, the 1 group x 3 time point design for the intervention group employed in this study is unique in the field of ID and is the first study to employ this design to test a school-based walking intervention in this population. Caruana et al. (2015) described the strengths of longitudinal designs in measuring change over time and that this type of design may provide a comprehensive approach to research. Furthermore, Stanish and Temple (2012) recommended the use of quantitative longitudinal designs for future studies involving adolescents with ID. The MRC (2008) stated that robust designs should be employed to test complex interventions, thus it was deemed that a longitudinal design was appropriate.

This study employed a multi-phase design through five distinct phases; systematic review (phase 1), focus groups (phase 2), co-production workshops (phase 3), feasibility trial (phase 4) and process evaluation (phase 5). This design employed two qualitative phases used to inform the quantitative phase followed by a further qualitative phase. Findings from phase 1 and phase 2 informed the development of the proposed walking intervention. Triangulation can be defined as bringing together different sources of data and using this evidence to develop a justification for themes. This adds to the validity of the study by developing themes developed based on several sources of data (Creswell, 2014). Triangulation occurred in phase 3 where the findings from phase 1 and phase 2 were brought together and stakeholders were involved in the further refinement of the intervention to add richness and depth (Heale et al., 2013).

The MRC (2008) suggest that, where possible, a randomised controlled trial (RCT) should be used to test an intervention. Due to the small number of special schools in Northern Ireland (n=40) and the smaller number of special schools that have pupils in the target age group (up to 19 years) (n=12), it was not possible to recruit enough participants to randomly assign to intervention or control group. Furthermore, there was no randomisation as the two schools receiving the intervention were involved in the development of the intervention and it was, therefore, considered unethical to randomise which schools received the walking intervention. As this is a preliminary study designed to test methods and identify methodological challenges prior to conducting an RCT, it is acceptable to have no randomisation. Arain et al. (2010) stated that feasibility studies for randomised controlled trials may not themselves be randomised. There is growing evidence to suggest that attention to design and feasibility of interventions is key to improving effectiveness (Wight et al., 2015). A recent systematic review by Hallingberg et al. (2018) synthesised the evidence for designing and conducting preliminary studies and found that there is limited guidance for exploratory studies of complex interventions. There has been some debate around the definition of pilot and feasibility studies (Arain et al., 2010; Whitehead et al., 2014) with the terms pilot and feasibility often used interchangeably, however the National Institute for Health Research, Evaluation, Trials and Studies Coordination Centre (NETSCC) stated that a feasibility study is research conducted prior to a main study to estimate important parameters for designing the main study whilst a pilot study is a version of the main study run in miniature (NETSCC, 2011). Similarly, Bowen et al. (2009) stated that the objective of feasibility studies is to determine if an intervention is appropriate and acceptable for further testing. Furthermore, Eldridge et al. (2016) defined feasibility as a concept which assesses whether an intervention is suitable for further testing and the adaptations required for further testing. Thus, it was deemed that the design of this preliminary study would be a feasibility trial to assess whether it would be feasible to conduct a full-scale study.

To ensure robustness of the methods employed, participants across groups were matched by age, conducting the same measurements over each time point, using the same measuring instruments at each time point and measuring a control group as well as the intervention group (Gray, 2009; Mitchell and Jolley, 2010).

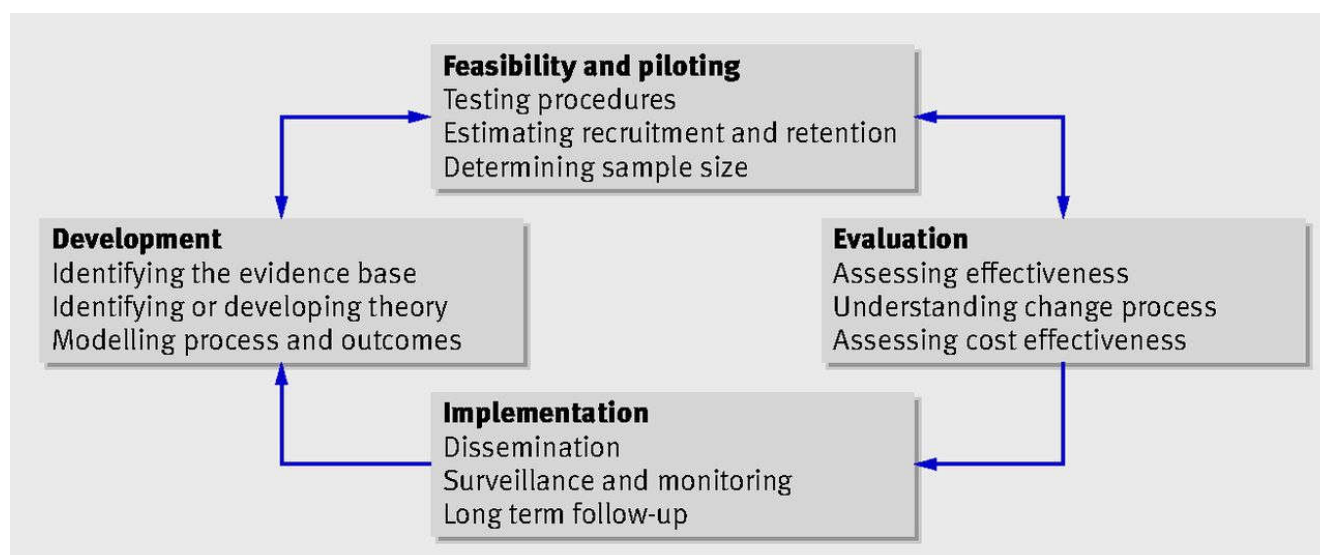
The MRC guidelines (2008) recommended that, in order to adopt robust methods to test complex interventions, appropriate theory should be identified. This doctoral thesis addressed this recommendation by applying individual and systems change theories to develop a theoretically underpinned intervention using COM-B (capability,

opportunity, motivation and behaviour) model (Michie et al., 2011) and the socio-ecological model (Bronfenbrenner, 1994). A review by Nilsen (2015) sought to clarify the terms theory, model and framework which are often used interchangeably and whilst there is some overlap, each term has a clear definition. A theory can be defined as principles which guide understanding, explaining and predicting phenomena (Frankfort-Nachmias and Nachmias, 1996; Davis et al., 2015). A model is closely related to theory but has a more clearly defined scope than theory and is descriptive, whilst a theory is explanatory (Nilsen, 2015). A framework is a structure that surrounds a theory or model and which comprises a number of categories (Nilsen, 2015). A framework was developed and applied to this study to surround the model (SEM) and theory (COM-B) and to demonstrate how the 5 phases of this research fit together (Fig. 4.3).

4.3 Theoretical underpinning of the walking intervention

It is well established that theoretically informed interventions are imperative for successful PA promotion (Buchan et al., 2012) and that interventions should be underpinned by a model of behaviour and its influencing factors (Michie et al., 2011). The Medical Research Council (MRC, 2008) guidelines identify four key stages for designing and evaluating complex interventions (Fig. 3). The MRC stated that it is best practice to design interventions systematically and to identify appropriate theory, however there is no further guidance on selection and application of theory (Michie et al., 2005). Therefore, it is necessary to focus on improvement of intervention design by application of a systematic method and identification of behaviour that needs to change in order to identify intervention components (Michie et al., 2011).

Fig. 4.1 Key elements of the MRC guidelines for designing and evaluating complex interventions.



4.4 Individual behaviour change theories

It is well reported that individual behaviour change theories have been used in physical activity interventions in the general population (McGoey et al., 2015). However there is a lack of theory-based interventions for individuals with ID (Van Schijndel-Speet et al., 2013) and more specifically for children with ID (Johnston et al., Submitted).

A recent systematic review by Owen et al. (2017) concluded that there were significant effects for multi-component interventions and interventions underpinned by a theoretical framework. A number of individual behaviour change theories have been previously used as a basis for PA interventions, the most commonly used are;

- Social Cognitive Theory (Stacey et al., 2016; Dewar et al., 2014);
- Self-Determination Theory (Jago et al., 2015; Sebire et al., 2016);
- Transtheoretical Model (Taymoori et al., 2008; Kim et al., 2008);
- Theory of Planned Behaviour (Stolte et al., 2017; Haerens et al., 2006).

There is limited evidence to suggest the effectiveness of these individual behaviour change theories in PA interventions (Mears and Jago, 2016), however this could be attributed to poor application of theory and sub-optimal use of theory to develop an intervention (Davis et al., 2015). Behaviour is multi-faceted and a limitation of these theories may be that they are not adaptable to enable sustainable behaviour change.

The COM-B model may provide a more comprehensive system by which to understand and change behaviour. The COM-B model is a behaviour system where capability, opportunity and motivation interact to influence behaviour and behaviour can also influence these factors (Michie et al., 2011). Capability is defined as an individual's physical and psychological capability to engage in an activity such as possessing the required knowledge and skills. Opportunity is defined as all of the factors that make a behaviour possible or prompt behaviour outside of the individual. Motivation is defined as an individual's brain process that directs their behaviour. The components of COM-B can be further subdivided; 1) Capability - physical and psychological; 2) Opportunity - physical and social and 3) Motivation - reflective and automatic. After conducting a behavioural analysis using COM-B, behaviour change techniques can be identified based on what is required for a target behaviour to occur. Although COM-B has been applied to interventions for health behaviour change in the general population (Webb et al., 2016; Munir et al., 2018), there is a

lack of evidence of the explicit application of theory in interventions aimed at the ID population.

Michie et al. (2013) developed the behaviour change technique (BCT) taxonomy as a method to reliably characterise interventions and to aid in the identification of active components which can then be replicated and implemented in future interventions. This taxonomy provides a tool to investigate the use of behaviour change techniques in health and physical activity behaviour change and has been used to identify effective intervention components to promote PA (Michie et al., 2009). This taxonomy has also been successful in identifying effective components to promote walking (Bird et al., 2013).

4.5 Systems change theory

Physical activity behaviour is affected by factors at various levels such as individual, interpersonal and environmental factors (Troost et al., 2003). Thus, it is appropriate to apply intersectoral approaches targeting various levels to increase physical activity (Bauman et al., 2012). Therefore, the socio-ecological model (SEM) (Bronfenbrenner, 1994; McLeroy, 1988; and Stokol, 2003) was the systems change theory underpinning this school-based multi-component walking intervention.

The SEM acknowledges that there must be a combination of both individual level and environmental level interventions to achieve significant changes in health behaviour, including physical activity behaviour. King et al. (2002) state that SEMs comprise principles that are crucial to understanding and influencing PA behaviour. While the components of the socio-ecological model remain the same and can be used in a range of populations, the specific examples within each component will vary according to the population group (Elder et al., 2007). The SEM has been successfully applied in a mainstream school setting (Townsend & Foster, 2011; Kriemler et al., 2010) and there is evidence to suggest that the SEM is effective in promoting and sustaining behaviour change in the schools setting (Simon et al., 2014). Findings show that school based PA interventions based on the SEM produced an increase in aerobic fitness, moderate-vigorous PA and total PA in school (Kriemler et al., 2010). Although this model has been successfully applied in a mainstream school setting, it has not been applied in a school for young people with ID. This model is based on four core principles; 1) multiple factors influence behaviours, 2) environments are multi-dimensional and complex, 3) human-environment interactions can be described at varying levels of organisation and 4)

the interrelationships between people and their environments are dynamic. This doctoral study aimed to target the first three aspects of the SEM; the individual, interpersonal and organisational elements.

Therefore, to address the recommendations of previous research, a coherent theoretical underpinning that incorporated both individual behaviour change theories and systems change theories was identified and applied to the development of the walking intervention. The COM-B system was mapped to the corresponding components of the SEM (Fig. 4.2) to identify behaviour change techniques and intervention components.

Fig. 4.2 COM-B mapped to components of the socio-ecological model

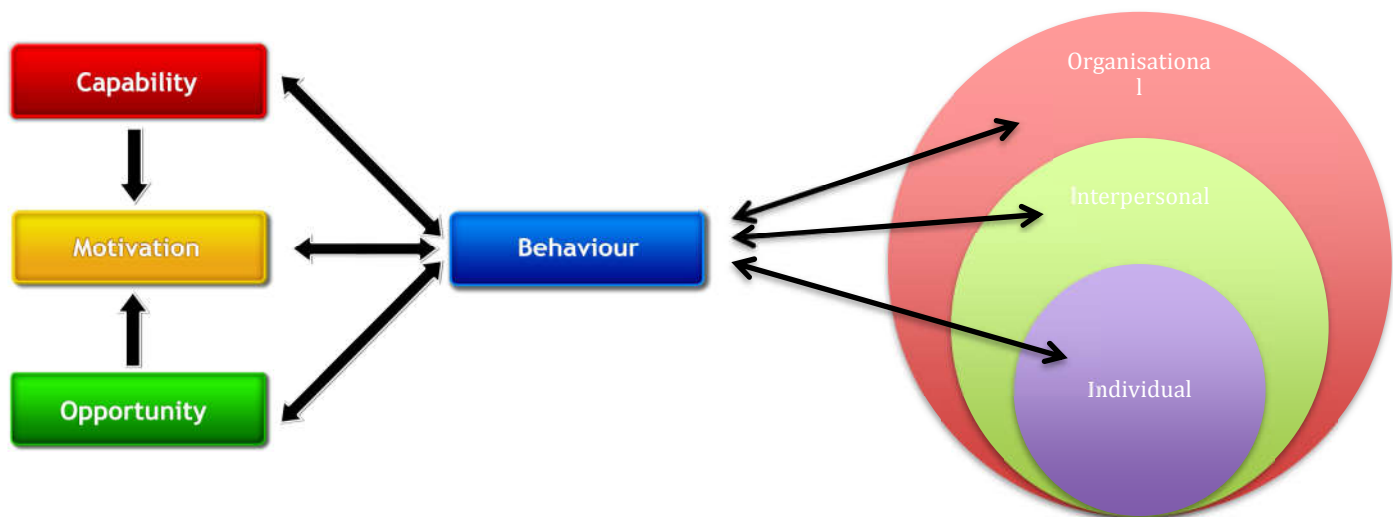
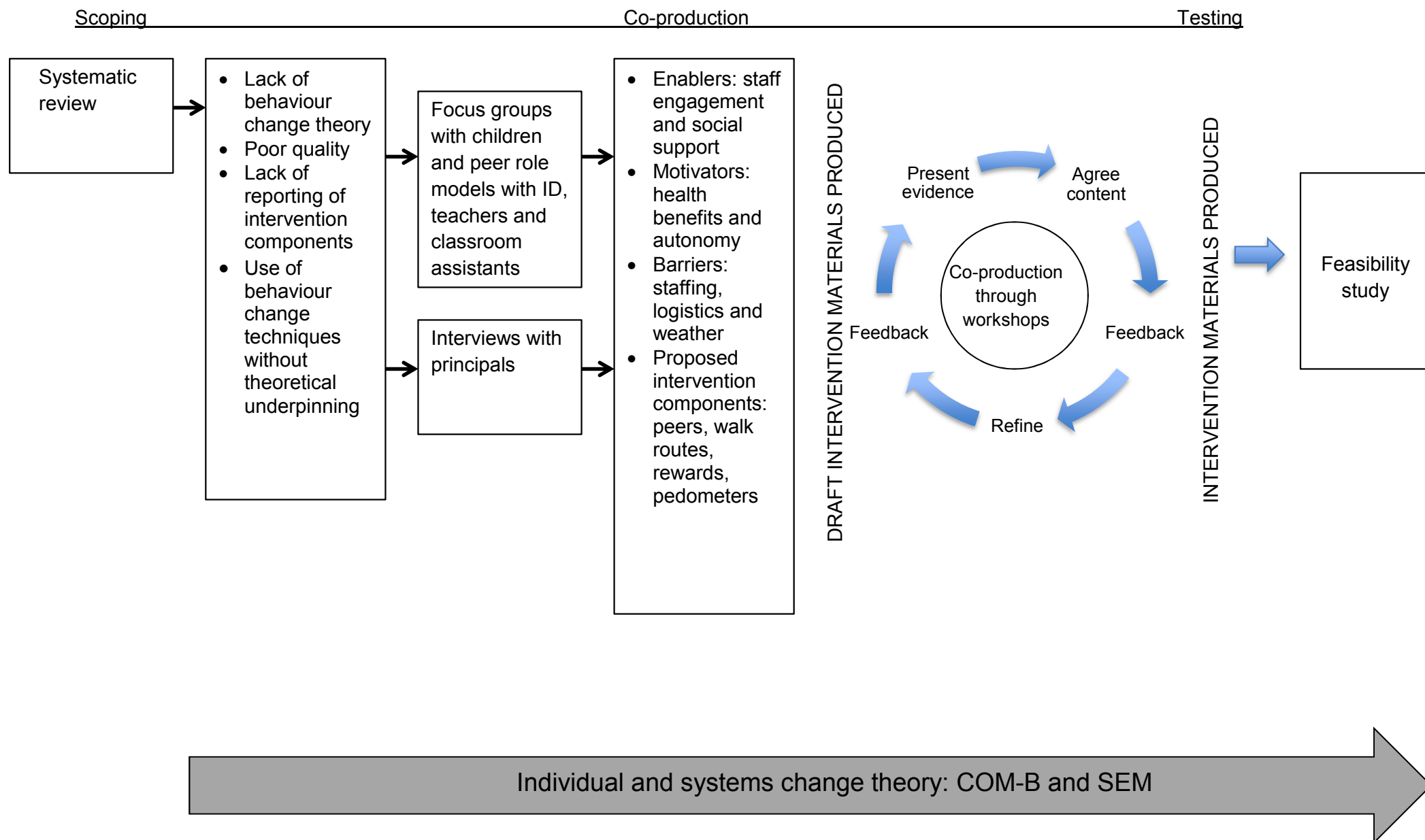


Fig. 4.3 Framework for intervention development



4.6 Phase 1: Systematic review

Phase 1 of the study involved conducting a systematic review of interventions aimed at increasing objectively measured physical activity levels among children and adolescents with ID (Chapter 3). Systematic reviews are conducted to assess and synthesise available evidence and assess the quality of the evidence base through reproducible methods (Mallett et al., 2012). Systematic reviews can identify areas for future research (Ferreira-Gonzalez et al., 2011). The systematic review was conducted in phase 1 to synthesise the evidence by identifying existing interventions aimed at increasing objectively measured physical activity among young people with ID in order to inform the development of the school-based multi-component walking intervention.

4.6.1 Phase 2: Focus groups

Phase 2 involved conducting focus groups to identify the barriers, enablers and motivators to physical activity for young people with ID (Chapter 5). Focus groups were conducted with children with ID, adolescents with ID, teachers and classroom assistants. A 1:1 interview was conducted with principals. The adolescents with ID were the proposed peer role models for the children with ID and will be referred to as peer role models throughout this thesis. Focus groups can be defined as carefully planned discussions designed to gain perceptions on a specific area of interest in a permissive and nonthreatening environment (Krueger and Casey, 2015). Focus groups can also stimulate new ideas and creative concepts (Stewart et al., 2007). Cambridge & McCarthy (2001) also stated that focus groups can help participants to gain confidence, create a safe environment and allow for peer support. The dynamics present in focus groups have already been shown to be helpful in overcoming some existing barriers to the direct inclusion of people with learning difficulties in research (Fraser & Fraser, 2001; Cambridge & McCarthy, 2001). Although focus groups and interviews have been conducted with parents, carers and teachers of children and adolescents with ID (Cartwright et al., 2017; Alesi and Pepi, 2015; Downs et al., 2014), there is less evidence of the inclusion of children and adolescents with ID in qualitative research. Scott et al. (2011) stated that with reasonable adjustments it is possible to collect data from children and adolescents with ID on a range of health and wellbeing issues.

4.6.2 Phase 3: Co-production workshops

Phase 3 involved co- production workshops with stakeholders in schools to further develop and refine the walking intervention through an iterative process (Chapter 6). Co-production can be defined as the involvement of stakeholders in the design, management, delivery and evaluation of an intervention (Osborne et al., 2016). The MRC guidelines (2008) recommend identifying an evidence base, developing appropriate theory and modelling of processes and outcomes, however there is no guidance on co-production of complex interventions with stakeholders. The NICE guidelines (2014) provide guidance on the design of behaviour change interventions to address behaviours related to health problems. Recently, the NICE guidelines have highlighted the importance of co-production in developing behaviour change interventions to ensure acceptability, sustainability and a coherent evidence base. Other frameworks have identified co-production with individuals and communities as a key aspect of intervention development (Wight et al., 2016; De Silva et al., 2014).

Fritz et al. (2017) recommended the use of workshops with stakeholders in order to facilitate change and Morton et al. (2017) stated that stakeholder engagement is considered integral to developing effective public health interventions. The World Health Organisation (WHO) also recommends involving stakeholders in the development process of interventions aimed at increasing levels of physical activity (WHO, 2007).

Furthermore, Hawkins et al. (2017) stated that co-production with stakeholders harnesses their expertise and maximises the acceptability of the intervention during the development process. Thus, the iterative process of workshops was an important phase in the development of the walking intervention.

4.6.3 Phase 4: Feasibility study

Phase 4 involved conducting the feasibility study of the school-based multi-component walking intervention (Chapter 7). The walking intervention was developed within the Medical Research Council (MRC) guidelines. There are four stages within the MRC guidelines (Fig. 4.1), this feasibility study falls within the piloting and feasibility stage which involves testing procedures, estimating recruitment and determining sample size.

The MRC (2012) also stated the importance of the fidelity of complex interventions in order to identify the active ingredients. However some interventions can be

deliberately designed to be adapted to local circumstances, this is especially true in the school setting (Patton et al., 2006), where a standardised intervention process may be developed but allow variation for pragmatic reasons. To limit the variation in intervention delivery, teachers from both intervention schools have been involved in the development of the intervention and are well versed in the various components and the delivery of the walking programme within the school. Teachers completed daily logs to ensure the walking programme was being delivered correctly. The researcher also visited both intervention schools on a regular basis to ensure the intervention was being delivered within the standardised intervention process.

4.6.4 Phase 5: Process evaluation

Phase 5 involved conducting a process evaluation (Chapter 8). Many physical activity interventions are complex multi-component interventions and the nature of these interventions mean that components may or may not be delivered as intended. An intervention could have successful outcomes but may not have been delivered as intended and it is therefore difficult to determine if outcomes observed can be attributed to the intervention (Robbins et al., 2014). As a result of this, a process evaluation is crucial to understand the fidelity of the intervention. The MRC guidelines (2008) recommend that process evaluations are carried out in order to inform the development of future interventions. Liu et al. (2016) stated that process evaluations are valuable to determine if interventions can be scaled up or if intervention components require adapting for different contexts.

4.7 Ethical considerations

There are many ethical issues to consider when conducting research involving participants with ID, mainly in relation to exploitation and harm to a vulnerable population (Iacono, 2006). However including people with ID in research can have numerous benefits including increasing self-esteem and confidence of participants, allowing participants to meet new people and give them an opportunity to feel included (McDonald et al., 2016).

4.7.1 Assent

Participant assent was sought from children and young people with ID for their participation in the study. Freedson (2001) stated that assent can be defined as the inclusion of participants for whom consent has been provided by proxy (parents/guardians in this study) accompanied by their agreement to participate in

the study. There has been much discussion around the issue of individuals with ID consenting to participate in research (Freedson, 2001; Lennox et al., 2005) and people with ID are often excluded from research because they are perceived to lack the capacity to provide informed consent (Horner-Johnson and Bailey, 2013). However with reasonable adjustments, there is a consensus that people with ID can provide assent for their participation in research studies (Lennox et al., 2005; Emerson and Hatton, 2011) and that people with ID should be included in research that is about them (Jepson, 2015). The reasonable adjustments in this study were user-friendly information sheets developed for children with ID and peer role models with ID, which included pictorial representations of the various phases of the study, including focus groups, workshops, the walking programme and the various devices to be used for data collection. The inclusion of these user-friendly information sheets contributed to the autonomy of children with ID and peer role models with ID to provide assent for their participation in the study. All participants provided their assent for participation in the study.

4.7.2 Parental consent

Parental consent was sought before commencement of the study. All parents/guardians completed and returned consent forms for their child's participation in the study. Participant information sheets were distributed to parents/guardians to provide information, explanation and justification for the study. The return of signed consent forms indicated that parents/guardians had read and understood the information provided and were willing for their child to participate. Consent forms also indicated that parents/guardians understood that their child's participation was voluntary and they were free to withdraw from the study at any time without giving any reason. Parents and guardians also consented to data being stored securely by the researcher, in line with Ulster University policy.

4.7.3 Confidentiality

All participants were informed that all information and data would be securely kept in a locked filing cabinet in the researcher's office at Ulster University Jordanstown campus. Electronic data would be stored on a computer in the researcher's office and would not be accessible through university domains. Electronic data would also be stored on the researcher's laptop and an external hard drive, which is encrypted, password protected, stored in a locked cupboard and only used for the purpose of this research. Participants were also informed that data stored on the researcher's laptop would be anonymised and coded. Before data collection commenced at each

time point and for each phase of the study (focus groups, workshops, walking intervention and process evaluation), all participants were reminded that their personal details would be kept confidential and that their data would be kept anonymous.

4.7.4 Ethics of the walking programme in school

For children and adolescents with more profound intellectual disabilities and those who suffer physical disabilities and therefore could not participate in the walking programme in school were able to continue on with their normal school routine without any disruption as a teacher or classroom assistant was always available to supervise them. Prior to commencement of the walking programme, teachers identified those whose disabilities would preclude them from participating in walking during school.

4.7.5 Ethical approval

Ethical approval was granted by Ulster University Research Ethics Committee (UUREC) in January 2016 for the development of the intervention (Phase 2 focus groups and Phase 3 workshops) and in October 2016 for the testing of the intervention in the feasibility study (Phase 4) and process evaluation (Phase 5) (see appendix).

4.8 Conclusion

This chapter described the rationale for the research design, the justification for the theoretical underpinning and the ethical considerations for interventions targeted at this population. It is evident that there is a requirement for developing and testing complex interventions for the ID population using robust methods and employing both individual and systems change theories to address the shortcomings identified in previous research.

The following four chapters discuss in detail the distinct phases of this research in relation to aims and objectives, design, methods, recruitment, analysis and findings.

Chapter 5

Exploring the barriers, enablers and motivators of physical activity for young people with ID

5.1 Introduction

This chapter discusses the aims and objectives of the focus groups and interviews with children with ID, adolescents with ID, teachers, classroom assistants and principals and presents findings from this phase. The enablers, motivators and barriers to a school-based multi-component walking intervention were explored in phase 2. Four core themes along with their associated sub-themes emerged and were mapped to COM-B and the SEM (chapters 4 and 6). These themes and their associated sub-themes are presented in this chapter.

5.2 Aims and objectives

The aim of focus groups and interviews in phase 2 was to identify the enablers, motivators and barriers to physical activity for children with ID.

The objectives of focus groups and interviews in this phase were:

- 1) To explore the enablers, motivators and barriers of a school-based multi-component walking intervention.
- 2) To identify themes to aid in the development of the intervention.
- 3) To map themes and sub-themes to COM-B and the SEM to identify intervention components.

5.3 Methods

5.3.1 Design

Phase 2 of this research involved focus groups with children (aged 9-13 years), peer role models (aged 15-19 years) and teachers/classroom assistants. Two interviews were also conducted with the principals. The focus groups and interviews in this phase allowed the researcher to identify the barriers, enablers and motivators of a school-based multi-component walking intervention from a range of different perspectives.

Focus groups were conducted with children with ID (aged 9-13 years), peer role models with ID (aged 15-19 years) and teachers/classroom assistants. Focus groups were deemed the most appropriate method of data collection as the researcher could make reasonable adjustments for children and adolescents with ID including; clearly explaining what will happen during the focus group, rewording or clarifying questions to ensure participants understand, conducting the focus group in a familiar

environment in school and arranging a quiet and private room, their teacher being present and support from their peers.

A total of 6 focus groups took place across two schools (2 focus groups with children with ID, 2 focus groups with peer role models with ID and 2 focus groups with teachers/ classroom assistants). Two 1:1 interviews with principals also took place across two schools.

5.3.2 Participants and recruitment

Two special educational needs (SEN) schools in Northern Ireland for children with mild ID were recruited via purposive sampling. This is an approach whereby the selection of participants, setting and other sampling units is purposive (Mason, 2002). The sample is chosen due to particular characteristics they possess which will enable exploration of the themes and questions that the researcher wishes to explore (Bryman, 2012). In this study, both schools were chosen as they had children with mild/moderate intellectual disabilities and in the correct age categories that the researcher wished to explore, thereby possessing the characteristics required for this study.

For recruitment of participants to focus groups and interviews, two SEN schools were initially contacted via e-mail. The researcher and the chief investigator then met with the principal and a senior teacher to explain the aim and procedure of the study. Once it was established that both schools were willing to take part in this research study, principals of both schools signed and returned consent forms to confirm the school's willingness to take part. User-friendly information leaflets, consent forms and assent forms were provided to the school for distribution to parents and young people with ID prior to the commencement of the study, by the relevant teachers. Parental consent was sought followed by participant assent. Young people were guided through the information and assent forms by their teacher.

Teachers/classroom assistants and principals were also provided with information leaflets and consent forms. All participants in the study were given the opportunity to ask any questions prior to commencement of the study. Those who were willing to participate in the study and gave consent were then included in the focus groups and interviews.

5.3.3 Inclusion and exclusion criteria

Inclusion and exclusion criteria were applied for recruitment of participants to focus groups. Inclusion criteria were that children and peer role models with ID were able to communicate verbally for participation in the focus group and returned completed and signed parental consent and participant assent forms. Children and peer role models with ID who could not communicate verbally were not included in the focus group. Those who did not return signed parental consent and participant assent forms were not included in the focus groups.

5.3.4 Focus groups: Children with ID

A total of 7 children with ID took part in the focus groups in two schools. The focus groups began with the researcher reminding the children with ID (9-13 years) about the topic of discussion and the confidentiality of the focus group. Participants were also shown the dictaphone and told that the focus group would be audio recorded. The focus groups began with informal introductions. The interview schedule (Appendix 7) for children with ID focused on physical activity participation, feelings around walking, participating in walking during school and intervention components. Children with ID had already met the researcher on previous occasions in school and were therefore comfortable with the researcher as the facilitator of the focus group, this created a safe environment and allowed for proper discussion. A private room was arranged at each school so that focus groups could be conducted in a quiet place without the distraction of other pupils or staff. Focus groups with children with ID lasted for up to 30 minutes in duration.

5.3.5 Focus groups: Peer role models with ID

A total of 6 young people with ID took part in focus groups across two schools. Focus groups with young people with ID (15-19 years) followed the same procedure as focus groups with children with ID as outlined above. Focus groups for young people with ID lasted for up to 30 minutes in duration.

5.3.6 Focus groups: Teachers/classroom assistants

A total of 10 teachers and classroom assistants took part in focus groups across two schools. Focus groups with teachers/classroom assistants followed a similar format to those of the children and peer role models with ID. Teachers and classroom assistants had been provided with information and consent forms. Signed consent

forms were collected before beginning the focus group. Two focus groups with teachers and classroom took place across the two schools. There were between 4-8 teachers and classroom assistants in each focus group. The focus group began with introductions and participants were reminded by the researcher of the topic of discussion, the confidentiality of what was said and that the focus group would be audio recorded via dictaphone. Focus groups with teachers/classroom assistants lasted for up to 60 minutes.

5.3.7 Interview with principals

A 1:1 interview was conducted with the principal of each of the two schools. The principals were contacted via email to ascertain a suitable date and time for the interview. Two members of the research team had previously met with the principals of both schools, therefore they were aware of the study and had consented for the school to participate. Both principals were interviewed in their offices at the schools. The researcher had provided the principals with consent forms which were collected before beginning the interview. The interview began with a brief summary of the topic of discussion and a reminder that the interview would be confidential. The researcher also informed the principals that the interview would be audio recorded via dictaphone throughout. Interviews with principals lasted for 30 minutes.

5.3.8 Interview Schedules

Separate semi-structured interview schedules were developed for each of the focus groups and the 1:1 interview with principals. Interview questions were developed from the literature, COM-B and the socio-ecological model. Key areas of exploration within these focus groups were the motivators, enablers and barriers to promoting a walking intervention from a range of perspectives in order to identify intervention components and aid in the development of the school-based walking intervention.

The interview schedule for children with ID (Appendix 7) and peer role models with ID (Appendix 8) focused on the physical activities they take part in, their feelings about walking and taking part in walking during school and how they think the walking programme should look. The interview schedule for teachers/classroom assistants (Appendix 9), by comparison, focused on how the walking programme might fit into the school day and how it could be staffed. The interview schedule for principals (Appendix 10) focused on the organisational aspects of the walking programme, how they might be prepared to support teachers/ classroom assistants

and children and young people with ID to take part in the walking programme and how they might be able to change certain aspects of the school day to allow for the walking programme.

5.3.9 Analysis

Focus groups were audio recorded and transcribed verbatim. In order to address study validity and trustworthiness, a range of methods were employed (Slevin and Sines, 2000). To ensure dependability, data collection, interpretation and analysis methods were documented so that the process was clear and reproducible by another researcher. A stepwise replication technique was also applied, where the researcher and the research team coded the data separately before comparing results to further enhance dependability (Ary et al., 2010). Authenticity was ensured by representing all realities to give meaning to the findings (Polit and Beck, 2011). Purposive sampling was used to ensure representation of the population whom the intervention would be developed for, diverse views and experiences were explored throughout focus groups and participants were able to inform the development of the intervention. Confirmability of the findings was established through the use of a reflective journal (Koch, 2006). Focus groups were recorded via dictaphone and then transcribed. Data was then subject to thematic content analysis using Newell and Burnard's (2011) framework (Table 1). The researcher read the transcripts and identified key themes which were then recorded in the margins. This process was then repeated to ensure all key themes had been identified. Subsequently a table of themes and sub themes was developed. Saunders et al. (2017) stated that the point of saturation differs depending on a specific study therefore for the purposes of this study emergent themes were identified to deduce if data saturation was being achieved and no new themes were being identified (Parahoo, 2014). To authenticate the themes and subthemes identified by the researcher (AJ), the chief investigator (LT) reviewed a random selection of the transcripts. The emergent themes identified through focus groups aided in the further development of the intervention in the subsequent phase 3 workshops.

Table 5.1 Thematic content analysis framework (Newell and Burnard, 2011).

Step 1	Notes were made after each focus group and interview.
Step 2	Focus groups and interviews were transcribed and notes were made in the margins of each transcript of emerging themes.

Step 3	Transcripts were re-read and open coding was used whereby words and phrases written in the margins to summarise the text. Words and phrases were then classed under headings.
Step 4	Overlapping open codes were grouped under higher order codes. This reduced the number of codes to make the data more manageable.
Step 5	Transcripts were revisited with the smaller list of codes. Text was highlighted according to codes.
Step 6	Data from focus groups and interviews were merged to facilitate the presentation of findings.

5.3.10 Reflexivity

Reflexivity can be defined as a researcher's continuous process of reflection on their values (Parahoo, 2014) and development of self-awareness (Lambert et al., 2010). Reflexivity also adds credibility to findings (Anney, 2014). Following focus groups, the researcher kept a reflective diary to record the mood of the focus group, the body language of participants, the general feelings expressed by participants and personal reflections. Bashan and Holsblat (2017) recommend a reflective diary to provide an insight that is not achieved through other methods of data collection. Furthermore, Ortlipp (2008) the use of reflective diaries can create transparency in the research process. The use of a reflective diary allowed the researcher to develop a sense of self-awareness and understand how their experiences, opinions and values were part of the research design and data analysis and interpretation process.

5.4 Findings

Four overarching themes emerged from the data; social support, organisational structure, reasons for participation/non-participation and rewards and incentives. Themes and sub-themes are presented with quotes from participants used to demonstrate the emerging themes, these are followed by a key as follows throughout; peer role model (PRM), child (C), teacher (T), classroom assistant (CA) and principal (P). Themes and their associated sub-themes were mapped to the components of COM-B and the SEM.

Table 5.2 Mapping of themes and sub-themes to COM-B and the SEM.

COM-B component	Socio-ecological model component	Themes	Sub-themes
Physical capability	Individual	Reasons for participation/non-participation	Freedom/autonomy Weather
Psychological capability	Individual	Reasons for participation/non-participation	Health benefits
Physical opportunity	Organisational	Organisational structure	Staffing Walk routes
Social opportunity	Interpersonal	Social support	Peers Pairing process Parents and others Direct supervision
Reflective motivation	Individual	Rewards and incentives	Pedometers
Automatic motivation	Organisational	Organisational structure	Logistics

5.5 Theme 1: Social Support

Within the core theme of social support mapped to the social opportunity and interpersonal components of COM-B and the SEM, there were four associated sub-themes that emerged; peers, pairing process, parents and others and direct supervision.

5.5.1 Peers

The importance of peer support was a commonly recurring theme among the children with ID and peer role models with ID with the social aspect of participating in PA with friends and peers appearing to be a key factor. Participants stated that;

“It’ll [PA with friends or peers] let you get to know the other person.” (PRM)

“It’s nice [PA with friends or peers], it keeps you company for you to talk to the other person.” (PRM)

Teachers and classroom assistants agreed that peer support would be an important factor for both the children with ID and peer role models with ID;

“I think they [Children with ID] would enjoy that, I do, I think they’d enjoy that, spending time with the older children.” (CA)

“It would be very good for the older ones, wouldn’t it? It would make them feel important.” (T)

Whilst staff acknowledged that peer support was an important component of the walking programme, there was a consensus among teachers, classroom assistants and principals that there should be direct supervision by staff of children with ID and peer role models with ID on the walk route. They stated that;

“So long as we’re still talking about staff supervision within that.” (T)

“There has to be some level of direct supervision.” (T)

5.5.2 Pairing process

Although peer support appeared to be an important predictor of PA in children and adolescents with ID, a number of participants, particularly the peer role models with ID (15-19 years), stated that it could also be a barrier;

“It depends which child it is [you are paired with].” (PRM)

“If you’re walking with people you don’t like...that stops me from walking.” (PRM)

Teachers and classroom assistants agreed that the pairing process would be important in motivating the children with ID and peer role models with ID to participate in the walking intervention;

“Well, I would say it has to be who they are paired with...that would be a key factor.”
(T)

This was not a factor that was considered by the children with ID (9-13 years), who thought that taking part in PA with an older pupil in school would be particularly enjoyable.

There was agreement among the peer role models with ID that they would prefer to walk with one or two other people and not in a large group;

“I wouldn’t walk with a big mad...like...big crowd. Like one person or two.” (PRM)

5.5.3 Parents and others

Family also played an important role in influencing PA levels of children and young people with ID. This may be due to the reliance of children and young people with ID on parents/guardians and siblings. The majority of children with ID and peer role models with ID explained that their parents or siblings would be the people who would help them to take part in PA outside of school, however when asked what types of PA these family members helped them take part in, bouts appeared short in distance and time;

“I would walk to get a bus or walk to the town...but...not every week.” (PRM)

“Well, sometimes we walk to the shop. Just very short (distance).” (PRM)

When children with ID and peer role models with ID were asked about PA and the activities they complete each week, most PA was accumulated during school hours on school days and participants often stated that it would be teachers or classroom assistants who help them participate in physical activity. When participants were asked what type of activities they participate in at home, sedentary activities were often cited “baking bread” and “playing computer games”. When asked about walking, there was agreement among children with ID and peer role models with ID

that they did not regularly participate in walking and none of them walked to or from school;

“Well I...I don’t ‘cause I just go out in the car.” (C)

A number of participants stated that they previously participated in physical activity outside of school but no longer did;

“Well, I used to do them [activities] outside of school but I only do them in school now.” (PRM)

“I used to go swimming but I don’t anymore.” (PRM)

This was only reported by the peer role models with ID (15-19 years) and not the children with ID (9-13 years), suggesting that participation in activities outside of school was decreasing as they got older. There was a consensus among teachers, classroom assistants and principals that there is a lack of autonomy for children and young people with ID and they rely on parents/guardians;

“They’re all very supervised, heavily supervised.” (T)

When asked about who helped them with physical activity, the majority of children with ID and peer role models with ID agreed that most often it was staff (teachers and classroom assistants) who helped them to participate in physical activity.

Teachers and classroom assistants agreed that children with ID and peer role models with ID were more inclined to participate in physical activity (school gym, playground activities, walking to activities outside of school grounds) in school as opposed to at home;

“They would be better at doing it (physical activity) in school than doing it at home... Far better at doing it in school.” (T)

“If it’s [physical activity] set up in school, yes [they will participate]...but if it’s set up at home, no [they will not participate].” (T)

Although there was a consensus among teachers and classroom assistants that young people with ID would be more likely to participate in PA at school than at home, there was no evidence of any structured PA programmes that pupils could participate in during school time to increase PA or have any health-enhancing benefits.

5.6 Theme 2: Reasons for participation/non-participation in physical activity

Within the core theme of reasons for participation/non-participation, which was mapped to physical and psychological capability and individual components of COM-B and the SEM, there were three associated sub-themes that emerged; freedom/autonomy, health benefits and weather.

5.6.1 Freedom/autonomy

Children with ID and peer role models with ID explained a number of reasons for participating in physical activity. The ability to choose to go outside during the school day appeared to be a motivating factor, with participants stating that;

"I just like getting out." (PRM)

"I like walking outside, because...because it is nice fresh air." (PRM)

There was consensus among the peer role models with ID particularly that they would be keen to have the opportunity to go outside during the school day.

5.6.2 Health benefits

The majority of participants, both children with ID and peer role models with ID, also demonstrated an awareness of the benefits of PA and the positive effects in relation to fitness and physical and mental health such as;

"Makes you feel better." (PRM)

"Keeps you fit." (PRM)

"To keep my legs fit." (C)

Both children with ID and peer role models with ID were also aware of the effects of physical activity on maintenance of a healthy weight;

"'Cause you can make your belly smaller." (C)

"You can burn a few pounds." (PRM)

Although the majority of children with ID and peer role models with ID demonstrated an awareness of the benefits of physical activity, they still reported that they completed little activity, particularly outside of school and were unaware of the duration and frequency of physical activity required to produce health benefits.

5.6.3 Weather

In relation to non-participation in physical activity, children with ID and peer role models with ID did not cite many factors that would prevent them from participating in a school-based walking intervention, however the majority of children with ID and peer role models with ID agreed that bad weather would be the most predisposing factor;

“Cause you get soaked.” (C)

“...Well it depends really, if the rain is light, yeah, but if it’s heavy, no.” (PRM)

“If it’s freezing.” (C)

5.7 Theme 3: Rewards and incentives

The core theme of rewards and incentives was mapped to the reflective motivation and individual components of COM-B and the SEM and one associated sub-theme emerged; pedometers.

There was agreement among all participants that rewards and incentives would be important for increasing and maintaining participation in physical activity;

“I think that it would be nice to highlight those children within things like assemblies, as the walking group, draw attention to them, give them an identity as part of that walking group and we could certainly look at incentives as part of that.” (P)

There was a consensus among teachers, classroom assistants, principals, children with ID and peer role models with ID that rewards would be an important aspect of the intervention and they could lead to increased motivation for this population, particularly rewards that could be presented in assembly. Teachers and classroom assistants stated that rewards such as certificates and small prizes would be incentives for participating in the walking intervention;

“Some of them do like medals. Some of them like medals and certificates.” (T)

5.7.1 Pedometers

There was a consensus among children with ID and peer role models with ID that a pedometer to measure step count would be an incentive for participation in the walking intervention. The majority of participants agreed that it would be beneficial to

see a step count after each walk for self-monitoring and goal setting. Participants stated that;

“It would be good to see how much steps you’re walking round the school, you probably don’t think you’re walking much steps but you are.” (PRM)

“At least if anyone says you probably don’t walk a mile, you can prove them wrong.” (PRM)

The use of a pedometer to measure step count appeared to be a motivating factor for participating in physical activity during school and for self-monitoring, however it was also evident that both children with ID and peer role models with ID would not like to be in competition with others in relation to step count and that they would not like a competitive element to be a component of the walking programme. For example, one participant stated they did not want a competition;

“Because they would obviously beat me.” (PRM)

Although children with ID and peer role models with ID appeared to be keen to monitor their step count with pedometers, teachers and classroom assistants thought that the pedometers would potentially be lost or damaged by participants;

“Some of them will be eaten...or thrown away.” (CA)

“Yes, there would be potential that they could be broken. They could be signed in and out I suppose but there is a possibility that they’ll be thrown and broken.” (T)

Despite reservations expressed by teachers and classroom assistants that pedometers could be lost or damaged, they agreed that it would be beneficial for children with ID and peer role models with ID to see their step count after each walk.

5.8 Theme 4: Organisational structure

The core theme of organisational structure was mapped to the physical opportunity and automatic motivation components of COM-B and the organisational component of the SEM. Within the core theme of organisational structure, three associated sub-themes emerged; staffing, walk routes and logistics. These sub-themes were most commonly occurring in focus groups and interviews with principals, teachers and classroom assistants, however there was also agreement among peer role models with ID that logistics could be a potential barrier to them participating in a school-based walking intervention.

5.8.1 Staffing

Staffing and the role of teachers in the walking programme was a commonly occurring theme among principals, teachers and classroom assistants, however schools were willing to meet the resource implications of participating in a walking intervention during the school day;

“In terms of changing the school routine, we can accommodate that but that will be lead by individual teachers.” (P)

“Individual teachers who are a part of that programme will be as flexible as they can be.” (P)

Although there was acknowledgement that there could be some logistical barriers to implementing a walking intervention during the school day, participants also demonstrated recognition of the importance of incorporating physical activity into the school day;

“It will depend which class time it encroaches on, so sometimes the children are involved in very fixed external activities that we have little control over. When it happens within the part of the school day that we do have control over, we would see it as an important part of their education.” (P)

5.8.2 Walk routes

The majority of teachers and classroom assistants stated that the establishment of walk routes within school grounds could be accommodated and this was something that they would be keen to develop;

“You could get an internal route because that gate [within school grounds] there is open. I know the principal would like it done [developing a walk route] because from what was said this morning. So it could be looked at.” (T)

Peer role models with ID (15-19 years) also stated that the development of a walking route in school grounds would be beneficial;

“It would be just good for walking, somewhere else.” (PRM)

Although there was scope for the development of walk routes within school grounds, there was consensus among teachers and classroom assistants that safety was also an important consideration when considering walk routes;

“Walking routes can be established, we are very limited in our outside space, we don’t have areas to walk in that are totally safe, so they would be adapted depending in the group that are involved.” (T)

Within the sub-theme of walk routes, there was a consensus among teachers and classroom assistants that a familiar routine and lack of variation in walk routes would be an important predictor of adherence to physical activity in school for children and adolescents in this population;

“They quite like routine.” (CA)

“They might like it being the same.” (T)

5.8.3 Logistics

In contrast to the barriers to walking in school identified by children with ID, teachers cited organisational barriers to walking in school such as logistics of the programme;

“People coming and going...timetabling. The mentors [peer role models] are in and out quite a lot.” (T)

“Sometimes the logistical element of doing everything becomes a challenge; we’re always competing for time.” (T)

The majority of peer role models with ID also reported that the logistics of taking part in a school based walking programme would need to be considered as they were often out during the school day to go to work or college;

“Some days we would be at work and we won’t be able to do it.” (PRM)

5.9 Discussion

The aim of the second phase of this doctoral thesis was to identify the enablers, motivators and barriers to promoting a school based walking programme from a range of perspectives and to aid in the development of the programme by identifying intervention components which may be successful in this population. Many studies have previously identified barriers and facilitators to physical activity through qualitative research with adults with ID (Mitchell et al., 2016; Temple and Walkley, 2007; Heller et al., 2002) and children with ID (Downs et al., 2013; Mayh et al., 2010), with some studies collecting this data by proxy from parents/guardians, carers and teachers (Downs et al., 2014; Menear, 2007). This study explored these themes by making reasonable adjustments to include children and adolescents with ID in the

focus groups to allow for co-production of the walking intervention with stakeholders. The themes identified through this qualitative phase of the study were used to develop the school-based multi-component walking intervention targeted at this specific population.

The importance of social support in the form of friends and peers were consistently recurring themes in relation to facilitation of physical activity. This is consistent with previous research which suggests that peer support is a key factor in influencing physical activity of children and adolescents with ID (Shields et al, 2012; Downs et al, 2013). The present study identified that the social interaction of participating in physical activity with friends and peers appeared to be an important factor in sustaining engagement in physical activity and being able to talk to someone was important. Similarly, Halle et al. (1999) also found that the social element of peer support was a key facilitator of physical activity for children and adolescents with ID. Within social support was also the theme of safety, participants identified that taking part in physical activity with friends or peers would make them feel safe. This may be directly linked to the lack of autonomy for children and adolescents with ID and that they are heavily supervised at all times with little free choice in their daily lives. Although this study highlighted the reliance of children and adolescents with ID on others for providing them with opportunities to be physically active, previous research (Downs et al., 2013) stated that parents expressed a desire for their children to gain some independence and be less reliant on them, particularly to prepare them for adulthood.

Children with ID and peer role models with ID frequently cited that parents played a role in influencing their participation in physical activity and their physical activity levels. Parental support has previously been highlighted as an important predictor of PA levels in children and adolescents with ID in qualitative studies conducted with parents and children (Shields and Synnot, 2016; Downs et al., 2013 and Barr & Shields, 2011). Participants stated that they did take part in some physical activity with parents and siblings, however this appeared to be infrequent, unstructured and for a short duration. This study highlighted the negative influence of parents on physical activity levels was often cited by participants, who stated that they would have high levels of sedentary behaviour at home and would not be encouraged to participate in physical activity. Previous research also identified that parents can impede their child's participation in physical activity (Biddle et al., 2004).

Similarly, Barr and Shields (2011) reported that parents acknowledged that they themselves were often a barrier to their child's participation in physical activity and identified a number of barriers to physical activity in relation to parents and family including lack of parental involvement and initiative, safety concerns and overprotective parents. This could suggest that parents lack awareness of the benefits of physical activity for their children and a potential lack of knowledge about the opportunities available. Similarly, Menear (2007) also reported that there was a need to educate parents about the various physical activity opportunities available within the community and at home. A recent systematic review by McGarty and Melville (2018) found that parents play a key role in supporting children with ID to be physically active and that providing education to parents could change barriers into facilitators for this population. One of the key barriers to physical activity for this population is lack of support and this tends to increase with age (Heller et al., 2002). This was evident in the focus groups when the older peer role models (15-19 years) reported that they had previously been taking part in physical activity outside of school but did not anymore, therefore it is important for young people with ID to have increased independence in order to address this barrier and decreased the likelihood of a sedentary lifestyle in adulthood. Longitudinal data collated over a period of two years showed that there was a decline in the physical activity of 11-20 year olds with ID (Izquierdo-Gomez et al., 2017).

Teachers and classroom assistants can have a significant impact on physical activity accumulated by children during the school day and the importance of the support of teachers and classroom assistants was a recurring theme throughout the focus groups. Story (2009) suggested that school is the ideal environment for physical activity interventions as this setting has the most influence on young people during the first two decades of life. Research also suggests that school based interventions may be most effective in increasing physical activity levels of children that can be tracked into adulthood with physically active children becoming physically active adults (Smith et al., 2015). A recent Cochrane Review by Dobbins et al. (2011) suggested that, given young people spend a significant amount of their day either travelling to or in school, school based physical activity programmes could potentially reduce population wide chronic diseases by increasing knowledge and producing behaviour change conducive to a healthier lifestyle.

Schools can play a crucial role in increasing the physical activity levels of young people with ID (Pitetti et al., 2009; Haney et al., 2014; Davis et al., 2011; Ozmen et

al., 2007; Golubovic et al., 2012). The findings indicate that significant gains can be made within the time young people with ID spend in health-enhancing physical activity in the school setting. Research by Dobbins et al (2009) also suggested that school based interventions designed to promote physical activity in young people have a positive impact on the duration of physical activity, indicators of physical fitness and reduced time spent watching television. Allender et al. (2006) stated that teachers need to be more involved in ensuring that children are participating in and enjoying physical activity during the school day. The potential opportunities for accumulation of physical activity during the school day further highlights the importance of the support of teachers and classroom assistants in aiming to increase daily physical activity of children and adolescents. This is consistent with research by Downs et al. (2014) who concluded that teachers acknowledged that they had important influence on physical activity levels and engagement of children and young people with ID. Shields and Synnot (2016) also highlighted that special schools can be a good source of information about available activities and opportunities for this population.

Although children and adolescents themselves were particularly aware of the benefits of physical activity, they were not aware of the duration and frequency required to produce health benefits and often reported that any physical activity they did participate in would often be for a short duration and infrequent bouts. This is consistent with research by Jobling and Cuskelly (2006) who investigated young people with ID's knowledge of physical activity and the associated benefits. This highlights the need for education at a young age in order to increase the knowledge of children and adolescents with ID, not only about the benefits of physical activity but also about the frequency and duration required to produce health enhancing benefits. Early intervention could be a key factor in ensuring young people with ID maintain an active lifestyle through to adulthood and to reduce morbidity and mortality from chronic disease in later life (Downs et al., 2013). Barr and Shields (2011) stated that lack of education was a major barrier to physical activity for children with ID.

In relation to organisational structure, schools can make a significant contribution to the physical, mental and social wellbeing of young people (Taggart and Cousins, 2014), however organisational barriers must be overcome in order for school based physical activity interventions to be effective. Staffing was a recurring theme within the domain of organisational structure; participants considered the resource

requirements in order for the walking programme to run efficiently and how this may be accommodated during the school day. Teachers, classroom assistants and principals agreed that logistics and timetabling would need to be considered and that changes may be made to the school day in order to incorporate the programme into the school routine. Dobbins et al. (2009) stated that the minimum changes required to produce benefits are educational materials and changes to the school curricula. The school environment may also be an important factor in increasing physical activity, Sallis et al. (2000) found that creating opportunities for children to be active outdoors was a variable that was consistently associated with children's physical activity. Teachers, classroom assistants and principals highlighted the importance of a structured walking programme but that could also be flexible to fit into the school routine, for example flexibility as to which days the programme runs and what time it takes place at, without changing any of the core components of the programme such as duration and frequency of walking.

Rewards and incentives were consistently highlighted as important in encouraging and maintaining participation in a walking programme. There was a consensus among all participants that certificates, small prizes and being presented with rewards in assembly would be incentives for them to take part in walking in school. Participants also stated that pedometers would be useful for goal setting and to keep track of step count. The use of pedometers as motivational tools in physical activity interventions for young people is becoming increasingly popular. Pedometers provide a source of feedback for the participant, which can be effective in providing information on physical achievement and can increase physical activity levels (Tudor-Locke and Myers, 2001). The use of pedometers as a motivational tool has been shown to be effective in increasing physical activity levels of school aged young people (Butcher et al., 2007; Schofield et al., 2005; Vanda et al., 2013). Pedometers have also been used as a motivational tool for adults with ID (Melville et al., 2015), however, although pedometers have been used to measure physical activity of young people with ID (Eiholzer et al., 2003; Beets et al., 2007; Pitetti et al., 2009), there is little evidence of the use of pedometers as motivational tools for young people with ID.

5.10 Conclusion

This chapter presented findings from focus groups and interviews with stakeholders which explored the barriers, enablers and motivators to children and adolescents with ID participating in a school-based multi-component walking intervention, and

identified key intervention components. The findings from this phase of the research indicate that an intervention targeted at this population should include components based around social support from peers, rewards and incentives for participation, pedometers as motivational tools, education around frequency and duration of physical activity for health and engagement of school staff. Potential barriers include logistics and staffing which should be overcome by co-production of the intervention with stakeholders to ensure the intervention is tailored to suit the school setting.

The following chapter will discuss the further co-production of the school-based multi-component walking intervention through the iterative process of a series of workshops with stakeholders based upon the application of individual change theory and systems change theories (COM-B and SEM) surrounding the intervention components.

Chapter 6

Co-production of the school-based multi-component walking intervention for children with intellectual disabilities

6.1 Introduction

The theoretical underpinning of the multi-component walking intervention using both individual behaviour change theories (COM-B) and system change theories (Socio-ecological model) will be presented in this chapter. This chapter will discuss the aim and objectives of the phase 3 co-production workshops and the iterative processes of the series of workshops with stakeholders that were undertaken to develop this multi-component walking intervention.

6.2 Aims and objectives

A core aim of this doctoral thesis was to develop a theoretically underpinned school-based multi-component walking intervention for children with ID (aged 9-13 years). Findings from the phase 1 systematic review (Chapter 3) and phase 2 focus groups and interviews with children with ID (9-13 years), adolescents with ID (15-19 years), teachers, classroom assistants and principals (Chapter 5) informed the development of the walking intervention. The co-production workshops in phase 3 identified the components and content of the school-based walking intervention.

The objectives of the co-production workshops with teachers and classroom assistants were:

- 1) To agree content and delivery of the multi-component walking intervention
- 2) To identify the organisational adaptations required for the intervention to be implemented within a school setting.
- 3) To explore the acceptability of the proposed data collection tools.

The walking intervention was designed based on findings from the systematic review in phase 1 and focus groups in phase 2. This proposed walking intervention was presented to participants during a series of co-production workshops. The workshops allowed for co-production of the intervention with participants suggesting amendments to tailor the programme for their school. Adaptations were made to the walking intervention through an iterative process (Table 6.2). Fritz et al. (2017) recommended the use of workshops with stakeholders in order to facilitate change and Morton et al. (2017) stated that stakeholder engagement is considered integral to developing effective public health interventions. The World Health Organisation (WHO) also recommends involving stakeholders in the development process of interventions aimed at increasing levels of physical activity (WHO, 2007). Four workshops were carried out by the researcher individually in two schools. One further

workshop was attended by senior teachers from both schools and two members of the research team (AJ and LT) and one further workshop was attended by senior teachers from both schools and the full research team (AJ, LT and MM) in order to ensure fidelity of the intervention and that the programme being developed was feasible for both schools.

6.3 Methods

6.3.1 Design: Workshops

A series of six workshops were conducted by the researcher across two schools over a period of four months. The workshops began with roundtable introductions followed by a presentation of the proposed intervention by the researcher based upon a succinct summary of the systematic review and findings from the focus groups. Following presentation of the proposed intervention, the researcher facilitated discussion around the components of the intervention as identified from the systematic review and focus groups and informed by COM-B and the SEM. Walk routes were also investigated by the researcher along with teachers and classroom assistants by walking within school grounds to identify suitable routes. Workshops were conducted with teachers and classroom assistants and each workshop lasted for up to 60 minutes. This was an iterative process and amendments made to the walking intervention across the 6 workshops can be seen in table 6.2.

6.3.2 Recruitment and participants

Workshop participants were recruited from the same two SEN schools that had previously participated in the focus groups in phase 2. A total of 7 participants (4 teachers and 3 classroom assistants) participated in the series of 6 workshops across two schools. Teachers and classroom assistants who had consented to take part in the focus groups (phase 2) subsequently took part in the workshops. Participants were provided with information and consent forms for participation in the workshops. Participant consent was sought prior to commencement of workshops. Workshops were arranged via email contact with senior teachers.

The series of 6 workshops were conducted by the researcher across two schools. The workshops began with roundtable introductions followed by a presentation of the proposed intervention by the researcher. Following presentation of the proposed intervention, the researcher facilitated discussion around the components of the intervention and walk routes were also investigated within school grounds.

Workshops were conducted with teachers and classroom assistants and each workshop lasted for up to 60 minutes in duration.

6.3.3 School characteristics

The two intervention schools were recruited via purposive sampling. Both schools had the same characteristics including; pupils with mild/moderate intellectual disabilities, pupils between the ages of 9 and 19, urban location, outdoor space for walk routes, a structured school day and were not participating in any structured physical activity programmes.

6.3.4 Inclusion and exclusion criteria

Inclusion criteria for teachers and classroom assistants were applied as follows; participants who provided consent by returning signed consent forms and could contribute to the development of the walking programme. Exclusion criteria for teachers and classroom assistants were applied as follows; those who did not provide consent by returning a signed consent form and those who could not contribute to the development of the walking programme.

6.3.5 Ethical considerations

Ethical approval was gained from the INHR filter committee and the Ulster University Research Ethics Committee (UUREC). Information sheets and consent forms were distributed to all participants. Participants were given the opportunity to ask any questions before consenting to taking part in the workshops.

6.4 Theoretical underpinning of the walking intervention

It is well established that theoretically informed interventions are imperative for successful PA promotion (Buchan et al., 2012) and that interventions should be underpinned by a model of behaviour and its influencing factors (Michie et al., 2011). The Medical Research Council (MRC, 2008) guidelines identified four key stages for designing and evaluating complex interventions. The MRC stated that it is best practice to design interventions systematically and to identify appropriate theory, however there is no further guidance on selection and application of theory (Michie et al., 2005). Therefore, it is necessary to focus on improvement of intervention design by application of a systematic method and identification of behaviour that needs to change in order to identify intervention components (Michie et al., 2011). The design of the study and the theoretical underpinning was previously discussed in further detail in chapter 4.

Therefore, to address the recommendations of previous research, a coherent theoretical underpinning that incorporated both individual behaviour change theories and systems change theories was identified and applied to the development of the walking intervention. The COM-B system was mapped to the corresponding components of the SEM to identify behaviour change techniques and intervention components (Table 6.1).

Table 6.1 Using COM-B mapped to SEM to identify BCTs and intervention components

COM-B component	Socio-ecological model component	What needs to happen for target behaviour to occur?	Is there a need for change?	BCT	Intervention component
Physical capability	Individual	Have the physical skills to walk	No change required as children with ID have these skills	No change required	No change required
Psychological capability	Individual	Know how to take part in walking for physical activity and gain knowledge on the harmful effects of low levels of PA	Children with ID do not know how to take part in walking for physical activity and do not have knowledge of the harmful effects of low levels of PA	Instruction on how to perform the behaviour	Peer role model training Supervisor training
Physical opportunity	Organisational	Have opportunities to take part in walking during the school day	Change required as there is no opportunity to take part in walking during the school day	Restructuring the physical environment	Walk routes
Social opportunity	Interpersonal	See peers take part in walking during school	Change required as children with ID do not see their peers take part in walking during school	Social support	Peer role model system
Reflective motivation	Individual	Believe that walking in school will have health enhancing benefits	Change required as children with ID do not have knowledge of the health enhancing benefits of walking	Goal setting Feedback on behaviour Self-monitoring of behaviour Material reward	Pedometers Walk diaries Reward system
Automatic motivation	Organisational	Establish walking as part of the school routine	Change required to establish walking as part of the school routine	Behavioural practice/rehearsal Habit formation	Maximum 4 walks per week

Table 6.2 The proposed intervention and amendments made across the series of co-production workshops with teacher and classroom assistants

Proposed Intervention	Participants' Comments/Amendments
16 weeks in duration	12 weeks to fit with the school calendar
1 walk per day, 3 days per week, 2 walks per day, 3 days per week, 3 walks per day, 3 days per week (15 min duration)	Only 1 walk per day, 3 days per week but increase duration of walks (15, 30, 45 mins). Later amended to final programme. Frequency and duration of the programme – maximum walking time of 30 minutes and highest frequency of 4 days, to ensure this is feasible within the school day and to allow flexibility within the school schedule. Increments in duration should be smaller.
Small rewards for steps achieved	Small rewards for walks completed
Peer role models and children in pairs	All agreed that peer role model system would be beneficial for both the older adolescents and the younger children
Accelerometers used to collect physical activity data	All agreed this was appropriate
Anthropometric data to be collected including height, weight and BMI	All agreed this was appropriate
6MWT to assess physical fitness	All agreed this was appropriate
SDQ to measure emotional wellbeing (to be completed by teachers and parents)	All agreed this was appropriate
Age range of participants: peer role models (16-18 years) and children (11-13)	Age ranges widened to; peer role models (15-19 years) and children (9-13 years)

years)	
Each pair to walk separately throughout the school day	Pairs to walk together but in a group with other pairs with 2 supervisors – more feasible for schools to coordinate
Walk diary to record walk details for all peer role models and children	Each child and peer role model to have own walk diary completed by a teacher or classroom assistant after each walk
Pedometers to measure step count for each participant	All agreed this would be a good source of motivation for participants. Peer role models and children were particularly interested in the pedometers and stated that they would like to see the steps they were achieving
Sign in and sign out system for pedometers	Agreed that this would be appropriate
Walk routes – within school grounds or at a location nearby	Agreed that walk routes could be identified within school grounds and at a location nearby. Possibility for extension of routes when walk duration increases throughout the programme. Walk routes may be accommodated indoors incase of bad weather i.e. in the school gym
Staff to supervise walking at all times	All agreed that all walks and walking pairs would be supervised for the duration of the walking programme
Training for peer role models	Teachers and classroom assistants thought training prior to walking would be beneficial for peer role models.
Training for walk supervisors	Teachers and classroom assistants agreed that this would be beneficial and guidance for supervisors should be developed and distributed prior to commencement of walking

6.5 Walking Programme

The final walking programme was developed based on the COM-B system mapped to the SEM to identify the BCTs and intervention components (based on findings from the systematic review, focus groups and workshops). The walking programme was delivered over a 12 week period in two schools for young people with ID. The walking programme was incremental, consisting of 1 walk per day, initially 3 days per week for 15 minutes duration (week1) and increasing to a maximum of 4 days per week for 30 minutes duration (weeks 9-12) (Fig. 6.1). Seven core components of the intervention were identified from the COM-B model;

- 1) A peer role model system
- 2) Pedometers
- 3) Rewards
- 4) Peer role model training
- 5) Walk routes
- 6) Incremental walking
- 7) Supervisor training

6.5.1 Peer role model system

Throughout focus groups, the researcher asked participants their thoughts on peer support and if this would be an important element for an intervention targeted at this population. Peer support was a consistent theme in the focus groups (Phase 2) with a consensus among young people with ID and school staff that a peer role model system would be an important component of the walking programme. This is consistent with the available literature which states that peers have a positive influence on engagement in and sustainability of physical activity of young people with ID (Klavina & Block, 2008; Halle et al., 1999). Thus, a peer role model system was identified as a component of the intervention to address the social opportunity aspect of COM-B at the interpersonal level of the SEM. The peer role model system involved pairing children with ID (9-13 years) with older pupils with ID in the same school, these older pupils were the peer role models (15-19 years). Dyads were paired by teachers in conjunction with the researcher based on likes, dislikes and walking speed. The pairs remained the same for the duration of the walking programme.

6.5.2 Peer role model training

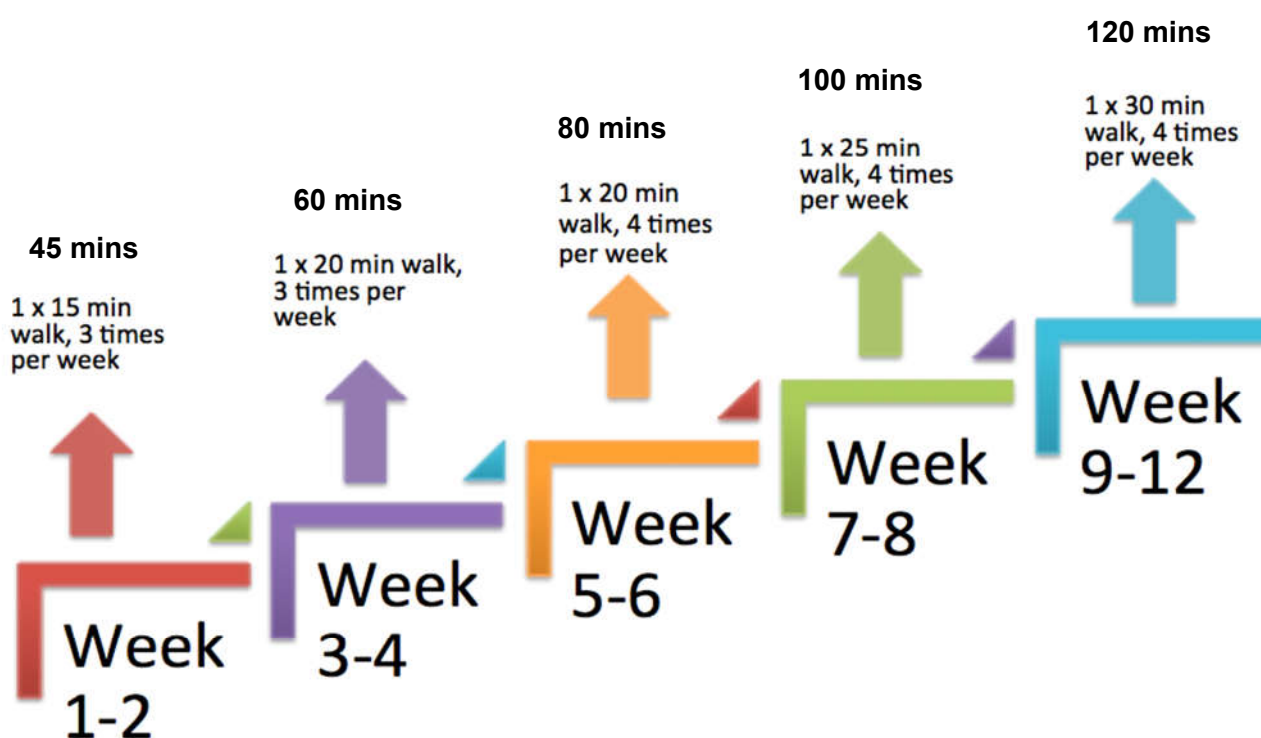
Peer role model training was identified as a component of the intervention in relation to the psychological capability aspect of COM-B. As peer role models with ID were a core component of the walking programme, a training programme was developed by the researcher in order to train peer role models (15-19 years) prior to commencement of the walking programme. The training programme involved an interactive presentation using pictures on aspects such as the benefits of walking, duration of walks and the walking programme, measurements, walking pace, walking with a younger child with ID, safety and appropriate clothing. The training was scripted to ensure the researcher provided the same information to all peer role models in each of the schools involved. Following the presentation, the researcher then asked questions in a quiz format to the peer role models to ensure their understanding of the walking programme and the role they were being asked to perform. Peer role models could also ask any questions about the walking programme following the training presentation. Peer role model training was conducted in the classroom during the school day for a period of 30 minutes; other pupils who were not involved in the walking programme were not in the classroom when the training took place. A teacher was present at all times throughout the training.

6.5.3 Rewards

Rewards and incentives were consistently highlighted as important in encouraging and maintaining participation in the walking programme throughout focus groups in phase 2. There is evidence to demonstrate that interventions that incorporate incentives lead to improvements in exercise behaviour in children and adolescents (Hardman et al., 2011; Christian et al., 2016). Throughout the co-production workshops, there was a consensus among all participants that certificates, small prizes and being presented with rewards in assembly would be incentives for young people with ID to participate in walking in school. In relation to the reflective motivation component of COM-B, it was identified that a reward system was required to modify behaviour at the individual level of the SEM. A reward system was agreed by all stakeholders and developed for the walking programme, whereby children with ID were provided with a reward sheet. Reward sheets were stamped by a teacher or classroom assistant each time participants completed a walk and if all walks were completed, participants were eligible for a small prize on a fortnightly basis. Small prizes included certificates, water bottles and bags. Prizes were often presented in

assembly to give participants a sense of achievement. Peer role models with ID were also provided with a reward sheet and they were eligible for small prizes as incentives for participation.

Fig. 6.1 Timeline of the walking programme.



6.5.4 Pedometers

Pedometers were provided to children with ID and peer role models with ID as a form of goal setting and to provide feedback on step count. The use of pedometers as motivational tools in physical activity interventions for young people is becoming increasingly popular. Pedometers provide a source of feedback for the participant, which can be effective in providing information on physical achievement and can increase physical activity levels (Tudor-Locke and Myers, 2001). The use of pedometers as a motivational tool has been shown to be effective in increasing physical activity levels of school aged young people (Butcher et al., 2007; Schofield et al., 2005; Vanda et al., 2013). Pedometers have also been used as a motivational tool for adults with ID (Melville et al., 2015), however, although pedometers have

been used to measure physical activity of young people with ID (Eiholzer et al., 2003; Beets et al., 2007; Pitetti et al., 2009), there is little evidence of the use of pedometers as motivational tools for young people with ID. Throughout focus groups (Phase 2), there was a consensus among children with ID and peer role models with ID that they would like to see their step count at the end of each walk and that this would encourage them to participate in the walking programme. Pedometers for goal setting and feedback were identified in relation to the reflective motivation component of COM-B mapped to the individual component of the SEM, therefore, pedometers were a core component of the walking programme. A teacher or classroom assistant helped children with ID to place the pedometers on their waistband. Peer role models were able to attach their own pedometers. Staff ensured that each participant had a pedometer before commencing each walk. A teacher or classroom assistant recorded step count for each participant after each walk in their walk diary.

6.5.5 Walk diaries

Walk diaries (Appendix 14) were developed by the researcher following exploration in focus groups (Phase 2) and throughout the series of co-production workshops. Schools were provided with a walk diary to log the details of each walk. Walk diaries were identified as an intervention component in relation to reflective motivation at the individual level of the SEM. Details such as the staff member who supervised the walk, the duration of the walk, general feelings of participants after the walk and step count of each participant. Walk diaries were completed by a teacher or classroom assistant directly following the completion of each walk. The details recorded in the walk diary were also used to assess fidelity of the walking intervention and to ensure the intervention was being delivered as intended (Campbell et al., 2015).

6.5.6 Walk routes

Throughout the focus groups and interviews in phase 2, it was a recurring theme among children with ID, peer role models with ID, teachers, classroom assistants and principals that walk routes should be identified within or close to school grounds. This was identified within the COM-B model as physical opportunity at an individual level within the SEM. Research suggests that future studies should include changes to the environment and that school based interventions that include environmental changes have demonstrated potential in promoting sustainable behaviour change (Sallis et al., 2000; Haerens et al., 2006; Simon et al., 2014). During the co-production workshops, the researcher visited schools and aided teachers and classroom assistants in the

development of walk routes within school grounds. Teachers and classroom assistants could tailor walk routes as appropriate to be accommodated within the school day provided the core components of the walking programme were not modified (e.g. frequency and duration).

6.5.7 Incremental walking

The walking intervention was incremental, initially comprising of 1 walk per day, 3 days per week for 15 minutes (45 mins per week) and increasing across the duration of 12 weeks to a maximum of 4 days per week for 30 minutes (120 mins per week) (Fig. 6.1). Incremental walking programmes have previously been used to increase physical activity (Tudor-Locke et al., 2001) in the non-ID population. The frequency and duration of walks were discussed with teachers and classroom assistants throughout the series of workshops and there was a consensus that a structured incremental walking programme would be suitable for the school setting. The automatic motivation component of COM-B mapped to the organisational component of the SEM identified that there was a need to establish walking as part of the school routine and that this should be achieved through behavioural practice and habit formation.

6.5.8 Supervisor training

Walk supervisors (teachers and classroom assistants) received training on aspects such as supervising the walking programme, completing the walk diaries and reward card and use of accelerometers and pedometers. The researcher also demonstrated the intensity and pace that each walk should be carried out at by taking teachers and classroom assistants on a walk route within school grounds. Walk supervisors were instructed that participants should be walking at moderate intensity where their heart rate should be faster and they should feel a little out of breath but still be able to carry on a normal conversation. The researcher delivered the training via PowerPoint presentation during the school day and any teachers or classroom assistants who would be supervising the walking programme at any time attended. Participants were given the opportunity to ask any questions prior to commencement of the walking programme. Supervisor training was carried out with teachers and classroom assistants in a classroom without the distraction of other pupils and staff. Teachers and classroom assistants were provided with handouts of the presentation for reference.

6.5.9 Data collection tools

The acceptability of the proposed data collection tools was explored throughout the series of co-production workshops. The researcher showed teachers and classroom assistants the accelerometers and it was explained how they worked and that children with ID and peer role models with ID would wear them for a period of 7 days in school and at home. There was a consensus throughout the co-production workshops that, although there could be some difficulties ensuring the accelerometers at home, this measure would be acceptable for this population with support from teachers and parents. There were no issues with collecting anthropometric data including height, weight and BMI when measured with discretion in a separate classroom for each participant. There were no issues with the proposed measure of physical fitness using the 6MWT. Teachers and classroom assistants agreed that this would be an appropriate measure of physical fitness for children with ID and peer role models with ID and that it could be easily accommodated during the school day with no resource implications. The researcher showed teachers and classroom assistants the SDQ and there was a consensus that this would be an appropriate tool for assessing emotional and behavioural wellbeing of children with ID and peer role models with ID.

6.5.10 Field testing of walking programme procedures

The walking programme procedure was field tested in schools prior to the commencement of the feasibility study. This involved completing one walk and following all the procedures associated with this whilst the researcher observed. One teacher organised all the walking dyads and attached their pedometer before going outside to begin the 15-minute walk. The researcher observed walking pace by ensuring participants were walking at a pace fast enough to elicit moderate intensity physical activity. The social interaction of the dyads was also observed during testing of the walking programme procedures. Upon completion of the walk, the researcher observed the teacher completing the paperwork which involved completing date, time, walk route, duration of walk, recording the number of steps from the pedometer of each participant and any comments from participants. A reward card was also stamped for each participant. The aim of testing the walking programme prior to the feasibility study was to identify any issues that may be encountered by schools when completing the 12-week walking programme. Testing of the walking programme procedures and administration did not identify any issues and there was a consensus among stakeholders that the components of the walking programme appeared

appropriate and acceptable.

6.6 Conclusion

This chapter discussed the development of a school-based multi-component walking intervention informed by COM-B and the SEM and based on findings from the systematic review, focus groups and co-production workshops.

The development of this walking intervention addressed recommendations from the MRC guidelines by applying a systematic approach and developing appropriate theory to inform this development stage.

Chapter 7

Testing of the school-based multi-component walking intervention for children with intellectual disabilities: a feasibility study

7.1 Introduction

Results from the feasibility study are presented in two chapters; this chapter will present results relating to the feasibility of conducting the trial, including the effectiveness of recruitment, representativeness of the sample, attrition and adherence to determine the acceptability of the walking intervention. Trends in outcome measures over time will also be explored and compared for intervention and control groups. The following chapter (chapter 8) will present the findings of the process evaluation used to explore the feasibility of the walking intervention from the perspective of children and young people with ID and teachers.

7.2 Methods

7.2.1 Design

The aim of this phase of the doctoral thesis was to undertake a feasibility study that examined the school-based multi-component walking intervention for children with intellectual disabilities (aged 9-13 years). Intervention development, content and components were previously discussed in chapter 6. The main aim was to examine the feasibility of conducting the walking intervention. The primary outcome measure was objectively measured physical activity. Secondary outcome measures included anthropometric measures, physical fitness and emotional and behavioural wellbeing.

The objectives of the feasibility study were:

- 1) To assess recruitment rate
- 2) To determine retention and attrition rates
- 3) To assess appropriateness and acceptability of outcome measures
- 4) To explore trends for improvement in outcome measures of the walking intervention

7.2.2 CONSORT

The CONSORT guidelines (Schulz et al., 2010) were developed in response to inaccurate and incomplete reporting of RCTs. The aim of CONSORT is to provide guidance to researchers on clear reporting of methodology and findings. Recently, the CONSORT guidelines were extended to include pilot and feasibility studies (Eldridge et al., 2016). A recent systematic review by Mulhall et al. (2018) identified the barriers to conducting RCTs with people with ID and highlighted the need for

more RCTs involving this population. Given the poor quality and replicability of existing studies involving people with ID, CONSORT is of particular importance to guide reporting of RCTs conducted with this population. Thus, the CONSORT checklist for reporting a feasibility trial (Eldridge et al., 2016) was used as a guideline for the reporting of the feasibility study results.

7.2.3 Participants and recruitment

A purposive sample of 4 schools in Northern Ireland were invited to participate in the study. Following correspondence with principals, 4 schools agreed to participate. 1 school subsequently withdrew due to changes in staffing therefore 3 schools participated in the feasibility study. It was a pragmatic decision to select intervention schools based on their input into phases 2 and 3 intervention development and co-production, therefore 2 schools that were involved in these phases received the intervention and 1 school was selected as a control group. Thus, this was a non-randomised controlled feasibility trial. A total of 40 invitational letters were sent to parents/guardians of children with ID (aged 9-13 years) and adolescents with ID who would act as peer role models (15-19 years) in 3 special schools in Northern Ireland. Information leaflets, consent and assent forms were provided to the school and distributed to parents and young people with ID prior to the commencement of the study, by the relevant teachers. Young people were guided through the information and assent forms by their teacher. All participants in the study were given the opportunity to ask any questions prior to commencement of the study. Those who were willing to participate in the study and gave consent were then included in the feasibility study.

A total of 40 consent and assent forms were completed and returned. Two participants withdrew prior to baseline measures due to changing their mind about participating in the walking intervention, therefore 38 participants were eligible for inclusion and completed baseline measures.

7.2.4 Intervention group

Two schools were recruited to the intervention group. In total, there were 28 (children with ID $n=11$, peer role models with ID $n=17$) participants in the intervention group across the two schools.

7.2.5 Waiting list control group

One school was recruited to the waiting list control group. In total, there were 10

participants (children with ID n=5, young people with ID n=5) in the waiting list control group. This group were instructed to continue their normal routine in school and at home, and therefore did not receive any type of intervention. The waiting list control group received the walking intervention when the feasibility study was completed.

7.2.6 Eligibility criteria for children with ID and peer role models with ID

Eligibility criteria were as follows; pupils with mild ID, returned signed parental consent forms, returned assent forms, able to walk unaided and no other health conditions that may be affected by participation in the walking programme. All participants who returned completed consent and assent forms were eligible for participation in the walking programme.

7.3 Walking intervention

The walking intervention was developed based on findings from the systematic review (Johnston et al., submitted), focus groups with children with ID (9-13 years), peer role models with ID (15-19 years), teachers, classroom assistants and principals (Phase 2) and co-production workshops with teachers and classroom assistants (Phase 3). The theoretical underpinning for the intervention was the COM-B behaviour system mapped to the SEM to identify behaviour change techniques and intervention components (as per chapter 6). The walking intervention was delivered over a 12 week period in 2 schools within school grounds. The walking programme consisted of 1 walk per day, initially 3 days per week for 15 minutes duration and increasing to 4 days per week for 30 minutes duration. Children with ID (9-13 years) were paired with adolescents (15-19 years) by teachers based on likes/dislikes and walking speed. The adolescents (15-19 years) were peer role models for the younger children and supported them in taking part in the walking intervention. The peer role models took part in training delivered by the researcher before commencement of the walking programme, training provided covered topics such as safety when walking, walking with their peer buddy (younger child), appropriate clothing, correct walking pace (i.e. a brisk enough pace to have health enhancing benefits) and use of the pedometer. Walks took place during the school day, at times convenient to each school and were supervised by 2 teachers or classroom assistants, who ensured the participants walked at a sufficient pace. Teachers and classroom assistants received training on how to complete walk diaries for each participant after walks, how to use the pedometers and the sufficient pace for the walks.

Each participant was provided with a pedometer for each walk. Teachers or classroom assistants completed a walk diary for each participant after each walk recording details such as step count, walk route and duration and general comments/feelings. Participants were offered small incentives and prizes for taking part including water bottles, certificates and gym bags. Participants also received a £10 Asda voucher for wearing and returning their accelerometer at each of the measurement points.

7.3.1 Fidelity

Fidelity can be defined as the extent to which an intervention is delivered as intended and measures to ensure fidelity can increase the validity and reliability of an intervention (Mars et al., 2013). To ensure intervention fidelity, the researcher visited the schools on a fortnightly basis throughout the intervention. On these visits the researcher monitored the duration and intensity of walks by ensuring participants were walking at a moderate pace, ensured walk diaries were being completed as intended, ensured pedometers were being worn and encouraged and motivated participants to continue taking part in the walking programme. The control school was instructed to continue with their normal school routine; this was a waiting list control group, therefore they received the walking programme when the initial study was complete.

7.4 Data collection tools

The primary outcome was objectively measured physical activity by accelerometer. Secondary outcome measures included anthropometric measures included height, weight and BMI. The 6 minute walk test (6MWT) was used to measure physical fitness by distance walked. Four teachers completed strengths and difficulties questionnaires (SDQ) for each child in their class to measure emotional and behavioural wellbeing. All measures were taken for the intervention group at three time points (baseline, mid-intervention and post-intervention). All measures were collected for the control group at two time points (baseline and post-intervention).

7.4.1 Anthropometric measures

Height (cm) and weight (kg) were measured to the nearest 0.1cm and 0.1kg respectively at three time points for the intervention group and two time points for the control group (baseline and time point 3). Height was measured using a free standing stadiometer (Leicester Height Measure, Rotherham) and weight was

measured using digital scales (Omron BF508, Omron Healthcare UK LTD, Milton Keynes). Height and weight measurements were used to calculate BMI (kg/m^2) for all participants. The researcher was accompanied by a teacher or classroom assistant at all times.

7.4.2 Measuring physical activity

Physical activity was objectively measured for children and adolescents with ID using an Actigraph accelerometer (Actigraph GT3X California, AM 7164-2.2 by MTI Health Services, Fort Walton Beach, FL, USA). The Actigraph accelerometer is a small device that is worn on a belt around the waist and positioned above the left hip. Placement of the accelerometer above the left hip has been identified as the best position for accurate measurement of PA levels and intensity (Cleland et al., 2013). Accelerometers measure acceleration along a given axis. In the case of the Actigraph GT3x, acceleration is measure on 3 axis. The major function of accelerometers is that the sensor converts movements into electrical signals (counts) that are proportional to the muscular force producing motion (Melanson and Freedson, 1996). These counts are summed over a specific period of time (epoch) to assess PA level. During the initialisation of the accelerometer, three parameters were established to allow for accurate measurement of PA levels in children and adolescents with ID, these include; epoch length, cut-points and wear time.

Epoch length is the period of time over which physical activity counts are collected. At the end of each epoch, the data recorded is summed and stored on the device. Due to the spontaneous and sporadic nature of children's physical activity with bouts lasting between 3 and 22 seconds (Baquet et al., 2007), it would be appropriate to use a shorter epoch length (Edwardson & Gorely, 2010). For this study, an epoch length of 15 seconds was used in order to accurately capture the physical activity patterns of children and adolescents with ID.

Data was initially downloaded and analysed using Actilife software version 6.12.1. A valid day was defined as 8 hours of wear (480 minutes), which has been shown to be a reliable measure of daily PA (Aadland and Ylvisaker, 2015) and has been used for children with ID (Boddy et al., 2015). A valid week was defined as 4 days, including at least one weekend day.

The Actigraph accelerometer has been widely used to measure physical activity in children and adolescents with ID (Phillips & Holland, 2011; Izquierdo-Gomez et al.,

2014; Einarsson et al, 2016). Participants were instructed to wear the accelerometer for all waking hours, except bathing/showering, swimming and sleeping, for a period of 7 days. To encourage wear time compliance, participants were provided with easy read guides as to when and how to wear the monitor, a calendar of the days the monitor must be worn and a reminder poster to put up in a prominent place at home. A letter was also sent home to parents at each time point when the accelerometer was worn to remind them to encourage participants to wear the monitor at home, in school and at the weekend. Accelerometer reminder posters were also placed in the classroom and teachers encouraged participants to continue wearing their monitors. Accelerometers were distributed and collected by the researcher in schools.

7.4.3 Cut points

At the end of each epoch, when the activity counts are summed and stored on the device, activity is classified as light, moderate or vigorous intensity. The points between these activity counts are known as cut-points. Cut points define whether activity is classed as light, moderate or vigorous intensity activity. There is a lack of population-specific cut points for classifying physical activity in children and adolescents with ID (McGarty et al., 2014), therefore the cut points used in this study have been taken from studies of children and adolescents without ID. The cut points chosen for this study are those established by Evenson et al. (2008). A systematic review by Kim et al. (2012) found that there was no consensus on the most appropriate cut points to classify children and adolescents' moderate to vigorous physical activity, however Evenson cut points demonstrated desirable classification precision across 4 intensities (sedentary, light, moderate and vigorous) and across a range of ages. Trost et al. (2011) also recommended the use of Evenson cut points when assessing physical activity of children and adolescents.

7.4.4 Measuring physical fitness

The six minute walk test (6MWT) was used to assess the physical fitness of children with ID and peer role models with ID. The 6MWT has been used successfully to measure physical fitness in adults with ID (Nasuti et al., 2013) and in adolescents with ID (Elmaghoub et al., 2012). The 6MWT was deemed the appropriate method of assessing physical fitness due to the validity and reliability in this population and it also mirrors the content of the walking intervention. The 6MWT involves walking back and forth along a 30 m path as quickly as possible for 6 minutes. The distance covered in 6 minutes was used as a measure of cardiovascular fitness. This test was

conducted and timed by the researcher, with pupils walking on a flat, hard surface, within school grounds. A teacher was present each time the 6MWT was conducted. Participants were instructed to walk up and down between two cones as fast as they could for a period of 6 minutes until the researcher asked them to stop. Participants wore appropriate foot wear and clothing for the 6MWT. All participants wore trainers and their usual school uniform (tracksuit bottoms and jumper) and brought a jacket in case of inclement weather. Participants completed the 6MWT in pairs. Other participants waited inside the classroom until it was their turn to complete the 6MWT to avoid any observer effects. The 6MWT was conducted in the morning at each time point to ensure performance was not affected by different levels of motivation at different times during the school day.

7.4.5 Psychological measures

Teachers completed the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) pre and post walking programme to measure emotional and behavioural wellbeing of the participants. This questionnaire has been validated for use by proxy (Becker et al, 2004). The SDQ is a 25 item emotional and behavioural assessment questionnaire comprising of five subscales including emotional symptoms, conduct problems, hyperactivity, peer problems and prosocial behaviour. The internal consistency coefficient demonstrated acceptable reliability ($\alpha = 0.77$) for total difficulties and acceptable reliability for all subscales ($\alpha = 0.72-0.76$) (He et al., 2013). The SDQ has been widely used in studies of children and adolescents with ID (Beck et al., 2004; Emerson, 2005; Lloyd & Hastings, 2007) and has proven to provide a robust measure of the mental health needs of this population (Emerson, 2005).

7.5 Data analysis

Due to the study design, small sample size and non-normal distribution, descriptive statistics were generated and compared for the children with ID (9-13 years) intervention and control groups. Descriptive statistics were also generated for the peer role models with ID (15-19 years) intervention and control groups. Descriptive statistics should be used when reporting feasibility studies to identify trends and limitations exist when conducting statistical null hypothesis testing for this type of study design (Arain et al., 2010; Thabane et al., 2010; Tickle-Degnen, 2013), therefore descriptive statistics were produced for anthropometric, physical fitness, physical activity and SDQ data. Mean and standard deviation are reported throughout.

7.6 Results

7.6.1 Recruitment

Of the 4 schools invited to take part in the study, all schools agreed to participate, however one school later withdrew their participation due to logistics and staffing. Therefore, 3 schools participated in the study, 2 intervention schools and 1 control school. Invitational letters were sent to 40 parents/guardians across the 3 schools. Initial recruitment was successful with a total of 40 consent and assent forms being returned (100% response rate). A total of 30 participants in the intervention group and 10 participants in the control group were eligible for inclusion; therefore the school based recruitment strategy was effective in this study to recruit sufficient participants for a feasibility study.

There was an over-representation of males in the sample (n=30 male, n=8 female), which is often observed in health-related research involving children with ID (Maiano et al. 2016) and may be due to the higher prevalence of ID in males compared to females (Lai et al., 2012). Schools participating in this study had notably more males compared to females in the age groups eligible for participation in the walking intervention.

7.6.2 Acceptability of the walking intervention

Acceptability of the intervention was determined by;

- 1) Attrition throughout the intervention
- 2) Adherence to the frequency of walks

Attrition

Across the two intervention schools recruited to the study, a total of 30 (n=11 children with ID, n=17 peer role models with ID) participants consented to participate in the intervention, however two participants (6.7%) subsequently withdrew prior to the commencement of baseline measures. Schools endeavoured to pair older participants (peer role models) with younger participants, however some participants were paired based on cognitive ability as opposed to chronological age for pragmatic reasons hence the over-representation of peer role models. Both participants decided that they no longer wished to participate in the walking intervention. Therefore, 28/30 (93.3%) completed the walking intervention.

Although 28 participants completed the walking intervention, there was drop out across the 12 week intervention in relation to outcome measures. The most notable attrition rates are those for physical activity measurement. Table 7.1 shows the flow of participants and attrition rates for outcome measures throughout the study from baseline to time point 3.

Table 7.1 Participant numbers and attrition rates from baseline to end of intervention.

Measurement and time point		Children with ID Intervention group	Children with ID Control group	Peer role models intervention group	Peer role models control group
Physical activity*	Baseline	8	2	11	1
	T2	7 (-12.5%)	n/a	6 (-45%)	n/a
	T3	5 (-37.5%)	1(-50%)	7 (-36.4%)	1
Anthropometric measures	Baseline	11	5	17	5
	T2	11	n/a	15 (-11.8%)	n/a
	T3	11	3 (-40%)	14 (-17.6%)	4 (-20%)
6MWT	Baseline	11	5	17	5
	T2	11	n/a	15 (-11.8%)	n/a
	T3	11	3 (-40%)	14 (-17.6%)	4 (-20%)
SDQ	Baseline Teachers	11	5	17	5
	T3 Teachers	11	3 (-40%)	17	4 (-20%)

***Each participant received an accelerometer at each time point. Physical activity numbers and attrition rates refer to participants who met the accelerometer wear time criteria.**

Adherence

Out of a total of 44 prescribed walks across the 12 week period, 36 walks (81.8%) were provided in the two intervention schools. 2 walks were missed due to school

closures (4.5%), 3 walks were missed due to bad weather (6.8%) and 3 walks were missed due to school outings (6.8%). For the peer role models with ID, a mean of 2 walks were missed over the course of the 12 week programme and 84.1% of missed walks were due to college or work commitments. Compliance to the walking programme was 78.5% across the two intervention schools. Compliance was higher in the children with ID group (82.1%) than in the peer role models with ID group (74.7%).

7.7 Baseline characteristics of participants

Baseline characteristics of the intervention and control participants are shown in Table 1.1. In total, 38 participants were eligible for inclusion and completed baseline measures (30 male and 8 female). The mean age of participants at baseline was 16.21 (SD 2.75) years. There were 11 participants in the intervention group and 5 participants in the control group in the children with ID group. There were 17 participants in the intervention group and 5 in the control group in the peer role model with ID group. The majority of participants in the children with ID intervention group were classed as normal at baseline (63.6%), with 18.2% classed as underweight and 18.2% classed as normal weight. Similarly, the majority of participants in the children with ID control group were classed as normal weight at baseline (60%) with 20% classed as overweight and 20% classed as underweight. The majority of participants in the peer role model intervention group were classed as overweight or obese at baseline (76.5%) with 5.9% classed as underweight and 17.6% classed as normal weight. The majority of participants in the peer role model control group were classed as overweight or obese at baseline (80%), whilst 20% were classed as normal weight. BMI was classified based on BMI cut-offs for children and adolescents by Cole et al. (2000).

Table 7.2 Baseline characteristics of participants by age group.

	Intervention		Control		Intervention		Control	
	9-13 years		9-13 years		15-19 years		15-19 years	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)	13.36	0.92	13.00	0	18.35	1.32	18.40	0.55
Height (cm)	150.85	11.17	151.38	12.47	170.48	3.10	170.08	6.78
Weight (kg)	48.85	15.03	49.22	18.25	93.42	37.79	83.28	18.71
BMI (kg-m⁻²)	21.19	4.41	21.00	4.93	31.38	8.86	28.89	6.77

7.7.1 Accelerometer Compliance

Based on a wear time criteria of 4 days (including a weekend day) and 8 hours per day (Boddy et al., 2015), overall compliance with accelerometer wear was 67.9% in the intervention group and 30% in the control group at baseline. At T3, compliance decreased further with only 42.9% of the intervention group and 20% of the control group meeting the wear time criteria. Compliance in the children with ID intervention group was 32.1% at baseline decreasing to 17.9% at T3, whilst the children with ID control group compliance was 20% at baseline decreasing to 10% at T3. Compliance for the peer role model intervention group was 35.7% at baseline, decreasing to 25% at T3, whilst the peer role model control group compliance was 10% at baseline and remained at 10% at T3. Participants who did not meet the minimum wear time criteria were excluded from the PA data analysis. Due to poor compliance to the accelerometer wear time, specifically in the control group, it is difficult to identify changes in PA for this group.

7.7.2 Physical activity

At baseline, none of the participants were achieving the recommended 60 minutes of MVPA per day. In the children with ID intervention group, 87.5% of participants achieved less than 30 minutes MVPA per day. In the peer role models with ID intervention group, 81.8% of participants achieved less than 30 minutes MVPA per day.

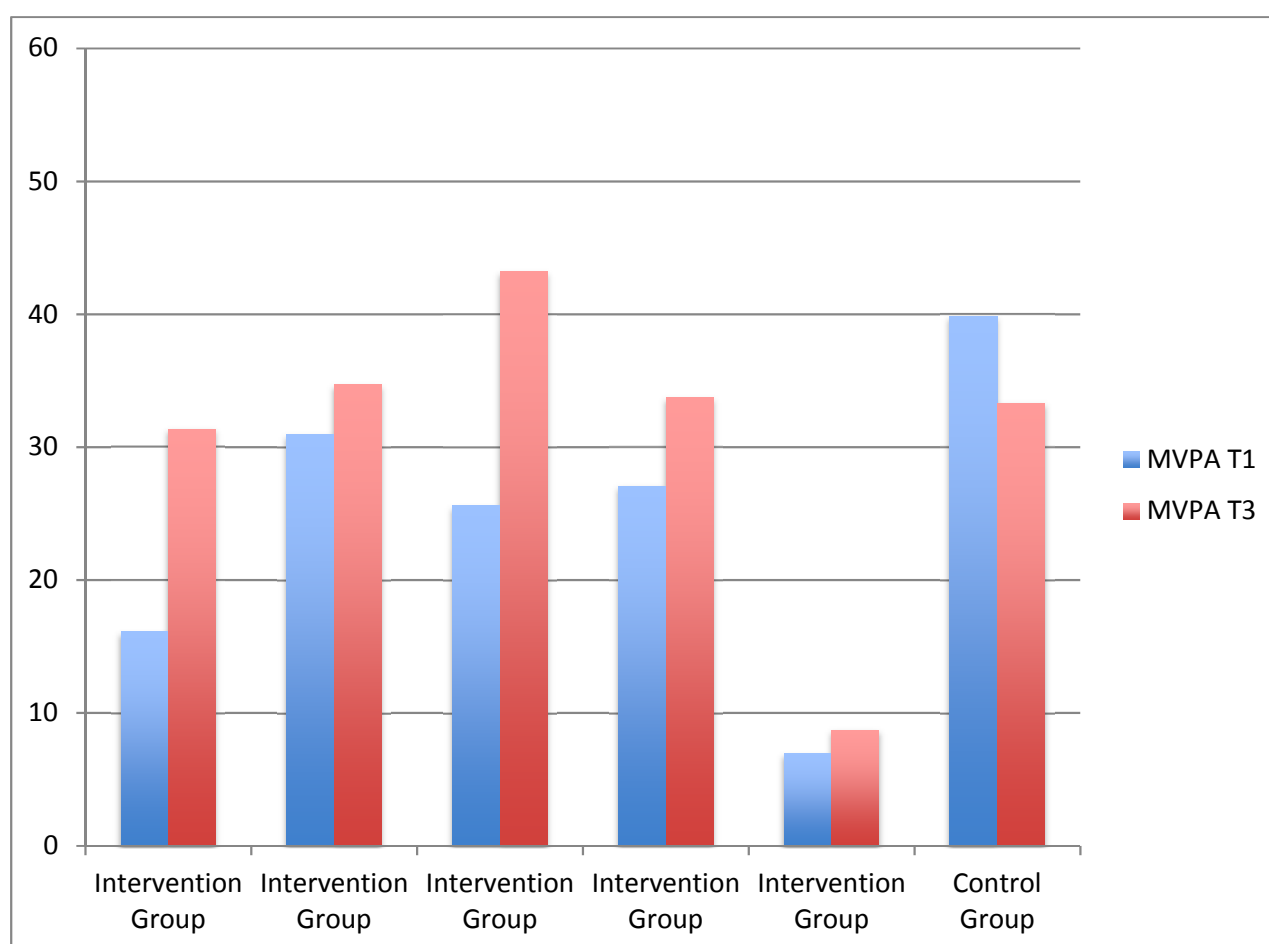
7.7.3 Total weekly physical activity

For the children with ID intervention group, there was a negative trend in sedentary behaviour from baseline (Mean=312.58, SD=35.25) to end of intervention (Mean=301.81, SD=49.78). A negative trend was observed in light PA from baseline (Mean=146.32, SD=29.70) to end of intervention (Mean=138.86, SD=38.11). This group also showed a positive trend in moderate PA from baseline (Mean=16.04, SD=5.94) to end of intervention (Mean=20.43, SD=8.93). There was a statistically significant increase in vigorous PA ($z=-2.023$, $p=0.043$) from baseline (Mean=5.05, SD=2.64) to end of intervention (Mean=9.91, SD=4.66). Of the 5 intervention group participants who met the wear time criteria at T1 and T3, all 5 showed an increase in MVPA. Trends in PA data for the children with ID intervention and control groups are shown in table 7.3. The small sample size in the control group precludes identification of trends in PA for this group.

Table 7.3 Objectively measured weekly physical activity and sedentary behaviour for 9-13 year old intervention and control groups at baseline, T2 and end of intervention.

	Baseline		T2	End of intervention (week 13)	
	Intervention	Control	Intervention	Intervention	Control
	N=8	N=2	N=7	N=5	N=1
Time (mins/day)					
Sedentary	312.58 (35.25)	294.21 (56.32)	305.03 (49.96)	310.81 (49.78)	288.91
Light PA	146.32 (29.70)	156.40 (41.54)	144.51 (42.74)	138.86 (38.11)	157.77
Moderate PA	16.04 (5.94)	16.81 (8.48)	19.32 (5.79)	20.43 (8.93)	18.53
Vigorous PA	5.05 (2.64)	12.59 (6.30)	11.14 (5.29)	9.91 (4.66)	14.79

Fig. 7.1 MVPA of 9-13 year old intervention and control group participants who met wear time criteria for T1 and T3.

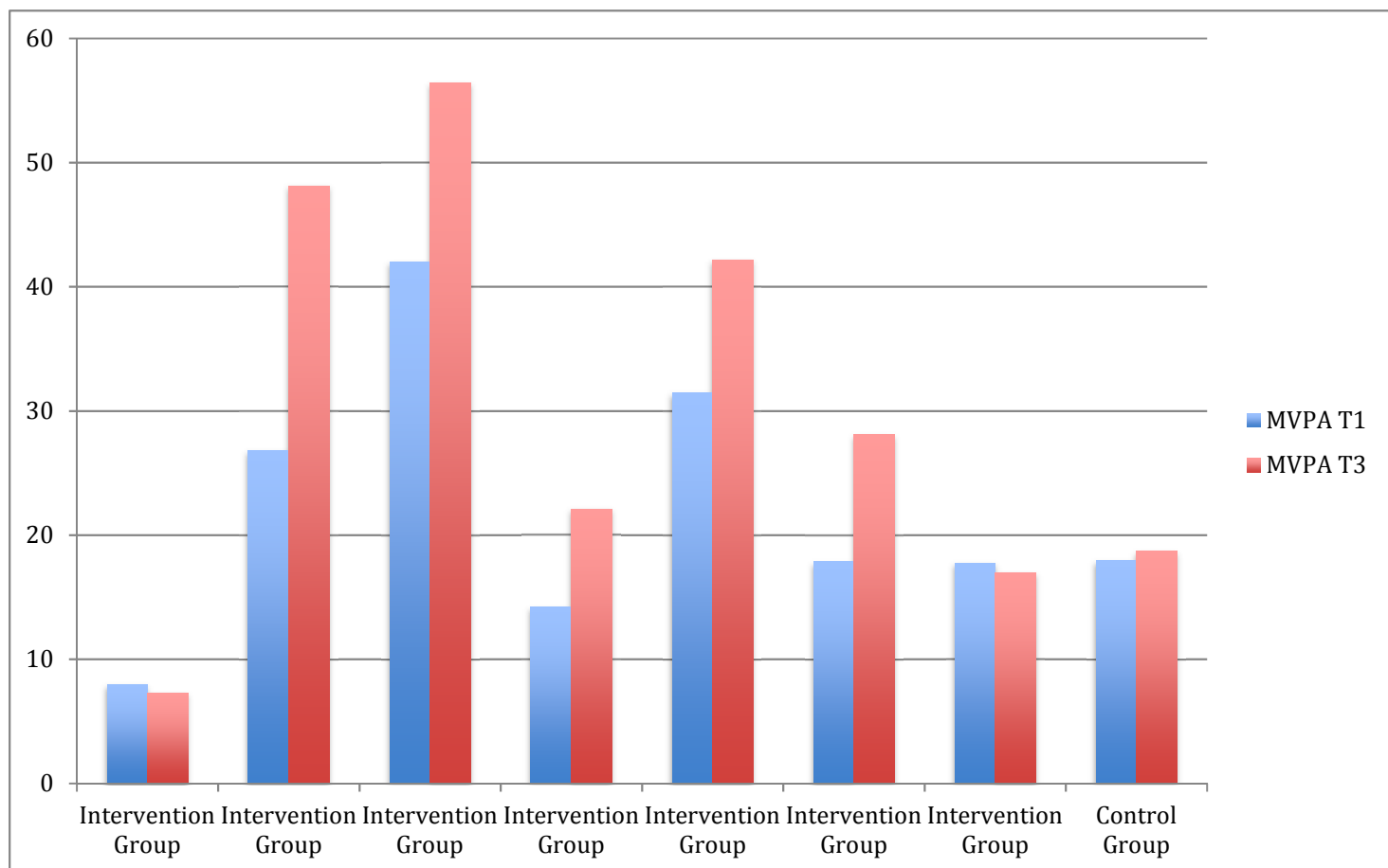


For the peer role model intervention group, there was a negative trend in sedentary behaviour from baseline (Mean=326.64, SD=36.70) to end of intervention (Mean=310.11, SD=32.47). There was a positive trend in this group across all intensities of physical activity from baseline to end of intervention. There was a positive trend in light PA from baseline (Mean=131.52, SD=34.74) to end of intervention (Mean=138.30, SD=18.89). There was also a positive trend in moderate PA from baseline (Mean=15.69, SD=5.97) to end of intervention (Mean=19.92, SD=8.74) and in vigorous PA from baseline (Mean=6.16, SD=4.45) to end of intervention (Mean=11.67, SD=9.64). Of the 7 15-19 year old intervention group participants who met the wear time criteria, 5 showed an increase in MVPA.

Table 7.4 Objectively measured weekly physical activity and sedentary behaviour for 15-19 year old intervention and control groups at baseline, T2 and end of intervention.

	Baseline		T2	End of intervention (week 13)	
	Intervention	Control	Intervention	Intervention	Control
	N=11	N=1	N=6	N=7	N=1
Time (mins/day)					
Sedentary	326.64 (36.70)	345.20	333.98 (42.42)	310.11 (32.47)	348.10
Light PA	131.52 (34.74)	116.83	118.14 (33.91)	138.30 (18.89)	113.17
Moderate PA	15.69 (5.97)	10.32	15.22 (8.72)	19.92 (8.74)	11.12
Vigorous PA	6.16 (4.45)	7.65	12.67 (14.15)	11.67 (9.64)	7.60

Fig. 7.2 MVPA of 15-19 year old intervention and control group participants who met wear time criteria for T1 and T3.



7.7.4 School time step count

There was a positive trend in school time step count in the children with ID intervention group from baseline (Mean=18047.75, SD=4277.25) to end of intervention (Mean=22423.60, SD=4175.76). There was also a positive trend in school time step count in the peer role models with ID intervention group from baseline (Mean=21387.45, SD=7520.55) to end of intervention (Mean=28820, SD=9335.93).

7.7.5 Physical fitness

Descriptive statistics showed a positive trend for the children with ID intervention group in metres walked in the 6MWT from baseline (Mean =501.09, SD=42.90) to T2 (Mean=530.45, SD=54.43). In the children with ID intervention group, 5 out of the 11 participants increased their physical fitness from baseline to end of intervention, whilst 2 participants maintained their physical fitness. A total of 4 participants in the

children with ID intervention group showed a decrease in physical fitness from baseline to end of intervention (Fig. 7.3). In comparison, there was a negative trend in the children with ID control group in metres walked from baseline (Mean= 500, SD=5.00) to T3 (Mean=486.67, SD=23.09). 2 out of 3 children with ID in the control group decreased physical fitness from baseline to end of intervention and 1 participant maintained their physical fitness. The peer role model intervention group showed a positive trend in metres walked from baseline (Mean=514, SD=57.84) to T2 (Mean=516.07, SD=73.91). There was also a positive trend in this group from T2 to T3 (Mean= 546.07, SD=73.36). In the peer role model intervention group, 10 out of the 14 participants showed an increase in physical fitness from baseline to end of intervention, whilst 1 participant maintained their physical fitness. 3 participants showed a decrease in physical fitness from baseline to end of intervention. The peer role model control group decreased from baseline (Mean=586.25, SD=69.69) to T3 (Mean=540.00, SD=56.57). 3 out of 4 participants in the peer role model control group showed a decrease in physical fitness, whilst 1 participant maintained physical fitness. Changes in metres walked in the 6MWT can be seen below in table 7.5.

Table 7.5 Physical fitness measured by 6MWT at baseline, time point 2 and time point 3.

	Intervention		Control		Intervention		Control	
	9-13 years		9-13 years		15-19 years		15-19 years	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
6MWT T1	501.09	42.90	500.00	5.00	514	57.84	586.25	69.69
6MWT T2	530.45	54.43	-	-	516.07	73.91	-	-
6MWT T3	526.36	54.55	486.67	23.09	546.07	73.36	540.00	56.57

Fig 7.3 Physical fitness of children with ID at T1 and T3 for intervention and control group.

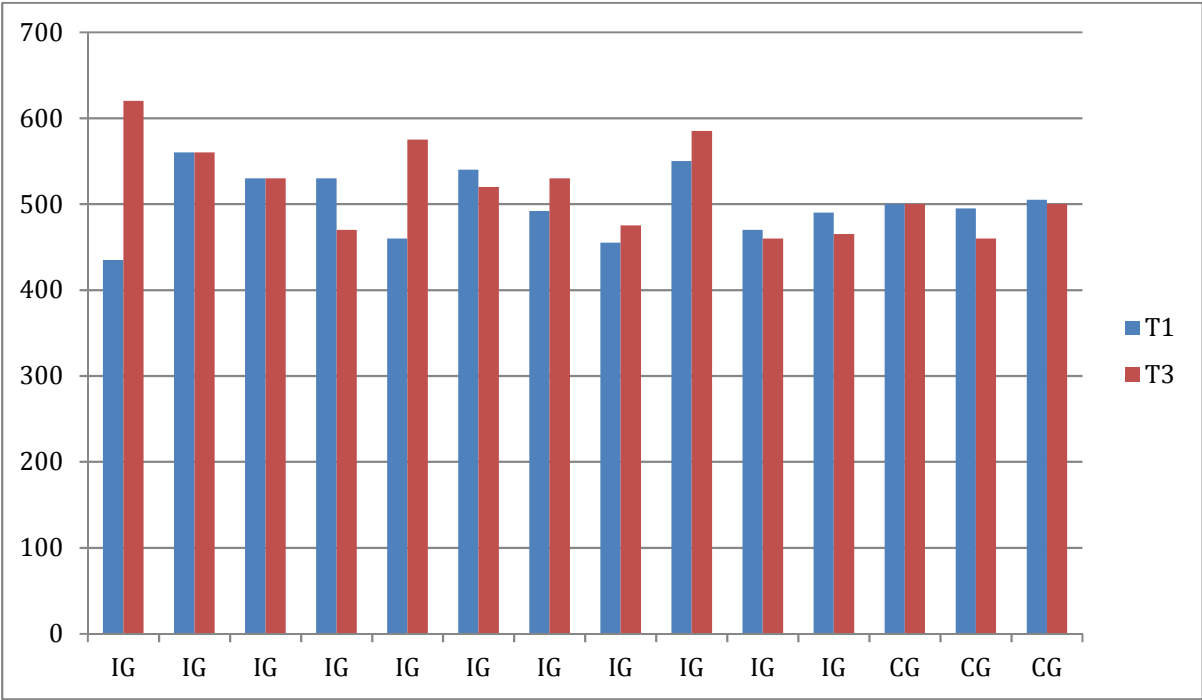
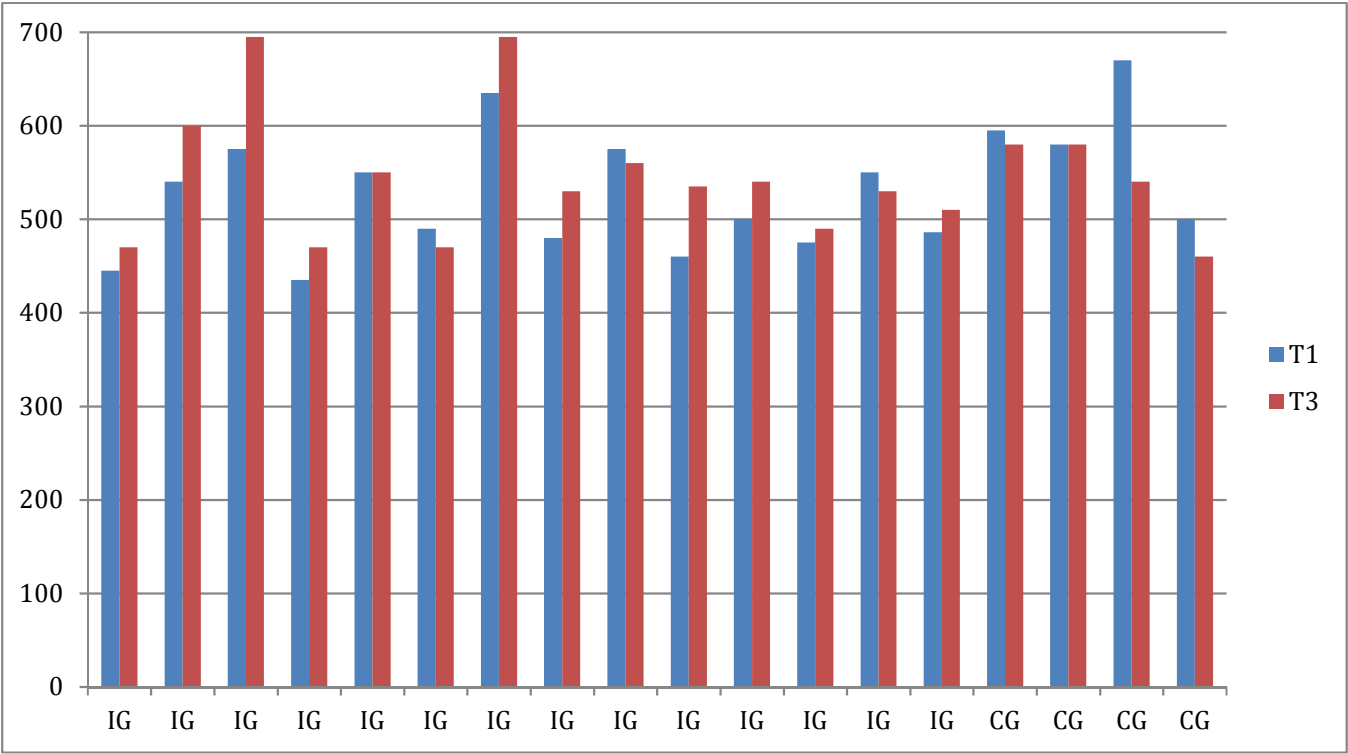


Fig 7.4 Physical fitness of peer role models with ID at T1 and T3 for intervention and control group.



7.7.6 Anthropometric measures

There was a small increase in weight in the children with ID intervention group from baseline (Mean=48.85, SD=15.03) to end of intervention (Mean=50.02, SD=15.96), however there was also an increase in height in this group from baseline (Mean=150.85, SD=11.17) to time point 3 (Mean=152.26, SD=11.31). There was also an increase in weight in the 9-13 year old control group from baseline (Mean= 36.77, SD= 1.86) to time point 3 (Mean= 38.20, SD= 1.40) There was also an increase in weight in the peer role model intervention group from baseline (Mean=90.54, SD=41.26) to time point 3 (Mean= 91.84, SD=9.59) and the peer role model control group from baseline (Mean= 89.63, SD=14.08) to time point 3 (Mean=89.80, SD=12.44).

Table 7.6 Anthropometric measures at baseline, time point 2 and time point 3.

	Intervention		Control		Intervention		Control	
	9-13 years		9-13 years		15-19 years		15-19 years	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Height T1	150.85	11.17	144.83	9.93	169.61	14.03	169.40	7.63
Weight T1	48.85	15.03	36.77	1.86	90.54	41.26	89.63	14.08
BMI T1	21.19	4.41	17.69	2.47	30.59	9.60	31.27	4.85
Height T2	151.91	11.24	N/A	N/A	169.99	13.88	N/A	N/A
Weight T2	49.91	15.81	N/A	N/A	91.26	41.76	N/A	N/A
BMI T2	21.36	4.55	N/A	N/A	30.70	9.79	N/A	N/A
Height T3	152.26	11.31	145.17	9.71	170.17	13.81	169.48	7.67

Weight T3	50.02	15.96	38.20	1.40	91.84	40.96	89.80	12.44
BMI T3	21.31	4.53	18.31	2.75	30.85	9.59	31.34	4.68

7.7.7 SDQ

Descriptive statistics show that the children with ID intervention group had a decrease in all the subscales and an increase in prosocial behaviour. The largest decreases are evident in the emotional symptoms subscale which decreased from baseline (Mean=3.27, SD=3.17) to end of intervention (Mean=1.73, SD=1.27), the conduct problems subscale which decreased from baseline (Mean=3.36, SD=1.75) to end of intervention (Mean=0.82, SD=1.83) and the peer problems subscale which decreased from baseline (Mean=4.91, SD=0.94) to end of intervention (Mean=2.27, SD=2.05). There was a decrease in total difficulties in this group from baseline (Mean=17.00, SD=6.26) to end of intervention (Mean=9.91, SD=8.54).

The children with ID control group also showed a decrease in the emotional symptoms, conduct problems and peer problems subscales. The largest decreases can be seen in emotional symptoms from baseline (Mean=5.67, SD=1.53) to end of intervention (Mean=3.67, SD=0.58) and in peer problems from baseline (Mean=4.33, SD=0.58) to end of intervention (Mean=2.00, SD=1.00). This group showed an increase in hyperactivity from baseline (Mean=5.00, SD=3.00) to end of intervention (Mean=6.00, SD=1.73). There was a decrease in total difficulties in this group from baseline (Mean=17.00, SD=6.25) to end of intervention (Mean=12.67, SD=4.51).

The peer role model intervention group showed a decrease in the conduct problems and peer problems subscales and an increase in prosocial behaviour. There also a small increase in emotional symptoms and hyperactivity in this group. Conduct problems decreased from baseline (Mean=3.24, SD=2.05) to end of intervention (Mean=1.41, SD=2.21) and peer problems also showed a decreased from baseline (Mean=5.00, SD=1.12) to end of intervention (Mean=2.24, SD=2.22). There was a decrease in total difficulties in this group from baseline (Mean=14.24, SD=4.21) to end of intervention (Mean=11.06, SD=6.60).

The peer role model control group showed a decrease in the emotional symptoms, hyperactivity and peer problems subscales. There was an increase in conduct problems and no change in prosocial behaviour. The largest changes can be seen in

emotional symptoms which decreased from baseline (Mean=2.00, SD=2.16) to end of intervention (Mean=0.50, SD=0.58) and in hyperactivity which decreased from baseline (Mean=2.25, SD=2.22) to end of intervention (Mean=0, SD=0). Total difficulties also decreased in this group from baseline (Mean=5.50, SD=3.70) to end of intervention (Mean=1.00, SD=1.41).

All changes in subscales for SDQs completed by teachers are shown in table 7.7.

Table 7.7 Teachers strengths and difficulties questionnaires at baseline and end of intervention.

	Intervention		Control		Intervention		Control	
	9-13 years		9-13 years		15-19 years		15-19 years	
Subscale	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Emotional symptoms T1	3.27	3.17	5.67	1.53	2.12	1.90	2.00	2.16
Conduct problems T1	3.36	1.75	2.00	2.65	3.24	2.05	00	00
Hyperactivity T1	5.45	2.16	5.00	3.00	3.82	1.47	2.25	2.22
Peer problems T1	4.91	0.94	4.33	0.58	5.00	1.12	1.25	0.50
Prosocial behaviour T1	6.91	2.34	5.00	1.73	6.59	2.37	8.00	2.31
Total difficulties T1	17.00	6.26	17.00	6.25	14.24	4.21	5.50	3.70
Emotional symptoms T3	1.73	1.27	3.67	0.58	3.47	2.72	0.50	0.58
Conduct problems T3	0.82	1.83	1.00	1.73	1.41	2.21	0.75	0.96
Hyperactivity T3	4.27	3.17	6.00	1.73	3.88	2.71	00	00
Peer problems T3	2.27	2.05	2.00	1.00	2.24	2.22	0.25	0.50
Prosocial behaviour T3	8.09	2.17	5.67	0.58	7.41	2.00	8.00	1.63
Total difficulties T3	9.91	8.54	12.67	4.51	11.06	6.60	1.00	1.41

Fig. 7.5 Total difficulties of children with ID at T1 and T3 for intervention and control group.

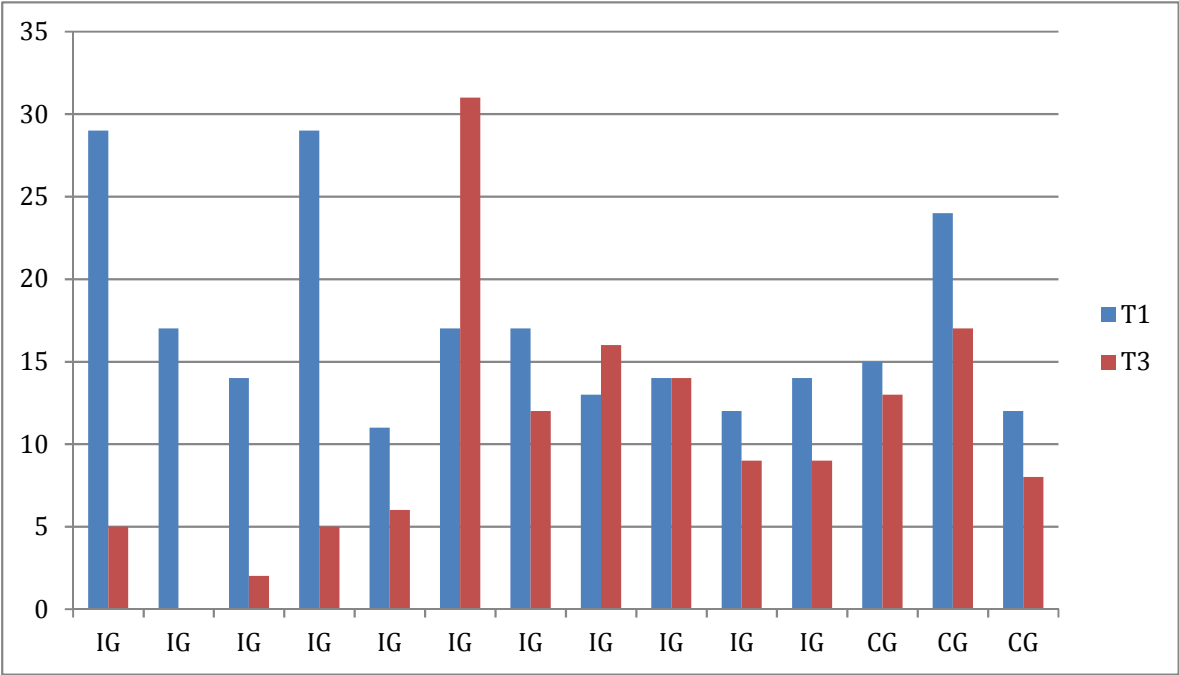
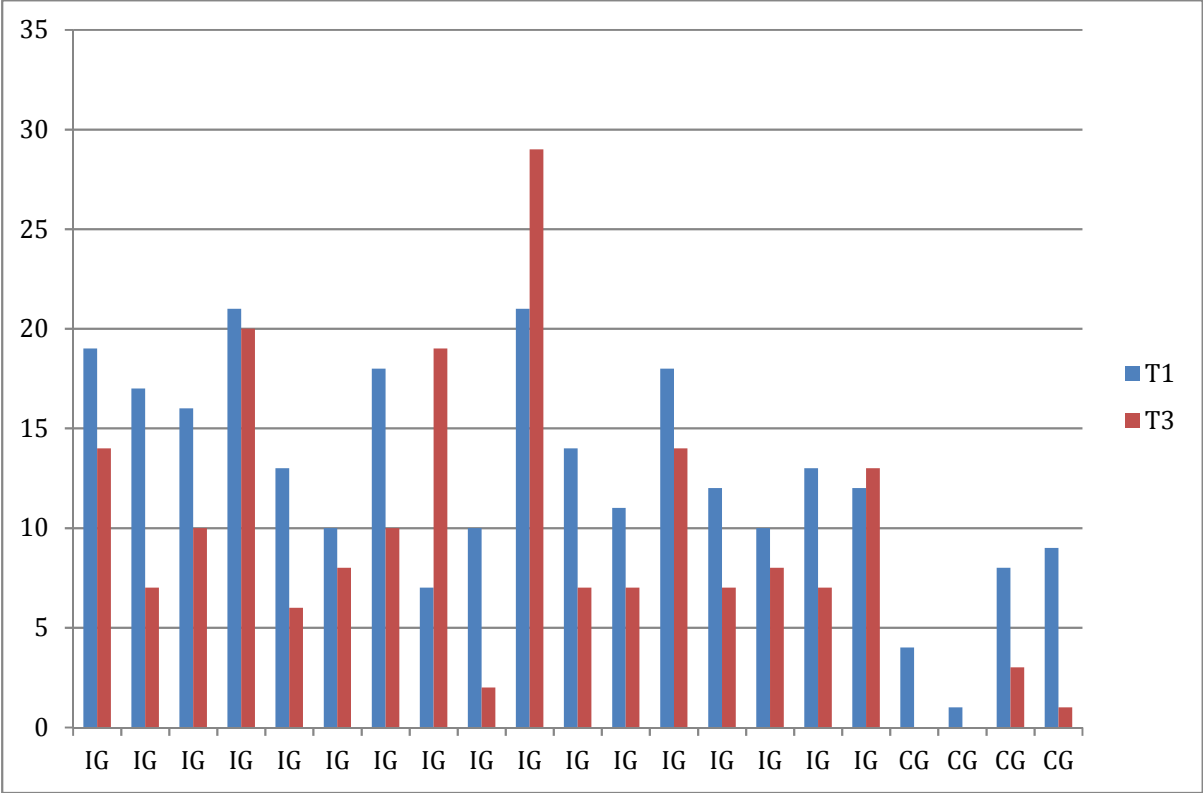


Fig. 7.6 Total difficulties of peer role models with ID at T1 and T3 for intervention and control group.



7.8 Summary of results

In summary, the main results from this study are as follows. In relation to feasibility, it was feasible to recruit schools and participants to the study. With regard to acceptability, attrition rate was low (6.7%) and participant drop outs were within the intervention group. Adherence to the prescribed frequency and duration of walks across the 12-week intervention was acceptable. Compliance to accelerometer wear time was low and declined from baseline to end of intervention. Findings from this study showed that there were consistent trends for decreases in sedentary behaviour and increases in moderate and vigorous PA in the intervention group, whilst the control group showed consistent trends for increases in sedentary behaviour and decreases in light and moderate PA. There was a consistent trend for improvement in physical fitness in both the children with ID and peer role models with ID in the intervention group and a decrease in physical fitness in both the children with ID and peer role models with ID in the control group. SDQ scores showed a reduction in total difficulties in both children and peer role model groups in the intervention group and in the control group.

7.9 Conclusion

In conclusion, this chapter has presented findings from the feasibility which show promising trends for children with ID and peer role models with ID. The implications of the above findings and a further exploration of the feasibility of a school-based multi-component walking intervention will be discussed in the next chapter (chapter 8 process evaluation).

Chapter 8

Process evaluation of the school-based multi-component walking intervention for children with intellectual disabilities

8.1 Introduction

This chapter will present findings from the process evaluation conducted post-intervention in phase 5 of this doctoral thesis.

The MRC stated that conducting a process evaluation is an integral part of designing and testing a complex intervention (Moore et al., 2015). Thus, a process evaluation was conducted post-intervention. The process evaluation explored the feasibility of a school-based walking intervention for children with ID via the use of a number of methods; focus groups, walk diaries and fortnightly school visits. At the 6 week follow up stage post-intervention, focus groups with young people with ID (9-13 years), peer role models with ID (15-19 years) and teachers/classroom assistants were conducted to assess which components of the intervention were successful in each of the two intervention schools. The details recorded in walk diaries by teachers and classroom assistants and fortnightly school visits by the researcher to ensure fidelity were also collated as part of the process evaluation.

8.2 Aim

The aim of the process evaluation was to explore the implementation, context, recruitment and sustainability of the 12 week school-based walking intervention for children with ID.

Objectives

The objectives of the process evaluation were:

- 1) To explore the components that affected implementation of the walking intervention
- 2) To explore the context in which the walking intervention was delivered
- 3) To assess procedures used for recruitment
- 4) To assess the sustainability of the walking intervention

8.3 Methods

Four key areas of exploration for the process evaluation were identified based on MRC guidelines, RE-AIM framework, Baranowski and Stables (2000) and Linnan and Steckler (2002). The four key areas of exploration were; implementation, context, recruitment and sustainability. Definitions for these elements can be found in table 8.1.

Process evaluation measures were collected throughout the 12 week intervention. The four key areas for this process evaluation were explored using a variety of methods including; focus groups with children with ID (9-13 years), adolescents with ID (15-19 years), teachers and classroom assistants, walk diaries and fortnightly school visits.

Table 8.1 Definition of key themes for process evaluation.

Implementation	Including reach, fidelity, structures, resources and processes through which delivery is achieved and the quantity and quality of what is delivered.
Context	The external factors influence on the delivery and functioning of interventions.
Recruitment	Procedures used to approach, attract and recruit participants.
Sustainability	The extent to which the programme becomes part of the routine organisational practices in a specific setting.

8.3.1 Participants and recruitment

Focus groups were conducted as part of the process evaluation. Children with ID, adolescents with ID and teachers who participated in the walking programme subsequently participated in focus groups post intervention. Consent and assent forms were provided to the school for distribution to parents and young people with ID prior to the commencement of the study, by the relevant teachers. Consent forms were also distributed to teachers/classroom assistants. Participants were given the opportunity to ask any questions prior to commencement of focus groups. Those who were willing to participate in the study and gave consent were then included in the focus groups and interviews.

Focus groups were conducted with children with ID (n=8), peer role models with ID (n=8) and teachers (n=10) in the two intervention schools. Children with ID and peer role models with ID who had participated in the school-based walking intervention also participated in phase 5 focus groups. Teachers who had been involved in

developing and supervising the walking intervention were also recruited to phase 5 focus groups.

8.3.2 Inclusion and exclusion criteria

Inclusion and exclusion criteria were applied for recruitment of participants to focus groups. Children with ID and peer role models with ID were included in focus groups if they were able to communicate verbally for participation in the focus group and if they returned completed and signed parental consent and participant assent forms. Children with ID and peer role models with ID were not included in focus groups if they could not communicate verbally or if they did not return signed parental consent and participant assent forms.

8.3.3 Focus groups: Children with ID

A total of 7 children with ID took part in the focus groups in two schools. The focus groups began with the researcher reminding the children with ID (9-13 years) about the topic of discussion and the confidentiality of the focus group. Participants were also shown the dictaphone and told that the focus group would be audio recorded. The focus groups began with informal introductions. The interview schedule (Appendix 7) for children with ID focused on physical activity participation, feelings around walking, participating in walking during school and intervention components. Children with ID had already met the researcher on previous occasions in school and were therefore comfortable with the researcher as the facilitator of the focus group, this created a safe environment and allowed for proper discussion. A private room was arranged at each school so that focus groups could be conducted in a quiet place without the distraction of other pupils or staff. Focus groups with children with ID lasted for up to 30 minutes in duration.

8.3.4 Focus groups: Young people with ID

A total of 6 young people with ID took part in focus groups across two schools. Focus groups with young people with ID (15-19 years) followed the same procedure as focus groups with children with ID as outlined above. Focus groups for young people with ID lasted for up to 30 minutes in duration.

8.3.5 Focus groups: Teachers/classroom assistants

A total of 10 teachers and classroom assistants took part in focus groups across two schools. Focus groups with teachers/classroom assistants followed a similar format

to those of the children and peer role models with ID. Teachers and classroom assistants had been provided with information and consent forms. Signed consent forms were collected before beginning the focus group. Two focus groups with teachers and classroom took place across the two schools. There were between 4-8 teachers and classroom assistants in each focus group. The focus group began with introductions and participants were reminded by the researcher of the topic of discussion, the confidentiality of what was said and that the focus group would be audio recorded via dictaphone. Focus groups with teachers/classroom assistants lasted for up to 60 minutes.

Focus groups were conducted with children with ID (n=8), adolescents with ID (n=8) and teachers (n=10) in two intervention schools. All participants provided written consent or assent prior to commencement of focus groups. Semi-structured interview schedules were developed for each focus group. All focus groups were recorded via dictaphone and transcribed verbatim.

8.3.6 Walk Diaries

Intervention schools completed walk diaries. Walk diaries recorded details including; supervisor name, date and time, walk duration, walk route, pedometer sign/out, steps achieved, reasons for non-participation and general comments. Walk diaries were completed for each participant (children with ID and peer role models with ID) in each school after each walk by the walk supervisor (teacher or classroom assistant).

8.3.7 School Visits

The researcher visited intervention schools on a fortnightly basis to ensure the intervention was being delivered as intended. This involved supervising walks to check that participants were walking at a sufficient pace to elicit moderate intensity physical activity, ensuring walk diaries were being completed, ensuring pedometers were being worn and presenting prizes/rewards to participants.

8.5 Analysis

Process evaluation outcomes were analysed based on guidance from MRC guidelines, RE-AIM framework, Baranowski and Stables (2000) and Linnan and Steckler (2002). Focus groups were subject to thematic content analysis (Newell and Burnard, 2011), the walk diaries were reviewed and data gathered from school visits which formed the components of this process evaluation. Four key themes relating to

the delivery of the intervention in schools were identified and are presented below; implementation, context, recruitment and sustainability.

8.6 Results

The main study outcomes have been previously discussed in the results chapter (Chapter 7) In summary, 38 participants participated in the school-based walking programme (intervention group n=28, control group n=10). Positive trends were observed for the intervention group on primary and secondary outcome measures.

8.6.1 Implementation

A number of factors were identified in relation to implementation of the walking programme. Teacher engagement was identified as key to the successful implementation the walking programme in school. Teachers and classroom assistants were integral to motivating and encouraging participants to take part in the walking programme. Young people and peer role models often remarked that it was their teachers and classroom assistants that helped them to take part in the walking programme in school.

(T) 'I just think its very important that kids get that exercise and our kids especially do not get that exercise usually you know outside of school, very few of them will get that exercise so I think its really important and you know even just the changes in their behaviour, changes in concentration, at the end of the day, that's what we're here to do and its helped so much so that's the main things'.

Pedometers were used as motivational tools and there was a consensus among staff, children and peer role models that these worked well for goal setting and self-monitoring. Participants understood that the pedometer counted their steps as they walked and were keen to see their step count at the end of each walk.

(T) 'Yeah, my class did love them (pedometers). Yeah, they actually started getting a bit competitive with one and other about who could get the most steps and all'.

(CA) 'Especially the older ones (peer role models), they were challenging themselves'.

(YP) 'I liked walking with the numbers counting'.

The peer buddy system was identified as an important aspect of the walking programme. Staff stated that participants enjoyed the social aspect of the

programme and that this was an incentive for them to take part in the walking programme. Teachers also highlighted that because participants were from different departments in school, it meant that they were able to make friends with other pupils that they would not usually have the opportunity to interact with. Young people and peer role models also agreed that they enjoyed walking with and talking to their buddy. Peer role models felt a sense of responsibility for their buddy and enjoyed the role of being a source of encouragement for the younger children.

(T) 'I definitely thought it was good, there was people who never would have spoke to each other or interacted'.

(PRM) 'It was different, they were smaller. We're bigger, more mature. With the wee ones, we'd be walking with them and all'.

(PRM) 'You're helping them because you're the older person, they look up to you'.

Participants were offered small rewards for taking part in the walking programme and these were considered a motivating factor by young people and peer role models. Teachers and classroom assistants also reported that the rewards were an incentive for young people to take part however as the walking programme progressed, the rewards became secondary.

(PRM) 'Prizes and getting fitter and losing weight'.

(T) 'I thought they were great (prizes), all of it they were really interested in'.

(T) 'But you know what, as it went along, they didn't really need a motivator, they were just doing it'.

To ensure fidelity of the walking intervention, teachers were provided with walk diaries for each participant which recorded details of each walk, step count, general feelings and comments. Although the walk diaries were a successful aspect of data collection and provided information in relation to the fidelity of the walking programme in school; teachers and classroom assistants highlighted that completion of walk diaries was time consuming and often added to their workload but this became more manageable when it became part of a routine.

(T) 'At the start filling in those forms (walk diaries) was a bit of a pain but then once we got into a system of somebody sits there and then it was just us trying to organise

things was a wee bit but at least it made us do it you know, if it hadn't been for walking group we probably would have gone oh we'll not do that'.

There was poor compliance to accelerometer wear time and it was difficult to collect sufficient data over the 7 day wear period, specifically at the last (week 13) time point post-intervention where only 35% of participants met the wear time criteria. Despite the poor compliance, young people (9-13 years) stated that they enjoyed wearing the red box and were proud of it whilst peer role models (15-19 years) stated that it was uncomfortable at times and they found it hard to remember to wear it. Teachers noted that participants enjoyed wearing the accelerometer however there were difficulties with compliance specifically at the second and third time points.

(T) 'The accelerometers, they all quite enjoyed I think. The only thing sometimes it was hard for them to remember, especially the second time I noticed a big difference'.

Adherence to the walking programme was measured by walk diaries. Schools completed the programme as intended. Compliance to the walking programme was 78.5% across the two intervention schools. Compliance was higher in the children with ID group (82.1%) than in the peer role model group (74.7%).

A Strengths and Difficulties Questionnaire (SDQ) was completed for each participant by their teacher pre and post intervention. The use of the SDQ as a data collection tool was feasible as demonstrated by 100% (n=28) of teachers completing the SDQ post-intervention (week 13).

8.6.2 Context

The walking programme was delivered in schools during the normal school day, which highlighted a number of challenges faced by staff in relation to implementing the programme during the school day. Staff highlighted the logistics of the walking programme during the school day often posed a challenge, particularly when the programme reached 30 minutes on 4 days per week.

(T) 'It's just difficult because you've got everybody doing different things, people out at work, people going to college, people have set lessons, you know, swimming, PE and different departments'.

(T) 'It was a bit tight as it increased'.

(T) '3 days was alright, 4 (days) was just a wee bit tight just because everybody's different schedules but 3 (days) definitely and also we felt half an hour would be really tough and it would be boring walking around there but you know it wasn't'.

School trips and other outings also resulted in disruption of the walking programme, particularly towards the end of term.

(T) 'Yeah and trips, school, we didn't have a lot of outings over that period luckily but our outings then came at the end and we noticed then that it was difficult with those too you know'.

8.6.3 Recruitment

Recruitment of participants to the study was successful; of the 4 schools contacted all 4 consented to participate in the study. 1 school withdrew from the study prior to commencement of data collection due to staffing changes. Across the 3 schools that participated in the study, 40 invitational letters were sent out to parents and 40 (100% consenting rate) participants were recruited to the study (n=30: intervention group, n=10: control group).

In relation to retention, 85% of participants completed anthropometric measures post intervention (week 13), whilst only 35% of participants met the wear time criteria post intervention compared to 55% at baseline. In general, young people (9-13 years) and peer role models (15-19 years) stated that they enjoyed wearing the accelerometers, however it was often difficult for them to remember.

(PRM) 'Well it was hard in the mornings to remember so my mum had to put it somewhere so I was reminded to put it on'.

Teachers stated that accelerometers were worn by all participants during the school day but that lack of parental engagement could be a factor in the low numbers of young people meeting the wear time criteria due to non-wear time outside of school and at weekends.

(T) 'The accelerometers, I don't know how many of them wore them at home, that's being honest with you'.

(T) 'It was the parents as well you know, they weren't really that, even though they were given I don't know how many times, explained in parent meetings, they were given letters, they were still, they were not...'

(T) 'To be honest, knowing our parents, not. But they aren't exactly the most...I don't know whether its our school or only some schools but sometimes to actually even get the parents in for IEP meetings and stuff is difficult enough'.

8.6.4 Sustainability

Due to the lack of long term follow up measures, it is difficult to discern the sustainability of the walking programme in schools, however teachers and classroom assistants were enthusiastic about the prospect of continuing to walk during the school day in the next school year.

(T) 'I'm definitely going to do the walking programme with my kids and I think I'll try and take them all, just you know, and possibly try to buddy up with another class if it's feasible'.

(T) 'I will be doing it (walking programme) next year, 100 percent'.

Staff also stated that they would be keen for a whole school approach to the walking programme.

(T) 'In general, I think its great and I, what I would like to see is everybody in school going out with a different class, you know'.

(T) 'There's been a few teachers that have asked me about it and I've said that, you know, I'll give you the wee programme that we got and feel free to do it and I'll help you in whatever way I can'.

Staff acknowledged that there were challenges in implementing the walking programme, however the benefits of the programme for the young people outweighed the logistical challenges.

(T) 'They really enjoyed it and I think I seen, you know, a lot of behaviour changes in a positive way. And since we've stopped recently, behaviour hasn't been great again'.

(T) 'Awk I think it went really well even aside from the physical aspect which hopefully we'll continue it next year as well, also like the social side like you know like in our wee class they made new friends and it was so sweet, and that's something that's like really important for them'.

Table 8.2 Positive and negative intervention components reported by children with ID, peer role models with ID, teachers and classroom assistants.

Positive intervention components	Negative intervention components
Teacher engagement	Walk diaries – time consuming in the beginning
Pedometers	Poor compliance to accelerometers
Peer buddy system	Fitting the walking programme into the school day when it reached 30 minutes on 4 days per week
Rewards and incentives	

8.7 Discussion

This is the first process evaluation of a school-based walking intervention for children and adolescents with ID. This process evaluation has identified the successful components of the intervention and a number of methodological challenges that should be considered for future interventions.

Engagement of school staff including principals, teachers and classroom assistants particularly was identified as a key factor in the successful implementation of the walking programme in schools. Similarly, Todd et al. (2015) also highlighted that school staff play an integral role in supporting school-based interventions and health promoting behaviour in school, whilst Eather et al. (2013) found that social support from teachers has a significant positive effect on pupils' health behaviour in school. Furthermore, it is evident that support from principals is key to successful implementation of school-based interventions (Forman et al., 2009). Support for the walking programme from the principal allowed for the recruitment of participants at each of the schools. Although it was important for principals' engagement to allow access to participants, successful implementation of the programme was more reliant upon the direct involvement of teachers and classroom assistants. The context and setting in which the programme was delivered appeared to present a number of

challenges in relation to logistics, staff resources and time, however this did not appear to affect the engagement of staff.

This was a structured multi-component intervention comprising of seven core components; 1) a peer role model system, 2) pedometers, 3) reward, 4) peer role model training, 5) walk routes, 6) incremental walking and 7) supervisor training with theoretical underpinning from the COM-B and the SEM. Each of these components were feasible, however some amendments were suggested by stakeholders in order to tailor the components more effectively for implementation in the school setting.

The peer role model system was feasible and provided a form of social support for participants. There is evidence to suggest that a peer buddy system may be effective in influencing health behaviours (Edwards et al., 2015). Children with ID looked up to their older peer role models and the peer role models enjoyed taking on some responsibility for their younger buddies. Participants and teachers agreed that support from peers was an important factor in sustaining participation in the walking programme. This is corroborated by Kouvonen et al. (2012) who reported that social support is a key factor in sustaining behaviour change. Similarly, previous research found that peer support positively influences physical activity behaviour (Klavina & Block, 2008; Vashdi et al., 2008) and has also proven to be effective in sustaining engagement in physical activity for young people with ID (Halle et al., 1999).

Teachers were supportive of the peer role model system and recognised that peer support was a key factor in engaging children with ID in physical activity. A systematic review of perceived barriers and facilitators to physical activity for young people with ID by Shields et al. (2012) also identified that key facilitators of physical activity for these young people was interaction, encouragement and assistance from peers. Although teachers were supportive of the peer role model system, some logistical challenges were highlighted in relation to scheduling of walks that suited both the young people and the peer role models. The older peer role models were often out of school at work or college which made it difficult to ensure they were in school to participate in walking. Due to time taken for the development of the intervention, the walking programme was not implemented in school until the spring term (January) which meant class schedules had already been set from the beginning of the new term in September. Teachers stated that beginning the programme at the start of the school year (September) would allow them to coordinate schedules for the different age groups involved and overcome some of the logistical challenges, which is important to consider for future school-based

interventions.

The pedometers were reported to be used successfully for goal setting, motivation and self-monitoring. There was a consensus among teachers, young people with ID and peer role models with ID that the pedometers were an important component of the intervention. Participants appeared to be able to interpret step count and understand whether they had increased or decreased their step count when compared to previous walks. Teachers strongly emphasised that participants were keen to know their step count at the end of each walk and were competitive when trying to increase their step count in subsequent walks. This is consistent with research by Tudor-Locke and Myers (2001) who found that pedometers provide a source of feedback for the participant, which can be effective in providing information on physical achievement and can increase physical activity levels. The use of pedometers as motivational tools in physical activity interventions for young people is becoming increasingly popular. The use of pedometers as a motivational tool has been shown to be effective in increasing physical activity levels of school aged young people (Butcher et al., 2007; Schofield et al., 2005; Vanda et al., 2013). Pedometers have also been used as a motivational tool for adults with ID (Melville et al., 2015), however, although pedometers have been used to measure physical activity of young people with ID (Eiholzer et al., 2003; Beets et al., 2007; Pitetti et al., 2009), there is little evidence of the use of pedometers as motivational tools for young people with ID. The findings from this study indicate that with support from others, pedometers can be used as a motivational tool for children and adolescents with ID.

Rewards were reported to be effective in encouraging and sustaining engagement for participants. Behavioural incentives such as rewards have been showing to be effective in positively influencing health-related behaviour change (Mantzari et al., 2015) and rewards have been shown to be effective in increasing physical activity in children (Hardman et al., 2011). All participants commented that they enjoyed receiving their prizes, however this was particularly the case for the children with ID whilst peer role models with ID placed less emphasis on the rewards. Teachers reported that the rewards system was effective however as the walking programme went on, the participants were less concerned with prizes and were enjoying walking because it had become part of their routine and for getting outside, socialising and trying to increase their step count. Similarly, Oliver and Brown (2012) reported that behavioural incentives could lead to sustained behaviour change if they are in place for a period of time sufficient to create habits after which they could be phased out.

Accelerometers were used to objectively measure PA at three time points throughout the walking intervention. Accelerometer compliance was 57.9% at baseline which is similar to previous studies in this population (Boddy et al., 2015). However only 36.8% of participants met the wear time criteria (4 days, 8 hours) post intervention (week 13). There is a lack of clear accelerometer protocols in the ID literature (McGarty et al., 2014) and there is poor reporting of accelerometer compliance therefore it is difficult to ascertain whether the compliance in this study is what would be expected given this population. Poor compliance may have been associated with lack of parental engagement, as teachers reported that it was difficult to ensure the accelerometer was being worn at home despite meetings with parents and distribution of letters, information sheets and wear time calendars to parents at each of the measurement points.

Teachers reported that it is often difficult engaging parents in school activities and due to the vast majority of pupils being bussed to school each day, parents often have little contact with the school or teachers. This is consistent with findings by Downs et al. (2013) who reported that difficulties exist when trying to engage parents. Support from parents has been deemed the main influence for children with ID to engage in physical activity (Alesi, 2017; Barr and Shields, 2011; Mayh et al., 2010) thus future research should include more strategies for engaging parents such as a text messaging system whereby parents receive a text message to remind them to ensure their child is wearing their accelerometer at home may help to increase accelerometer wear time over a 7 day period.

Teachers reported that as the walking programme incrementally increased to its maximum of 4 days and 30 minutes per day that it became increasingly difficult to accommodate within the school day. It was recommended that the frequency of walks should be reduced to 3 walks per week, however the 30 minute duration was feasible.

8.8 Strengths and limitations

This is the first process evaluation of a school-based walking intervention for young people with intellectual disabilities. This study was conducted in schools in Northern Ireland and therefore findings may not be generalisable to other locations. This was a feasibility study and as such any findings in relation to outcome measures should be interpreted with caution.

8.9 Conclusions

This process evaluation shows that a school-based multi-component walking intervention is feasible and acceptable for children with ID, peer role models with ID and teachers and these promising findings require further exploration. However, some methodological challenges were identified that should be addressed in future school-based interventions aimed at this population. School is an appropriate environment for physical activity interventions aimed at this population however logistics of co-ordinating the walking intervention within the school day was challenging and added to the workload of teachers. Future interventions should aim to adapt and tailor interventions that can be incorporated into the school timetable. Objective measurement of physical activity was difficult in this population and future studies should aim to address this by developing strategies to encourage compliance with accelerometer wear time, specifically outside of school hours. Engagement of parents may be key to encouraging children with ID to wear the accelerometer and to ensure that children meet the wear time criteria.

Chapter 9

Discussion and Recommendations

9.1 Introduction

This chapter will synthesise the main findings, contribution to knowledge and implications of this study. Findings from each phase of the study will be discussed and explored with the existing literature and the strengths and limitations presented. Recommendations for future research will also be presented.

The overarching aim of this thesis was to develop and test a theoretically underpinned school-based multi-component walking intervention for children with ID (9-13 years). The specific objectives were to;

- 1) Conduct a systematic review to assess the evidence base in relation to objectively measured physical activity interventions in children and adolescents with ID
- 2) Explore the enablers, motivators and barriers to PA among children and adolescents with ID
- 3) Co-produce the school-based walking intervention with stakeholders
- 4) Test the feasibility of the school-based walking intervention for children with ID
- 5) Conduct a process evaluation to determine the acceptability of the school-based walking intervention aimed at increasing PA in children with ID

This thesis has achieved the aims and objectives set out at the beginning (Chapter 4) by conducting the 5 phases comprised within the work of this thesis.

The main findings from this study are: there are a limited number of physical activity interventions targeted at children and adolescents with ID. A systematic review of the literature (Johnston et al. submitted) found that short to medium term interventions are effective at increasing PA levels in this population, however there were a small number of studies eligible for inclusion and these studies were of poor quality with small sample sizes. None of the studies were conducted in a school setting and there was a lack of theoretical underpinning (Chapter 3). Focus groups and interviews with children with ID, adolescents with ID, teachers, classroom assistants and principals highlighted that children with ID would like to participate in walking with a buddy and that being able to monitor their step count would improve engagement. Furthermore, there was a consensus that a reward system would improve adherence (Chapter 5). Based on the findings from the systematic review and focus groups/interviews, a preliminary walking intervention was developed with underwent further development

and refinement with stakeholders in schools throughout co-production workshops (Chapter 6) and results show that the walking intervention is feasible for this population in this setting (Chapter 7). A process evaluation conducted post-intervention found that the walking intervention was acceptable for this population in this setting and subject to minor amendments may be feasible to implement in other special schools (Chapter 8).

Findings have shown that it is possible to recruit and retain children with ID (9-13 years) and peer role models with ID (15-19 years) to a school-based multi-component walking programme. Adherence to the walking programme was high (78.5%) overall, although adherence was higher in children with ID (82.1%) than their peer role models with ID (74.7%). The children with ID intervention group decreased sedentary behaviour and increased moderate and vigorous physical activity from baseline to end of intervention, whilst peer role models with ID decreased sedentary behaviour and increased physical activity across all intensities from baseline to end of intervention, demonstrating that increasing physical activity via a school-based walking programme is feasible in this population. Furthermore, there was an increase in step count and physical fitness in the children with ID and peer role models with ID intervention group which may be directly related to increased physical activity.

As children and adolescents with ID generally have lower levels of physical activity than the general population and as it is likely that this behaviour carries through to adulthood, there is a need to find suitable interventions for sustainable behaviour change in this population at a younger age. Based on the findings from this study, it is evident that a multi-component school-based walking intervention is feasible in this population and shows a trend for improvement in physical activity and other outcomes, however there are a number of methodological challenges that should be addressed prior to conducting a fully powered RCT. Further findings are presented below and recommendations for future research are discussed.

9.2 Key findings and contribution to knowledge

9.2.1 Intervention components

9.2.1.1 Peer role model system

This is the first innovative study to use a peer role model system as a component of a school-based walking intervention for this population. Research by Shields et al. (2012) found that peer support was one of the key facilitators of physical activity for

young people with ID and Kouvonen et al. (2012) stated that social support is a key factor in sustaining behaviour change. Previous studies have used peer buddy systems comprising of dyads with one young person with ID and a non-ID peer (Stanish and Temple, 2012), however there is little evidence of the use of a peer buddy system where both participants have an ID. In the present study, children with ID (9-13 years) were paired with a 'peer role model' with ID (15-19 years) in the same school. Findings from focus groups carried out post-intervention as part of a process evaluation identified that the peer role model system was feasible within the school setting. Children with ID enjoyed being paired with an older pupil in their school and peer role models with ID highlighted that they enjoyed taking responsibility for the younger child. Despite the benefits of the peer role model system for children with ID and peer role models with ID, teachers and classroom assistants highlighted that, whilst the age gap between the children and their peer role model was good for socialising and getting to know others from different departments, logistics and schedules of different departments made organising days and times for walks difficult. However, staff also stated that if the walking intervention had been planned before the commencement of the new school term (in September), then departments could have organised their schedules to coordinate the walking programme.

9.2.1.2 Pedometers

This is the first study to use pedometers for goal setting in children with ID. The use of pedometers as motivational tools has been shown to be effective in increasing physical activity levels of school-aged young people in the general population (Gu et al., 2018; Vanda et al., 2013; Hardman et al., 2011). Pedometers have been used to quantify PA in children with ID (Eiholzer et al., 2003; Pitetti et al., 2009; Beets et al., 2011), however there has been a lack of evidence of the use of pedometers as a motivational tool for this population. Pedometers have been used as a motivational tool for adults with ID (Melville et al., 2015) however findings suggested that adults with ID experienced difficulties with goal setting and self-monitoring. Contrary to this, findings from this study show that children with ID were able to understand behaviour change techniques such as goal setting and self-monitoring with support from a teacher or classroom assistant. Pedometers were worn by each participant (children with ID and peer role models with ID) and step count was recorded by a teacher or classroom assistant after each walk. Throughout focus groups conducted post intervention as part of a process evaluation (Chapter 8), there was a consensus

among children with ID, peer role models with ID, teachers and classroom assistants that participants were able to understand their step count and endeavoured to beat their own step count on each walk. Findings show that behaviour change techniques can be implemented for children and adolescents with ID with support from others in the school setting.

9.2.1.3 Application of individual and systems change theories

The theoretical underpinning of the walking intervention (Chapter 4) is novel and unique in the field of ID. The MRC guidelines (2010) for designing and evaluating complex interventions stated that it is best practice to identify appropriate theory and that interventions should be underpinned by a coherent theoretical framework. Michie et al. (2011) stated that all interventions should be underpinned by a model of behaviour. Despite findings by Mears and Jago (2016) that there is limited evidence for the use of behaviour change theory as the basis for an intervention. A recent systematic review by Owen et al. (2017) concluded that there were significant effects for multicomponent interventions and interventions underpinned by a theoretical framework. McGoey et al. (2015) found that of 128 physical activity interventions with children and adolescents without ID, 59% and 78% respectively were underpinned by a theoretical framework. However, although theory-based interventions are well reported in the non-ID literature, a recent systematic review of interventions to promote physical activity in young people with ID (Frey et al., 2017) found that none of the studies were theory-based. This is consistent with findings in the systematic review comprised in this thesis (Chapter 3).

A number of behaviour change theories have previously been used as a basis for PA interventions, however the most commonly used are; Social Cognitive Theory (Stacey et al., 2016; Dewar et al., 2014); Self-Determination Theory (Jago et al., 2015; Sebire et al., 2016); Transtheoretical Model (Taymoori et al., 2008; Kim et al., 2008) and Theory of Planned Behaviour (Stolte et al., 2017; Haerens et al., 2006). There is limited evidence to suggest the effectiveness of these theories in PA interventions (Mears and Jago, 2016), however this could be attributed to poor application of theory and sub-optimal use of theory to develop an intervention (Davis et al., 2015). Physical activity levels are influenced by both individual and environmental factors thus future interventions should include environmental changes to promote behaviour change (Kremers, 2010). There is strong evidence to suggest that the socio-ecological model is effective in promoting and sustaining behaviour change in the school setting (Simon et al., 2014). The socio-ecological

model has been successfully applied in a mainstream school setting (Townsend & Foster, 2011; Kriemler et al., 2010; Simon et al., 2014), however there is a dearth of research into the application of coherent theoretical frameworks in the ID literature (Frey et al., 2017) and specifically in the school setting.

Globally, this is the first study to apply a coherent theoretical framework in a school setting for this population by mapping components of COM-B to the SEM and using behaviour change techniques from the behaviour change techniques taxonomy (Michie et al., 2013) to components of the socio-ecological model. BCTs have been shown to be effective in health behaviour change interventions for the general population (Bird et al., 2013), however the evidence for the use of BCTs in the ID population is less clear (Van-Schijndel-Speet, 2015). Recommendations from a recent systematic review of using BCTs for people with ID by Willems et al. (2017) stated that employing BCTs which underpinned by an explicit theoretical framework and clear reporting of intervention components could contribute to the effectiveness of interventions aimed at this population. The present thesis addressed these recommendations by employing BCTs underpinned by a coherent theoretical framework and clear reporting of the intervention components. BCTs have been employed in walking programmes involving children and adolescents without ID (Carlin et al., 2015) with the most frequently employed including social support, repetition and substitution, feedback and monitoring and goals and planning. To date, no other studies of walking interventions for young people with ID exist however the systematic review of interventions aimed at increasing PA in children and adolescents with ID (Chapter 3) corroborated these findings by Carlin et al. (2015) identifying the same four BCTs in the ID literature. To address the findings of previous research and test the effectiveness of BCTs for children and adolescents with ID, this study employed the most commonly used BCTs including social support, feedback and monitoring and goals and planning. The findings showed that with support from teachers, these BCTs can be applied to PA interventions for young people with ID.

9.2.2 The feasibility of a walking intervention in a school setting

This is the first study to conduct a walking intervention in a school setting. School based physical activity interventions have previously been successful in mainstream schools (Kriemler et al., 2010; Pearson et al., 2015; Van Sluijs et al., 2007). Children and adolescents spend most of their day either travelling to or in school, therefore this setting presents an opportunity for behaviour change. Findings from this study

show that school was a feasible setting for a walking intervention. Compliance to the walking programme was (78.5%), with higher compliance rates in children with ID (82.1%). Lower compliance in peer role models with ID (74.7%) was often due to college or work related commitments. Promoting physical activity in school may be of particular importance for children and adolescents with ID as this population often have low levels of physical activity outside of school, thus this setting may be their best opportunity for engaging in physical activity (Dobbins et al., 2009).

The work comprised within this thesis highlights the role that schools can play in providing opportunities for young people to be physically active throughout the day. Teachers recognised that school could be a suitable environment for physical activity interventions and acknowledged the health enhancing benefits of physical activity for young people with ID. To date, research on PA provision in schools in Northern Ireland has focused solely on timetabled PE (Sport Northern Ireland, 2010) with special schools providing the least PE for pupils. There is limited evidence on the provision of physical activity opportunities for young people with ID throughout the school day. Throughout focus groups in the present thesis, teachers often cited the sports opportunities and gym facilities available to pupils in school however there was less focus on physical activity.

Schools play a key role in PA promotion among children and adolescents who spend the majority of their day either travelling to or in school (Dobbins et al., 2012). Thus PA opportunities during the school day should extend beyond the provision of curricular PE with a focus on activities that can be sustained into adulthood. Walking is the most popular physical activity among adults with ID (Barnes et al., 2013), however there is limited evidence of walking as a physical activity for young people with ID and none of the participants in this study reported walking either for purpose or for leisure. As walking is the second largest contributor to PA in children and adolescents without ID (Payne et al., 2013) and given that walking interventions can increase PA by between 30-60 minutes per week in specific populations (Ogilvie et al., 2007), further consideration is warranted to the potential role schools can play in the promotion of walking as a form of physical activity for children and adolescents with ID.

9.2.3 Involving children and adolescents with ID in intervention development and evaluation

In order to understand what might be effective, it is important to involve children and adolescents in the development of interventions aimed at promoting PA in this population (Lewis, 2014). Although the importance of the involvement of children and adolescents in intervention development is well reported in the non-ID literature (Fernandez et al., 2017; Hesketh et al., 2017; Carlin et al., 2015), there is limited evidence of the involvement of young people with ID in intervention design. There is limited evidence of pupil involvement in the development of school-based PA interventions in mainstream schools (O’Cathain et al., 2013). Similarly, people with ID and specifically young people with ID are often excluded from research, therefore it is particularly important to engage this population in order to tailor PA interventions and provide sustainable opportunities. Van Sluijs and Kriemler (2016) recommended involving participants in the research process to increase the likelihood of developing an acceptable intervention and to ensure intervention success and sustainability.

Previous research has focused on identifying the barriers and facilitators to PA for children and adolescents with ID with a systematic review by Shields et al. (2012) highlighting that the barriers to PA are more often explored than the facilitators and from the perspective of parents and carers. Involvement of stakeholders was a key aspect in the development of the school based walking intervention. A novel contribution of this thesis is the direct involvement of children and adolescents with ID in focus groups to allow for co-production of the walking intervention (Chapter 5). The co-production of the walking intervention with young people with ID aided in the identification of potentially successful intervention components when aiming to increase physical activity in this population.

In addition to the inclusion of children and adolescents with ID in the intervention development phases, focus groups were conducted with these participants post-intervention to explore the experiences of those involved in the school-based walking intervention and identify which components were successful or unsuccessful (Phase 5). Whilst previous research has reported anecdotal evidence on intervention acceptability of walking interventions aimed at increasing PA in typically developing children and adolescents (Sirard et al., 2008; McKee et al., 2007) and in adults with ID (Matthews et al., 2016), this is the first study to report on intervention acceptability from the perspective of children and adolescents with ID. The inclusion of focus groups post-intervention is particularly useful within exploratory studies to determine

the acceptability of the intervention and to provide recommendations for future research (Campbell et al., 2007; Morrison et al., 2013). Throughout the process evaluation focus groups conducted post-intervention, participants identified successful components of the walking intervention including social support from peers, rewards as a motivating factor and pedometers for goal setting. Future interventions aimed at this population should incorporate these components to ensure sustainability.

9.2.4 Feasibility trial findings

9.2.4.1 Recruitment

Recruitment took place over a period of three months (October-December 2016). Overall, the recruitment strategy was effective in recruiting sufficient numbers of participants who met the inclusion criteria. There is no minimum number of participants required to achieve the aims of a feasibility study (Thabane et al., 2010), however the sample size should be adequate to estimate parameters such as recruitment rate (NIHR, 2011). Therefore, a sample size of 40 was deemed appropriate and feasible for the purposes of this study. Purposive sampling was used; of 40 participants approached, 40 (100%) consented to participate in the study. In total, 38 participants completed baseline measures (95%). The recruitment rate in this study is higher than reported in other studies of children and adolescents with ID; for example, Adams et al. (2016) reported a recruitment rate of 58.5% whilst Boddy et al. (2015) reported a recruitment rate of 33% in ID samples.

9.2.4.2 Attrition and adherence

As this was a school-based intervention, all 38 participants who consented to participate in the walking programme completed the programme, therefore there was no drop out. Out of a total of 44 walks across the 12 week period, 2 walks were missed due to school closures (4.5%), 3 walks were missed due to bad weather (6.8%) and 3 walks were missed due to school outings (6.8%). For the peer role models with ID, an average of 2 walks were missed over the course of the 12 week programme and 84.1% of missed walks were due to college or work commitments. Teachers and classroom assistants reported in focus groups post-intervention (Phase 5) that it was difficult to accommodate the walking programme when it reached the maximum of 4 days per week, 30 minutes per day, specifically whilst coordinating children and their peer role models across different departments. In

order to increase adherence in a future study, a maximum of 3 days per week for 30 minutes would be more feasible in a school setting.

9.2.5 Acceptability of outcome measures

9.2.5.1 Physical activity

Physical activity was measured by accelerometer for children with ID and peer role models with ID. Across intervention and control groups, overall accelerometer compliance was comparable to previous studies in this population (57.9%) (Boddy et al., 2015; Ulrich et al., 2011). There is a lack of clear accelerometer protocols in the ID literature (McGarty et al., 2014) and there is often poor reporting of accelerometer compliance in this population. There was poor retention in relation to objective measurement of physical activity with accelerometer compliance decreasing to only 36.8% at T3. Based on a wear time criteria of 4 days (including a weekend day) and 8 hours per day (Boddy et al., 2015), overall compliance with accelerometer wear was 67.9% in the intervention group and 30% in the control group at baseline. At T3, compliance decreased further with only 42.9% of the intervention group and 20% of the control group meeting the wear time criteria. Compliance in the children with ID intervention group was 32.1% at baseline decreasing to 17.9% at T3, whilst the children with ID control group compliance was 20% at baseline decreasing to 10% at T3. Compliance for the peer role model intervention group was 35.7% at baseline, decreasing to 25% at T3, whilst the peer role model control group compliance was 10% at baseline and remained at 10% at T3.

Based on these findings and compliance rates, the protocol to enhance accelerometer compliance was unsuccessful. Every effort was made to ensure optimum adherence to the accelerometer wear time; Parents received easy read guides of when their child should wear the accelerometer, calendars of days of wear, reminder posters to place in the home and letters to remind parents to check if their child was wearing their accelerometer to school and at home. Participants and parents were also aware that if they wore the accelerometer for the specified time (7 days) in school and at home, they would receive a £10 Asda voucher. Teachers and classroom assistants also reminded participants to wear their accelerometer. Despite these reminders and incentives, compliance to the accelerometer wear time protocol was poor.

Accelerometers have been proven to be valid and reliable in the non-ID population (De Vries et al., 2009). Despite the literature on accelerometry for the non-ID

population, there is a lack of evidence of the validity and reliability of accelerometry to provide an accurate measurement of physical activity in the ID population (Hinckson & Curtis, 2013; McGarty et al., 2014). Findings from the process evaluation (Chapter 8) highlighted the lack of engagement of parents which may provide an explanation for the poor accelerometer compliance in this study. As young people with ID are often reliant on parents (Machalicek et al., 2015), the key to increasing wear time compliance could be engaging parents.

It is evident from the findings of this study that accelerometry was not a feasible measure of physical activity in young people with ID due to issues surrounding wear time compliance. This is consistent with recent findings by Ptomey et al. (2017) who also identified poor compliance with accelerometer protocol in the ID population. Future research should aim to use other measures of physical activity for this population; whilst the limitations of self-report methods are well reported and specifically for young people with ID when self report methods may rely on proxy reporting by parents, teachers or carers, other measures such as direct observation may be a more accurate measure of physical activity for children and adolescents with ID.

9.2.5.2 Physical fitness

The 6 minute walk test (6MWT) was used to measure physical fitness in children with ID and peer role models with ID. The 6MWT test reflected the intervention content and was a pragmatic approach to measuring physical fitness in this population in a school setting as it did not require any specialist equipment, was feasible to carry out within school grounds or sports hall in case of inclement weather and participants were able to easily understand the instructions for participation in the test. Furthermore, this method of measuring physical fitness was acceptable as there was high compliance in children with ID, 100% of participants completed the 6MWT at baseline, T2 and end of intervention. Compliance was lower for peer role models with ID at T2 (88.2%) and end of intervention (82.4%). This is consistent with findings by (Casey et al., 2012; Nasuti et al., 2013) who showed acceptable validity and reliability for measuring physical fitness in individuals with ID.

9.2.5.3 Emotional and behavioural wellbeing

The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) was used to measure emotional and behavioural wellbeing. The SDQ was an acceptable

measure of emotional and behavioural wellbeing in children with ID and peer role models with ID when completed by teachers. This is corroborated by previous research by Emerson (2005) who found that the SDQ is robust measure of emotional and behavioural wellbeing in children and adolescents with ID. There was a 100% compliance rate at baseline and end of intervention. Although the SDQ was an appropriate questionnaire for this study, future studies may wish to include more comprehensive measures to assess psycho-social wellbeing in this population.

9.2.6 Trends observed for the intervention and control groups

Evidence of the impact of the walking intervention on primary and secondary outcomes was reported as part of the feasibility study (Chapter 7). Trends indicative of improvements in physical activity, physical fitness and emotional and behavioural wellbeing were observed in the children with ID and peer role models with ID intervention group. Improvements were also observed in relation to emotional and behavioural wellbeing in the control group, therefore it is difficult to determine if these improvements are directly related to the walking intervention.

As previously mentioned, this is a feasibility study therefore it is not sufficiently powered to identify significant changes in outcomes however the findings show a trend for improvement in physical activity, physical fitness and emotional and behavioural wellbeing and are comparable to previous research. Golubovic et al. (2012) reported that tailored physical activity interventions were effective in increasing physical fitness in children with ID. Similarly, Shields et al. (2013) reported an increase in physical activity levels of young people with Down Syndrome as a result of a community-based physical activity programme. There is less evidence of an improvement in emotional and behavioural wellbeing due to physical activity interventions in the ID literature pertaining to children and young people, however Ahn and Fedewa (2011) stated that physical activity can lead to improved mental health outcomes for children without ID. Although previous studies provide evidence of the health enhancing benefits of physical activity in children and adolescents with ID, no studies have tested a school-based multi-component walking intervention in relation to physical activity, physical fitness and emotional and behavioural wellbeing in this population.

9.2.6.1 Physical activity

Positive trends for physical activity levels were observed in the children with ID and

peer role models with ID intervention group suggesting that participation in the walking programme increased physical activity levels. Children with ID in the intervention group decreased sedentary behaviour from baseline to end of intervention and increased moderate and vigorous physical activity by 21% and 49% respectively. This trend was also evident for the peer role models with ID intervention group whose sedentary behaviour decreased from baseline to end of intervention and moderate and vigorous physical activity increased by 21% and 47% respectively. It is difficult to identify a trend within the control group due to poor wear time compliance leaving a small sample size for each age group at baseline (children with ID n=2, peer role models with ID n=1) and post-intervention (children with ID n=1, peer role models with ID n=1). As the walking intervention was aimed at increasing physical activity levels in children with ID, it was not appropriate to combine the age groups for analysis, as it was empirical to differentiate between results from the children with ID as the peer role models with ID were a component of the walking intervention but it was also important to measure outcomes for this group too.

9.2.6.2 Physical fitness

Physical fitness was measured by the 6MWT as it has previously been found to be a valid and reliable measure in this population (Nasuti et al., 2013) and this test reflected the content of the walking intervention. Positive trends for improvement in metres walked in the 6MWT were observed for the children with ID and peer role models with ID in the intervention group whilst a negative trend was observed in the children with ID and peer role models with ID control groups. Previous studies have shown the role of physical activity in improving physical fitness including aerobic capacity and muscular strength and endurance in children and adolescents with ID (Collins & Staples, 2017; Gulobovic et al., 2012). Although studies have shown the validity and reliability of the 6 MWT in this population (Casey et al., 2012; Elmaghoub et al., 2011; Nasuti et al., 2013), there is little evidence of this test being used for pre and post intervention measures.

9.2.6.3 Emotional and behavioural wellbeing

Although previous studies have highlighted the benefits of physical activity on mental health of children and adolescents without ID (Biddle & Asare, 2011), there is limited evidence in young people with ID. The results of this feasibility study showed positive trends for improvements on a number of subscales and total difficulties scores for the children with ID and peer role models with ID intervention groups. However,

improvements were also observed for the children with ID and peer role models with ID control groups, therefore it is difficult to attribute these changes to the walking intervention. The children with ID intervention group showed a decrease in 4 subscales, an increase in prosocial behaviour and a notable decrease in total difficulties from baseline to post-intervention.

In summary, there were no deleterious effects of the walking intervention on the children with ID or peer role models with ID intervention groups.

9.7 Strengths

This is the first study to develop and test a theoretically underpinned school-based multi-component walking intervention in the target population. The synthesising of the evidence base in the systematic review provided an overview of the existing literature in order to inform the development of the intervention. The co-production of the intervention with stakeholders through focus groups and workshops ensured the intervention was tailored for children with ID and the school setting. The application of a coherent theoretical framework using both individual and systems change theories is unique in this field and addresses previous recommendations for the use of a theory in interventions aimed at this population. The process evaluation conducted to identify the successful intervention components and the methodological challenges is also novel in the field of ID.

9.8 Limitations

The systematic review conducted in phase 1 included only 5 studies. This may be due to the inclusion and exclusion criteria which restricted the inclusion of studies that only used objective measures of PA, therefore this may have excluded other potentially relevant papers. The small number of studies eligible for inclusion limits the conclusions that can be drawn from the systematic review in relation to PA interventions aimed at children and adolescents with ID. This study was conducted in the school setting in Northern Ireland and therefore findings may not be representative of the ID population or generalisable to other settings. Lack of long-term follow up measures limits conclusions on the sustainability of the walking programme. The study design and the resulting small sample size precluded statistical null hypothesis testing and meant that only descriptive statistics could be produced limiting conclusions on the effectiveness of the intervention.

There was poor compliance to the accelerometer wear time protocol, particularly at the post-intervention measurement point which made comparisons between intervention and control groups difficult. Post-intervention measurements were conducted at the end of the school term, this may have impacted upon adherence to the walking intervention as participants were often out at end of term trips and events.

9.9 Contribution to knowledge

This is the first study to develop, test and evaluate a theoretically underpinned school-based multi-component walking intervention for children with ID. A number of components of the walking intervention are unique to this study; 1) co-production of the walking intervention with children and young people with ID, 2) an incremental walking intervention in a school setting, 3) application of individual and systems change theories using COM-B and the SEM, 3) a peer role model system whereby both peers have an ID, 5) pedometers used for goal setting in this population, 6) focus groups conducted post-intervention with children and adolescents with ID to identify successful intervention components and highlight recommendations for future interventions.

9.10 Conclusions and recommendations

This study has identified a number of recommendations for future research involving young people with ID;

- 1) The methodological challenges highlighted throughout this thesis should be overcome in order to scale up this school-based multi-component walking intervention.
- 2) Future walking interventions should apply a coherent theoretical framework using both individual and systems change theories to ensure sustainable behaviour change.
- 3) Children and adolescents with ID can participate in physical activity together and a peer buddy system between young people with ID is successful.
- 4) The development of specific PA guidelines for young people with ID
- 5) Effective strategies to engage parents of children and adolescents with ID
- 6) Use of alternative measures of physical activity to overcome poor compliance with accelerometer wear time criteria for young people with ID such as self-report, direct observation, pedometers, wrist-worn accelerometers.
- 7) Clear reporting of intervention components for replicability.

9.10.1 Theory

This doctoral thesis has highlighted the lack of and poor application of theory in physical activity interventions aimed at the ID population, particularly in the systematic review conducted in phase 1. Those interventions that have adopted a theoretical approach have often used individual level theory (Moore et al., 2015) and have demonstrated poor application and lack of clear reporting of the theoretical underpinning. More recently, the application of both individual and systems change theories has been proposed in order to design more effective interventions. The present thesis applied both individual and systems change theories and despite the lack of long term follow up measures, the promising results suggest that this could facilitate sustainable behaviour change for young people with ID. Future studies should aim to further explore the incorporation of a coherent theoretical framework using both individual and systems change theories in interventions targeted at this population.

9.10.2 Co-production

The present thesis involved stakeholders in the co-production of the walking intervention through a series of workshops. There is a lack of evidence of involving people with ID in research, and more specifically young people with ID, however it is important to co-produce interventions targeted in this population in order to tailor interventions and make reasonable adjustments to increase the likelihood of success. The involvement of teachers and classroom assistants, for interventions in the school setting, provides an invaluable insight into the structure and logistics of the school day and enables researchers to tailor intervention for implementation in this environment. In future studies, co-production of physical activity interventions for the ID population should be an integral component of intervention development and design.

9.10.3 Logic model

Recent thinking has moved towards developing a logic model to ensure better planning, implementation and evaluation of interventions. Logic models can help to identify intervention inputs, activities, mechanisms and outcomes and to improve the quality of intervention. Although this doctoral thesis did not involve the development of a logic model, this may be an important model to inform intervention development and identify the potential effectiveness of the intervention prior to implementation.

Future research should examine the effect of a complex system on the development of a logic model.

9.10.4 Setting

The school setting has often been used to quantify PA in children and adolescents with ID, however the use of this setting to increase PA among this population lacks evidence. Although the challenges of implementing a PA intervention in the school setting for young people with ID have been highlighted in this thesis (Chapter 8), this setting provides a suitable environment to form habits and facilitate sustainable health behaviour change in this population. Future interventions aimed at children and adolescents with ID should continue to investigate the potential of the school setting in providing a sustainable, low cost, low requirement for resources opportunity for PA during the school day.

9.11 Conclusion

In conclusion, this thesis has met the aims and objectives of developing and testing a school-based multi-component walking intervention for children with ID. It is evident that there are few physical activity interventions aimed at young people with ID and those that exist are of poor quality, do not clearly report intervention components and often lack a theoretical basis. Findings from this doctoral thesis show that young people with ID are not meeting the current recommended guidelines for physical activity and are not sufficiently active to produce health-enhancing benefits. Results of the feasibility trial suggested that a school-based walking intervention was feasible for this population and participation in walking during the school day was associated with positive trends for improvement in physical activity, physical fitness and total emotional and behavioural difficulties in children and adolescents with ID. The process evaluation conducted post intervention identified the successful intervention components and the methodological challenges of a walking intervention in the school setting targeted at the ID population. Thus physical activity interventions in the school setting have the potential to increase physical activity participation and begin to address health inequalities in this population.

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APPENDICES

Appendix 1

PIS and Consent Form for Parent/Guardian and Consent Form for Child's Participation

Project Title

Developing walking in schools for children and young people with learning disabilities.

My name is Anne Johnston and I am a PhD student at Ulster University.

You are being invited to take part in a research study, which is being conducted by the Institute of Nursing and Health Research and Sport and Exercise Science Research Institute within Ulster University. We will be seeking your permission for you to take part in a focus group and a workshop with other parents.

Your child is also being invited to take part in this study and will receive a separate information and assent form, where they can make their own decision to take part. You can also provide consent for your child to take part in the study on the consent form attached to this information sheet.

Before you decide if you want to take part, it is important that you understand what the research is for and what you will be asked to do. Please read the following information and do not hesitate to ask any questions about anything that might not be clear to you. Make sure you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

Aim of the study

This study aims to develop a school based walking intervention for children with learning disabilities.

What will be involved in the study?

Phase 1 of the study will be focus groups whereby children with learning disabilities (11-12 years), peer role models with learning disabilities (16-19 years), parents, teachers/classroom assistants and principals will take part to identify the motivators, enablers and barriers to promoting a walking intervention and aid in the development of the walking intervention. A focus group is a group discussion about a certain topic, in this case, a walking intervention. This will involve a group discussion with 3-7 others around physical activity and the walking intervention. Focus groups will last for approximately 60 minutes. Phase 2 will be workshops with the same participants from phase 1 to develop the intervention and discuss their perception of the intervention. Walk routes within school grounds will also be identified during phase 2 with input from participants. Workshops will last for approximately 60 minutes. Phases 1 and 2 will take place throughout the school year from September to June. Phases 1 and 2 will take place within the school.

Do I have to take part?

No. Participation in the study is entirely voluntary and it is up to you to make the decision. If you do decide to take part, you will be given a consent form to sign and your child will be provided with an information sheet and an assent form, which means they can provide their own consent to take part. If you or your child agrees to take part and then change your mind then you can withdraw from the study at any time without giving a reason. Any data already collected up to the date of withdrawal of the participant will still be included in the study.

Risks or disadvantages:

This is a low risk study. There are few risks or disadvantages associated with this study. If at any point concerns are raised by the parents, children, peer role models, teachers/classroom assistants or principals then these will be addressed immediately and confidentially by me

Are there any possible benefits of taking part?

The benefits of taking part in the study are that the children with learning disabilities and peer role models with learning disabilities will be given the opportunity to increase their daily physical activity levels within school. The main benefit of taking part in the study is that it will provide information that will be important for researchers to understand the effects of such physical activity programmes on children and young people with learning disabilities. This could potentially be significant in developing future programmes and further increasing accessible opportunities to take part in physical activity for children and young people with learning disabilities.

What happens when the study ends?

When the study ends, information on results of the study will be provided to the school for participants to access. You can continue to keep in touch with the researcher regarding any future research or if you have any questions at any point in the future.

What happens if something goes wrong?

It is very unlikely that anything will go wrong within the research study, however as the study is being conducted by Ulster University, it has procedures in place for investigating, reporting and recording any adverse events. Any complaints will be taken very seriously and you can contact the following if you wish to make a complaint;

Chief Investigator, Laurence Taggart:

E-mail: l.taggart@ulster.ac.uk

Telephone: 0044 2890366538

Address: Room 12J19

Institute of Nursing and Health Research

Ulster University
Shore Road, Newtownabbey
BT37 0QB

Nick Curry in the Research Office:

E-mail: n.curry@ulster.ac.uk

Telephone: 028 90366629

Address: Room 01H12

Research and Innovation
Ulster University
Shore Road, Newtownabbey
BT37 0QB

Will my information be kept confidential?

Yes. All information and data will be securely kept in a locked filing cabinet in the researcher's office at Ulster University Jordanstown campus. Electronic data will be stored on a computer in the researcher's office and will not be accessible through university domains. Electronic data may also be stored on the researcher's laptop, which is encrypted, password protected, stored in a locked cupboard and only used for the purpose of this research.

What will happen to the results of the study?

Findings from the study will be disseminated to participants. Findings will be included in the thesis as part of this PhD study. Findings may also be used in publications and presented at conferences. It is hoped that results will lead to further research in this area and lead to a greater understanding of how to develop future programmes designed to increase the physical activity levels of children and young people with learning disabilities. There may also be opportunity for wider implementation of the walking intervention for children with learning disabilities, if it is deemed to be successful.

Who has reviewed this study?

This study has been approved by an ethics committee in accordance with Ulster University procedures.

Contact details: For further information regarding the study and if you have any questions, you can contact Anne Johnston:

- **Email:** Johnston-A41@email.ulster.ac.uk
- **Address:** Room 12J06
Ulster University, Jordanstown Campus, Shore Road,
Newtownabbey, BT37 0QB

Parent/Guardian Consent Form**Please initial each box**

1. I confirm that I have read and understood the information leaflet for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without my rights being affected. ☐
☐
3. I agree to take part in the focus groups of the above study. ☐
4. I agree to take part in the workshops of the above study.

Name of Parent/Guardian: -----

Signed: -----

Date: -----

Name of Researcher: -----

Signed: -----

Date: -----

Parent's Consent Form for Child's Participation**Please initial each box**

1. I confirm that I have read and understood the information leaflet for the above study and have had the opportunity to ask questions. ☐
2. I understand that my child's participation is voluntary and that they are free to withdraw at any time, without giving any reason, and without their rights being affected. ☐
☐
3. I give consent for my child to take part in the focus groups of the above study. ☐
4. I give consent for my child to take part in the workshops of the above study.

Name of Parent/Guardian: -----

Signed: -----

Date: -----

Name of Researcher: -----

Signed: -----

Date: -----

Appendix 2

PIS and Consent Form for Teachers/Classroom

Assistants and Principals

Project Title

Developing walking in schools for children and young people with learning disabilities.

My name is Anne Johnston and I am a PhD student at Ulster University.

You are being invited to take part in a research study, which is being conducted by the Institute of Nursing and Health Research and Sport and Exercise Science Research Institute within Ulster University. Before you decide if you want to take part, it is important that you understand what the research is for and what you will be asked to do. Please read the following information and do not hesitate to ask any questions about anything that might not be clear to you. Make sure you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

Aim of the study

This study aims to develop a school based walking intervention for children with intellectual disabilities.

What will be involved in the study?

Phase 1 of the study will be focus groups whereby children with learning disabilities (11-12 years), peer buddies with learning disabilities (16-19 years), parents, teachers/classroom assistants and principals will take part to identify the motivators, enablers and barriers to promoting a walking intervention and aid in the development of the walking intervention. A focus group is a group discussion about a certain topic, in this case, a walking intervention. This will involve a group discussion with between 3-7 other teachers around physical activity and the walking intervention. Focus groups will last for approximately 60 minutes. Phase 2 will be workshops with the same participants from phase 1 to develop the intervention and discuss their perception of the intervention. Walk routes within school grounds will also be identified during phase 2 with input from participants. Workshops will last for approximately 60 minutes. Phases 1 and 2 will take place throughout the school year from September to June. Phases 1 and 2 will take place within the school.

Do I have to take part?

No. Participation in the study is entirely voluntary and it is up to you to make the decision. If you do decide to take part, you will be given a consent form to sign. If you agree to take part and then change your mind then you can withdraw from the study

at any time without giving a reason. Any data already collected up to the date of withdrawal of the participant will still be included in the study.

Risks or disadvantages:

This is a low risk study. There are few risks or disadvantages associated with this study. If at any point concerns are raised by the parents, children, peer role models, teachers/classroom assistants or principals then these will be addressed immediately and confidentially by me.

Are there any possible benefits of taking part?

The benefits of taking part in the study are that the children with intellectual disabilities and peer buddies with intellectual disabilities will be given the opportunity to substantially increase their daily physical activity levels within school. The main benefit of taking part in the study is that it will provide information that will be important for researchers to understand the effects of such physical activity programmes on children and young people with intellectual disabilities. This could be potentially be significant in developing future programmes and further increasing accessible opportunities to take part in physical activity for children and young people with intellectual disabilities.

What happens when the study ends?

When the study ends, information on results of the study will be provided to the school for participants to access. You can continue to keep in touch with the researcher regarding any future research or if you have any questions at any point in the future.

What happens if something goes wrong?

It is very unlikely that anything will go wrong within the research study, however as the study is being conducted by Ulster University, it has procedures in place for investigating, reporting and recording any adverse events. Any complaints will be taken very seriously and you will be given information and you can contact the following if you wish to make a complaint:

Chief Investigator, Laurence Taggart:

E-mail: l.taggart@ulster.ac.uk

Telephone: 0044 2890366538

Address: Room 12J19

Institute of Nursing and Health Research

Ulster University

Shore Road, Newtownabbey

BT37 0QB

Nick Curry in the Research Office:

E-mail: n.curry@ulster.ac.uk

Telephone: 028 90366629

Address: Room 01H12

Research and Innovation

Ulster University

Shore Road, Newtownabbey

BT37 0QB

Will my information be kept confidential?

Yes. All information and data will be securely kept in a locked filing cabinet in the researcher's office at Ulster University Jordanstown campus. Electronic data will be stored on a computer in the researcher's office and will not be accessible through university domains. Electronic data may also be stored on the researcher's laptop, which is encrypted, password protected, stored in a locked cupboard and only used for the purposes of this research.

What will happen to the results of the study?

Findings from the study will be disseminated to participants. Findings will be included in the thesis as part of this PhD study. Findings may also be used in publications and presented at conferences. It is hoped that results will lead to further research in this area and lead to a greater understanding of how to develop future programmes designed to increase the physical activity levels of children and young people with intellectual disabilities. There may also be opportunity for wider implementation of the walking intervention for children with learning disabilities, if it is deemed to be successful.

Who has reviewed this study?

This study has been approved by an ethics committee in accordance with Ulster University procedures.

Contact details: For further information regarding the study and if you have any questions, you can contact Anne Johnston:

- Email: Johnston-A41@email.ulster.ac.uk
- Address: Room 12J06

Ulster University
Jordanstown Campus
Shore Road
Newtownabbey
BT37 0QB

Teachers/Classroom Assistants and Principals Consent Form

Please initial each box

1. I confirm that I have read and understood the information leaflet for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without my rights being affected. ☐
☐
3. I agree to take part in the focus groups of the above study ☐
4. I agree to take part in the workshops of the above study





Name of Teacher/Classroom assistant or Principal: -----




Signed: ----- Date: -----




Name of Researcher: -----

Signed: ----- Date: -----

Appendix 3
Children's Information Sheet

	<p>Hi, my name is Anne Johnston.</p>
	<p>I am a student at Ulster University.</p>
	<p>I am doing a study. A study is a way of finding things out. This information sheet tells you about the study.</p> <p>This will help you decide if you want to take part in the study or not.</p>
	<p>I want to find out what types of physical activity do you like to do? Walking, football, swimming, running? Who helps you to do these things? What stops you from doing these things?</p>

	<p>I would like you to join a small group to talk about physical activity. This group is called a focus group.</p> <p>There will be between 4-8 people in the group.</p> <p>I will hold the focus group in your school. A teacher or classroom assistant from your school who you know will be in the focus group.</p>
	<p>I will record what you say during the focus group. Others in the group and other people involved in the study will be the only people who hear what you say.</p>
	<p>You can tell me 'Yes' if you want to take part.</p>
	<p>You can tell me 'No' if you do not want to take part.</p>
	<p>If you want to be in the study, you must sign your name on a special form called a consent form.</p> <p>If you find it difficult to write, someone else can help you.</p>

	<p>After I speak with you, I will write down everything I found out.</p> <p>All the words will be put on a computer.</p> <p>This will help me to understand what you said.</p>
	<p>I and other people involved in the study will be the only people who will read your words, but if you tell us that someone is hurting you or you are hurting someone else I will have to pass this information on to your teacher.</p>
	<p>You must ask your mum, dad or guardian if it is ok for you to take part, they also need to sign your consent form.</p> <p>Thank you for looking at this.</p>

Anne Johnston

E-mail: Johnston-A41@email.ulster.ac.uk

Anne's signature:-----

Principal's signature:-----

Appendix 4

Children's Assent form

I say it is OK for me to take part in the focus group and workshop at school.

I have seen the information sheet about the study.

I understand what it says.

I had a chance to ask questions about it.

I agree to take part in the focus groups

YES ☐ NO ☐

I agree to take part in the workshops

YES ☐ NO ☐

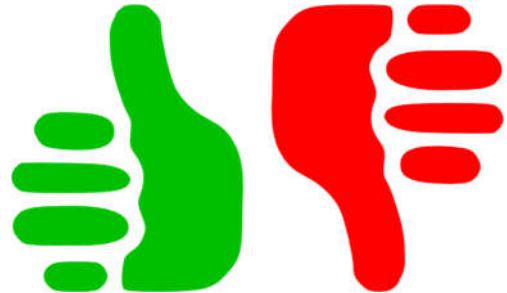
I say it is OK for my voice to be recorded when we talk.

YES ☐ NO ☐

If I do not want to be in the study anymore, I do not have to.

I can tell Anne or a teacher if I do not want to be in the study anytime.

Anne will not let anyone know who is in the study. She may write what I say and do but no one will know it was me.







My signature




Date




Anne's signature

Date

Appendix 5
Peer role model's information sheet

	<p>Hi, my name is Anne Johnston.</p>
	<p>I am a student at Ulster University.</p>
	<p>I am doing a study. A study is a way of finding things out. This information sheet tells you about the study.</p> <p>This will help you decide if you want to take part in the study or not.</p>
	<p>I want to find out what types of physical activity do you like to do? Walking, football, swimming, running? Who helps you to do these things? What stops you from doing these things?</p>

	<p>I would like you to join a small group to talk about physical activity. This group is called a focus group.</p> <p>There will be between 4-8 people in the group.</p> <p>I will hold the focus group in your school. A teacher or classroom assistant from your school who you know will be in the focus group.</p>
	<p>I will record what you say during the focus group. Others in the group and other people involved in the study will be the only people who hear what you say.</p>
	<p>You can tell me 'Yes' if you want to take part.</p>
	<p>You can tell me 'No' if you do not want to take part.</p>
	<p>If you want to be in the study, you must sign your name on a special form called a consent form.</p> <p>If you find it difficult to write, someone else can help you.</p>

	<p>After I speak with you, I will write down everything I found out.</p> <p>All the words will be put on a computer.</p> <p>This will help me to understand what you said.</p>
	<p>I and other people involved in the study will be the only people who will read your words, but if you tell us that someone is hurting you or you are hurting someone else I will have to pass this information on to your teacher.</p>
	<p>You must ask your mum, dad or guardian if it is ok for you to take part, they also need to sign your consent form.</p> <p>Thank you for looking at this.</p>

Anne Johnston

E-mail: Johnston-A41@email.ulster.ac.uk

Anne's signature:-----

Principal's signature:-----

Appendix 6

Peer role model's assent form

I say it is OK for me to take part in the focus group and workshop at school.

I have seen the information sheet about the study.

I understand what it says.

I had a chance to ask questions about it.

I agree to take part in the focus groups

YES ☐ NO ☐

I agree to take part in the workshops

YES ☐ NO ☐

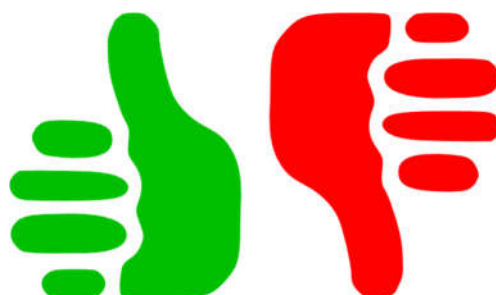
I say it is OK for my voice to be recorded when we talk.

YES ☐ NO ☐

If I do not want to be in the study anymore, I do not have to.

I can tell Anne or a teacher if I do not want to be in the study anytime.

Anne will not let anyone know who is in the study. She may write what I say and do but no one will know it was me.



My signature

Date

Anne's signature

Date

Appendix 7

Interview Schedule for Children with Intellectual Disabilities

Ensure all children participating in focus group have written parental/guardian consent and have returned consent form prior to commencement of focus group.

Focus group ground rules:

- **The facilitator will guide the conversation and keep participants engaged**
- **If participants move off topic, the facilitator will redirect the conversation back to the interview schedule**
- **The facilitator will ensure each participant is provided with the opportunity to engage**
- **Participants can freely express their opinions without consequence**

Introduction:

- Introduce self
- Explain the purpose and nature of the project and their role in the study
- Obtain written consent for participation and consent for use of Dictaphone
- Explain confidentiality and anonymity

Physical Activity:

1. What type of physical activities do you like to do?
2. Tell me about the physical activity you do in school?
3. Tell me about the physical activity you do outside of school?
4. Who helps you to take part in these physical activities?
5. What stops you from taking part in physical activities?
6. Do you like walking?
7. Do you walk much? How often and for how long?
8. Do you think walking is good for you?
9. Would you like to take part in walking during school?
10. Do you think it would be easier for you to walk with a peer role model or walk leader who is older than you?
(A peer role model is an older child from your school who will lead your walk, make sure walking is fun, someone who you can talk to and can help you to walk in school.).
11. Would you like to be able to count the steps you walk?
12. Would you like to take part in a walking competition?

Friends:

13. Do you like to do activities with friends?
14. Do you take part in more activities when you are with your friends?
15. Do you find it easier to take part in activities with friends?
16. Are there any other comments you would like to make?

Close:

Thank participants for their time and inform them of what happens to the information.

Appendix 8

Interview Schedule for Peer Role Models

Ensure all children participating in focus group have written parental/guardian consent and have returned consent form prior to commencement of focus group.

Focus group ground rules:

- **The facilitator will guide the conversation and keep participants engaged**
- **If participants move off topic, the facilitator will redirect the conversation back to the interview schedule**
- **The facilitator will ensure each participant is provided with the opportunity to engage**
- **Participants can freely express their opinions without consequence**

Introduction:

- Introduce self
- Explain the purpose and nature of the project and their role in the study
- Obtain written consent for participation and consent for use of Dictaphone
- Explain confidentiality and anonymity

Physical Activity:

17. What type of physical activities do you like to do?
18. Tell me about the physical activity you do outside of school?
19. Who helps you to take part in these physical activities?
20. Do you like walking? Why?
21. Do you walk much? How often and for how long?
22. Who do you walk with?
23. Where do you walk?
24. Do you walk to school?
25. Do you do any walking during school?
26. Do you do any walking with friends or family?
27. Do you feel it is easier for you to walk with friends or family?
28. Do you think walking is good for you?
29. Would you like to take part in a walking project during school?
30. Do you think you could be a peer role model and help a younger child to take part in the walking project?
(A peer role model is an older child from your school who will lead your walk, make sure walking is fun, someone who you can talk to and can help you to walk in school.).
31. What would stop you from taking part in a walking programme in school?
32. Would you like to be able to count the steps you walk?
33. Would you like to take part in a walking competition?
34. Would you like walking areas or zones in school?
35. Is there anything else you would like to say?

Close:

Thank participants for their time and inform them of what happens to the information.

Appendix 9

Interview Schedule for Teachers/Classroom

Assistants

Focus group ground rules:

- **The facilitator will guide the conversation and keep participants engaged**
- **If participants move off topic, the facilitator will redirect the conversation back to the interview schedule**
- **The facilitator will ensure each participant is provided with the opportunity to engage**
- **Participants can freely express their opinions without consequence**

Introduction:

- Introduce self
 - Explain the purpose and nature of the project and their role in the study
 - Obtain written consent for participation and consent for use of Dictaphone
 - Explain confidentiality anonymity
1. What type of physical activity do children participate in during school?
 2. Tell me about the children's preference for physical activity or sedentary activities?
 3. Are the children involved in any type of walking programme during the school day?
 4. Do you feel walking would be a beneficial activity for the children?
 5. Do you feel the children would participate fully in a walking programme?
 6. Would you be prepared to support children in taking part in a walking programme throughout the school day?
 7. Could opportunities be offered to children to participate in walks throughout the school day and could time be allocated to this during the school day?
 8. Could the walks take place during class time?
 9. How many walks would it be feasible to have in a school day?
 10. Could competitions and incentives be offered in order to encourage children to participate in the walks?
 11. Do you feel walking zones/routes could be established in school grounds?
 12. Do you feel there are any barriers to children taking part in walking in school?
 13. Do you feel children would be more likely to take part in a walking programme when in the company of friends/peers?
 14. Would children benefit from the use of peer role models to encourage them/motivate them to take part in walking and lead the walks?
 15. Would it be possible to work with 16-18 year olds as peer role models for the younger children (11-13 years) and support them in taking part in a walking programme within school grounds throughout the school day? (Each child (11-13 years) would be assigned a peer role model (16-18 years) who would support them in taking part in the walking programme throughout the school day. The peer role model will aim to walk at a pace which elicits moderate intensity physical activity (children slightly out of breath but able to maintain a conversation and feeling slightly warmer). Moderate intensity activity will vary

for each child and the peer role model can adjust the pace to suit the needs of the child.

16. Do you feel it would be feasible for young people and their peer role models to take part in these walks in pairs without a member of staff walking with them?
17. Any other comments?

Close:

Thank participants for their time and inform them of what happens to the information.

Appendix 10

Interview Schedule for Principals

Focus group ground rules:

- **The facilitator will guide the conversation and keep participants engaged**
- **If participants move off topic, the facilitator will redirect the conversation back to the interview schedule**
- **The facilitator will ensure each participant is provided with the opportunity to engage**
- **Participants can freely express their opinions without consequence**

Introduction:

- Introduce self
 - Explain the purpose and nature of the project and their role in the study
 - Obtain written consent for participation and consent for use of Dictaphone
 - Explain confidentiality and anonymity
1. Would you be prepared to support teachers and children in participating in a walking programme during the school day? How?
 2. Could opportunities be offered to children to participate in walks within school grounds throughout the school day?
 3. How do you feel about children taking part in the walking programme during class time?
 4. Could walking zones/routes be established within school grounds?
 5. What would you expect the barriers to be for promoting a walking intervention for children with learning disabilities in school?
 6. How do you feel children could be motivated to take part in a walking intervention? (incentives, competitions, rewards)
 7. Do you feel there could be a change in organisational structure within the school in order to facilitate the walking programme? For example, a change in routine?
 8. Could older pupils (16-18 years) be peer role models for the younger children (11-13 years) to support them in participating in a walking programme during school?
 9. Could the use of peer role models encourage/motivate children to take part in walking during school? How?
 10. Do you feel it would be feasible for young people and their peer role models to take part in these walks in pairs without a member of staff walking with them?
 11. What do you feel would help make a walking intervention successful in this school?
 12. Any other comments?

Close:

Thank participants for their time and inform them of what happens to the information.

Appendix 11

Information for Parent/Guardian and Consent Form for Child's Participation

Project Title

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities.

My name is Anne Johnston and I am a PhD student at Ulster University.

Your child is being invited to take part in a research study, which is being conducted by the Institute of Nursing and Health Research and Sport and Exercise Science Research Institute within Ulster University. We will be seeking your permission for your child to take part in the study.

Your child will be offered the opportunity to take part in a walking programme in school and a focus group when the walking programme has finished. Your child will receive a separate information and assent form, where they can make their own decision to take part. You can also provide consent for your child to take part in the study on the consent form attached to this information sheet.

Before you decide if you want your child to take part, it is important that you understand what the research is for and what they will be asked to do. Please read the following information and do not hesitate to ask any questions about anything that might not be clear to you. Make sure you are happy before you decide what to do. Thank you for taking the time to consider this invitation.

Aim of the study

This study aims to test a school based walking programme for children and young people with learning disabilities. This will help us to determine which parts of the walking programme are effective.

What will be involved in the study?

Children (9-13 years) and adolescents (15-19 years) will take part in a walking programme during the school day for 12 weeks (commencing January 2017). There will be a maximum of 1 walk per day and the walk duration will increase from 15 minutes to 30 minutes over the course of the 12 week programme.

Children will be matched with an older pupil (peer role model) to participate in the walks. Children and peer role models will wear an accelerometer (a small red box on a belt which is attached around the waist) for 8 days to measure their physical activity at four time points throughout the intervention (beginning, middle, end and 6 week follow up). Children and peer role models will also be provided with a pedometer (a small device which measures step count) to allow them to see how many steps they are achieving during each walk. Height and weight will also be measured in conjunction with the school nurse. Children and peer role models will be supervised at all times during walks by teachers and classroom assistants. Walk routes will be developed within school grounds or at a suitable location close to the school. Small incentives will be offered to children and peer role models for their

participation in the walking programme and children and peer role models will receive a £10 voucher at the end of the walking programme for wearing and returning the accelerometer at each of the four time points.

Children and peer role models will take part in focus groups when the walking programme has ended. This will allow the researcher to understand which parts of the walking programme were most effective. A focus group is a group discussion about a certain topic, in this case, a walking intervention. This will involve a group discussion with 3-7 others around the walking intervention. Focus groups will last for approximately 60 minutes.

Focus groups will be audio recorded. Only others in the group will hear what your child says. The researcher, the chief investigator and an additional investigator will be the only people who have access to the recordings.

Before and after the walking programme, you will be given a Strengths and Difficulties Questionnaire (SDQ) to complete for your child, which will measure the emotional wellbeing of your child before and after taking part in the walking programme.

Does my child have to take part?

No. Participation in the study is entirely voluntary and it is up to you to make the decision. If you do decide that your child can take part, you will be given a consent form to sign and your child will be provided with an information sheet and an assent form, which means they can provide their own consent to take part. You can choose for your child to take part in the walking programme and/or the focus group by initialing the boxes on the consent form provided. If you or your child agrees to take part and then change your mind then you can withdraw from the study at any time without giving a reason. Any data already collected up to the date of withdrawal of the participant will still be included in the study.

Risks or disadvantages:

This is a low risk study. There are few risks or disadvantages associated with this study. If at any point concerns are raised by the parents, children, peer role models, teachers/classroom assistants or principals then these will be addressed immediately and confidentially by me.

Are there any possible benefits of taking part?

The benefits of taking part in the study are that the children with learning disabilities and peer role models with learning disabilities will be given the opportunity to increase their daily physical activity levels within school. The main benefit of taking part in the study is that it will provide information that will be important for researchers to understand the effects of such physical activity programmes on children and young people with learning disabilities. This could potentially be significant in developing future programmes and further increasing accessible opportunities to take part in physical activity for children and young people with learning disabilities.

What happens when the study ends?

When the study ends, information on results of the study will be provided to the school for participants to access. You can continue to keep in touch with the researcher regarding any future research or if you have any questions at any point in the future.

What happens if something goes wrong?

It is very unlikely that anything will go wrong within the research study, however as the study is being conducted by Ulster University, it has procedures in place for investigating, reporting and recording any adverse events. Any complaints will be taken very seriously and you can contact the following if you wish to make a complaint;

Chief Investigator, Laurence Taggart:

E-mail: l.taggart@ulster.ac.uk

Telephone: 0044 2890366538

Address: Room 12J19

Institute of Nursing and Health Research

Ulster University

Shore Road, Newtownabbey

BT37 0QB

Nick Curry in the Research Office:

E-mail: n.curry@ulster.ac.uk

Telephone: 028 90366629

Address: Room 26A17

Research and Innovation

Ulster University

Shore Road, Newtownabbey

BT37 0QB

Will information be kept confidential?

Yes. Any personal information and hard copies of questionnaires collated throughout the study will be kept in a locked filing cabinet in the researcher's office at the Ulster University campus in Jordanstown. Only the researcher has access to this filing cabinet. Electronic data will be stored on the researcher's computer in the researcher's office at the UU campus in Jordanstown and will not be accessible

through university domains. Only the researcher has access to this computer which is encrypted, password protected and in a locked office. Electronic data may also be stored on an external hardrive, which is encrypted, password protected, stored in a locked cupboard and only used for the purposes of this research. Data will also be coded and anonymised to protect personal information of participants. Transcripts from focus groups following the intervention will also be subject to systematic coding, whereby quotes and examples from participants will be assigned a code. The chief investigator, the researcher and an additional investigator will have access to the full data set. Should participants wish to withdraw at any stage, data collected up to the point of withdrawal will still be included in the study.

What will happen to the results of the study?

Findings from the study will be disseminated to participants. Findings will be included in the thesis as part of this PhD study. Findings may also be used in publications and presented at conferences. It is hoped that results will lead to further research in this area and lead to a greater understanding of how to develop future programmes designed to increase the physical activity levels of children and young people with learning disabilities. There may also be opportunity for wider implementation of the walking intervention for children with learning disabilities.

Who has reviewed this study?

This study has been approved by an ethics committee in accordance with Ulster University procedures.

Contact details: For further information regarding the study and if you have any questions, you can contact Anne Johnston:

- **Email:** Johnston-A41@email.ulster.ac.uk
- **Address:** Room 12J06
Ulster University

Jordanstown Campus

Shore Road

Newtownabbey

BT37 0QB

Anne Johnston:-----

Principal:-----

Parent's Consent Form for Child's Participation in Walking Programme

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities

Please initial each box:

You can choose for your child to take part in the walking programme and/or the focus group by initialing the relevant boxes.

5. I confirm that I have read and understood the information leaflet for the above study and have had the opportunity to ask questions.

☐

6. I understand that my child's participation is voluntary and that they are free to withdraw at any time, without giving any reason, and without their rights being affected.

☐

7. I understand that any personal data will be anonymised and stored securely by the researcher.

☐
☐

8. I give consent for my child to take part in the walking programme.

Name of Child: -----

Name of Parent/Guardian: -----

Signed: -----

Date: -----

Name of Researcher: -----

Signed: -----

Date: -----

Parent's Consent Form for Child's Participation in Focus Group

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities

Please initial each box:

You can choose for your child to take part in the walking programme and/or the focus group by initialing the relevant boxes.

1. I give consent for my child to take part in the focus group of the above study.

☐

2. I give permission for my child's voice to be recorded during the focus groups.

☐

Name of Child: -----

Name of Parent/Guardian: -----

Signed: ----- Date: -----

Name of Researcher: -----

Signed: ----- Date: -----

Appendix 12

Walking programme training for teachers and classroom assistants

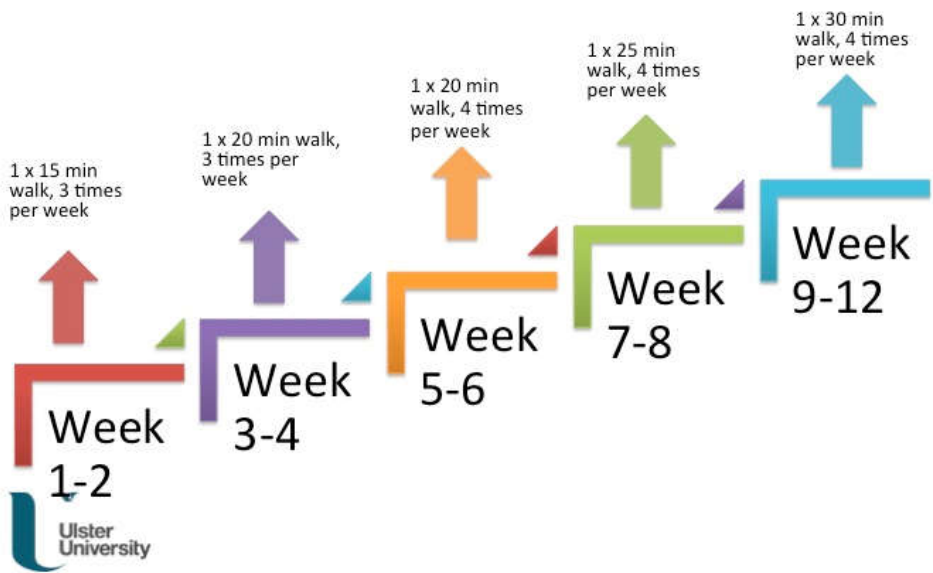


Supervisor's Walking Programme Training

ulster.ac.uk



Walking Programme



Supervision of walking programme

- One teacher/classroom assistant will supervise the walking programme at all times
- Supervisors should ensure the walking pair (child and peer role model) are walking at a sufficient pace
- Supervisors should complete the walk diary for each child at the end of each walk
- Supervisors should attach the pedometer to the waistband of the child and peer role model prior to each walk



Walk Diary

Participant Name:

Supervisor Name	Date & Time	Walk Duration	Walk Route	Pedometer out (tick)	Steps achieved	Pedometer in (tick)	Reasons for non-participation	General comments/feelings



Reward Card



Participant Name: _____

Week	Walk 1	Walk 2	Walk 3	Walk 4	Rewards
1				N/A	Sticker
2				N/A	Certificate
3				N/A	Sticker
4				N/A	Bag
5					Sticker
6					Sticker
7					Ball
8					Sticker
9					Wristband
10					Sticker
11					Sticker
12					Certificate and pedometer

Use of accelerometers

- Accelerometers will be worn at school and at home for a period of 8 days at four time points (before the beginning, in the middle, immediately at the end and 6 weeks post intervention)
- The researcher will deliver accelerometers to school at these time points
- Accelerometers must be worn around the waist at all times except when bathing, swimming or sleeping



Remember

your special belt!



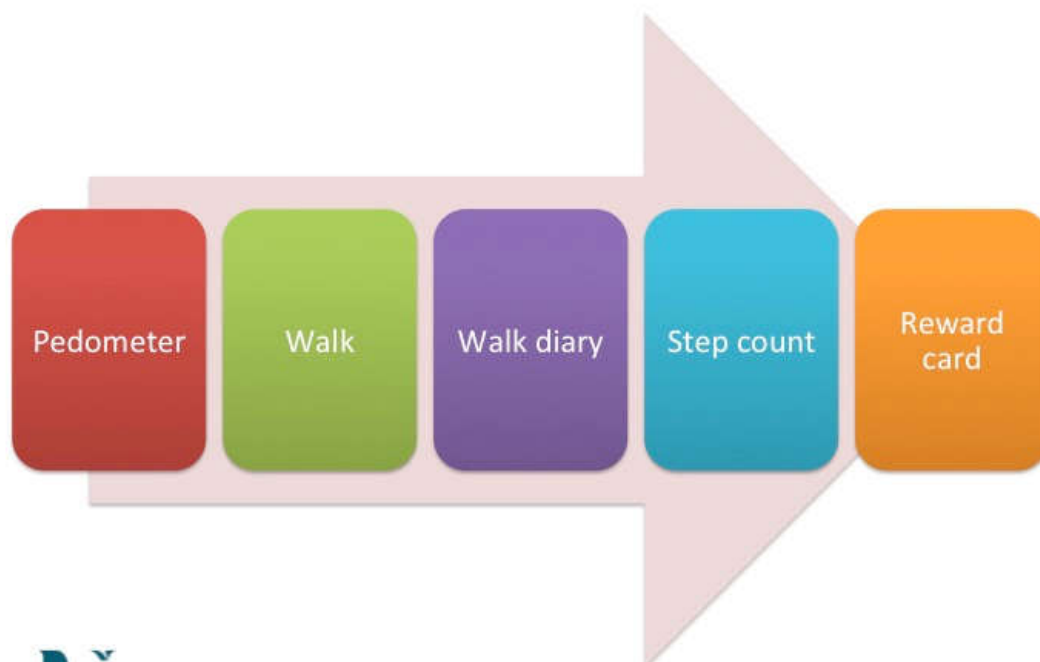
Walk routes

- Supervisors should ensure participants (child and peer role model) walk the correct route for the correct amount of time.
- Walk routes will usually be within school grounds (or occasionally at a location nearby)



Supervisor's duties for walks

- Attach pedometers to waistband of each participant (child and peer role model)
- Supervise walking pairs for the duration of each walks and ensure the correct walk route is taken
- Fill out the walk diary for each child and peer role model at the end of each walk
- Record step count for each participant (child and peer role models) at the end of each walk
- Stamp each participant's (child and peer role model) reward card at the end of each walk



Appendix 13 Walking programme training for peer role models



Why is walking good for you?

- Keeps you active
- Makes you fit
- Make friends and talk to them
- Gets you outside
- Is fun



How much walking in school?

- 12 weeks
- Start at 15 minutes, 3 days per week
- By the end, 30 minutes, 4 days per week
- Rewards for taking part



Measurements

- Height
- Weight
- Fitness
- Physical activity



How fast do we need to walk?

- Walking fast but not running
- Feel a bit warmer
- A bit out of breath
- Still be able to talk to your buddy
- Walk like you are a bit late for class
- Walk like you're trying to catch a bus



Walking with a buddy

- Walk beside your buddy
- Help them to walk fast enough
- Talk to your buddy when you walk with them



Safety when walking

- Be careful
- Try not to trip or fall
- Make sure your buddy is with you
- Don't go off the walk route
- Don't run



What clothes do I wear?



Remember!



Well Done!



Appendix 14 Walk Diary

Participant Name:

Supervisor name	Date & time	Walk duration	Walk route	Pedometer out (tick)	Step count	Pedometer in (tick)	Reasons for non-participation	General comments/feelings











Appendix 15 Reward Card






Participant name:





Week	Walk 1	Walk 2	Walk 3	Walk 4	Rewards
1				N/A	
2				N/A	Certificate
3				N/A	
4				N/A	Bag
5					
6					Water bottle
7					
8					Ball
9					
10					Wristband
11					
12					Certificate and pedometer

Appendix 16
Children's information sheet

	<p>Hi, my name is Anne Johnston.</p>
	<p>I am a student at Ulster University.</p>
	<p>I am doing a study. A study is a way of finding things out. This information sheet tells you about the study.</p> <p>This will help you decide if you want to take part in the study or not.</p>
	<p>I would like you to take part in walking during school time for 12 weeks.</p> <p>A teacher and classroom assistant from your school who you know will always be with you when you are walking.</p>

	<p>You can walk with another young person in your school. They will be older than you and will help you to take part in walking.</p>
	<p>Before you start walking in school, you will take part in a walking test. All you will have to do is walk along a path for 6 minutes.</p>
	<p>I will give you a special belt to wear and this will help me to see how much walking you do in school.</p> <p>You will only have to wear this belt 4 times for 8 days during school and at home.</p>
	<p>I will also give you a special box that helps you see how many steps you are doing in school.</p> <p>You should try to do more steps each time you walk.</p> <p>You will get a reward for taking part in the walking.</p>

	<p>The number of walks during school will increase during the walking programme. You will start with 1 walk a day for 15 minutes and by the end of the walking programme, you will be doing 1 walk a day for 30 minutes.</p>
	<p>If it's only raining a little bit, you can put your coat on and still walk outside. If it's raining really heavy, you can walk inside.</p> <p>Your teacher will decide where you walk.</p>
	<p>You can tell me 'Yes' if you want to take part.</p>
	<p>You can tell me 'No' if you do not want to take part.</p>
	<p>If you want to be in the study, you need to sign your name on a special form called a consent form.</p> <p>If you find it difficult to write, someone else can help you.</p>

	<p>At the end of the walking programme, I would like you to join a small group to talk about walking. This group is called a focus group.</p> <p>There will be between 4-8 people in the group.</p> <p>I will hold the focus group in your school. A teacher or classroom assistant from your school who you know will be in the focus group.</p>
	<p>I will record what you say during the focus group. Others in the group and other people involved in the study will be the only people who hear what you say.</p>
	<p>I and other people involved in the study will be the only people who will read your words, but if you tell us that someone is hurting you or you are hurting someone else I will have to pass this information on to your teacher.</p>
	<p>You need to ask your mum, dad or guardian if it is ok for you to take part, they also need to sign a consent form.</p> <p>Thank you for looking at this.</p>

My name:

Anne's signature:

Principal's signature:

Anne Johnston

E-mail: Johnston-A41@email.ulster.ac.uk

Appendix 17**Children's Assent Form for Walking Programme**

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities.

You can choose to take part in the walking programme and/or focus group.

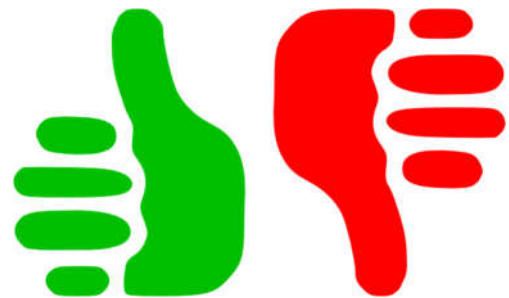
I say it is OK for me to take part in the walking programme at school.

I have seen the information sheet about the study.

I understand what it says.

I had a chance to ask questions about it.

I agree to take part in the walking programme



YES ☐ NO ☐

If I do not want to be in the study anymore, I do not have to.

I can tell Anne or a teacher if I do not want to be in the study anytime.

Anne will not let anyone know who is in the study. She may write what I say and do but no one will know it was me.

My name

Date

Anne's signature

Date

Appendix 18**Children's Assent Form for Focus Group**

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities.

You can choose to take part in the walking programme and/or focus group.

I say it is OK for me to take part in the focus group at school.

I have seen the information sheet about the study.

I understand what it says.

I agree to take part in the focus group

YES ☐ NO ☐



I say it is OK for my voice to be recorded when we talk.

YES ☐ NO ☐

If I do not want to be in the study anymore, I do not have to.

I can tell Anne or a teacher if I do not want to be in the study anytime.

Anne will not let anyone know who is in the study. She may write what I say and do but no one will know it was me.





My name

Date






Anne's signature





Date

Appendix 19
Peer role models information sheet

	<p>Hi, my name is Anne Johnston.</p>
	<p>I am a student at Ulster University.</p>
	<p>I am doing a study. A study is a way of finding things out. This information sheet tells you about the study.</p> <p>This will help you decide if you want to take part in the study or not.</p>
	<p>I would like you to take part in walking during school time for 12 weeks.</p> <p>A teacher or classroom assistant from your school who you know will always be with you when you are walking.</p>

	<p>You can walk with another young person in your school. They will be younger than you and you can help them to walk.</p> <p>Before you start walking in school, you will learn the walk route, why you are walking and how to be safe when walking. You will get a certificate for this.</p>
	<p>Before you start walking in school, you will take part in a walking test. All you will have to do is walk along a path for 6 minutes.</p>
	<p>I will give you a special belt to wear and this will help me to see how much walking you do in school.</p> <p>You will only have to wear this belt 4 times for 8 days during school and at home.</p>
	<p>I will also give you a special box that helps you see how many steps you are doing in school.</p> <p>You should try to do more steps each time you walk.</p> <p>You will get a reward for taking part in the walking.</p>

	<p>The number of walks during school will increase during the walking programme. You will start with 1 walk a day for 15 minutes and by the end of the walking programme, you will be doing 1 walk a day for 30 minutes.</p>
	<p>If it's only raining a little bit, you can put your coat on and still walk outside. If it's raining really heavy, you can walk inside.</p> <p>Your teacher will decide where you walk.</p>
	<p>You can tell me 'Yes' if you want to take part.</p>
	<p>You can tell me 'No' if you do not want to take part.</p>
	<p>If you want to be in the study, you need to sign your name on a special form called a consent form.</p> <p>If you find it difficult to write, someone else can help you.</p>

	<p>At the end of the walking programme, I would like you to join a small group to talk about walking. This group is called a focus group.</p> <p>There will be between 4-8 people in the group.</p> <p>I will hold the focus group in your school. A teacher or classroom assistant from your school who you know will be in the focus group.</p>
	<p>I will record what you say during the focus group. Others in the group and other people involved in the study will be the only people who hear what you say.</p>
	<p>I and other people involved in the study will be the only people who will read your words, but if you tell us that someone is hurting you or you are hurting someone else I will have to pass this information on to your teacher.</p>
	<p>You need to ask your mum, dad or guardian if it is ok for you to take part, they also need to sign your consent form.</p> <p>Thank you for looking at this.</p>

My name:

Anne's signature:

Principal's signature:

Anne Johnston

E-mail: Johnston-A41@email.ulster.ac.uk

Appendix 20

Peer Role Models Consent Form for Walking Programme

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities.

You can choose to take part in the walking programme and/or focus group.

I say it is OK for me to take part in the walking programme at school.

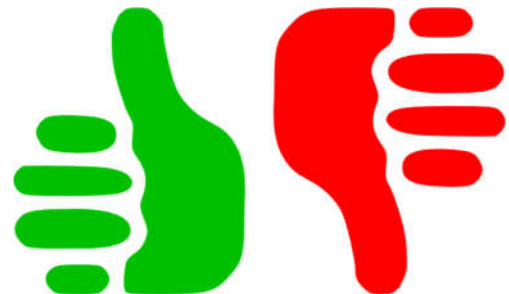
I have seen the information sheet about the study.

I understand what it says.

I had a chance to ask questions about it.

I agree to take part in the walking programme

YES ☐ NO ☐



If I do not want to be in the study anymore, I do not have to.

I can tell Anne or a teacher if I do not want to be in the study anytime.

Anne will not let anyone know who is in the study. She may write what I say and do but no one will know it was me.

My name

Date

Anne's signature

Date

Appendix 21

Peer Role Models Consent Form for Focus Group

A pilot feasibility study of a peer-led special school based walking intervention for young people with intellectual disabilities.

You can choose to take part in the walking programme and/or focus group.

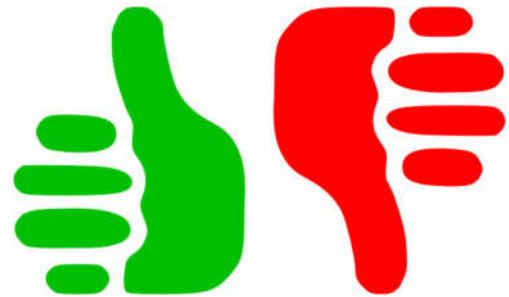
I say it is OK for me to take part in the focus group at school.

I have seen the information sheet about the study.

I understand what it says.

I had a chance to ask questions about it.

I agree to take part in the focus group



YES ☐ NO ☐

I say it is OK for my voice to be recorded when we talk.

YES ☐ NO ☐

If I do not want to be in the study anymore, I do not have to.

I can tell Anne or a teacher if I do not want to be in the study anytime.

Anne will not let anyone know who is in the study. She may write what I say and do but no one will know it was me.

My name

Date

Anne's signature

Date

Our Ref: NC:GOV

26 November 2015

Dr L Taggart
Room 12J19
School of Nursing
Ulster University
Jordanstown Campus

Dear Dr Taggart

Research Ethics Committee Application Number: REC/15/0102

Study Title: Development of a school based walking intervention for children with intellectual disabilities

Thank you for your recent response to matters raised by the committee. This has been considered and the decision of the committee is that the research should proceed.

Please also note the additional documentation relating to research governance and indemnity matters, including the requirements placed upon you as Chief Investigator.

The committee's decision is valid for a period of three years from today's date (this means that the study should be completed by that date). If you require this period to be extended, please contact the Research Governance section.

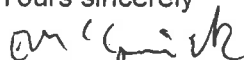
- 1. Please complete and return the Chief Investigator Statement of Compliance prior to commencing the study and keep a copy for your file.**
- 2. Please retain all other documents.**

Further details of the University's policy along with guidance notes, procedures, terms of reference and forms are available at the following web address:

<http://research.ulster.ac.uk/office/rofficeeg.html>

If you need any further information or clarification of any points, please do not hesitate to contact me.

Yours sincerely



N Nick Curry
Senior Administrative Officer
Research Governance
028 9036 6629
n.curry@ulster.ac.uk

Our Ref: NC:GOV

27 October 2016

Dr L Taggart
Room 12J19
School of Nursing
Ulster University
Jordanstown Campus

Dear Dr Taggart

Research Ethics Committee Application Number: REC/16/0093

Study Title: A pilot feasibility study of a peer-led school based walking intervention for young people with intellectual disabilities

Thank you for your recent response to matters raised by the committee. This has been considered and the decision of the committee is that the research should proceed.

Please also note the additional documentation relating to research governance and indemnity matters, including the requirements placed upon you as Chief Investigator.

The committee's decision is valid for a period of three years from today's date (this means that the study should be completed by that date). If you require this period to be extended, please contact the Research Governance section.

- 1. Please complete and return the Chief Investigator Statement of Compliance prior to commencing the study and keep a copy for your file.**
- 2. Please retain all other documents.**

Further details of the University's policy along with guidance notes, procedures, terms of reference and forms are available on the Ulster University Portal.

If you need any further information or clarification of any points, please do not hesitate to contact me.

Yours sincerely



Nick Curry
Senior Administrative Officer
Research Governance
028 9036 6629
n.curry@ulster.ac.uk

Appendix 24 Table of CASP criteria used for quality assessment

Criteria	Eiholzer et al. (2002)	Schlumpf et al. (2006)	Shields et al. (2013)	Ulrich et al. (2011)	Ptomey et al. (2014)
Did the study address a clearly focused issue?	Yes	Yes	Yes	Yes	Yes
Were participants randomised?	No	No	Yes	Yes	No
Were all participants accounted for at conclusion?	Yes	Yes	Yes	Yes	Yes
Were researchers blinded?	No	No	Yes	Cannot tell	No
Were the groups similar at the start of the trial?	Yes	Yes	Yes	Yes	Yes
Were the groups treated equally?	Yes	Yes	Yes	Yes	Yes
How large was the intervention effect?	Increase in walking distance ($p<0.05$).	Increase in walking distance ($p<0.05$). Increase in PA ($p<0.05$).	Increase in upper limb strength (MD 7 kg, 95% CI 3–11; SMD 0.8). Increase in lower limb strength (MD 25 kg, 95% CI 8–42; SMD 0.7). Increase in PA (MD 58 activity counts/min, 95% CI 5–112; SMD 0.8).	Decrease in sedentary behaviour 7 weeks ($p=0.001$) and 1 year post intervention ($p<0.001$). Increase in MVPA 1 year post intervention ($p=0.023$). Increase in average minutes of MVPA 7 weeks ($p=0.023$) and 1 year post intervention ($p=0.004$).	Decrease in sedentary time ($p=0.028$). No change in PA.

How precise was the estimate of the intervention effect?	No confidence intervals given	No confidence intervals given	Confidence intervals given	No confidence intervals given	No confidence intervals given
Are the results generalisable?	No	No	Yes	Yes	No
Were all important outcomes considered?	Yes	Yes	Yes	Yes	Yes
Are the benefits worth the harms and costs?	Yes	Yes	Yes	Yes	Yes