CSPPA Plus:
A 5-year longitudinal study of children's sport and physical activity participation.

by

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This thesis is submitted for the award of PhD
to the School of Health and Human Performance,
Dublin City University, Dublin, Ireland.

Under the supervision of

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and
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Declaration

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Doctor of Philosophy is entirely my own work, and that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

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Date: 7th of September 2016

Author contribution to publications/studies

This thesis includes four original manuscripts; three have been published in peer review journals and the fourth remains to be submitted for publication. The development and writing of all manuscripts were the principal responsibility of the candidate. The inclusion of co-authors reflects the fact that part of the work came from active collaborations between researchers in Dublin City University and the University of Strathclyde. A summary of the candidate's contribution to each manuscript is outlined below. A more detailed description of the candidate's contribution and the extent of the research collaborations have been accurately described in the authors' contribution sections in Chapters 4 – 7. The content of the remaining chapters (1 – 3, and 8) were developed and completed by the candidate.

Thesis chapter	Article title	Publication status	Nature and extent of candidate's contribution
4	Validity of a two-item physical activity questionnaire for assessing attainment of physical activity guidelines in Irish youth.	Published (2015), BMC Public Health, 15, 1080. DOI: 10.1186/s12889-015-2418-6.	First author. Development of the Study plan. Data collection (2014 data collection period). Statistical analysis. Manuscript development, write up and submission to the journal.
5	Sports participation in youth as a predictor of physical activity: A 5-year longitudinal study.	Published (2016), Journal of Physical Activity and Health, 13(7), 704-11. DOI: 10.1123/jpah.2015-0526.	First author. Development of the Study plan. Follow-up study design. Data collection (all follow-up data). Statistical analysis. Manuscript development, write up and submission to the journal.
6	Impact of physical activity domains on subsequent activity in youth: A 5-year longitudinal study.	Published (2016), Journal of Sports Sciences, Advance online publication.	First author. Development of the Study plan. Follow-up study design. Data collection (all follow-up data). Statistical analysis.

		DOI: 10.1080/02640414. 2016.1161219	Manuscript development, write up and submission to the journal.
7	Modelling the psychosocial determinants of physical activity in youth. A 5-year longitudinal study.	To be submitted for publication	• First author. • Development of the Study plan. • Data collection (all follow-up data). • Statistical analysis. • Manuscript development, write up and submission to the journal.

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Dr. David Rowe

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3 Hardie Murphy, M., Rowe, D. A., Belton, S. & Woods, C. B. (2015) Validity of a two-item physical activity questionnaire for assessing attainment of physical activity guidelines in Irish youth. *BMC Public Health*, 15(1080). DOI: 10.1186/s12889-015-2418-6

Conference presentations

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3 Hardie Murphy, M., Belton, S. & Woods, C. B. (2015) Predictors of physical activity in female youth: Longitudinal findings from the Children's Sport Participation and Physical Activity Study. *14th Annual Meeting of the International Society of Behavioural Nutrition and Physical Activity (ISBNPA)*, Edinburgh, UK, 05 June 2015.

4 Hardie, M., Woods, C. B. & Belton, S. (2014) Trends in physical activity levels over a 5-year period in 6th Year post-primary students. *Physical Education, Physical*

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Abstracts accepted for future oral presentations

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Poster presentations

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2 Duff, O., O'Brien, A., Mahon, C., Hardie, M. & Woods, C. B. (2014) Physical education, extra-curricular sports and extra-school sports among 18-year old Irish youth. *Physical Education, Physical Activity and Youth Sport (PEPAYS) Research Forum*, Limerick, Ireland, 06 June 2014.

3 Hardie, M. & Woods, C. B. (2013) The Transitions Project. The methodology of a 5-year longitudinal study investigating Irish children's perspectives of physical activity and sedentary behaviour over key lifetime transitions. *Physical Education, Physical Activity and Youth Sport (PEPAYS) Research Forum*, Dublin, Ireland, 13-14 June 2013.

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Abbreviations

ADM	All days method (statistical method used in chapter 4)
AIC	Akaike information criterion
AM	Average method (statistical method used in chapter 4)
ANCOVA	Analysis of covariance
BEF	Behavioural Epidemiology Framework
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CI	Confidence interval
CPM	Counts per minute
CSPPA	The Children's Sport Participation and Physical Activity Study
DCU	Dublin City University
ET	Ecological Theory
ICC	Intraclass correlation coefficient
HBSC	Health Behaviour in School-Aged Children
IPAQ	International Physical Activity Questionnaire
MET	Metabolic equivalent of task
MVPA	Moderate to vigorous physical activity
NCD	Non-communicable diseases
NPV	Negative predictive value
NS	Non-significant
OR	Odds ratio
PA	Physical activity
PAGL	Physical activity guidelines
PE	Physical education
PPV	Positive predictive value
RMSEA	Root means square error of approximation
SAPAC	Self-Administered Physical Activity Checklist
SB	Sedentary behaviour
SC	Social class
SCT	Social Cognitive Theory
SD	Standard deviation
SEM	Structural equation modelling
SPSS	Statistical Package for the Social Sciences
T1	Time point 1 (2009)
T2	Time point 2 (2014)
TPB	Theory of Planned Behaviour
TLI	Tucker-Lewis index
UCC	University College Cork
UL	University of Limerick
WHO	World Health Organization
YPAP	Youth Physical Activity Promotion

Abstract

CSPPA Plus:
A 5-year longitudinal study of children's sport
and physical activity participation

Michelle Hardie Murphy

Globally, physical inactivity is the fourth leading modifiable risk factor for premature mortality. Adolescence is a critical time where physical activity (PA) habits developed may persist into adulthood. However, evidence demonstrates that PA levels decline with increasing age in adolescence. The purpose of this thesis is: (1) to validate a PA instrument for use in youth aged 10 – 18 years; (2) to appraise tracking of PA and sports participation over a 5-year period in youth; and (3) to assess behavioural and psychosocial factors that influence PA over time among Irish children and youth.

As part of the Children's Sport Participation and Physical Activity study, data were collected on a sample of 5,397 youth aged 10 – 18 years (46.6% male) in the Republic of Ireland. Five years later, participants (n = 873; 30.4% male) completed multi-section self-report surveys developed using Social Cognitive Theory and Ecological Theory as part of a longitudinal study. All elements included in the surveys were psychometrically valid and developmentally appropriate measures that have been validated for use in adolescents.

Four papers were undertaken as part of this thesis. In paper 1, levels of subjectively reported PA from the survey were validated with objective measurement of activity (via accelerometry), in a sub-sample of participants. In paper 2, changes in PA levels and sports participation were evaluated between time point one (2009) and two (2014). Results suggest that PA can, to an extent, track into later life and advocate for a greater frequency of sports participation and competitive sports engagement in youth. Paper 3 assessed PA domains (club and extra-curricular sports participation, active commuting to school and physical education) as predictors of 5-year PA. Of the PA domains examined, sport plays the most valuable role in sustaining PA involvement. A description of the uptake, dropout and participation levels in different sports and reasons for a change in participation are included in paper 3. In paper 4, the psychosocial determinants of youth PA were appraised using the framework of the Youth Physical Activity Promotion Model. Findings indicate that friend social support and PA self-efficacy play instrumental roles in influencing 5-year PA in youth.

PA promotion strategies should include frequent, high-quality opportunities for sports participation, consider what sports are attractive to young people, and address the reasons for uptake and dropout identified in this thesis. Efforts to promote longevity in PA behaviour should direct attention to improving self-efficacy for PA and encouraging peer social support.

CHAPTER 1

Introduction to the thesis

Chapter 1 Introduction

This chapter describes the background context, rationale and need for physical activity (PA) research in young people. In particular, it describes the health-related benefits of PA for individuals and nations, the context of youth PA nationally and internationally, factors influencing PA, and construes the requirement for a longitudinal research methodology.

1.1 Introduction

1.1.1 Rationale for the thesis

Physical inactivity has been identified as the fourth leading mortality risk factor across the world (Kohl et al., 2012). PA is a complex, multi-dimensional and highly variable behaviour that can include sport, exercise, general activity and active transport. At a population level, regular monitoring of PA should be considered a public health priority (Hallal et al., 2012). Longitudinal determinants studies are needed to gain a more definitive understanding of why people are active (Bauman et al., 2012). Data from this type of research would help with understanding the reasons why children and youth engage in specific health-related behaviours and would consequently provide an evidence base for interventions. However, there is a dearth of longitudinal data on these PA-related behaviours in Ireland and limited large-scale research of this type internationally.

1.1.2 Physical activity and health

Strong evidence shows that physical inactivity contributes to many adverse health conditions including major non-communicable diseases (NCDs), and is responsible for 5.3 million deaths per year worldwide (Lee et al., 2012). Using population attributable fractions, the Lancet PA Series Working Group estimated the burden of disease for a number of NCDs and the effect on life expectancy of physical inactivity (Lee et al., 2012). In Ireland, physical inactivity is estimated to cause 8.8% of coronary heart disease, 10.9% of type 2 diabetes, 15.2% of breast cancer and 15.7% of colon cancer. These Irish figures are higher than the global averages (based on 122 countries) by 3% for coronary heart disease, 3.7% for type 2 diabetes and > 5% for the cancers listed. Consequently, the gain in life expectancy for eliminating physical inactivity is greater for Ireland than the global estimate with a forecasted increase in life expectancy of 0.87 years and 0.68 years respectively.

In Ireland, NCDs pose the greatest risk to health accounting for 88% of deaths (World Health Organization, 2014). By the year 2020, the prevalence of NCDs in the adult

population will be approximately 40% higher than a decade previous (Balanda et al., 2010). In a systematic review of longitudinal studies (> 5 years), evidence showed a long-term positive influence of PA on coronary heart disease, type 2 diabetes, Alzheimer's disease, weight gain and obesity (Reiner et al., 2013). As Ireland is on course to be the fattest country in Europe in the next 15 years (UK Health Forum et al., 2015), the role of PA in obesity prevention is key. A Cochrane review showed that childhood obesity is associated with an increased risk for health in adult life but also with poor cognitive function, school achievement and future success (Oude Luttikhuis et al., 2009). In Ireland, 20% of 10 – 18 years olds were found to be overweight or obese, as assessed by physical measurements (Woods et al., 2010), and are susceptible to the risks associated with childhood obesity.

The benefits of PA to health are widely accepted (World Health Organization, 2010) and there is a plethora of evidence, documented in systematic reviews, supporting these benefits in school-aged children and youth (Hallal et al., 2006; Janssen & LeBlanc., 2010). The main short-term benefits and long-term protective effects of PA identified by Hallal and colleagues (2006) included effects on bone health, mental health and cancer while Janssen and LeBlanc (2010) reported positive influences of PA on cholesterol, hypertension, bone health and depression. Observational studies have illuminated a dose-response relationship where a greater volume of PA is associated with larger health benefits (Janssen & LeBlanc, 2010).

PA research to date has provided a global picture of PA participation and levels of exposure to the risks associated with physical inactivity. This data created a foundation for national and international policy development including the Global Strategy for Diet, Physical Activity and Health (World Health Organization, 2004), the Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013 – 2020 (World Health Organization, 2013), and the Physical Activity Strategy for the WHO European Region 2016 – 2025 (World Health Organization, 2015). Within the Irish context, recent national policy documents such as the Healthy Ireland Framework for Improved Health and Wellbeing have seen the inclusion of PA in their target areas (Department of Health, 2013). This framework identified the promotion of health in children and the creation of healthy generations of youth as critical to the country's future. It set a target to increase the proportion of the population undertaking regular PA by 20% within the 12-year lifecycle (2013 – 2025) of the Framework (Department of Health, 2013). The Healthy

Ireland Framework paved the way for Ireland's first National Physical Activity Plan (Healthy Ireland, 2016). This plan contains eight thematic action areas including 'Children and Young People' and 'Research, Monitoring and Evaluation' and provides a focus on increasing compliance with the 2009 National Physical Activity Guidelines (Department of Health and Children, 2009).

1.1.3 Physical activity recommendations

For school-aged youth, physical activity guidelines (PAGL) have been developed and adopted by health authorities worldwide (OECD, 2012). In Ireland, the PAGL recommend that children and young people (aged 2 – 18) achieve a minimum of 60 minutes of moderate-to-vigorous physical activity (MVPA) daily. Further, activities should include muscle-strengthening, bone-strengthening and flexibility exercises three times per week. All PA should be developmentally appropriate for the participant and should include a variety of activities that are enjoyable (Department of Health and Children, 2009). Ireland's National PA Plan specifies that new national PAGL for the early childhood years (0 – 5 years) should be developed to address differences in PA need between children under 5 years and older children (Healthy Ireland, 2016). Ireland's current PA recommendations were adopted from the European Union Physical Activity Guidelines (EU Working Group Sport and Health, 2008). The MVPA guidelines are consistent with those for youth aged ≥5 years in the United States (Physical Activity Guidelines Advisory Committee, 2008), Canada (Canadian Society for Exercise Physiology, 2011), Australia (Department of Health and Ageing, 2004), the United Kingdom (BHF National Centre for Physical Activity and Health, 2013) and members of the European Union (World Health Organization, 2010).

The PAGL have evolved over the years and were first developed in 1988 when the American College of Sports Medicine created a Position Stand on the quantity of PA needed for optimal functional capacity and health in youth (American College of Sports Medicine, 1988). It was recommended that children and adolescents should attain 20 – 30 minutes of vigorous intensity PA every day. Ten years later, the influential role of moderate intensity PA was acknowledged, and it was recommended that youth should engage in PA for at least 60 minutes per day in at least moderate intensity (Biddle et al., 1998).

With the evolution of the PAGL, the evidence supporting the PAGL has been assessed. In 2001, Twisk (2001) stated that there was only marginal scientific evidence to support the PAGL at that time. In 2006, Hallal and colleagues (2006) queried the amount of PA that should be recommended but recognised that different volumes of PA are needed to gain different health benefits. Most recently, Janssen and LeBlanc (2010) highlighted that some of the health benefits of PA can be gained with an average of 30 minutes of daily MVPA. However, they acknowledged that youth should meet the current widely accepted PAGL for health by accumulating at least 60 minutes per day (up to several hours) of at least moderate intensity PA (Janssen & LeBlanc, 2010).

1.1.4 Physical activity in youth

Despite all the evidence of benefit, epidemiological data indicates that the proportion of children and adolescents attaining the recommended levels of PA per day is minimal. In one study (Hallal et al., 2012), findings were combined from the Global School-based student Health Survey (GSHS) and the Health Behaviour in School-aged Children (HBSC) survey to include PA data from 105 countries worldwide (Currie et al., 2008; Melkevik et al., 2010; World Health Organization, 2015). Results indicated that the rate of non-compliance with PAGL was greater than or equal to 80% in boys from 56 countries and girls from 100 countries. Overall, 80.3% (95%CI 80.1 – 80.5) of the 13 – 15 year-olds studied did not meet the PAGL (Hallal et al., 2012).

Results from numerous Irish studies are similar to the international figures. In the Growing Up in Ireland study of 8,570 children aged 9 years, 71% of boys and 79% of girls did not meet the MVPA recommendation (Williams et al., 2009). In the Children's Sport Participation and Physical Activity (CSPPA) Study, 86% (82% of boys; 90% of girls) of the 5,397 young people aged 10 – 18 years studied did not meet the PAGL (Woods et al., 2010). More recently, results from a sample of 13,611 youth aged 10 – 17 years from the HBSC study indicated that only 23% of children (30% of boys, 16% of girls) reported being physically active every day in the previous week (Gavin et al., 2015). Although the measurement instruments used in these studies differed, and therefore comparisons are limited, the results paint a picture of low levels of PA in youth in Ireland.

In 2014, Ireland's inaugural Report Card on PA in Children and Youth was created by drawing together findings from studies that examined PA across the island of Ireland (both Northern Ireland and the Republic of Ireland). The aim of the Report Card was to

facilitate national surveillance of youth PA and comparisons of PA internationally (Harrington et al., 2014). It allocates a 'grade' to the PA indicators based on the proportion of young people meeting a defined benchmark such as the PAGL. In an amalgamation of Report Cards from 15 countries (from five continents), Tremblay and colleagues (2014) reported that the overall grades for PA around the world were poor. Regarding the grade for overall PA, Ireland was placed 11th alongside Australia, Canada and the United States with a grade of D- (Tremblay et al., 2014). A 'D' grade equates to 21 – 40% of youth meeting the PAGL, and the proportion of young people meeting the PAGL in Ireland is on the lower end of this scale.

Research consistently shows that PA levels decline immensely during adolescence (Dumith et al., 2011; Hallal et al., 2012; Kimm et al., 2000; Ortega et al., 2013). Over the teenage years, PA levels decline by a mean of 7% (5.9% when adjusted for baseline age) per year equating to a global PA decline of 60 – 70% throughout adolescence (Dumith et al., 2011). Large-scale national and international studies consistently show that adolescent boys are more physically active than adolescent girls (Currie et al., 2012; Woods et al., 2010) and this evidence is supported in review studies of the correlates of PA (Dumith et al., 2011; Hallal et al., 2012). In the CSPPA study, the percentage of boys meeting the PAGL declined from 24% in those aged 12 – 13 years to 16% in the 14 – 15-year-old age group. In girls, the PA levels were consistently lower and declined from 13% to 8% in the same age brackets (Woods et al., 2010). By the age of 15 years, on average, across 39 countries in the HBSC study, only 10% of girls and 19% of boys self-reported sufficient MVPA (Currie et al., 2012). This compelling information highlights the need to investigate factors related to PA behaviour at this stage of life.

Furthermore, the promotion of PA in childhood and adolescence is warranted as evidence suggests that habits developed in childhood may track into adulthood (Malina, 2001; Telama et al., 2005; Telama, 2009). In order to change behaviour we must understand its influences. The Youth Physical Activity Promotion (YPAP) Model (Welk, 1999) provides an approach to understanding PA behaviour in young people and is the guiding framework of this thesis. The YPAP Model was developed to assist with bridging the gap between theory and PA promotion practice in youth. The model was constructed by drawing on Social Cognitive Theory (Bandura, 1986), Ecological Theory (Stokols, 1996) and the Theory of Planned Behaviour (Ajzen, 1991). It enables us to fathom the interactions between various personal (e.g. self-efficacy), behavioural (e.g. previous PA,

the domain of PA participation) and environmental factors (e.g. social support for PA). Utilising the theoretical foundations of the YPAP Model, correlates (factors associated with behaviour) and determinants (factors with a causal relationship) of PA may be examined. A distinction can be made between modifiable and non-modifiable (e.g. age, sex, and, to an extent, social class) correlates and determinants of behaviour. Modifiable factors may include PA self-efficacy, perceived barriers towards PA, and social support for PA. When designing evidence-based behavioural health interventions, it is the correlates and determinants of PA that can be modified that we need to comprehend and prioritise (Sallis et al., 2000). The focus of this thesis is on examining the modifiable factors associated with PA including the behavioural and psychosocial determinants of PA which can be investigated through the longitudinal research design of this study. Other determinants of PA, outside the remit of this thesis, include physical environmental factors. Examples of correlates and determinants of PA from the physical environment include accesss to facilities, proximity of homes to other destinations like schools and shops, access and proximitiy to recreation facilities and equipment, and policies that may influence participation in PA such as a no running policy in schools (Bauman et al., 2012).

In terms of the behavioural factors of PA, systematic reviews of cross-sectional data indicate that sports participation (Sallis et al., 2000) and active commuting in youth (Lee et al., 2008) are positively correlated with overall PA levels. Longitudinal research from Finland has found that regular adolescent sports participation increases the probability of being physically active in adulthood (Tammelin et al., 2003; Telama et al., 2005). Longitudinally, active commuting in childhood and adolescence may also be associated with higher PA in young adulthood (Yang et al., 2014). Notwithstanding this evidence, studies examining the different domains of childhood PA behaviour as predictors of adult PA are limited (Cleland et al., 2012).

Concerning the psychosocial factors of PA, previous research suggests that a complex set of psychological and social variables in the everyday life of young people can determine their propensity to become either physically active or not. There is strong evidence that higher levels of self-efficacy for PA positively influence youth PA (Bauman et al., 2012; Biddle et al., 2005; Young et al., 2014). It has been revealed that children and adolescents who are physically active systematically differ from those who are not in respect of the perceived social support for PA they receive from significant others (Salmon et al., 2011).

In review studies, the positive association between parental social support and PA level (Beets et al., 2010; Edwardson & Gorely, 2010) and between friend social support and PA have been documented (Mendonca et al., 2014; Van Der Horst et al., 2007).

The information gained through research on the modifiable factors associated with youth PA will provide an evidence-base for interventions designed to encourage health promoting lifestyles and lifelong participation in PA.

1.2 Justification for the project

To my knowledge, no large-scale longitudinal research on youth PA exists in Ireland. As longitudinal research can test the stability of behaviours over time and investigate causal relationships, this form of research is imperative in this context. The CSPPA study, conducted in 2009, was the first nationally representative study with a specific focus on assessing youth PA (Woods et al., 2010). It has provided a strong foundation and baseline data for use as part of a follow-up study. The CSPPA Plus (5-year longitudinal) study tracks individuals over time to establish the stability or otherwise of individual PA patterns and their determinants over time. PA behaviour will be assessed over key transitional periods in the lives of youth, e.g. moving from primary to post-primary school. This contributes to the originality and innovative nature of this project within this setting. The purpose of this thesis was: (1) to validate a PA instrument for use in youth aged 10 – 18 years that can assist with PA monitoring; (2) to appraise tracking of PA and sports participation over a 5-year period in youth; and (3) to assess specific indicators of PA and sports participation among Irish children and youth including behavioural and psychosocial factors that influence PA over time. The information gained through this body of work will be valuable for the development of government policies and providing an evidence-base for the advancement of strategies to enhance PA levels and promote activity maintenance in youth.

1.3 Overall aims and objectives of the thesis

The hierarchical thesis aims and objectives are presented below. Further information on the purpose of each research paper and associated hypotheses are described in Chapters 4 to 7.

1.3.1 Thesis aims

1. To conduct longitudinal research on youth physical activity in the Republic of Ireland.
2. To gain a deeper understanding of physical activity behaviour from adolescent years into young adulthood, a period of transition in the lives of youth.
3. To identify and model behavioural and psychosocial determinants of later physical activity behaviour in youth.
4. To assess factors influencing youth sports uptake and dropout over a 5-year period.

1.3.2 Thesis objectives

1. To utilise school-based research and postal-based research to track participants over a 5-year period.
2. To design a follow-up self-report survey, employing questions from the baseline survey in addition to new questions to assess changes in physical activity over time.
3. To validate the primary measure of physical activity to be used in this thesis through comparisons of self-reported physical activity with accelerometer-determined physical activity.
4. To assess domains of physical activity at baseline and follow-up, and engagement in different physical activity domains as predictors of follow-up physical activity behaviour, measured using a self-report survey.
5. To examine changes in youth sports participation over a 5-year period and the reasons for behaviour change, measured using a self-report survey.
6. To model, based on the Youth Physical Activity Promotion Model, baseline psychosocial factors associated with physical activity in predicting follow-up physical activity behaviour using data from a self-report survey.

1.4 Structure of the thesis

The thesis consists of eight chapters, as illustrated in **Figure 1.1**. This chapter provides an introduction to the thesis. It is followed by Chapter 2 which critically reviews the current literature. Chapter 3 describes the overall study methodology in detail. Chapters 4 to 7 comprise of the manuscripts prepared for publication. They include the following particulars: Peer review status, keywords, purpose of the chapter, contribution to new knowledge, candidates' contribution to the publication/chapter, abstract, introduction, hypotheses, methods, results, discussion, references, a review of hypotheses, and chapter conclusions. Chapter 8 draws on Chapters 1 to 7 to provide conclusions and recommendations. Additional supporting material is contained within the Appendices.

A breakdown of chapter contents are as follows:

Chapter 1 Introduction: Describes the rationale and need for PA research in young people, in particular, it construes the requirement for a longitudinal methodology. The chapter outlines the aims and objectives of the thesis.

Chapter 2 Review of the Literature: Provides a critical review of the literature on theory and evidence associated with psychosocial influences on PA behaviour and the behaviour itself. It creates a foundation for the thesis narrative.

Chapter 3 Methodology: Gives background information on the study design and sampling of the first wave of data collection as part of the Children's Sport Participation and Physical Activity (CSPPA) Study. This chapter provides an overview of the research design, participant recruitment, procedures, survey design, measures and data treatment for CSPPA Plus, the 5-year follow-up study.

Chapter 4 Study 1: Contains the first study of the thesis. The study examines the validity of the PACE+ instrument for assessing PA, and the attainment of the PA recommendations, through comparisons with accelerometer data. The chapter provides a base for studies 2 to 4 as they utilise the PACE+ survey.

Chapter 5 Study 2: Assesses tracking of PA and investigates the role of sports participation in youth as a predictor of PA levels 5 years later. It addresses the impact of early behaviour on later behaviour.

Chapter 6 Study 3: Expands on Chapter 5 by investigating the impact of additional PA domains on subsequent activity in youth. It depicts details of sports participation; specifically, uptake, dropout and participation levels in different sports, and overall change and reasons for change in sports participation.

Chapter 7 Study 4: Develops on Chapter 6 by examining psychosocial factors that influence 5-year PA using the framework of the Youth Physical Activity Promotion Model.

Chapter 8 Conclusions and recommendations: Synthesises the findings of the literature review and the thesis to develop recommendations for PA promotion strategies and future research. The broader implications and impact of the findings of this research are discussed.

Appendices: Contain the surveys, evidence of ethical approval for the study, details of the pilot study, forms associated with data collection and additional materials in support of the research publications.

The structure of the research conducted herein may be organised within the Behavioral Epidemiology Framework (BEF). The BEF outlines a sequence of research phases that lead to the development of evidence-based interventions (Sallis et al., 2000). The BEF is discussed in greater detail in Chapter 8 where it shapes the discussion of the conclusions and recommendations of this thesis. The five phases of the framework are detailed below with reference to their connection to work undertaken in this thesis.

1. To establish links between behaviours and health (documented in Chapter 1).
2. To develop methods for measuring the behaviour (the study methodology is detailed in Chapter 3 and a validation of the main measure of PA is reported in Chapter 4).
3. To identify factors that influence the behaviour (behavioural and psychosocial determinants of youth PA are established in Chapters 5 – 7).
4. To evaluate interventions to change behaviour (this phase is beyond the scope of this thesis. However, recommendations for interventions and public policy are made in Chapter 8 based on the findings of Studies 1 – 4).
5. To translate research into practice (this phase is beyond the scope of this thesis. This phase follows on from Phase 4 and involves conducting research on intervention adoption).

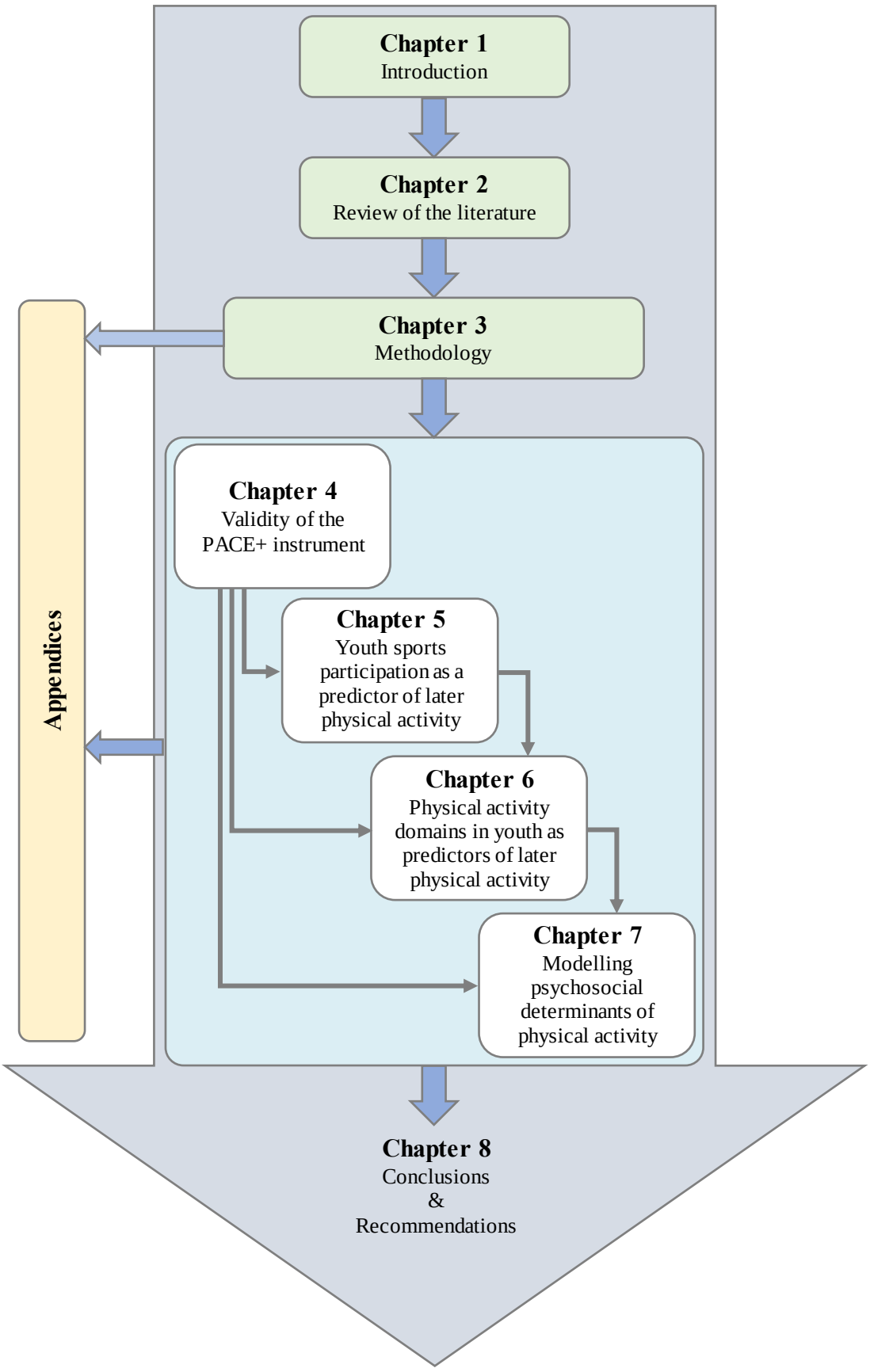

Figure 1.1 Flow chart of the contents of the thesis.

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CHAPTER 2

Review of the literature

Chapter 2 Review of the Literature

2.1 Introduction

This chapter presents a broad range of evidence on physical activity (PA) through a review of the literature. It provides a policy context for PA promotion and describes trends in PA over time including temporal and longitudinal trends. It elucidates the theoretical underpinning of the thesis. It discusses correlates and determinants of PA, outlines behavioural and psychosocial factors related to PA participation and debates the methodology for measuring PA. The information presented in this chapter informs the direction of the remaining chapters in this thesis.

For this review of literature that incorporates research articles and grey literature, a literature search plan was developed to integrate three search strategies: (1) database searches using key terms; (2) browsing targeted websites of worldwide organisations/agencies, non-governmental organisations and government departments; and (3) reviewing reference lists for additional resources not identified in the first two search strategies.

Initially, a search of PubMed, EBSCOhost and Science Direct was completed. The following keywords were used to gather articles for use in their respective sections:

- All sections: physical activity, youth, adolescence, systematic review, review, longitudinal, cohort and Ireland.
- Section 2.2 (policy context): policy, strategy, plan, public health.
- Section 2.3 (PA): levels, prevalence, trends, temporal trends, tracking, transition and change.
- Section 2.4 (theoretical basis of the thesis): theory, model, framework, behaviour, Social Cognitive Theory, Ecological Theory, Theory of Planned Behaviour and Youth Physical Activity Promotion Model.
- Section 2.5 (correlates and determinants of PA): correlate, determinant, factor, predictor, social and environment.
- Section 2.6 (psychosocial factors related to PA): psychosocial, psychological, social, self-efficacy, barriers, perceived barriers, enjoyment, parental social support, family social support, peer social support, friend social support and teacher social support.
- Section 2.7 (domains of PA): domain, mode, sport, organised sport, unstructured sport, sports participation, play, recreation, outdoor recreation, leisure time, active

transport, active commute, walking, cycling, physical education, school, uptake, maintenance and dropout.

- Section 2.8 (measuring PA): methods, measurement, surveillance, epidemiology, objective measurement, accelerometry, survey, questionnaire, validity and protocol.

The titles and abstracts that were returned in the search were screened for suitable literature. Where articles were not immediately available through the databases, the "LinkOut – more resources" option was clicked to find the article in other databases.

The grey literature was searched to provide information on the policy context for this thesis and for Irish studies on youth PA. The organisations included in the website search were the World Health Organization (www.who.int), the International Society for Physical Activity and Health (www.globalpanet.com), the Department of Health (www.health.gov.ie), the Department of Education and Skills (www.education.ie), the Department of Children and Youth Affairs (www.dcya.gov.ie), the Department of Transport, Tourism and Sport (www.dtts.ie) and the Irish Sports Council (www.irishsportscouncil.ie).

Upon reading the articles, reports and policy documents, the reference lists were inspected for additional relevant resources that may have been missed in the initial searches. A search to locate these was then carried out using Google and Google Scholar. For studies/documents included in this literature review, preference was given to systematic reviews, reviews, large studies and Irish studies with children and adolescents aged 10 – 18 years. However, cross-sectional studies were also included.

2.2 Policy context

Upon close inspection, PA may be detected in a diverse range of national and international policies. The significance of PA for young people has been acknowledged by major international organisations including the United Nations (United Nations, 1989) and the World Health Organization (World Health Organization, 2015). In 1989, the United Nations Convention on the Rights of the Child (Article 31 Leisure, Recreation and Cultural Activities) addressed PA by: (1) recognising the right of the child to engage in recreational activities and play that is appropriate to the age of the child; and (2)

encouraging the provision of equal and appropriate opportunities for recreational and leisure activity (United Nations, 1989).

The approach taken by the World Health Organization (WHO) involves endorsing the promotion of PA as a mechanism for non-communicable disease (NCD) risk reduction. The first strategy document specifically targeting PA, the "*Global Strategy on Diet, Physical Activity and Health*", was endorsed by the 57th World Health Assembly in May 2004 (World Health Organization, 2004). The strategy which was requested by the WHO Member States at the 2002 World Health Assembly, and aimed to improve two major NCD risk factors (i.e. diet and PA). Its four objectives included: (1) reducing NCD risk through public health and health promotion efforts; (2) increasing awareness of the influences of these lifestyle behaviours on health; (3) encouraging the development of additional policies and plans from community to international levels; and (4) monitoring and evaluation of key influences on behaviour.

In 2015, the first European PA strategy for the years 2016 – 2025 was launched (World Health Organization, 2015). Five priority areas were identified within the strategy and included:

1. Providing leadership and coordination for the promotion of PA.
2. Supporting the development of children and adolescents.
3. Promoting PA for all adults as part of daily life.
4. Promoting PA among older people.
5. Supporting action through monitoring, surveillance, the provision of tools, enabling platforms, evaluation and research.

Priority areas two and five are the most applicable to this thesis. The objectives of priority area two includes promoting recreational PA and PA in schools while priority area five includes efforts to strengthen PA surveillance and the evidence-base for PA promotion. The "*Physical Activity Strategy for the WHO European Region 2016 – 2025*" (World Health Organization, 2015) was shortly followed by Ireland's first National Physical Activity Plan "*Get Ireland Active! National Physical Activity Plan for Ireland*" (Healthy Ireland, 2016). The plan was composed by drawing on previous PA policy and advocacy documents such as the Toronto Charter for PA (Bull et al., 2010) and the WHO "*Global Strategy on Diet, Physical Activity and Health*" (World Health Organization, 2004). In total, the plan includes 60 actions across eight action areas. Targeted completion

timeframes for each of the actions range from ongoing to up to 4 years, i.e. by the year 2020 at the latest.

The eight action areas of the National PA Plan include:

1. Public awareness, education and communication.
2. Children and young people.
3. Health.
4. Environment.
5. Workplaces.
6. Sport and physical activity in the community.
7. Research, monitoring and evaluation.
8. Implementation through partnership.

Action areas two, four, six and seven are the most applicable to this thesis and include topics covered in the European PA Strategy (World Health Organization, 2015). The connection between these action areas and previous Irish policy are henceforth described. Action area two complements "*Better Outcomes, Brighter Futures: The National Policy Framework for Children and Young People 2014 – 2020*" that aims to ensure that all children and adolescents experience active and healthy lives (Department of Children and Youth Affairs, 2014). This action area highlights the need for youth to learn the necessary skills to participate confidently in PA. It specifies that all young people should encounter opportunities for active living as part of their normal day whether in school, with family or in the community setting. The opportunities can include PA, active play or sport. Action area two links with the "*Get Active! Physical Education, Physical Activity and Sport for Children and Young People: A guiding framework*" formulated by the Department of Education and Skills with a commitment from the Department of Health, the Department of Children, and the Department of Transport, Tourism and Sport (Department of Education and Skills, 2012). The framework sets out to generate an integrated approach to physical education (PE), PA and sport for children and young people with the aim of promoting lifelong participation. It identified three contexts where activity can occur in youth; in the class setting, i.e. programmes as part of school curriculum and PE; in co-curricular activities, i.e. school-based PA and sport outside of the curriculum time; and in the community, i.e. outside of school including community clubs and general PA.

Action 15 (action area two) refers to further Irish policy documents related to youth PA and states that these policies should be reviewed and updated by 2017. The policies it specifies are "*Ready! Steady! Play! A National Play Policy*" (National Children's Office, 2004) which targets children under 12 years of age and "*Teenspace. A National Recreation Policy*" (Office of the Minister for Children, 2007) which targets young people aged 12 – 18 years. The National Play Policy endeavours to ensure children's play needs are met by improving and maximising quality public play opportunities and facilities. The objectives of the National Recreation Policy include promoting and maximising the range of organised activities and recreational opportunities for adolescents and examining ways to motivate participation.

Action area four of Ireland's National PA Plan concerns the natural and built environment and how it may be used to promote PA. This action area complements transport policy including "*Smarter Travel – A sustainable transport future a new transport policy for Ireland 2009 – 2020*" that aims to shift away from private car use towards active modes of transport such as walking and cycling (Department of Transport, 2009). Under this policy, the Department of Transport is responsible for increasing the number of children and adolescents walking or cycling to and from school daily. In particular, it is responsible for developing and implementing initiatives that: (1) promote active transport; and (2) create a safe environment for actively commuting. Examples of initiatives include providing cycling skills courses within schools, increasing cycle friendly routes and reducing traffic congestion.

Action area six of Ireland's National PA Plan targets sport and PA in the community. The "*Get Active!*" guiding framework (Department of Education and Skills, 2012), the National Play Policy (National Children's Office, 2004) and the National Recreation Policy (Office of the Minister for Children, 2007) all tie into the promotion of community-based youth sport and PA. In this action area, local stakeholders are urged to work together to promote PA and provide opportunities for PA and sport in the local community.

Action area seven of Ireland's National PA Plan recognises the vital need for comprehensive monitoring and evaluation of PA participation, programmes and policies. It emphasises that all aspects of PA should be assessed to provide an evidence-base to direct programme delivery, further develop PA policies and to enhance accountability.

Specifically, it stipulates the requirement of repeated measurement of PA levels and describing of barriers to participation.

In recent years, the PA policy agenda has grown and has been included in documents of the Department of Education and Skills, the Department of Children and Youth Affairs, and the Department of Transport. The National PA Plan elucidates that cross-departmental collaborations and efforts are needed at national and local levels for effective promotion of PA. Local communities, the business community, the sporting community and the voluntary sectors also play key roles.

2.2.1 Comment on physical activity policy

Incongruent with other NCD risk factors, such as diet, tobacco use and alcohol consumption, the recognition of the significance of PA globally and action on promoting PA at a population level has been slow to arise (Das & Horton, 2012). Despite the robust evidence supporting PA, it is yet to amass a commensurate level of global organisation and advocacy power to obtain adequate political acknowledgement and investments (Kohl et al., 2012). Resultantly, PA lags behind in comparison with advancements made in the areas of tobacco, alcohol and diet (Kohl et al., 2012). Ireland is no exception to the delayed focus on PA with the National PA Plan only being launched this year. Notwithstanding the slow steps toward PA policy, globally, thirty-five countries (of 127 assessed) have specific PA plans (Pratt et al., 2015). With regard to providing an evidence-base for PA, PA intervention and policy, a small number of countries dominate the scientific publications. In 2013, 52% of research articles originated from 6 countries, i.e. United States, Australia, Canada, Netherlands, Spain and Germany (Pratt et al., 2015). Progressions in the field of PA are called for internationally. The global challenge of augmenting PA as a public health priority is apparent. Lessons from other NCD risk factors may assist in progressing the PA sphere, yet withal, PA should be identified as a speciality in public health in its own right (Hallal et al., 2012b).

2.3 Physical activity

2.3.1 Trends in youth physical activity

International epidemiological data indicate that rates of compliance with youth PA guidelines are low (< 20%) (Hallal et al., 2012a). The declining trends in youth PA across the adolescent years are discernible in international literature (Currie et al., 2012; Dumith

et al., 2011; Ortega et al., 2013) and supported by studies conducted in Ireland (Gavin et al., 2015; Woods et al., 2010). The drop-off in PA is more pronounced in girls than boys with adolescent girls being less active than their male counterparts in all WHO regions (World Health Organization, 2014). Much of the large-scale international literature on PA prevalence is dependent on survey data. The International Children's Accelerometry Database (ICAD) provides an opportunity to assess trends in accelerometer measured PA from 20 studies in 10 countries (n = 27,637). Findings from this data were consistent with survey-based research and found analogous associations between demographic characteristics (i.e. age and sex) and PA, and concurs with previous evidence that PA levels differ between countries (Cooper et al., 2015). Details of PA participation trends are described in more detail in Chapter 1, Section 1.1.4.

In addition to assessing trends in youth PA related to demographic factors, it is essential to uncover if observed changes are due to temporal trends. The number of studies that investigate this is limited (Booth et al., 2015; Ekelund et al., 2011; Knuth & Hallal, 2009). In a systematic review, Knuth and Hallal (2009) identified nine studies that examine temporal trends of PA in children and young people; four from the United States, two from Australia, one from Canada, one from Sweden and one from Switzerland. Time-dependent decreases in PA were found in six of these studies, PA showed signs of stabilisation in two studies and PA increased over time in one study (Knuth & Hallal, 2009). More recently, evidence from a review by Booth and colleagues (2015) found that minimal change has occurred in objectively measured PA in the past two decades. This conclusion is based on very limited research – just three studies – investigating time-dependent trends in objectively measured youth PA. In Ireland, evidence from the Economic and Social Research Institute study (n = 7,460) (Fahey et al., 2005) and the Children's Sport Participation and Physical Activity (CSPPA) study (n = 5,397) (Woods et al., 2010) suggest that overall adolescent PA trends remained constant from the years 2004 to 2009. More recently, data from the Health Behaviour in School-aged Children study illustrated that the proportion of children aged 10 – 17 years who reported being physically active on 7 days in the previous week, remained stable from 2010 to 2014 (n = 12,200 and 13,584 respectively) (Gavin et al., 2015).

Changes due to the aging of the cohort rather than differences that can occur due to time trends are reflected in cohort studies. These studies measure PA at one point in time, track the same participants at a later date and reassess their engagement in PA (Malina, 2001).

Details of cohort studies that discuss longitudinal PA are described in more detail in Section 2.3.2. A benefit of longitudinal research is its ability to assess the extent of which PA (or factors related to PA) at the baseline measurement predict PA at the second time point (Knuth & Hallal, 2009; Telama, 2009). The information gained from longitudinal research is useful for instructing activities that promote sustained PA behaviour.

2.3.2 Physical activity tracking

Research indicates that PA habits developed in childhood may continue into later life (Malina, 2001; Telama, 2009; Telama et al., 2005). In order to determine the degree that PA tracks through life stages, surveillance of PA over a minimum of two time points in the same participant is required (Jones et al., 2013). Pearson and Spearman correlations are the most frequently used indicator of tracking as behaviour tracking involves an assessment of the relative rank or position within a group over time (Malina, 2001).

Three recent systematic reviews have synthesised the findings of tracking studies related to youth PA (Craigie et al., 2011; Evans et al., 2009; Jones et al., 2013). The number of research articles covered in these publications ranged from 11 to 26 with an overlap between the papers cited in each. Overall, tracking coefficients (correlations) for youth PA were weak to moderate. Tracking coefficients of between 0.27 and 0.57 were reported in early childhood (baseline age < 6 years with variable follow-up durations) (Jones et al., 2013), while in youth aged ≤ 18 years at baseline tracking ranged from -0.11 to 0.59 (Evans et al., 2009). In a systematic review comparing PA tracking in four regions, tracking coefficients were greatest in Europe (-0.01 to 0.47) followed by Canada (-0.1 – 0.24), the United States (0.01 – 0.17), and finally, Australia (0.04 – 0.07) (Craigie et al., 2011). Despite disparities in youth PA levels for males and females, evidence of sex differences in PA tracking is inconclusive. Craigie and colleagues (2011) reported that males had stronger levels of PA tracking than females, in contrast to, an earlier systematic review that documented an absence of sex-related differences (Evans et al., 2009).

The level of tracking can be influenced by a number of factors including the time lapse between measurements. As the time interval between assessments increases, the level of tracking declines (Craigie et al., 2011; Friedman et al., 2008; Malina, 2001). For instance in a 21-year tracking study (n = 1,563; aged 3 – 18 years at baseline), Spearman correlations ranged from 0.33 to 0.44 in males and from 0.14 to 0.26 in females, with higher correlations exhibited for shorter time intervals between measurements (Telama et

al., 2005). Results from this study also demonstrated that the odds of being physically active in adulthood were higher amongst youth who were continuously active for several years. It is also hypothesised that the degree of tracking may be influenced by the volume of PA at baseline. In an 8-year longitudinal study of 557 adolescents aged 13 years at baseline, the highest level of stability in PA was found among the least active participants at baseline (Anderssen et al., 2005). These findings propose that physical inactivity may track better than PA. Further, it has been suggested that a greater degree of tracking occurs with increasing age at baseline assessment meaning that tracking coefficients are higher in those measured in late adolescence compared with those measured in the early teenage years (Craigie et al., 2011; Telama et al., 2005). By late adolescence, participants may have resisted changes in participation that typically occur over the teenage years so their levels of participation (either high or low) may remain more constant than their younger peers.

There are various elements that support this concept of tracking. Certain factors that influence PA tend to remain stable in the lives of adolescents, for example, living arrangements with family, which in turn maintains proximity to friends. Other factors may include stability of self-efficacy and societal norms concerning PA behaviour (Anderssen et al., 2005). Theoretically, there are a number of tracking hypotheses including the carry-over, habit formation, ability and readiness, and self-selection hypotheses (Telama, 2009). The carry-over hypothesis proposes that physical activities participated in at a young age are maintained into adulthood. Automatic repeated behaviour resulting from a habit is the basis of the habit formation hypothesis. The ability and readiness hypothesis relates to previous PA experiences and the skills attained through these. It is believed to support maintenance of PA or uptake after a break period. Activities taken up may not necessarily be the same as dropped activities. Finally, the self-selection hypothesis describes those with a genetic disposition for sports performance as likely to participate more often in PA than those without the same disposition (Telama, 2009).

On the contrary, there are a number of reasons to expect an absence of PA tracking. Transitional phases in youth can influence levels of PA engagement (Telama, 2009). Changes associated with these periods, such as in social relations and resulting from changing of schools, may impact on PA participation. The transition from late childhood to early adolescence constitutes a growth spurt and sexual maturation alongside

progressing from primary to post-primary school. Evidence from a 2-year longitudinal study of Flemish children (N = 472; aged 11 – 12 years at baseline), demonstrated declines in self-reported MVPA (-12.2%) in the progression from elementary to secondary school, suggesting that transition-related changes occur during this period (Rutten et al., 2014). Nonetheless, higher levels of MVPA at follow-up were self-reported in children who self-reported higher levels of MVPA at baseline, implying a degree of tracking (Rutten et al., 2015). Within adolescent years, young people advance through post-primary school and are required to sit state examinations. Finally, the transition from adolescence to young adulthood involves moving on from school and joining the workforce or continuing to further education. Relocation or moving home upon finishing school is a factor that may influence PA tracking. Timperio and colleagues (2011) found stronger PA tracking in those who did not relocate during the transition out of secondary school than those who did.

2.3.3 Comment on physical activity tracking

Public health approaches often target PA in youth with the aim of promoting lifelong PA engagement. These objectives are based on the assumption that PA is habitual and can track from childhood into later life (Malina, 2001). It is therefore important to assess the varying levels of PA tracking across a series of transitional periods in the lives of youth as it may pinpoint when early antecedents and determinants of behaviour occur (Jones et al., 2013). The documentation of the onset of tracking can inform the timing of PA promoting interventions by targeting periods in the lives of youth where PA is more likely to be sustained into the future (Jones et al., 2013).

In theory, policies that concentrate on sustaining PA among young people will yield a greater return if they target times within the life course where PA tracking is highest. However, in instances where tracking is low, or the link between PA in childhood and adulthood is modest, the promotion of PA should not be ruled out. Although initial thoughts point towards averting limited resources from targeting stages where PA tracking is low, the contrary should be the case as these stages provide an opportunity for policymakers to influence PA positively. When tracking is low, it not only implies that those who were active did not maintain their PA levels relative to others but that those who had low levels of PA may have increased their PA participation. Indeed, successful interventions are likely to alter tracking. Where reductions in PA drop-out occur, the levels of PA tracking increase, and on the contrary, improvements in uptake of PA reduce

tracking. This illustrates a key limitation of tracking statistics as the direction of PA change is unclear. Modifications in PA tracking levels may serve as an estimation of intra-individual behaviour change over time.

2.4 Theoretical basis of the thesis

Many theories have been proposed over the years to explain the causes and mechanisms of human behaviour and to support the testing of correlates (factors associated with behaviour) and determinants (factors with a causal relationship) of PA. A theory provides an applicable template to explain a phenomenon, systematically collect facts, predict associations and outcomes and formulate hypotheses (Dishman et al., 2004; Nigg & Geller, 2012). The application of theory to youth PA inevitably leads to a greater understanding of significant variables that influence behaviour, informs interventions and ultimately leads to improved public health practices for PA (Nigg & Geller, 2012). Theories are: (1) testable (i.e. verifiable or falsifiable); (2) parsimonious (i.e. have the ability to explain the desired relationships in a simplistic manner while maintaining model integrity); (3) generalisable (i.e. transferable from one situation or population to another); and (4) encourage productivity (i.e. have the ability to produce further knowledge relating to the phenomenon) (Nigg & Geller, 2012; Nigg & Paxton, 2008). The terms "theory" and "model" are frequently used interchangeably in PA literature (Nigg & Paxton, 2008) and will be used in this fashion in this thesis. Theory differs from frameworks in that a conceptual framework is a standardised approach applied to an idea or concept related to PA research. Frameworks are often visual in nature and guide the development of instruments and tools for quantifying PA and related parameters in different settings (Pettee Gabriel et al., 2012).

Social Cognitive Theory (SCT) (illustrated in **Figure 2.1**) provides a theoretical basis for explaining PA behaviour. SCT offers a model of triadic reciprocal determinism where personal, behavioural and environmental factors operate by interacting and influencing each other bidirectionally (Bandura, 1986). The interaction between these three factors is profoundly complex (Ryan et al., 2006) and specific to an individual who experiences varying aspects of each of the factors. Self-efficacy (an individual's belief in their ability to perform PA) is considered central to SCT and has received much more research attention than the other components of the model (Heitzler et al., 2010; Rhodes & Nigg, 2011). The use of SCT in PA research has recently been supported by findings from a

systematic review and meta-analysis of studies incorporating SCT (Young et al., 2014). However, researchers have proposed that theoretical integration may provide a viable approach to improving our understanding of PA behaviour (Hagger, 2009). A recent systematic review and meta-analysis of SCTs used to explain PA behaviour in adolescents concluded that SCT should be expanded alongside ecological approaches (Plotnikoff et al., 2013).

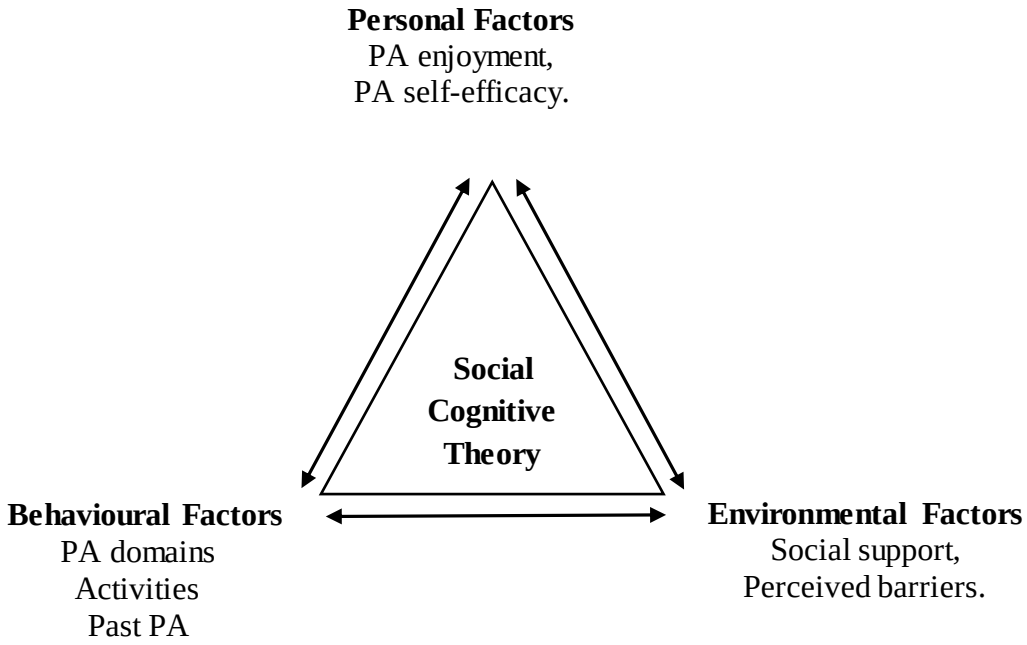

Figure 2.1 Social Cognitive Theory (SCT). Adapted from Bandura (1986).

Ecological Theory (ET) provides a theoretical foundation for assessing environmental factors, from both the physical and social environments, associated with PA behaviour. Models within ET postulate that PA behaviour has multiple levels of influence that include intrapersonal, interpersonal, organisational, community, physical environment and policy (Sallis et al., 2008). It is these broader environmental levels of influence that distinguish ecological models from behavioural models (Sallis et al., 2008). Social ecology is a component of ET that refers to the interaction between individuals and their social, cultural and institutional environments (Stokols, 1992). In the context of social ecology, the environment includes elements that are modifiable by society and that are predominantly outside the control of the individual (Sallis et al., 1997). An assumption of social ecology is the notion that environments are multidimensional such that they may be actual or perceived, and comprise of discrete attributes or constructs (Stokols, 1992). A further assumption is that it is possible for individuals to influence their settings and the changed settings can, in turn, influence behaviour (Sallis et al., 2008).

The Theory of Planned Behaviour (TPB) (Ajzen, 1991), illustrated in **Figure 2.2**, is another theory that may be utilised to formulate hypotheses regarding youth PA. The TPB is an extension of the Theory of Reasoned Action (Ajzen & Fishbein, 1980), and was developed in acknowledgement of the influence of perceived behavioural control on behaviour. It posits that behaviour is not performed automatically but follows reasonably and consistently from information available to us about the behaviour. Within the TPB, intention is an immediate antecedent of behaviour. Behavioural intention is a function of attitude towards behaviour (i.e. positive or negative value beliefs about the likely consequences of the behaviour), subjective norms (i.e. an individual's perception of a behaviour as influenced by the judgement or expectations of significant others) and perceived behavioural control (i.e. the perceived ease or difficulty of undertaking a given behaviour). Perceived behavioural control is linked with self-efficacy as described by Bandura (1986).

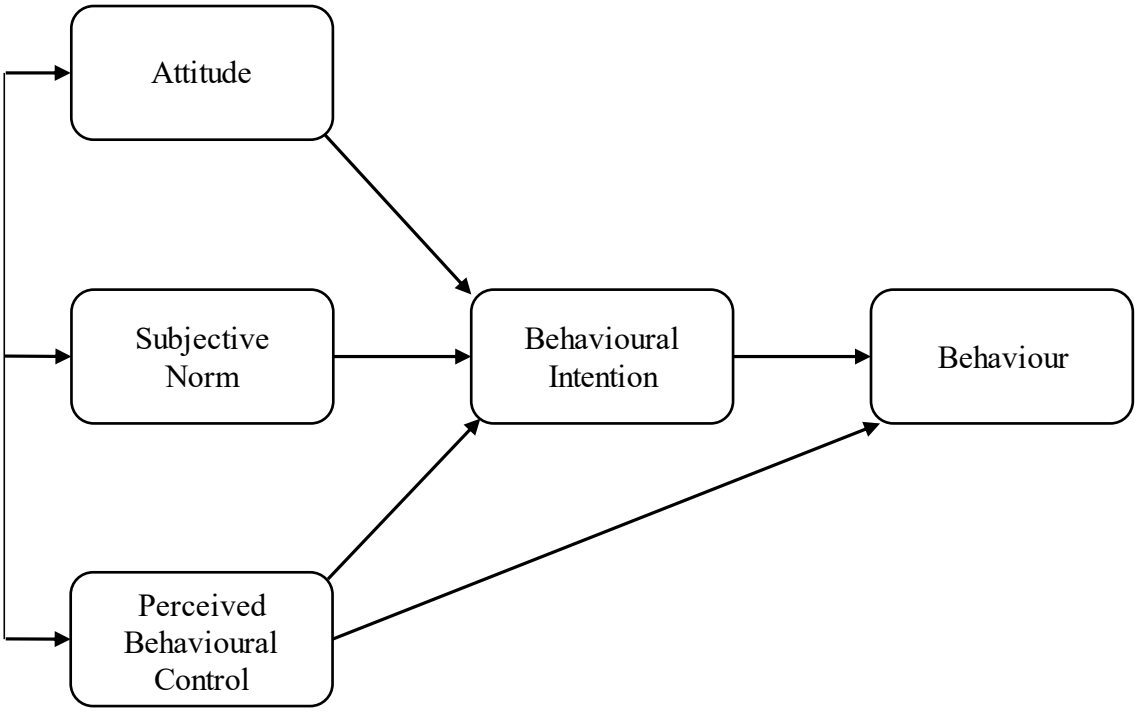

Figure 2.2 Theory of Planned Behaviour. Adapted from Ajzen (1991)

The Youth Physical Activity Promotion (YPAP) Model (illustrated in **Figure 2.3**) draws on SCT (Bandura, 1986), ET (Stokols, 1996) and the TPB (Ajzen, 1991). The YPAP Model is a theoretical framework that provides a conceptual approach to systematically investigate factors related to behaviour (Welk, 1999). It is a heuristic model as it aims to bridge the gap between theory and youth PA promotion practice. As the YPAP Model

integrates intrapersonal and interpersonal theories, it recognises the influence of both intra-individual and extra-individual factors related to youth PA engagement. Within the YPAP Model, Welk (1999) arranged relevant factors into those that predispose, enable or reinforce PA participation.

Predisposing factors refer to intrapersonal factors that have a direct influence on PA behaviour. At the individual cognitive level, a distinction is made between "am I able?" (e.g. perceptions of competence, self-efficacy) and "is it worth it? (e.g. enjoyment, beliefs, attitudes). Enabling factors such as biological (e.g. fitness and skills) and environmental factors (e.g. access to facilities) enable or allow young people to be physically active. The relationship between enabling factors and PA is bidirectional meaning that enabling factors may be influenced by, as well as, influence PA participation. Reinforcing factors are interpersonal factors that exist within the social environment and have both direct and indirect effects on youth PA. In Chapter 7, the YPAP Model is discussed in further detail.

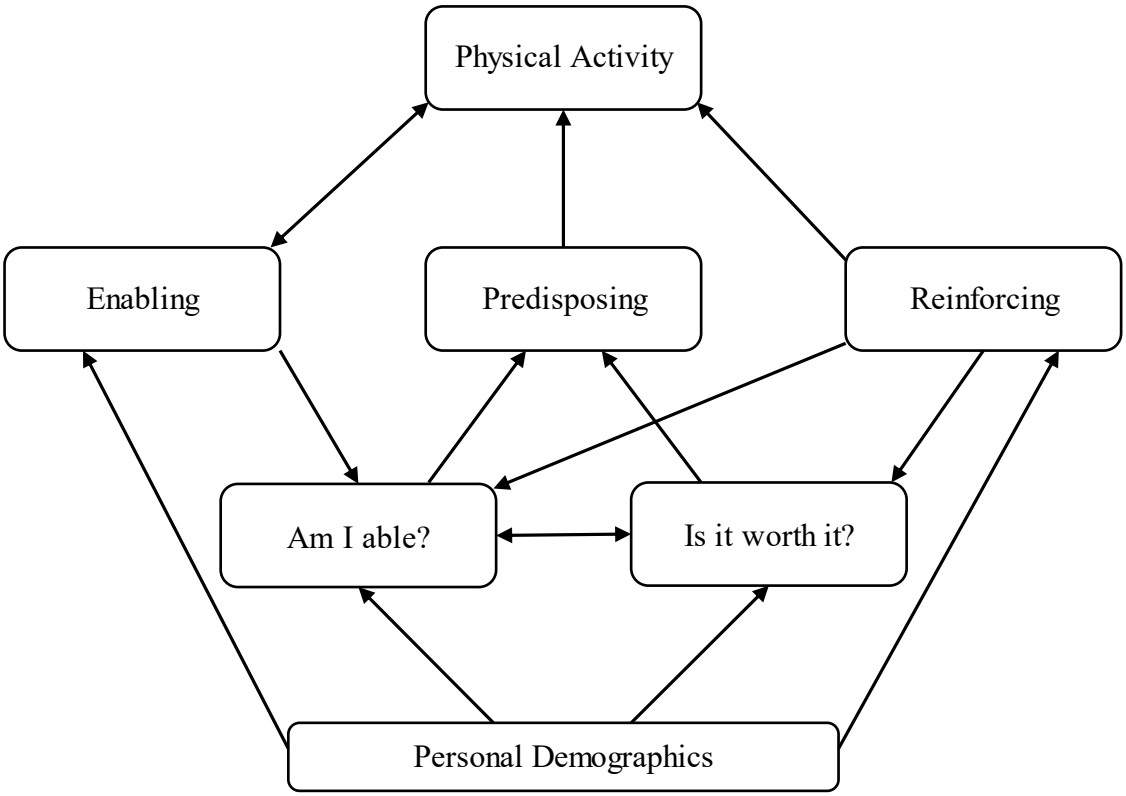

Figure 2.3 Youth Physical Activity Promotion Model. Adapted from Welk (1999).

Two theoretical approaches were undertaken in this thesis. Firstly, the CSPPA Plus survey encompasses both SCT (Bandura, 1986) and ET (Stokols, 1996). These theories were selected as they provide a holistic approach to understanding PA behaviour through the inclusion of intra – and inter-personal determinants of PA. They include both cognitive and broader environmental approaches to understanding behaviour. An overview of the amalgamated theoretical foundation for the survey design is illustrated in **Figure 3.2** (Chapter 3). Secondly, this thesis was guided by the YPAP Model. The applied nature of the YPAP Model makes it particularly useful for understanding interaction (moderating or mediating) effects of variables on youth PA behaviour. As the YPAP Model was generated using multiple theories (SCT, ET and TPB) and findings from PA research in children, it is ideal for assessing longitudinal factors associated with youth PA behaviour.

2.5 Correlates and determinants of physical activity

Understanding the reasons why young people are physically active or inactive creates an evidence-base for the development and planning of interventions that promote PA and aim to reduce physical inactivity (Bauman et al., 2012). With the progression of PA research, research methods, concepts and terminology become more complex, and diversity in these areas makes integration of findings between studies challenging (Bauman et al., 2002). In response to this limitation, Bauman and colleagues (2002) proposed definitions, which are widely accepted today, to distinguish clearly between the terms "correlate" and "determinant". They described correlates as factors that are associated with PA. Evidence from cross-sectional studies provide details of associations between a variety of personal, social and environmental variables and PA, and comprise the correlates of PA. Alternatively, determinants are described as factors that have a causal relationship with PA and variations in these factors tend to systematically reflect differences in PA behaviour. It is important to note that there are no absolute causal factors in behavioural research (i.e. causal factors do not cause the outcome in 100% of cases). Further, there may be multiple causal factors and the relationships between factors and PA may be bidirectional. Randomised controlled trials and cohort studies provide evidence for PA determinants.

Reviews of review papers may provide a clearer vision of the correlates and determinants of PA as they synthesise vast amounts of research findings. To date, there is an abundance

of literature on the correlates of PA while large-scale research on the determinants of PA is still emerging. As part of the Lancet series on PA, evidence from review studies on correlates and determinants of PA was compiled, and findings were separated into children, adolescent and adult categories (Bauman et al., 2012). In the adolescent category, six review studies were identified that covered the years 1970 to 2010 and an age range of 10 – 18 years (Biddle et al., 2005; Craggs et al., 2011; Edwardson & Gorely, 2010; Sallis et al., 2000a; Uijtdewilligen et al., 2011; Van Der Horst et al., 2007). The number of correlates in each review study ranged from 35 (Sallis et al., 2000a) to 76 (Craggs et al., 2011; Edwardson & Gorely, 2010; Uijtdewilligen et al., 2011). Determinants were only included in the two most recent reviews (six determinants in Craggs et al., 2011; eight determinants in Uijtdewilligen et al., 2011).

The wide range of factors identified as part of these studies reflects the complex nature of youth PA. Bauman and colleagues (2012) assorted the factors into demographic, behavioural, psychosocial, social and cultural variables. In the following lines, an overview of the number of review studies that found specific results are detailed in brackets after each variable. The demographic variables included male sex (correlate: 3, inconclusive: 2), age (inversely correlated: 2, inconclusive: 2) and socio-economic status (correlate: 1, not correlate: 2, inconclusive: 1). The behavioural variables were not widely reported in the reviews but included organised competitive sports (correlate: 1) and previous PA (correlate: 1, determinant: 1, inconclusive: 1). The psychological variables demonstrated mixed results and included self-efficacy (correlate: 2, determinant: 1, inconclusive: 1), fun/enjoyment of PA (correlate: 1, not correlate: 2, inconclusive: 1) and barriers to PA (inverse correlate: 1, not correlate: 1, inconclusive: 1). The social variables showed similarities across the reviews and included parental/family support (correlate: 4, inconclusive: 1) and friend/significant others support (correlate: 2).

2.5.1 Comment on correlates and determinants of physical activity

There are numerous inconsistencies across findings in review studies of the correlates and determinants of PA which may be explained by the heterogeneity of research consolidated in the reviews, for example, varying sample sizes, participant characteristics, measurement instruments and measurement error, and analysis techniques. Regardless of the inconsistencies, the results illustrate that PA may be influenced by multiple factors. As factors associated with PA vary by region and across cultures, more research is needed on the correlates and determinants of youth PA from different countries (Tremblay et al.,

2014). This research can then inform evidence-based practice unique to the region it is undertaken in.

2.6 Psychosocial factors related to physical activity

The psychological and social factors related to PA have been touched upon in Section 2.5 where the results of a review of reviews on the correlates and determinants of PA are described. As it is not possible to examine all psychosocial factors in detail, the variables PA self-efficacy, PA enjoyment, social support for PA and perceived barriers to PA have been selected for further appraisal in the current section. These psychosocial variables were chosen for inclusion in this thesis as they: (1) were included in the CSPPA study and provide baseline data for this thesis; (2) fit within the guiding framework of the thesis (YPAP Model); (3) are frequently examined in the literature; and (4) there is evidence supporting an association between them and youth PA in Ireland.

2.6.1 Self-efficacy

Self-efficacy for PA, an individual's belief in their ability to perform PA, can be developed from four major sources; performance accomplishments, vicarious experiences, verbal persuasion and physiological states (Bandura, 1977). Successful past performances can increase mastery expectations and self-efficacy whereas repeated failures may have the opposite effect. Modelling of behaviour can allow for social comparisons to be made and can contribute to vicarious experiences by generating expectations that the behaviour is possible for the individual. Behaviour may be reinforced by leading people through suggestion or using verbal persuasion to convince individuals that they may be successful in PA related tasks. Finally, an individual's belief in their ability to perform PA may be influenced by their physiological state, where self-efficacy may be higher when in a calm and relaxed state versus a stressed and apprehensive state (Bandura, 1977).

In a review of the correlates of PA in children and adolescents, Sallis and colleagues (2000) reported indeterminate results on the association between PA self-efficacy and PA behaviour. However, evidence from more recent review studies has elucidated the consistent positive relationship between PA self-efficacy and PA participation (Bauman et al., 2012; Biddle et al., 2005; Van Der Horst et al., 2007; Young et al., 2014). Moreover, in a review of the determinants of change in PA, greater levels of self-efficacy were

related to smaller declines in PA over time (Craggs et al., 2011). In an Irish study of 256 youth aged 12 – 14 years, self-efficacy displayed moderate effects on PA level. Findings demonstrated that inactive adolescents exhibited significantly lower scores for self-efficacy than their peers who were moderately or highly active (Belton et al., 2014).

2.6.2 *Enjoyment*

Enjoyment can be described as a positive affective state that reflects feelings such as pleasure, liking and fun (Scanlan & Simons, 1992). Despite an intuitive logic alluding to an association between PA enjoyment and PA levels, evidence of the relationship is mixed. In one review study, enjoyment of PA in adolescents was unrelated to PA levels across five studies (Sallis et al., 2000a). These results were confirmed in a later review study that reported no correlation between the two variables in five of the eight studies meeting the inclusion criteria (Van Der Horst et al., 2007). On the contrary, a systematic review of correlates of PA in adolescent girls highlighted that enjoyment of PA had a small-to-moderate positive relationship with PA in seven out of the eight studies included in the review (Biddle et al., 2005). It has since been proposed that PA enjoyment may be more eminent in girls than boys, in particular at a time when PA participation declines (Biddle et al., 2011b).

In a randomised controlled trial of the Lifestyle Education for Activity Program (LEAP), Dishman and colleagues (2005) investigated the influence of the intervention on PA enjoyment, PA self-efficacy and PA levels in adolescent girls (N = 2,087; 50% in control group; aged 13 – 14 years at baseline). It was the first study to provide experimental evidence showing that increases in PA enjoyment and PA self-efficacy, due to the intervention, resulted in increased PA. In a paper utilising a subsample of CSPPA study participants (n = 902, aged 12 – 18 years), it was revealed that adolescents in Ireland have high levels of PA enjoyment and the average enjoyment score was greater in those who met the PA guidelines than those who did not (Woods et al., 2012). Focus groups (n = 18; participants: n = 124; aged 12 – 18 years) also conducted as part of the CSPPA study, identified "experiencing fun" as one of the top five themes associated with PA, PE and sport. All youth, regardless of sex, activity level or school level (primary or post-primary) pinpointed enjoyment and pleasure as key for choosing to participate in PA (Tannehill et al., 2015). More recently, in focus groups (n = 8) conducted with youth (n = 59, aged 12 – 14 years) in Ireland, PA enjoyment was identified as a key emergent theme for PA motivation (Belton et al., 2014).

2.6.3 Social support

Engagement in a new PA may be dependent on social connections and networks (Lunn et al., 2013). In adolescents, general social support for PA was affirmed as a determinant of PA change in a systematic review, where greater levels of social support for PA were linked with reduced PA declines over time (Craggs et al., 2011). Another review study highlighted that young people who perceive various types and sources of social support are more likely to be physically active than those who do not (Beets et al., 2010).

Different sources of social support, such as family or parental support and peer or friend social support for PA, are often investigated independently in the literature. In a systematic review of 75 studies published between 2006 and 2011 on PA social support in adolescents, 35% of studies covered parental support and 64% of studies addressed social support from friends (Mendonca et al., 2014). Of the nine longitudinal studies included in the review, eight detected that increases in or maintenance of social support over time were associated with PA levels being augmented or sustained, respectively (Mendonca et al., 2014). Parental social support may occur in the form of transportation to/from activities, supply of sports equipment, and reinforcement and encouragement to partake in PA (Mendonca et al., 2014). Many systematic reviews have provided evidence that substantiate the positive influence parental social support has on youth PA (Beets et al., 2010; Biddle et al., 2005; Biddle et al., 2011b; Edwardson & Gorely, 2010; Gustafson & Rhodes, 2006). Review studies have also illustrated the positive relationship that friend social support for PA has on PA levels (Mendonca et al., 2014; Van Der Horst et al., 2007). In a systematic review of friendship networks and PA, levels of PA participation among friends were associated with PA of the individual. Longitudinal studies included in the review revealed that young people's levels of PA change to reflect that of their friends (Sawka et al., 2013). A further review of the influence of friends on children's PA found that encouragement from friends, friends PA and participation with friends in PA all had a positive effect on concurrent youth PA (Maturo & Cunningham, 2013).

Irish research has corroborated the relationship between social support for PA and engagement in youth PA. Findings from the CSPPA study demonstrate that social factors are important for PA for both sexes at primary and post-primary school levels (Woods et al., 2010). Tannehill and colleagues (2015) uncovered that one of the main reasons for young people to engage in PA is the want to be physically active with friends. Themes

related to social support that they identified in the focus groups include "being with friends" and "parent and sibling influence".

2.6.4 Barriers to physical activity

Barriers to PA can be real or perceived and may include a lack of time, lack of resources, lack of willpower, social influence, lack of interest, lack of energy, lack of skill, fear of injury or other competing activities such as school work (Biddle et al., 2011b; Centers for Disease Control and Prevention, 2001). The relationship between perceived barriers to PA and PA levels in youth has exhibited varying results. Evidence of small-to-moderate inverse correlations between perceived barriers to PA and PA behaviour have been reported in two systematic reviews (Biddle et al., 2005; Sallis et al., 2000a) while findings were inconclusive (Craggs et al., 2011) and no association (Van Der Horst et al., 2007) was described in other systematic reviews.

In a cross-sectional survey of 15,239 persons, aged over 15 years, from 15 member states of the European Union, the main barriers to increasing PA were work/study commitments (28%) and the individuals' belief that they are not the 'sporty type' (25%) (Zunft et al., 1999). The top results for barriers to PA in Ireland reported in this study were work/study commitments (25%), not the 'sporty type' (18%), no need (12%), no energy (11%) and an 'other' option (16%) (Zunft et al., 1999). More recently, the primary barrier to PA engagement reported by Irish adolescents aged 12 – 14 years was insufficient time to participate, with subjects also citing the distance to the activity as a concern (Belton et al., 2014).

2.6.5 Comment on psychosocial factors

Understanding why young people are physically active or inactive assists with the design of PA promoting interventions (Bauman et al., 2012; Biddle et al., 2011b). Of particular interest are the factors, including psychosocial factors, that are modifiable and can, therefore, be positively altered to encourage long-term PA engagement. Based on the review of the literature, it is clear that a range of psychosocial factors with varying levels of evidence may impact on youth PA. This section (2.6) describes a selection of psychosocial factors and the form in which they exist. Although the evidence from the reviews and systematic reviews presented here is mixed, findings from studies undertaken in Ireland highlight the potential role that each may play in youth PA.

Due to the limited availability of determinants studies, conclusions of present review studies are mostly drawn from cross-sectional research. This overdependence on studies with a cross-sectional design was highlighted in a recent review and meta-analysis of studies that explain PA behaviour in adolescents (Plotnikoff et al., 2013). A fundamental limitation of this research design is that causal inferences cannot be made. Further research is necessary to uncover the potential longitudinal benefits of certain psychosocial factors and provide strength or clarify previous findings in the literature. In Chapter 7 of this thesis, the longitudinal relationships between PA self-efficacy, PA enjoyment, social support for PA and perceived barriers to PA with 5-year PA are examined.

A further limitation of the review studies on correlates and determinants (including psychosocial and other factors) is the investigation of factors in isolation of each other when in reality they form a complex web of relationships with moderating and mediating effects. Although reviews recognise that correlates and determinants may be mediators (intervening variables that affect the pathway between exposure and outcome PA) or moderators (interaction variables that affect the direction or strength of the relationship between a mediator and PA) of PA, they do not describe the interaction effects or relationships with other correlates/determinants as part of the reviews. Instead, factors tend to be grouped under common themes with results listed separately for each. An example of these themes includes demographic and biological, psychosocial, behavioural, social/cultural and environmental correlates in the case of the review of quantitative systematic reviews by Biddle and colleagues (2011b). The interaction effects of the psychosocial variables included in this thesis are discussed in Chapter 7, Sections 7.4 and 7.8. Again, most of the literature that models these factors is cross-sectional in design.

When designing PA programmes, a good starting point would be conducting an audit of the evidence-base provided by review studies. However, it is necessary to highlight that factors associated with PA vary across countries and cultures (Tremblay et al., 2014) and therefore, caution should be practiced when relying solely on their findings to inform public health approaches that promote long-term PA engagement. As such, it is necessary to integrate this information with research findings from the country in question.

2.7 Domains of physical activity

PA is performed in various contexts and consists of many structured and unstructured forms (Bangsbo et al., 2016). According to the SLOTH Model, PA exists with reference to Sleep, Leisure-time, Occupation (includes school for children and adolescents), Transportation and Home contexts (Pratt et al., 2004). Specifically, domains of youth PA include sport, active outdoor recreation or play, active transportation and PE (Bangsbo et al., 2016; Cleland et al., 2012). Each domain varies regarding levels of youth engagement and factors influencing participation. Due to these inherent differences, it is important to investigate their individual contribution to PA, in particular, long-term PA.

2.7.1 Sports participation

According to the Council of Europe, sport may be defined as:

> "All forms of physical activity which, through casual or organised participation, aim at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels" (Council of Europe, 2001: Article 2).

In young people, sport may take place in the school setting in the form of extra-curricular sport or the community setting as part of a club. It is necessary to point out that extra-curricular sport is differentiated from PE as it occurs outside of school curriculum time, i.e. at lunch times, before or after school, or at weekends.

The contribution of sport to overall health is significant. As demonstrated by large cohort studies, sports participation may be associated with a 20 – 40% reduction in all-cause mortality when compared with non-participation (Khan et al., 2012). Youth sports participation is positively correlated with overall PA levels (Sallis et al., 2000a) and sports contribute between 23% and 65% of total youth PA (Katzmarzyk & Malina, 1998; Wickel & Eisenmann, 2007). In post-primary students in Ireland, participation in either extra-curricular sport or community-based sport were significantly associated with daily bouts of 60 minutes of moderate to vigorous physical activity (MVPA) (Woods et al., 2010). The volume of MVPA undertaken in sports sessions varies by sport, sex and age (Leek et al., 2011). In a U.S. study of 200 youth aged 7 – 14 years, MVPA was greater in soccer practice than in baseball/softball practice. Irrespective of sport, girls achieved ~11 minutes less of MVPA than boys and older children (aged 11 – 14 years) obtained 7

minutes less of MVPA per training session than the younger age group (aged 7 – 10 years) (Leek et al., 2011).

Not only are there sex and age gaps in the level of MVPA in training, but there is also a divide in overall participation rates. Irish research has consistently demonstrated that adolescent girls are less likely to participate in sports than teenage boys (Fahey et al., 2005; Harrington et al., 2014; Woods et al., 2007; Woods et al., 2010). The Health Behaviour in School-aged Children study recently reported that 75% of boys compared to 59% of girls play sport in a club and that a higher proportion of younger children participate in club sport compared with older children (Gavin et al., 2015).

Sports preferences are another aspect that differs between the sexes. Girls tend to take part in a mix of individual and team sports while traditional invasive team-based games dominate male sports participation (Woods et al., 2010). In adulthood, irrespective of sex, there is a shift to individual sports where approximately three-quarters of sports participated in are individual sports. The majority of these sports are adopted in adulthood (Lunn et al., 2013).

The participation rates in most sports decline across adolescent years (Belanger et al., 2009; Brooke et al., 2014; Kjonniksen et al., 2008). In a combined analysis of the CSPPA study (Woods et al., 2010), the School Leavers' study (Byrne et al., 2009) and Irish Sports Monitor (Lunn & Layte, 2009; Lunn et al., 2009), Lunn and colleagues (2013) reported that just six sports accounted for over 60% of dropouts in those aged over 16 years (through early adulthood) (Lunn et al., 2013). The sports with the highest dropout included Gaelic football (↓14.4%), soccer (↓13.9%), hurling (↓9.9%), exercise (↓9.3%), swimming (↓7.1%) and basketball (↓6.2%).

A number of studies have assessed tracking of sports participation over time and the influence of sports participation in youth on later PA. In a systematic review of tracking of PA behaviours during childhood, adolescence and young adulthood, low to moderate levels of tracking were reported for sports participation (Evans et al., 2009). Nonetheless, sports participation in youth has been found to significantly predict participation in young adulthood (Basterfield et al., 2015; Malina, 2001; Perkins et al., 2004; Tammelin et al., 2003; Telama et al., 2006). In the Gateshead Millennium Birth Cohort Study (n = 525), participation in sport at age 9 predicted participation at age 12 (Basterfield et al., 2015).

In the Northern Finland 1966 Birth Cohort Study (n = 7,794), frequent participation (>1 session per week) in sport at age 14 years was associated with high levels of PA at age 31 (Tammelin et al., 2003). Elsewhere, in a multivariate analysis of 257 females aged 12 – 18 years at baseline, involvement in sports during adolescence was found to be a greater predictor of adult sports participation (20 years later) than education or parental socioeconomic status (Scheerder et al., 2006). In males, being persistently active into adulthood was associated with playing sport outside of school in youth (Jose et al., 2011).

It has been hypothesised that taking part in numerous youth sports may positively influence later PA levels (Dumith et al., 2012; Kjonniksen et al., 2008). In a Finnish twin study, participation in several different sports was related to higher stability in leisure-time PA from age 16 to 18 years (Aarnio et al., 2002). In a 4-year longitudinal study of Brazilian adolescents (n = 4,120), the number of recreational activities engaged in at age 11 was the main predictor of leisure-time PA change at age 15, where more activities were associated with more PA (Dumith et al., 2012). In a 10-year Norwegian tracking study with eight data collection points (n = 630, aged 13 years at baseline), participation in multiple adolescent physical activities was moderately associated with later PA (Kjonniksen et al., 2008).

There is a gap in the literature examining the types of sport engaged in (e.g. team-based or individual sports) and the highest standard of participation (e.g. elite or competitive levels) as predictors of later PA. Longitudinal research is needed to understand the impact of the various aspects of youth sports participation on long-term PA. Due to the dearth of this type of research within the Irish setting, investigation within this context is warranted.

Concerning temporal trends in youth participation in organised sports, results from a recent review of nine studies found an increase in participation in most studies (Booth et al., 2015). Evidence from Ireland illustrates a small increase (3%), between the years 2004 and 2009, in the proportion of post-primary school children who engaged in extra-curricular sport at least once per week (Fahey et al., 2005; Woods et al., 2010). This contrasted to the decrease (6%) in proportion of the same group engaging in club sport between these years. There was little change in primary school students.

In youth, sports participation is influenced by a broad range of factors. Correlates and determinants of youth PA (for example, the psychosocial factors associated with PA described in section 2.6) may also elucidate factors influencing engagement in sports. Over the years, Irish research has examined the reasons why youth drop out of sport. In 1995, the Sports Council of Northern Ireland survey identified other commitments (school/work) and a lack of interest as the top reasons for sports dropout (Kremer et al., 1997). In 2005, a report by Cork Institute of Technology on behalf of the National Children's Office reported time, not liking the leader, skill level and peer dropout as the most pertinent reasons for sports dropout respectively (De Róiste & Dinneen, 2005). More recently, Lunn and colleagues (2013) identified work commitments, leaving school/college, losing interest, preference for another sport, family commitments and injury as reasons for dropping out of a team sport. On the other hand, work and family commitments, loss of interest and injury were the main reasons reported for dropping out of an individual sport (Lunn et al., 2013).

From the review of the literature, it is clear that sport has a critical role in contributing to overall youth PA (Sallis et al., 2000a) and that sports participation occurs in many different forms. The aspects of youth sports participation that may offer long-term benefits for PA engagement remain to be fully deciphered (Walters et al., 2009). Longitudinal research can provide the answer to understanding the impact of sport over time (Telford et al., 2015).

2.7.2 Active outdoor play

Research examining incidental PA is minimal (Biddle & Fuchs, 2009). Regarding active outdoor play, publications are generally restricted to younger children (Schaefer et al., 2014). Nonetheless, one study of youth aged 9 – 17 years (n = 306) reported that outdoor time was correlated with PA levels (Schaefer et al., 2014). Elsewhere, research findings from a cross-sectional study (n = 760) demonstrated that younger children (aged 9 years) were more inclined to engage in active play than older children (aged 15 years) (Ommundsen et al., 2006). The rationale given for the difference between age groups is that older children may view play and games as being child oriented. For this reason and due to limitations in data available from the baseline study, active outdoor recreation is not examined within this thesis.

2.7.3 Active transportation

Active transportation involves utilising physical activities such as walking or cycling as a mode of transport. The majority of research that investigates active travel in youth examines the commute to school. Of 19 studies identified in a review of active transportation in young people, only 2 reported travel to other local destinations (Panter et al., 2008). For young people who do not live within close proximity to school, travel to these other locations may be the only opportunity they have to engage in active transportation. Leisure-time destinations include, for example, friends' homes, shops, sports facilities and parks (Carver et al., 2011; Panter et al., 2008). Little is known about the relationship between daily active transport to all destinations and overall PA levels among youth (Carver et al., 2011). Further research should (1) investigate the impact of active transport accumulated across different destinations on youth PA, and (2) differentiate between the contribution of each travel destination to overall PA levels. Within this thesis, research on active transportation is constrained to active commuting to school due to data limitations of the surveys. The domain of active commuting to school is henceforth discussed in more detail.

Commuting by active modes of transport to school provides an opportunity for children and adolescents to accumulate PA (Davison et al., 2008). Evidence from systematic reviews illustrates that walking or cycling to school is associated with higher overall levels of PA (Faulkner et al., 2009; Larouche et al., 2014; Lee et al., 2008). Young people who actively commute are more likely to achieve the youth PA guidelines, have better cardiovascular fitness (Davison et al., 2008), and have a healthier body composition than their counterparts (Lubans et al., 2011).

Similar to general PA and sport, boys are more likely to actively commute to school than girls (Davison et al., 2008). However, evidence is mixed with regard to the age-related decline across adolescent years emblematic to PA participation and other domains of youth PA. Some studies reported higher rates of active commuting in older children while others reported the opposite trend in a review by Davison and colleagues (2008). It should be noted that caution needs to be taken when comparing between studies the proportions actively commuting to school as self-report measures tend to be heterogenous (Herrador-Colmenero et al., 2014).

Ireland has lower levels of walking and cycling to school than its European neighbours (Murtagh et al., 2016). Findings from the CSPPA study (N = 5,397) revealed rates of active commuting to school were 31% for primary school children (aged 10 – 12 years) and 40% for post-primary school students (aged 12 – 18 years) in 2009 (Woods et al., 2010). At a post-primary school level, males were significantly more likely to actively commute to school than females, in contrast to, no difference between the sexes at the primary school level. Moreover, active commuting to school was a significant determinant of participation in MVPA for girls and the age-related declines in PA did not extend to active commuting (Woods et al., 2010). In a further study of 199 youth aged 15 – 17 years in Ireland, females living within 2.4km of their school were as likely to actively commute to school as their male counterparts living within the same distance (Woods & Nelson, 2014).

A small number of studies have assessed longitudinal patterns of active commuting to school. In a 1-year longitudinal study of British children aged 9 – 10 years, children who changed their mode of transport to school from a passive to an active mode increased their daily MVPA by an average of 6 (girls) to 9 (boys) minutes (Smith et al., 2012). The first study to assess tracking of active commuting to school was published in 2011 and found moderate levels of tracking in children (n = 134) but not among adolescents (n = 201) (Carver et al., 2011). Elsewhere, it has been reported that active commuting in childhood and adolescence was prospectively associated with adult PA (Yang et al., 2014). In Ireland, the first longitudinal analysis of active commuting to school was only recently published (Murtagh et al., 2016). The Growing Up in Ireland (GUI) study collected data on 8,502 9-year-old children between August 2007 and May 2008, and followed-up with 7,479 of these youth 4 years later. The proportions engaging in active commuting to school were 25% and 20% respectively, highlighting a decline in the transition from primary to post-primary school. These rates are notably lower than those reported in the CSPPA study. It is unclear why this is the case and characteristics of the sample do not shed any light on the reason (figures represent CSPPA and GUI studies respectively; male sex: 48%, 49%; living in an urban area: 36%, 46%; age: 10 – 18 years, 9 years at baseline and 13 years at follow-up).

Regarding temporal trends, a recent review identified consistent declines in active commuting in children and adolescents over time (Booth et al., 2015). As there is a dearth of research in this area, just nine studies were included in the review. Evidence from

Ireland does not support these findings. Differences in prevalence rates between the Economic and Social Research Institute cross-sectional study in 2004 (Fahey et al., 2005) and the CSPPA cross-sectional study in 2009 (Woods et al., 2010) account for increases of 5% and 10% in primary and post-primary students, respectively.

The decision-making process associated with choosing the mode of commuting to school is complex (Faulkner et al., 2010). One of the most consistently cited barriers is the distance between the child's residence and their school (Lu et al., 2014; Murtagh et al., 2016; Panter et al., 2011; Panter et al., 2008; Woods et al., 2010). The criterion distance of active commuting to school has been examined in Belgium and Irish youth. The criterion distance is the distance that is deemed to be feasible to actively commute. It is based on an assessment of the distance above which young people choose not to actively commute (Nelson et al., 2008). In 11 – 12-year-old Belgian children (N = 696), the criterion distance for walking to school was 1.5km and for cycling to school was 3km (D'Haese et al., 2011). The distances were higher in older adolescents aged 17 – 18 years (N = 1,281; also from Belgium) where the criterion distances were 2km for walking and 8km for cycling to school (Van Dyck et al., 2010). In an Irish study of 15 – 17-year-olds (N = 4,013), the majority of walkers lived within 2.4km (1.5 miles) and cyclists within 4km (2.5 miles) of their school. For each 1.6km (1 mile) increase in distance from the school, the odds of either walking or cycling decreased by 71% (Nelson et al., 2008). It is possible that perceptions of distances may not only influence active commuting behaviour but also be influenced by this behaviour. Results from a study of 15 – 17 year-old adolescents in Ireland (n = 199, 52.8% male) found that passive commuters significantly overestimated the distance travelled to school (actual distance = 1.35km, perceived distance = 2.74km, $P < 0.01$) while active commuters were accurate in their perception of distance (actual distance = 1.29km, perceived distance = 1.40, nonsignificant difference) (Woods & Nelson, 2014). Environmental factors other than distance also impact on the likelihood of active commuting to school and may explain the differences between these studies. One such example is the positive association between living in an urban area and active commuting (Murtagh et al., 2016; Pabayo et al., 2011).

The list of perceived barriers to children's active commuting to school is extensive. A systematic review of 39 studies by Lu and colleagues (2014) summarises many of these barriers by drawing them together under the headings personal barriers, physical environmental barriers and social environmental barriers. The personal barriers include a

lack of time, the ease of dropping the child off on the way to work, the heaviness of the child's backpack and the child's preference of being driven to school. The most cited physical environment barrier was traffic safety, followed by the distance to the destination and then the quality of the route. Barriers related to the social environment included neighbourhood safety, personal safety and concern about something happening the child on the way to school (Lu et al., 2014).

There is a clear evidence-base for the contribution that active commuting to school has to overall PA. From the review of the literature, it is apparent that there is extensive research examining the factors that influence engagement in active commuting. Nonetheless, there are a minimal number of longitudinal studies examining this domain of PA in youth. It is clear that more evidence is required to explain the contribution of active commuting in youth to longer-term PA.

2.7.4 Physical education

For over 100 years, PE has been included in the school curriculum (Sallis et al., 2012) with the aim of providing students with the knowledge, skills and confidence to participate in PA throughout their lifetime (Healthy Ireland, 2016; Sallis et al., 2012). PE contributes to overall PA levels, in addition to, chronic disease prevention (Le Masurier & Corbin, 2006; Sallis et al., 2012). Review studies have quantified the proportion of time children and adolescents spend partaking in MVPA in PE classes. In a review of 44 studies on elementary school PE, an average of 34% of lesson time was spent in MVPA (Fairclough & Stratton, 2006). On the other hand, students in middle or high school spend 27 – 47% of their class time in MVPA (evidence from a review of 40 studies) (Fairclough & Stratton, 2005). As the prescribed PE teaching time significantly differs from country to country (European Commission et al., 2013), the contribution of PE to overall PA levels differs by region. In the vast majority of European countries, the time allocated to PE as a relative proportion of total taught time is higher in primary than in post-primary education (European Commission et al., 2013). Of the 30 countries included in a European report on PE and sport at school, Ireland had the lowest minimum time recommendation for PE in primary schools (European Commission et al., 2013) at a minimum of 60 minutes of PE weekly (Department of Education and Science, 1999). This equates to a total of 37 hours per school year. The guidelines for provision of PE in post-primary school stipulate that pupils should be provided with 120 minutes of PE per week (Department of Education and Science, 2003). This recommendation equates to a total of

45 hours per school year and is the fourth lowest guideline for post-primary students in the European Commission report (European Commission et al., 2013).

Evidence from the CSPPA study illustrates that only 35% of primary school children and 10% of post-primary school students are provided with these minimum levels of weekly PE (Woods et al., 2010). The average PE received in Ireland by primary school students is 46 minutes per week and by post-primary school pupils is 77 minutes weekly (Woods et al., 2010). Trends show that provision of PE for females and senior pupils is lower than for males and younger peers (Woods et al., 2010; Woods et al., 2012). In another Irish study, youth attending fee-paying post-primary schools received a significantly greater amount of weekly PE than children and adolescents attending disadvantaged schools (80 and 75 minutes, respectively) (Lunn, 2006). In post-primary schools in Ireland, improvements in weekly PE minutes occurred between the years 2004 and 2009 with an average increase of 5 minutes per week (Woods et al., 2010). In a review of temporal trends in PA, there were just four studies identified that assessed changes in PE over time. The inconsistent results from these studies demonstrate differing trends between and within countries over time (Booth et al., 2015). Further, there is a dearth of longitudinal literature assessing PE as a predictor of later PA with the author of this thesis identifying just one study on the topic. Findings from the Australian 20-year prospective tracking study (n = 2,047, baseline age 9 – 15 years) were unclear and inconclusive for both sexes in relation to the long-term impact of PE on PA behaviour (Cleland et al., 2012).

Evidence suggests that PE contributes to overall PA levels in youth. It has also been hypothesised that PE may provide a foundation for lifelong PA (European Commission et al., 2013; MacNamara et al., 2011; Seghers et al., 2009). However, there is a clear need for further research examining the potential role that PE may have on long-term PA. Addressing this gap in the literature will provide an evidence-base to assist with directing future health promotion strategies.

2.7.5 Comment on domains of physical activity

Each domain of youth PA is complex and unique in terms of its contribution to overall (simultaneous) PA levels and future PA levels (the strength of evidence varies by domain), participation rates and factors influencing participation (cross-sectionally and longitudinally). Moreover, there are intra-domain differences, for example, varying features and popularity of specific sports, differences between walking and cycling as

forms of transport, and a diversity in the provision and quality of teaching in PE. In addition, there are sex and age disparities within each PA domain. To complicate matters even further, there are changes in the availability of, for example, extra-curricular sport and PE, during adolescence and young adulthood. Upon leaving school, these domains are no longer accessible to young people.

It is clear from the complexities of each domain of PA that it is meaningful to investigate each domain individually but it is also critical to assess the domains of youth PA collectively to examine their relative contribution to PA behaviour. It is beyond the scope of this thesis to investigate each domain of PA in isolation. However, based on an examination of specific domains of youth PA (i.e. sports participation - extra-curricular and community club-based, active commuting to school and PE) as predictors of PA five years later (see Chapter 6), one domain will be selected to investigate in further detail.

2.8 Measuring physical activity

Measurement of PA is a prerequisite to understanding PA, trends in PA behaviour and behaviour change (Wanner et al., 2014). Due to the complex and multidimensional properties of PA, measurement of this behaviour is fraught with difficulties (Janz, 2006; Warren et al., 2010). Robust, standardised PA surveillance procedures are a necessity for examining PA behaviour in children and youth across the world (Hallal et al., 2012a; Tremblay et al., 2014). The use of valid and reliable PA measurement methodologies is critical for determining the prevalence of PA and assessing the extent of the impact of PA interventions or policies (Milton et al., 2013) and population prevalence rates are dependent on the instrument used to assess PA (Sarkin et al., 2000). There are two main approaches to measuring free-living PA; self-report, e.g. surveys, diaries, recalls and interviews and; objective measures, e.g. motion sensors including accelerometers and pedometers, heart rate monitors and direct observation (Warren et al., 2010). In a review of methodologies for assessing PA, Warren and colleagues (2010) acknowledged that the perfect PA measurement method does not exist, and neither self-reported PA nor accelerometry determined PA provide a 'gold standard' of PA assessment.

In large-scale epidemiological studies, self-report instruments are the most widely used tools for assessing youth PA (Helmerhorst et al., 2012; Sallis & Saelens, 2000). The low cost and convenience of administration are factors that support the selection of surveys

as the methodology of choice (Biddle et al., 2011a). A benefit of PA surveys is their ability to capture data on multiple dimensions of PA, describing the frequency, duration, location, domain and context of the activity (Warren et al., 2010). Overall, review studies illustrate that PA surveys developed for use in children and young people have acceptable reliability, but validity tends to be moderate at most (Adamo et al., 2009; Helmerhorst et al., 2012).

Measurement error and bias due to misreporting are widely acknowledged limitations of self-report surveys. Misreporting may occur consciously in the form of social desirability bias where respondents reply to questions in a manner that they believe will be viewed more favourably by others. It may also result from cognitive limitations related to comprehension of questions or recall of activity (Helmerhorst et al., 2012). In young children, activity patterns are spontaneous and sporadic. The lack of structure and organised nature of this activity, in addition to younger children having a poorer sense of time and reduced cognitive maturity, hinders the ability to accurately recall PA behaviour (Loprinzi & Cardinal, 2011). This is evidenced by findings from a systematic review that revealed correlations between objectively measured PA and subjectively recalled PA to be higher in adolescents than in children (Chinapaw et al., 2010). Over-reporting of PA may arise intentionally or unintentionally as described above and is commonplace in self-reported PA measurement. Of the studies included in a systematic review comparing indirect and direct measures for assessing PA in a youth population, 72% of surveys overestimated PA relative to objectively measured PA values (Adamo et al., 2009).

Accelerometers have become increasingly popular tools for objectively assessing PA behaviour and have led to increased measurement precision among child and youth PA research (Mattocks et al., 2008). Review studies have concluded that these motion sensors are practical and provide a reliable and accurate measure of youth PA (Reilly et al., 2008; Rowlands, 2007). Accelerometers overcome issues of recall and response bias (Adamo et al., 2009) and allow for data to be collected in 'real time' facilitating the discovery of intra-daily patterns of activity (Warren et al., 2010).

Despite the advantages that accelerometers hold over subjective measurement of PA, there are a number of shortcomings and unresolved issues concerning their use (Trost et al., 2005). Traditionally, accelerometers have not been widely used in large epidemiological studies due to the expense associated with the devices and software, the

time burden for researchers, and the burden and intrusiveness of wearing the motion sensors for the participant (Adamo et al., 2009). A weakness of accelerometers is their ability to capture cycling and upper body PA when the device is worn on the waist (Corder et al., 2007).

When measuring PA, it is the habitual or usual PA that is of interest as health benefits obtained from PA participation result from prolonged and sustained engagement (Hallal et al., 2006; Janssen & LeBlanc, 2010). The majority of studies using accelerometers collect data on one occasion only (the duration of this may differ across studies) and this does not factor in the intra-individual variation that occurs from week to week and over longer periods of time (Mattocks et al., 2008). Moreover, the number of days of valid accelerometer data to determine habitual activity is disputed (Reilly et al., 2008). There is much debate surrounding the processing, summarising and interpretation of accelerometer data outputs (Mattocks et al., 2008). For example, a range of cut points have been proposed from studies comparing accelerometer data with criterion measures of energy expenditure (Mattocks et al., 2008). These cut points are thresholds that are applied to raw accelerometer scores to translate counts of acceleration per minute into an intensity of PA (Cain et al., 2013). Currently, there is no consensus on which accelerometer cut points are the most appropriate for classifying MVPA in youth (Kim et al., 2012). Variations in counts per minute thresholds between different cut points result in zones of possible misclassification where, for example, light PA may be misclassified as moderate to vigorous PA (Kim et al., 2012). In the case of the Freedson (2005) and Evenson (2008) cut points, the counts per minute difference between the two ranges from ~1,400 to ~2,300. A further critical methodological issue that has not been satisfactorily addressed is the use of cut points tailored to the age of the participant contrariwise to the single cut points per intensity for youth (Trost et al., 2011). In the absence of a clear consensus on the methodology pertaining to accelerometer use, the value of using this objective measure is undermined (Cain et al., 2013).

The benefits and limitations of both subjectively recalled PA via self-report surveys and the objectively measured PA via accelerometry discussed in this section illustrate the challenges associated with PA measurement. Due to practicality reasons the use of self-report surveys as part of large scale studies is widespread (Helmerhorst et al., 2012). However, PA measurement may be enhanced by incorporating the two approaches into PA assessment (Janz, 2006). To overcome the limitations of self-report measures in

youth, surveys are often validated against accelerometry data (Fitzgerald et al., 2015; Ridgers et al., 2012; Troped et al., 2007). Although, self-report measures have many limitations they provide a means of evaluating actual behaviours and activities that would not be possible through objective measurement (Reilly et al., 2008).

2.9 Implications for current research

Ireland's National PA Plan calls for action to integrate PA into the lives of young people in the class setting, in school-based extra-curricular activities and the community context (Healthy Ireland, 2016). The Plan pinpointed the requirement for repeated measurement of PA levels and the investigation into factors associated with participation, to contribute to the monitoring and evaluation of PA and to inform evidence-based practice (Healthy Ireland, 2016). This thesis responds to the call for action by conducting longitudinal research on personal, behavioural and socio-environmental determinants of 5-year PA in young people in Ireland.

Guided by the YPAP Model, the determinants of youth PA may be examined. It is the PA determinants that can be modified that need to be prioritised and comprehended in more detail (Sallis et al., 2000b). The focus of this thesis is on examining modifiable behavioural and psychosocial determinants of PA participation.

Concerning behavioural determinants of PA, this thesis addresses gaps in the literature regarding the input of different domains of youth PA on future PA behaviour. Differentiating between the longitudinal impacts of specific PA domains is essential to identify where limited resources should be directed to obtain greatest PA benefit. Current evidence from other countries points towards a positive role of sports participation in youth on sustained activity (Basterfield et al., 2015; Tammelin et al., 2003; Telama et al., 2006). However, the characteristics of sports participation that may influence future PA are unclear (Dumith et al., 2011). In particular, the long-term role of the number and types of sports engaged in and the highest standard achieved need to be clarified. At present, there is a minimal number of longitudinal studies published that assess active commuting to school (Yang et al., 2014) and in this review of the literature, only one study was identified that examines PE as a predictor of later PA (Cleland et al., 2012).

Regarding the psychosocial determinants of PA, overall findings of this review of the literature suggest that self-efficacy for PA and social support for PA have a positive influence on concurrent PA participation, while evidence of the impact of PA enjoyment and perceived barriers to PA are mixed. More research is needed to understand the longer term effects of these psychosocial variables on PA in young people, and to clarify the relationships within an Irish context. Within this thesis, these psychosocial factors are modelled to investigate their direct effect on 5-year PA and also to determine interactions between the factors which may indirectly influence longitudinal PA. In keeping with the literature, friend and family social support are studied separately to discriminate which source of social support is more influential for adolescents.

In examining factors that influence youth PA, it is of utmost importance to ensure that the measure of PA is valid for use within the study population (Hallal et al., 2012a). Self-report surveys were chosen for this thesis as they enabled large numbers of participants to be recruited and the inclusion of participants who were only contactable through their home address. Validation of self-report instruments with objectively measured PA is commonplace. Prior to conducting analysis on the trends or determinants of PA in this thesis, the validity of the main measure of youth PA, the PACE+ (Prochaska et al., 2001) was tested against accelerometry.

The information gained through this body of work will be beneficial for the progression of strategies that aim to enhance PA uptake and maintenance in children and adolescents with effects into young adulthood. Moreover, the findings of this research will be valuable for the development of future and review of current government policies that incorporate PA.

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CHAPTER 3

Methodology

Peer review status

The follow-up study methodology was presented in poster format at the 2013 Physical Education, Physical Activity and Youth Sport (PEPAYS) Research Forum.

Citation

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Keywords Survey, accelerometry, school, postal, longitudinal.

Chapter 3 Methodology

This chapter gives background information on the study design and sampling of the Children's Sport Participation and Physical Activity (CSPPA) Study (Woods et al., 2010). Furthermore, it summarises the methods used in CSPPA Plus, the 5-year follow-up study of CSPPA. It includes details of the research design, participant recruitment, procedures, survey design, measures and data treatment.

3.1 The CSPPA Study

In 2009, Dublin City University, the University of Limerick and University College Cork, in collaboration with the Irish Sports Council, undertook a cross-sectional study on youth physical activity (PA) (Woods et al., 2010). In order to obtain a representative sample of Irish youth aged 10 – 18 years, a systematic, one-stage cluster sampling method was utilised. For this, schools were stratified by sex (male, female, mixed), geographic location (urban, rural), socioeconomic status (designated or non-designated disadvantaged), type (primary school, secondary school, community college, comprehensive college, vocational school), size (small: < 33rd percentile, medium: 33rd – 66th percentile, large: > 66th percentile) and fee paying status (fee or non-fee paying). All schools (primary, N = 3,292; post-primary, N = 732), with the exception of special schools, within the Republic of Ireland were eligible for sampling. In each recruited school, all children within the selected year group were targeted for participation. Participants were recruited from the final 2 years of primary school (5th and 6th class) and all years in post-primary school (1st to 6th year) to meet the age requirements of the study. The final sample consisted of 5,397 participants aged 10 – 18 years (mean age 13.95 ± 1.97 years) from 123 schools (N = 53 primary, N = 70 post-primary) from across the island of Ireland, 46.6% were male, and 23.6% were from primary school.

Under the supervision of the research teams in the school setting, participants completed a comprehensive multi-section self-report survey that included demographic information, questions on specific PA and sedentary behaviours, and correlates of PA such as psychological, social and environmental aspects. There were separate surveys for primary school (see **Appendix A.1**) and post-primary school (see **Appendix A.2**). Additionally, a subsample of participants (n = 284) wore accelerometers for validating self-reported PA. The Research Ethics Committees in each of the three universities involved in the study approved the study protocol in 2009.

3.2 CSPPA Plus

3.2.1 Study design and sampling

Of the 5,397 CSPPA participants, 4,200 (77.8%) agreed to be followed-up as part of a longitudinal study. Five years later, participants were contacted, either in school or via their postal address, as part of the CSPPA Plus study. This thesis focuses on the longitudinal data from both data collection periods. It contains an element of retrospective design due to specific questions added at follow-up.

The Research Ethics Committee at Dublin City University approved the CSPPA Plus study protocol in 2014 (see **Appendix B.1** for approval letter). Written informed consent was obtained from adolescents ≥ 18 years while written assent, in addition to, parental consent was gathered from participants < 18 years.

For inclusion in this study, participants were required to:

- Provide assent to be contacted for follow-up.
- Provide assent to participate in the study at both time points (and parental consent for those < 18 years).
- Answer the survey at both time points.

3.2.2 Participants

Participants (n = 873; aged 15 – 23 years; 30.4% male) completed a self-report survey. The baseline demographic characteristics of the full CSPPA and CSPPA Plus study participants is tabulated in **Appendix C.1.** In Chapter 5, the sample was subdivided into three cohorts for analysis; namely the Primary School, Post-primary School and School Leaver Cohorts. The cohorts represented key phases of transition in the lives of youth (see Section 5.6 for details). The overall response rate was 22.3%. A flow chart of the CSPPA Plus participants is illustrated in **Figure 3.1**.

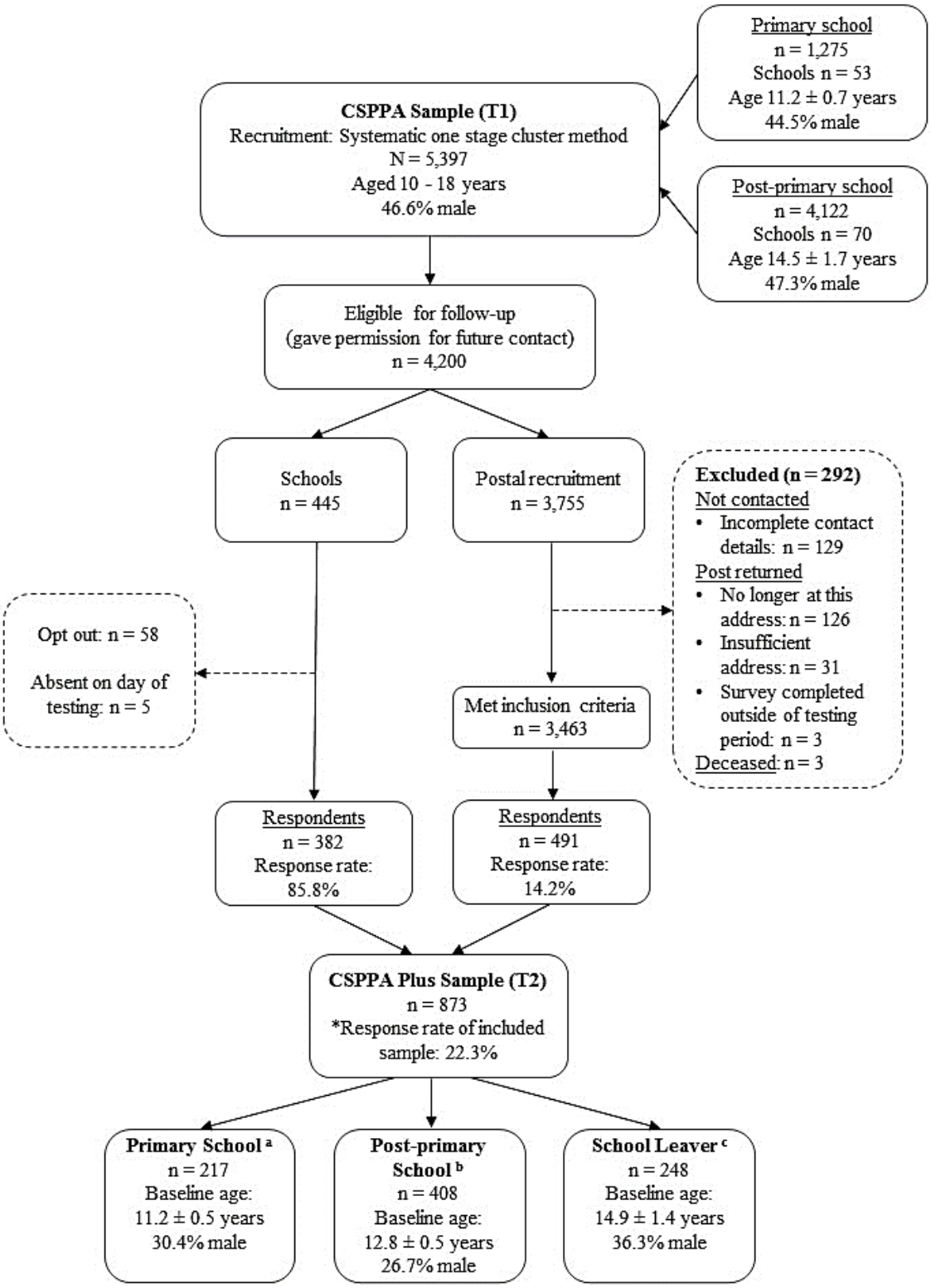

Figure 3.1 Flow chart of the CSPPA Plus participants.

* Response rate calculated based on the school sample and those who met the inclusion criteria for the postal sample.

[a] Primary School Cohort: Participants progressed from primary to post-primary school.

[b] Post-primary School Cohort: Participants progressed from first to final year in post-primary school.

[c] School Leaver Cohort: Participants progressed from post-primary school to school leaver.

3.2.3 Procedures

The research team consisted of nine undergraduate students who were managed, supervised, and trained by the author. The principal investigator supervised one school visit and all other school visits were led by the author. Prior to data collection, extensive training was undertaken to minimise potential measurement error. Standardised procedures from the initial study were replicated in schools and were adapted for the postal component in the follow-up. CSPPA Plus surveys were administered in schools where students continued to attend the same school, i.e. in schools where participants were in 1st year in post-primary school at baseline. All remaining surveys were sent by mail to the postal address supplied in 2009 surveys. Testing took place during the same period in the school year as the original study (February – May). Before contacting participants, the original assent forms were double-checked to ensure permission to follow-up had been granted. A pilot study was conducted to assess the usefulness of the survey for understanding the changing pathways into/out of active participation, and stable pathways that sustain activity or inactivity over time.

Pilot study. The procedures of the pilot study are available in **Appendix D**. Participants (n = 38, aged 15 – 17 years, 52.6% male), from two classes in one urban public school, took part in the pilot study in January 2014. The school was a convenience sample that was not included in the CSPPA study. As participants represented the youngest possible age for those completing CSPPA Plus, they were ideal for assessing level of comprehension of questions, time for survey completion and for providing opinions on methods to make the survey more appealing.

The following issues were highlighted and changes made due to the pilot study:

Colour and formatting

1. Formatting changes were made to make the survey more attractive. Examples include; the cover page was updated to include more colour; large tables for responses were removed, where possible, to allow for more blank space on the page.
2. On the cover page of the survey, the term ‘physical activity’ was replaced with ‘lifestyle’ to minimise potential bias, in the following sentence: By answering these questions, you will help us understand more about the ‘physical activity’ of young people like yourself.

3. The only issue with comprehension of questions was with those including the term 'sedentary behaviour'. Although this term was explained, some participants skipped over the text box that explained it. As a result, the formatting was changed to make it clearer and to remove excess words and boxes from the page.

Question and section review

4. The questions about meeting or not meeting the PA guidelines were moved to Section A as they were deemed to be the most important questions. The order of other questions and sections were reviewed and alterations were made to ensure the questions were logical and ordered. In the case of non-applicable items, a skip logic was used to direct participants onto questions relevant to them and a review of the best use of this was conducted.
5. The research aim of gaining a greater understanding into the reasons for uptake and drop out of physical activities was not adequately answered with the pilot survey. Resultantly, additional questions were added to investigate this.
6. Participants reported that the length of the survey was too long and they would be unlikely to complete it if they received it in the post. Questions were removed to reduce the time for survey completion. E.g., the section on parental occupation was removed as this information was available from the original CSPPA study. The pilot survey took 60 minutes to complete while the final survey took between 20 and 45 minutes to complete depending on the number of applicable questions and the cognitive ability of the participant.

School procedures. A school recruitment letter (see **Appendix E.1**) was sent to the principal in each of the 23 schools where participants were in 1st year of post-primary school at baseline. Of these, it was not possible to access participants in six schools as they had either skipped Transition Year (4th year) or had ceased their education. Within the letter, the context of the study was described, and the number of students that were eligible for participation was given. One week later, the letter was followed-up with a phone call where further details of the study were outlined. Upon providing permission for the study to proceed, in most cases, the principal delegated a member of staff from the PE department to facilitate the school visits. A list of students who gave permission to be contacted for further research was forwarded to the relevant person within each school. In advance of the first school visit, a letter, Information Sheet and Consent Form (see **Appendix E.2**) were sent home to parents. Surveys were administered, and height and

weight measurements were taken in 17 schools. Due to resource limitations, accelerometer data was collected in only six of these schools. In preparation for data collection, a customised visit checklist was made for each school (see **Appendix E.3**). They included school details, a list of student names, Participant Information Sheets, pre-coded surveys and other resources needed for height, weight, and where appropriate, accelerometer measurements. School details included visit date and time, directions to the school, contact details, research team members, measurements to be taken, confirmed sample and special requests made by the school. Upon completion of the study, students were thanked for their time and participation. Likewise, teachers were thanked for facilitating data collection during their class time and for distributing and collecting the parental consent forms.

Survey administration

The School Survey (see **Appendix A.3**) was administered, with a ratio of one researcher to 10 students, to class groups of between 6 and 79 participants. Survey completion took approximately 45 minutes. On the day of testing, researchers liaised with the school to ensure parental permission had been obtained for participants. Students who did not have permission or who did not wish to participate were given other activities to do by the teacher. The author introduced the research team, gave a brief explanation of the study and handed out the Participant Information Sheet (see **Appendix E.4**) to participants.

After allowing 5 minutes to read the document, the following information was relayed to participants:

1. Instructions on how to complete the survey.
2. Participation is voluntary, and they could withdraw at any stage without being penalised.
3. All information is confidential and would be seen only by the research team. ID numbers allocated to each participant would ensure anonymity.
4. Participants were encouraged to ask questions should they not understand or require clarification about any question.
5. Participants were instructed to take their time with the survey, to complete it individually, to answer each question as honestly and accurately as possible, and to remember it was not a test so there were no right or wrong answers.

At this point, students were given the opportunity to ask questions. While distributing the surveys, researchers spoke individually to each participant to clarify they understood and assure them they could ask questions at any stage. Once the participant Assent Form and demographic details were completed on the first page of the survey, the page was detached. An ID number on both components facilitated data matching with 2009 data.

Height and weight measurements

As some principals were concerned about the acceptability of measuring height and weight to participants, they were offered as a supplemental option to the survey. An announcement was made inviting participants to notify a research team member if they wanted their measurements taken. To ensure privacy, measurement stations were set-up away from other students either at the opposite end of the sports hall or outside the classroom door. Three people were present at each station for all measurements. Using a SECA stadiometer and mechanical scales (Hamburg, Germany), height (cm) and weight (kg) were measured to the nearest 0.1 centimetres and 0.1 kilogrammes, respectively. Weighing scales were calibrated before each testing session. The height and weight protocols and the record sheet are available in **Appendix F.1** and **Appendix F.2**. The number of participants who completed height and weight measurements at each data collection period are detailed in **Table 3.1**.

Accelerometers

Prior to visiting the schools, the accelerometers were fully charged and initialised for an 8-day period commencing on the date of the school visit. Monitors were pre-coded with unique identifier numbers and were set to collect data at 15-second intervals.

Upon survey completion, participants were directed to collect their accelerometer from the 'ActiGraph Station'. Participants completed an additional Assent Form specific for accelerometers (see **Appendix E.5**). The monitor ID number was noted beside the participant ID number on a Record Sheet (see **Appendix F.3**). Mobile phone numbers were also documented on this sheet for participants (95.6%) who opted to receive SMS reminders to wear their monitor. A demonstration was given on the correct way to wear the monitor, i.e. positioned tight against the body in the centre of the right hip under clothes or over thin clothes. Participants were instructed to wear the monitor as much as possible for the next 8 days, to put it on as soon as they get up in the morning and to wear it all day except when swimming or bathing. In order to maximise compliance with

wearing the accelerometers, a researcher called into the school each morning between 9 am and 10 am and checked participants were wearing their monitor correctly. Additionally, an SMS reminder message was sent 1.5 hours before the start time of the school day (start times varied from 8:30 am to 9 am) and at 9 am on weekend days. Evidence from a study in Irish adolescents shows that these strategies increase the likelihood of participants remembering to wear their monitor (Belton et al., 2013). Monitors were collected from schools at the end of the 8-day period. Data were downloaded from the monitors and cleaned using ActiLife software (Version 6.11.8). The number of participants who wore accelerometers at each data collection period is detailed in **Table 3.1**.

Table 3.1 Summary of objective physical measures for each survey group.

	2009 Surveys		**2014 Surveys**		
	Primary	**Post-Primary**	**Adolescent**	**School**	**Young Adult**
Objective physical measures					
Height	✓ (n = 419)	✓ (n = 914)		✓ (n = 143)	
Weight	✓ (n = 425)	✓ (n = 914)		✓ (n = 129)	
Accelerometers	✓ (n = 157)	✓ (n = 127)		✓ (n = 136)	

***Postal survey procedures*.** Postal surveys packs were sent by mail to participants who could not be contacted through school including those who had skipped Transition Year. Names and addresses were cross-referenced with assent forms from the original study to ensure correct spelling. Where addresses were incomplete, internet searches were conducted using partial addresses and school name in an attempt to complete them. In cases where writing was illegible, the area near the school was searched for potential street names. Surveys sent by post were pre-coded with the participant ID number, allocated in the initial study, to avoid the return of personal identifying information via the public postal system. Participants were given the option to complete the survey online via a link to SurveyMonkey supplied in the pack. The first section of the survey for both the paper-based and online options included an informed consent section.

The postal survey packs included:

1. A participant recruitment letter (see **Appendix G.1** and **Appendix G.2**)
2. A parental letter of recruitment (for participants aged < 18 years, see **Appendix G.3**)
3. An Informed Consent Form for parents/guardians (for participants aged < 18 years, see **Appendix G.4**)
4. An Information Sheet (see **Appendix G.5**)
5. The survey:
    a. The Adolescent Survey (see **Appendix A.4**) for school-aged participants, i.e. who were in primary school at baseline.
    b. The Young Adult Survey (see **Appendix A.5**) for participants who had completed school, i.e. who were in post-primary school at baseline.
6. A freepost envelope to return the survey.

Returned surveys were immediately stored in a secure area. Similar to the School Survey, the first page with the Assent Form and demographic details was detached and stored separately to the survey. For post returned to sender, the postal worker attached a sticker to the envelope that detailed reasons why the post could not be delivered. These reasons included; an incomplete/insufficient address; no longer at the address; and not known at the address. These reasons were recorded and informed the response rates (as illustrated in **Figure 3.1**). Direct correspondence (telephone, email or letter) with a small number of parents provided updated records for some participants, e.g. updated postal address or notification of deceased participants.

3.2.4 Measures

Survey design and development. A multi-section, self-report survey was developed to assess PA behaviour and the correlates of PA. All elements included in the surveys were psychometrically valid and developmentally appropriate measures that have been validated for use in adolescents. The CSPPA Plus surveys replicated questions from the Economic and Social Research Institute (ESRI) study of School Children and Sport in Ireland (Fahey et al., 2005), the Take PART Study (Woods et al., 2009) and the original CSPPA survey (Woods et al., 2010). They also included additional questions to assess changes in PA over time. The Take PART Study and original CSPPA Study surveys were underpinned by Social Cognitive Theory (personal, behavioural and environmental factors; details in **section 2.4**; Bandura, 1986) and Ecological Theory (physical and social

environment; details in **section 2.4**; Stokols, 1996). Therefore, these theories provided a basis for the CSPPA Plus research. The theoretical framework is illustrated in **Figure 3.2.**

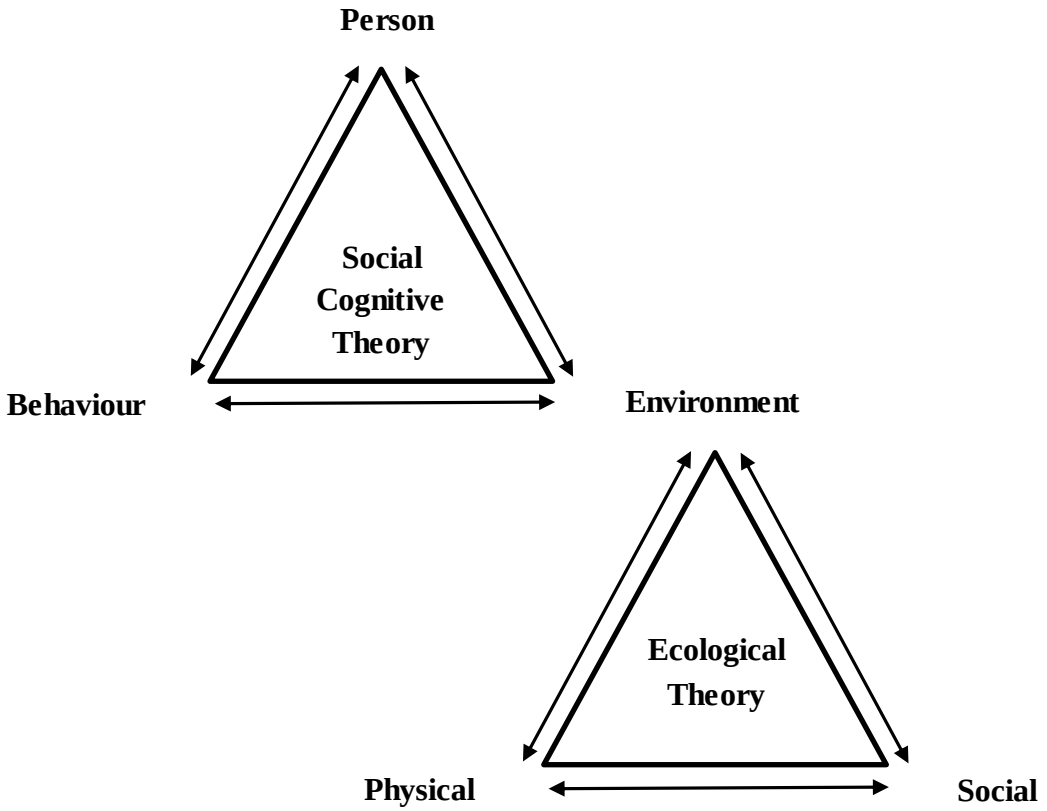

Figure 3.2 An overview of the theoretical underpinning of the Take PART and CSPPA studies. Diagram adapted from Woods et al. (2009).

All survey data collected as part of CSPPA and CSPPA Plus are summarised in **Table 3.2**. Self-report surveys at both time points included data on personal characteristics, PA behaviour (e.g. PA levels, PA domain, PA activities) and correlates of PA (e.g. PA social support, PA self-efficacy). Questions relating to physical education and extra-curricular sport were not included in the Young Adult Survey as participants were no longer in school. For longitudinal comparative purposes, participants were analysed based on the adolescent PA recommendations. However, the International Physical Activity Questionnaire (IPAQ) short-form (Craig et al., 2003) was added to all CSPPA Plus surveys to allow for assessment of meeting adult PA guidelines as many participants were aged over 18 years at follow-up.

The author designed and formatted the surveys with the exception of the cover page which was composed by a graphic designer under the direction of the author. In order to maximise survey response rates, several considerations were made in the design of the surveys. These were informed by a Cochrane Review on methods to increase response to postal and electronic questionnaires (Edwards et al., 2009) and include the following approaches*:

- Assurance of confidentiality (OR 1.18: 95% CI 1.03 to 1.34).
- Hand written signature on cover letter (OR 1.24: 95% CI 1.08 to 1.41).
- Specify a deadline for survey completion (OR 1.61: 95% CI 1.14 to 2.26).
- Most relevant questions placed first (OR 1.23: 95% CI 1.10 to 1.37).
- The easiest questions presented first (OR 1.61: 95% CI 1.14 to 2.26).
- Horizontal orientation of response options rather than vertical (OR 3.12: 95% CI 1.63 to 5.96).
- Use of a white background - for electronic surveys (OR 1.31: 95% CI 1.10 to 1.56).

**Note*: odds ratios represent odds of survey response when included versus not included.

Additionally, the following survey design elements were utilised based on an article on best practices for formatting a paper-based survey (Fanning, 2005):

- Front cover: Short simple title and coloured cover (increases response rate 2 – 4%).
- Back cover: Simple, did not have any questions on it and included a thank you note.
- Directions: Specified what the respondent should do when finished the survey and explained how to handle non-applicable items (skip logic).
- Question groupings: By content, type and logical order.
- Question layouts: Used bold print for questions and light print for answers, was consistent with the layout of answer spaces (i.e. answers consistently in horizontal orientation) and used colour to serve as a navigational guide for questions responses.

Table 3.2 Summary breakdown of contents of all surveys (2009 and 2014)

	2009 Surveys		2014 Surveys		
	Primary (n = 1,275) 44.5% male	**Post-Primary** (n = 4,111) 47.3% male	**Adolescent** (n = 217) 30.4% male	**School** (n = 408) 26.7% male	**Young Adult** (n = 248) 36.3% male
	Total: 5,386 (46.6% male)		Total: 873 (30.4% male)		
Personal factors					
Date of birth[1]	✓	✓	✓	✓	✓
Sex[1]	✓	✓	✓	✓	✓
Residential location: Urban/rural classification[1,2]		✓	✓	✓	✓
Nationality[1]		✓			
Highest level of education[3]			✓		✓
Current education status: Post-primary school or further education			✓		✓
Occupation			✓		✓
Parental occupation[4]	✓	✓			
Disability[1]	✓	✓	✓	✓	✓
Year in school[1]	✓	✓		✓	
Behavioural data					
Physical activity (PA) levels					
PACE+ screening tool[5]	✓	✓	✓	✓	✓
IPAQ short form[6]			✓	✓	✓
Self perceived PA levels compared to others[7]			✓	✓	✓
PA recall: Time spent in PA in the last 7 days[8a]	✓	✓			
Review of PA: Last 7 days typical of normal activity?[8a]		✓	✓	✓	✓
Active commuting & walking					
Commuting mode to school/work[9]	✓	✓	✓	✓	✓
Commuting time to school/work[9]	✓	✓	✓	✓	✓
Commuting mode home from school/work[9]	✓	✓	✓	✓	✓
Commuting time home from school/work[9]	✓		✓	✓	✓
Recreational walking[10a]			✓	✓	✓
Walking pace[11]			✓	✓	✓
Recreational running[10b]			✓	✓	✓

Table continued...

	2009 Surveys		2014 Surveys		
	Primary	**Post-Primary**	**Adolescent**	**School**	**Young Adult**
Behavioural data continued					
Physical education (PE)					
No. of PE classes[12]	✓	✓	✓	✓	
Duration of PE classes[12]	✓	✓	✓	✓	
PE sports/activities[13]	✓	✓	✓	✓	
PE enjoyment[14]		✓			
Extra-curricular sport					
Participation frequency[12]	✓	✓	✓	✓	
Extra-curricular sports/activities[13]	✓	✓	✓	✓	
No. of school teams[8a]	✓	✓		✓	
Club sport					
Participation frequency[12]	✓	✓	✓	✓	✓
Club sports/activities[13]	✓	✓	✓	✓	✓
Level/type of involvement[15]		✓	✓	✓	✓
Highest standard achieved (e.g. elite)[15]		✓	✓	✓	✓
Reason for continued participation[15]		✓	✓	✓	✓
Reason for not taking part in more clubs[8a]		✓			
Gym attendance & activities				✓	✓
Swimming ability[8a]	✓	✓			
PA uptake					
New sport/activity taken up			✓	✓	✓
Reason for new sport/activity uptake[8b]		✓	✓	✓	✓
Current involvement status			✓	✓	✓
PA dropout					
Sport/activity dropped out of			✓	✓	✓
Reason for sport/activity dropout[15]			✓	✓	✓

Table continued…

	2009 Surveys		2014 Surveys		
	Primary	**Post-Primary**	**Adolescent**	**School**	**Young Adult**
Behavioural data continued					
Sedentary behaviour (SB)					
SB enjoyment[16]			✓	✓	✓
Decisional balance: PA vs. SB[17]			✓	✓	✓
Sedentary activities - days & mins/day[13]	✓	✓	✓	✓	✓
Frequency of watching sport on TV[8]	✓	✓			
SB social support: Peers[16a]			✓	✓	✓
SB social support: Parents[16a]			✓	✓	✓
SB social support: Teachers[16b]				✓	
Psychosocial & environmental correlates of PA					
PA motivation[18]			✓	✓	✓
PA enjoyment[14]	✓	✓	✓	✓	✓
PA social support: Peers[19a]	✓	✓	✓	✓	✓
PA social support: Parents[19a]	✓	✓	✓	✓	✓
PA social support: Teachers[19b]	✓	✓		✓	
PA self-efficacy[20]		✓	✓	✓	✓
PA stage of change[17]		✓			
PA perceived barriers[21]		✓	✓	✓	✓
Environment[22]		✓	✓	✓	✓
Neighbourhood walkability[23]			✓	✓	✓
Parental PA[8]	✓				
Parental volunteering at sports club[8]	✓				
Health & wellbeing					
Self-rated health[24]			✓	✓	✓
Self-rated happiness			✓	✓	✓
Sleep duration			✓	✓	✓
Sleep quality[25]			✓	✓	✓
Perceived PA level for health[26]			✓	✓	✓
Dieting & weight loss attempts[27]	✓	✓	✓	✓	✓
Body size perception of self[27]	✓	✓	✓	✓	✓
Dietary supplements				✓	
Subjective physical measures					
Height			✓	✓	✓
Weight			✓	✓	✓

Table 3.2 Notes:

[1]Woods et al., 2009; [2]Central Statistics Office, 2002; [3]Note: Adapted from the 2011 Irish Census: Central Statistics Office, 2011; [4]Currie et al., 2001; [5]Prochaska et al., 2001; [6]Craig et al., 2003; [7]Woods, et al., 2008; [8a]Woods et al., 2010; [8b]The reason for uptake of a new sport question from Woods et al. (2010) was used in the Post-primary survey. An open-ended style question was used in the 2014 surveys; [9]Central Statistics Office, 2006; [10a]Booth, 2000; [10b]This question was developed using the format of [10a]; [11]Ipsos MRBI & Irish Sports Council, 2013; [12]Fahey et al., 2005; [13]Sallis et al., 1996; [14]Motl et al., 2001; [15]Kremer et al. (Eds.), 1997; [16]Norman et al., 2005; [16b]The questions on teacher social support for SB were adapted from Norman et al., 2005; [17a]Norman et al., 2004; [18]Adapted from Burns, 2011; [19a]Sallis et al., 2002; [19b]The questions on teacher social support for PA were adapted from Sallis et al., 2002; [20]Nigg & Courneya, 1998; [21]Centers for Disease Control and Prevention, 2001; [22]Saelens et al., 2003; [23]Fitzsimons D'Arcy 2013; [24]Ware, Kosinski & Keller, 1996; [25]Katzmarzyk et al., 2013; [26]Paffenbarger et al., 2003; [27]Hart et al., 1989; All questions without reference numbers were developed to address gaps in the literature for questions of the areas of interest.

3.2.5 Data treatment

Data storage. The hard copies of data (i.e. surveys and physical measurement record sheets) are stored in a locked area in the School of Health and Human Performance, Dublin City University. The front page of the paper-based surveys, which contains personal details, was detached from the remainder of the survey and stored separately. An electronic copy of data was saved in SPSS (Statistical Package for Social Sciences) and included unique participant ID numbers to ensure participant confidentiality. The ID numbers utilised were those assigned at the data collection period in 2009, and therefore, allowed for data to be linked across the two time points. Data from online respondents (through SurveyMonkey) were downloaded, and personal information was removed to a separate file. Again, ID numbers allowed for data linkage.

Data entry. The author trained the research team on the appropriate protocol for survey data entry. A blank SPSS template file with pre-entered variable names, values, labels and types was prepared by the author and supplied to all researchers. A second SPSS template file was provided to record ID numbers and sensitive personal data (names and addresses), independent of the main survey data. Accidentally or deliberately missed responses were coded 999 while non-applicable questions were left blank. Responses to

open-ended questions were typed in full into the dataset. Upon entering data into the appropriate datasets, the files were saved with the researchers' name in the file name. The files were uploaded to a shared folder in the cloud storage application Dropbox, and hard copies were returned to the author for secure storage.

A stratified random sample of surveys were selected for quality control checks. These accuracy checks were performed on 5% of surveys inputted by each researcher. Where necessary, referral was made to the hard copies of the surveys to check for possible data entry errors. Data were checked for duplicate ID numbers and participant replications were removed. Frequency analysis were conducted for all survey variables to check that data complied with the response options. For example, if a scale had values 0 – 7 then all values must lie within these boundaries. Irregularities were checked against surveys and updated appropriately.

Data preparation.

Contact details for the postal survey

A dataset with full contact details for participants to be included in the postal component of the study was generated. Firstly, contact details for all 2009 participants were merged into one file, and the data were screened to exclude those who were contacted in schools. The names and addresses were cross-referenced with hard copies of the assent forms to ensure correct spelling and assent had been granted. Addresses that used slang language were re-written in the correct format. The dataset was split into two groups; one to receive the Adolescent Survey and the other to receive the Young Adult Survey.

SurveyMonkey output

SurveyMonkey output files were downloaded and converted into SPSS files. Variables were renamed so that they matched across all T2 surveys. The variable names were replicated from T1 variable names and a prefix of 'T2_' was added to each variable name, to distinguish when the data were collected and so repeated questions would be clear in the dataset. The SurveyMonkey output does not code values of zero correctly. Therefore, questions with this value as their response option were recoded appropriately, e.g. for the PACE+ survey, the response options are 0 – 7 days and SurveyMonkey output gives values of 1 – 8. Furthermore, date of birth was provided in the American format and was manually altered to the European format.

SPSS files

The ID file (containing names and addresses) were cross-referenced with the survey response files to ensure all participants were present in each. Accelerometer ID numbers were added and paired with participants for those who wore monitors. Additional variables were created to indicate whether height and weight were self-reported or measured by a member of the research team. Codes were developed on a continuous basis for open-ended questions and new variables were created using these unique code numbers.

Merging datasets. Preliminary data preparation had to be conducted before merging datasets. Variable details (variable name, string length, type of data, labels) were changed so that they were consistent across all files. To facilitate file merging, dummy variables were created where a variable occurred in one dataset but not in another. The dummy variables had the same variable properties as the ones they were replicating but the actual data were blank.

Using the add cases option in SPSS, a full dataset for data collected in 2009 was formed by merging the T1 Primary and Post-primary Surveys. A prefix of 'T1_' was added to variables names to signify data were collected at baseline. The same method was utilised to provide a full dataset for data collected in 2014, by merging the T2 School, Adolescent and Young Adult Surveys (variable names included the prefix 'T2_').

To merge T1 and T2 data, the add variables option in SPSS was used. Firstly, the ID numbers of participants not followed-up were added to the T2 file so that all ID numbers present in the 2009 file were present in the 2014 file. Secondly, ID numbers from baseline and follow-up files were placed in ascending order. The datasets could now be merged. The output file was screened to ensure participants were matched correctly. Sex and date of birth details collected in 2009 and 2014 were checked for consistency for each participant.

Data cleaning. Data were explored for outliers, missing data and irregular data using descriptive statistics (e.g. means, standard deviations, minimum values, maximum values, skewness, kurtosis) and frequency analysis. Outliers, detected using boxplots and histograms, were removed from the dataset. The number ($\leq$ 6.1%) and randomness of missing values were assessed and did not pose any issues for analyses. The IPAQ (Craig

et al., 2003) data were processed, cleaned and truncated based on the standardised guidelines for their processing and analysis (available from www.ipaq.ki.se).

Data analysis. Specific analysis details are available for each study in Chapters 4 to 7. Statistical analysis included descriptive statistics, t-tests and Wilcoxon sign rank tests, correlations (Pearson and Spearman), chi-square tests (Pearson and McNemar), analysis of covariance, multiple linear regression, confirmatory factor analysis and structural equation modelling. For variables with categorical data, non-parametric tests were utilised. The curvilinearity of scale variables was examined using scatterplots. Collinearity and covariance of variables were checked prior to entering them into ANCOVA or regression models. The internal consistency of self-report measurement scales were tested using Cronbach Alpha (α) where applicable. All analysis was conducted using SPSS v.21 (IBM Corp, Armonk, NY) with the exception of confirmatory factor analysis and structural equation modelling that were performed using AMOS v.21 (IBM Corp, Armonk, NY). Before importing accelerometer data to SPSS, data were cleaned and analysis criteria were applied to data using ActiLife software v.6.11.8 (ActiGraph Corp, Pensacola, FL).

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CHAPTER 4

Validity of a two-item physical activity questionnaire for assessing attainment of physical activity guidelines in Irish youth.

Peer review status

The study in this chapter is published in BMC Public Health, is accepted for an oral presentation at the 2016 Health-Enhancing Physical Activity (HEPA) Europe conference, and was presented orally at the 2015 Physical Education, Physical Activity and Youth Sport (PEPAYS) Research Forum.

Citations

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3. Hardie Murphy, M., Rowe, D. A., Belton, S. & Woods, C. B. (2015) Validity of a two-item physical activity questionnaire for assessing attainment of physical activity guidelines in Irish youth. *PEPAYS Research Forum*, Limerick, Ireland, 09 June 2015.

Keywords Physical activity, validity, youth, adolescence, epidemiology.

Chapter 4 Study 1

The overall objective of this chapter is to examine the validity of the PACE+ screening measure for assessing physical activity (PA), and attainment of the PA recommendations through accelerometry.

4.1 Purpose of the chapter

4.1.1 Rationale

The main theme of this project is youth PA so it is fundamental to discuss the strengths and weaknesses of the main measure of habitual PA levels used in this thesis (Chapters 5 – 7). The PACE+ instrument was chosen for this study as it is short and simple, and therefore, useful as part of longer surveys. Additionally, it was used in the original CSPPA study (Woods et al., 2010) so allows for longitudinal analysis of PA.

Surveillance of population PA prevalence is dependent on the use of valid measurement tools. It is essential to validate the PACE+ instrument as it has been used extensively in Europe and across the world for assessing compliance with physical activity guidelines (PAGL) in youth. Furthermore, it is necessary to demonstrate that the PACE+ instrument is valid for use in the study population.

4.1.2 Contribution to new knowledge

This study is the first to assess the criterion validity of the PACE+ instrument in a European sample and across all adolescent years (10 – 18 years). This is despite it being frequently used in this region. This paper addresses the gap in the literature.

4.2 Authors' contributions to the publication

4.2.1 Candidates' contribution to the publication

The lead author (MHM) undertook the following activities:

- Developed the plan for the paper.
- Collected accelerometer and self-report data in the 2014 data collection period. This involved organising the research team for school visits, liaising with school staff regarding these visits, preparing equipment, data storage, cleaning and inputting.
- Developed a statistical analysis plan and carried out all analysis.
- Wrote the paper and made changes based on feedback from the other authors.
- Submitted the paper to the journal, managed communication with the journal, responded to and made alterations based on reviewers' comments, and checked the final 'proof' of the paper.

4.2.2 Contribution of other authors to the publication

All authors read, reviewed and approved the final paper and the resubmitted paper.

- DAR provided advice and guidance on statistical methods and analysis including double-checking results.
- SB assisted with statistical methods, in particular, regarding accelerometer data, and provided editing assistance for tables and content.
- CBW assisted with the development of the concept and methodology, provided editing assistance for tables and content and provided advice and assistance with responding to reviewers' comments. CBW also supervised the research team who collected the 2009 data.

4.3 Abstract

Introduction

As PA is important for health and well-being, it is essential to monitor population prevalence of PA. Surveillance is dependent on the use of valid and reliable measurement tools. The PACE+ survey is used globally in youth and has acceptable reliability; however, it has not been validated in a European sample. The purpose of this study was to validate this instrument in a sample of 10 – 18 year old Irish youth.

Methods

Participants (n = 419, 45.7% male) completed the PACE+ two-item survey and were asked to wear an Actigraph accelerometer for eight consecutive days. Freedson cut points were used to estimate moderate-to-vigorous physical activity (MVPA) from accelerometer counts. Analyses compared self-report and accelerometry data in participants with (1) ≥ 5 and (2) 7 valid accelerometer days. Calculations were performed for the whole sample, and were stratified by sex and school level (primary; post-primary).

Results

Spearman correlations between self-reported PA levels and accelerometry derived minutes of MVPA per day were small ($\rho = 0.27$; 7 valid days) to moderate ($\rho = 0.34$; ≥ 5 valid days). Higher correlations were found in older participants (post-primary $\rho = 0.39$; primary $\rho = 0.24$) and females ($\rho = 0.39$; males $\rho = 0.27$) using ≥ 5 valid days. The agreement level was high (68 – 96%). The accuracy of classifying those not meeting the guidelines (specificity) was moderate to high (59 – 100%).

Conclusions

The PACE+ self-report instrument has acceptable validity for assessing non-achievement of the adolescent PA recommendations. The validity is higher in females and increases with age. The continued use of the tool is recommended and will allow for comparability between studies, tracking of PA over time including trends in youth population prevalence.

4.4 Introduction

The benefits of PA to health are widely documented (World Health Organization, 2010). Monitoring and surveillance of population prevalence are of paramount importance (Hallal et al., 2012) and vital for the progression of PA and public health (Kohl et al., 2012). Due to the complexity and multifaceted nature of PA, measurement of this behaviour can be challenging (Janz, 2006). Valid and reliable PA measurement is essential for establishing prevalence, including trends over time (Shephard, 2003), and verifying if efforts to promote PA are having a positive influence (Milton et al., 2013). Prevalence rates are dependent on the instrument used to measure it (Sarkin et al., 2000). The process of selecting a suitable survey is based on two fundamental criteria; validity and reliability of the instrument (Warren et al., 2010). The use of one valid and reliable tool across many countries would provide consistency and comparability of findings (World Health Organization Europe, 2009). Such an instrument would need to be simple and adept at assessing compliance with physical activity guidelines (PAGL) for health at a population level (Ridgers et al., 2012). In youth aged 5 – 18 years, the PAGL stand at a minimum of 60 minutes of MVPA on every day of the week (World Health Organization, 2010). Although PAGL were developed using predominantly self-report data (Biddle et al., 1998), due to the limitations of self-report measures in youth, validation of these measures with accelerometers is commonplace (Milton et al., 2013; Prochaska et al., 2001; Ridgers et al., 2012; Fitzgerald et al., 2015; Garriguet et al., 2015; Vega-Lopez et al., 2014; Troped et al., 2007). This combined approach to the assessment of PAGL compliance provides for informed discussion on the accuracy of prevalence estimates.

In epidemiology, self-report surveys are frequently used due to their low cost and convenience (Helmerhorst et al., 2012). Ease of administration is a factor determining survey choice for large scale studies (Biddle et al., 2011). A brief two-item PA screening tool (PACE+) was designed for use in adolescents (Prochaska et al., 2001). The tool was first developed for use in a primary care setting with the function of identifying individuals not meeting the PAGL and who, from a health perspective, could benefit from intervention. It assesses the number of days adolescents engage in a minimum of 60 minutes of MVPA and is used as an indicator of habitual PA. It does not aim to describe PA behaviour beyond this. This instrument is widely used across the globe. It is utilised by 43 countries in the WHO HBSC questionnaire (Currie et al., 2012), and by up to 94 countries in the Global School-based Student Health Study (Guthold et al., 2010; Peltzer,

2010; World Health Organization, 2015) and other studies (Belton et al., 2014; Rowe & Murtagh, 2012; Woods et al., 2009; Woods et al., 2010).

Test-retest reliability has been conducted on the instrument. In a Finnish study, it was assessed alongside a vigorous PA item. It was found to have acceptable reliability with intraclass correlation coefficients (*ICC*) ranging from 0.6 to 0.8 (Vuori et al., 2005). In a Chinese study with a sample of 11 and 15 year olds, an *ICC* of 0.82 (95% CI 0.74 – 0.88) was reported for the first item (MVPA in the last 7 days) and an *ICC* of 0.74 (95% CI 0.64 – 0.82) for the second item (MVPA in a usual week) (Liu et al., 2010). More recently, the tool showed moderate reliability, in the same age groups, with an *ICC* ranging from 0.51 to 0.98 in three Eastern European countries. The *ICC* for the whole sample was 0.60 (95% CI 0.55 – 0.64) (Bobakova et al., 2015). No significant sex or age differences were noted in the Chinese or European studies described. These studies address the reliability of the PACE+ but not its validity.

Elsewhere it has been validated via correlations with accelerometer derived MVPA. It demonstrated moderate validity in a sample of 11 – 13 year old youth in the U.S. (ρ = 0.40, $P < 0.001$; test-retest *ICC* = 0.77) (Prochaska et al., 2001) and later in an Australian sample of 15 – 17 year olds (ρ = 0.40 with 5 days accelerometer data, ρ = 0.49 with 7 days accelerometer data) (Ridgers et al., 2012).

Surveys appraised in one population cannot be systematically transferred to other geographical regions or populations (Helmerhorst et al., 2012). There is a strong need for assessment of the validity of these items across the regions which utilise it (Bobakova et al., 2015). Particularly as results from studies using this instrument are used for health promoting strategies and policies targeting youth (Currie et al., 2012). It is also essential to validate it across all adolescent years. The need for further studies that investigate the validity of this instrument using objective PA monitoring has been highlighted in the literature (Bobakova et al., 2015). The purpose of the study was to examine the validity of the PACE+ survey for assessing PA, and attainment of the European PA recommendations of 60 minutes of MVPA per day through accelerometry.

4.5 Hypotheses

The following hypotheses were formulated with respect to the validity of the PACE+ instrument:

1. The PACE+ instrument is a valid tool for assessing PA and compliance with PAGL in Irish youth.
2. Validity of the PACE+ instrument is higher in older adolescents (post-primary school students) than in younger participants (primary school students).
3. The validity of the PACE+ instrument is similar for males and females.

4.6 Methods

4.6.1 Participants

This study was conducted within the Children's Sport Participation and Physical Activity (CSPPA) Study (Woods et al., 2010). Initially, data were collected from a nationally representative sample (N = 5,397) of youth from the Republic of Ireland using a systematic, one-stage cluster sampling method. A follow-up study took place 5 years after the original study. The validation study included a convenience sample of 419 participants (n = 284 from 2009; n = 135 from 2014) from 19 schools. Standardised procedures were adopted during data collection in 2009 and 2014 (both February – May). Dublin City University's Research Ethics Committee approved the study in 2009 and 2014. Written informed consent was obtained from adolescents ≥ 18 years and written assent, in addition to, parental consent was gathered from participants < 18 years.

4.6.2 Measures

Participants completed a self-report survey, which included demographic information (sex, date of birth, nationality, urban/rural classification and social class (SC)) as well as the PACE+ questions. The place of residence was classified as urban (>20,000 inhabitants) and rural (<20,000 inhabitants). A proxy of social class was appraised using parental (father's and mother's) occupation (Health Promotion Agency of Northern Ireland, 2000). Social class was categorised as low (semi- and unskilled manual or unemployed SC5-6, SC8), medium (non-manual/skilled manual SC3-4) or high (professional/managerial SC1-2). Those who were gainfully occupied and unknown (SC7; n = 54, 6.2%) were removed due to a lack of information.

Surveys were administered in primary (5th and 6th class; age 10 – 12 years) and post-primary (1st to 6th year; age 12 – 18 years) schools, from across the Republic of Ireland, in the presence of a research team member. Participants were provided with definitions of moderate and vigorous effort and instructed to only include activities of this intensity when completing the PACE+ questions. The first item asked them to report the number of days (0 – 7) they were physically active for at least 60 minutes per day in the past 7 days. The second item asked the same question with respect to a typical or usual week (Prochaska et al., 2001). An average value of the two items yielded a score of days per week that participants accumulated 60 minutes of MVPA. Compliance with PA recommendations was assessed in two ways; by creating binary variables for those achieving / not achieving ≥ 5 days MVPA and 7 days MVPA.

Additionally, PA was objectively measured using the ActiGraph accelerometer (GT1M and GT3X). This monitor is an acceptable criterion measure for evaluating survey validity (Welk, 2005) and the most widely used for this purpose (Helmerhorst et al., 2012). Accelerometers were distributed to participants on the same day as survey completion. Participants were instructed to wear the devices for 8 consecutive days on their right hip during all waking hours, except for when they were swimming or bathing. In order to reliably estimate habitual PA among children and adolescents, a range of 4 to 9 days is required (Trost et al., 2005). The 8th day was excluded from analysis as accelerometers were collected during the daytime. The epoch length was set at 15 seconds. This epoch length is suitable to capture short bursts of PA which are common in young people (Trost et al., 2005). Data from the devices were downloaded and cleaned using ActiLife software. Consecutive zero counts of 20 minutes or more were eliminated from total wear time as it is biologically implausible for children to remain motionless for this length of time (Esliger et al., 2005).

Accelerometer data were analysed using Freedson age-specific cut points (Freedson et al., 2005; Trost et al., 2002) which have demonstrated excellent specificity and sensitivity for MVPA (Trost et al., 2011) and allow for comparison with the study by Ridgers and colleagues (2012). The calculation of the age-specific cut points is available in **Appendix H.1**. Similar to the NHANES study (Troiano et al., 2008) and the validation study by Ridgers and colleagues (2012), a threshold of four METs for moderate activity was chosen. A summary score of counts per min (CPM) represented total PA. For comparability purposes, compliance with PA recommendations was established using the

same two methods as Ridgers and colleagues (2012); the average method and the all days method. In the average method (AM), the average minutes of MVPA per valid days was calculated and dichotomised as above or below 60 mins/day. In the all days method (ADM), valid days that participants engaged in ≥ 60 minutes of MVPA was determined and dichotomised into those meeting ≥ 5 days and 7 days.

4.6.3 Statistical analysis

Descriptive statistics were calculated for demographic, self-report and accelerometer data. For inclusion in the study, participants were required to have complete self-report data and meet accelerometer wear time criteria of a minimum of 8 hours per day on at least 5 days. This wear time criteria was chosen to maximise the sample size while maintaining acceptable levels of wear time. The same criteria were applied to accelerometer data in the Ridgers and colleagues validity study (2012). A summary of participants meeting various accelerometer wear time criteria (i.e. > 5, > 6 or 7 days, with 8, 9 or 10 hours of wear time) are tabulated in **Appendix H.2**. The sample that met inclusion criteria was compared to the full sample for sex, age, school level and self-reported days of ≥ 60 minutes of MVPA. All statistical analyses were performed for the whole sample and stratified by sex and school level. All calculations were completed using those with (a) ≥5 valid accelerometer days (n = 235; 41.3% male) and (b) a subsample with 7 valid accelerometer days (n = 77; 36.4% male). Spearman rho correlation coefficients were calculated between self-report (average days 60mins MVPA) and accelerometry data (mins of MVPA/day; CPM). The strength of the correlations were ranked as small (> 0.1), moderate (> 0.3) and strong (> 0.5) (Cohen, 1988). The percent agreement between self-report and accelerometry was established by assessing the consistency of the classification of achieving the PAGL between the two methods. Sensitivity was defined as the accuracy of classifying those achieving the PAGL. Specificity referred to the accuracy of classifying those who did not meet the PAGL. The positive predictive value (PPV) is the percentage who self-reported meeting PAGL who actually met the guidelines and the negative predictive value (NPV) is the percentage who self-reported not meeting PAGL who did not actually meet the guidelines (Parikh et al., 2008). All analyses were performed using SPSS v.21 (IBM Corp, Armonk, NY).

4.7 Results

4.7.1 Participant characteristics

Of the 419 youth (45.7% male) aged 10 – 18 years who participated in the study, 56.1% (n = 235; 41.3% male; 14.7 ± 3.1 years) met the inclusion criteria. Participants were excluded from the analysis if they were missing one item of the screening tool (n = 6) or if they did not meet accelerometer wear time criteria (n = 175). A malfunction in accelerometer files led to the loss of three participants. Participants attended both primary (37%; 11.17 ± 0.35 years) and post-primary (63%; 16.78 ± 1.85 years) school levels. **Table 4.1** presents the participant characteristics.

Table 4.1 Descriptive characteristics of study participants.

	Full sample	**Included sample**		
		Primary	Post-primary	Total
	n = 419	n = 87	n = 148	n = 235
Age (mean ± SD)	14.8 ± 3.1	11.2 ± 0.4	16.8 ± 1.9	14.7 ± 3.1
Age (range)	10 - 18	10 - 12	12 - 18	10 - 18
Sex (%)				
Male	45.7	32.2	46.6	41.3
Female	54.3	67.8	53.4	58.7
Nationality (%)				
Irish	93.8	93.1	91.9	92.3
Other	6.2	6.9	8.1	7.7
Urban/rural classification (%)				
Urban	43.4	57.6	41.5	47.4
Rural	56.6	42.4	58.5	52.6
Social Class (%)				
Low	9.4	9.3	9.3	9.2
Medium	37.7	41.9	36.9	38.9
High	47.6	40.7	50	46.3
Unknown	5.3	8.1	3.8	5.6

There were no significant differences between the final sample and those excluded in terms of age ($t(414) = 0.84$, $P = 0.40$), school level ($X^2(1) = 1.38$, $P = 0.14$) or self-reported days of 60 minutes MVPA ($t(407) = 0.16$, $P = 0.87$). However, a difference in sex was found ($P = 0.03$) with girls more likely to comply with wearing the accelerometer than boys (61.1% vs. 51.1%).

4.7.2 Physical activity measured by self-report and accelerometer

Table 4.2 shows PA levels and compliance with PAGL for both self-report and accelerometer data. Across participant groups, the proportion meeting PAGL on all days of the week was low in both self-report (4 – 8%) and accelerometry (AM 12 – 25%; ADM 0 – 2%). Rates were higher for meeting PAGL on ≥ 5 days per week (self-report 30 – 45%; AM 12 – 32%; ADM 6 – 16%). Males had significantly ($P < 0.01$) higher values than females for MVPA mins/day, CPM and self-reported days of PA for ≥ 5 valid accelerometer days but not for 7 days of data. Primary level students scored higher than post-primary students ($P < 0.01$) for MVPA mins/day (≥ 5 and 7 days) and total PA (≥ 5 days only).

4.7.3 Criterion validity

Correlation coefficients were small to moderate ($\rho = 0.27 – 0.34$) between self-reported days meeting 60 minutes of MVPA and accelerometer data in terms of minutes of MVPA per day and total PA per day in the whole sample (**Table 4.3**). Stronger correlations were found in older participants (post-primary, $\rho = 0.36 – 0.39$; primary, $\rho = -0.12 – 0.25$) and girls ($\rho = 0.38 – 0.41$; males, $\rho = 0.10 – 0.27$) using both ≥ 5 and 7 days. Correlations were significant for girls, post-primary students and the total sample using 7 accelerometer days and in all groups using ≥ 5 days.

Details of agreement, sensitivity, PPV, specificity and NPV between self-reported PA and accelerometer data are displayed in **Table 4.4**. There was a high level of agreement between the PACE+ and accelerometer data. Using the AM, the agreement level was 68 – 85% for ≥ 5 valid days and 71 – 82% for 7 days. For the ADM, agreement was 89 – 91% for ≥ 5 days and 88 – 96% for 7 days of accelerometer data. Overall, the accuracy of classifying those achieving the guidelines (sensitivity) was low to moderate (≥ 5 days; 38 – 67% accuracy) and in some cases not computable due to a lack of participants meeting the PAGL (7 days; not computable to 17% accuracy). Values were higher in males than females (AM 67% vs. 38%; ADM 67% vs. 50%). The percentage of male and primary school students who self-reported meeting the PAGL, who actually met them (PPV; 9 – 50%) was higher than in female and post-primary school students. The accuracy of classifying those not meeting the guidelines (specificity) was moderate (≥ 5 days; 59 – 72% accuracy) to high (7 days; 92 – 100% accuracy). The NPV was high (74 – 100%) across all analyses.

Table 4.2 Physical activity levels and proportion achieving physical activity recommendations assessed by self-report and accelerometry.

	Total	**Males**	**Females**	**Primary**	**Post-primary**
≥ 5 valid accelerometer days	n = 235	n = 97	n = 138	n = 87	n = 148
Physical Activity Levels (mean ± SD)					
MVPA (mins/day)	40.8 ± 28.7	47.2 ± 34.5	36.3 ± 22.9	57.9 ± 24.1	30.8 ± 26.5
Total PA (CPM)[a]	238.5 ± 111.7	267.0 ± 123.2	218.5 ± 98.4	271.1 ± 86.9	219.4 ± 120.2
Self-reported PA (days)[b]	4.0 ± 1.7	4.6 ± 1.5	3.7 ± 1.8	4.3 ± 1.4	3.9 ± 1.9
Meeting 5 day PA recommendations (%)					
Self-reported PA ≥ 5 days[c]	36.6	45.3	29.7	42.4	32.5
Accelerometer (average method)[c]	19.6	30.9	11.6	32.2	12.2
Accelerometer (all days method)[d]	9.8	15.5	5.8	14.9	6.8
7 valid accelerometer days	n = 77	n = 28	n = 49	n = 28	n = 49
Physical Activity Levels (mean ± SD)					
MVPA (mins/day)	38.7 ± 26.2	41.7 ± 30.2	37.0 ± 23.8	51.7 ± 16.4	31.3 ± 28.0
Total PA (CPM)	223.5 ± 100.7	237.1 ± 106.9	215.7 ± 97.2	245.0 ± 58.8	211.1 ± 117.0
Self-reported PA (days)[b]	3.9 ± 1.7	4.2 ± 1.6	3.7 ± 1.8	4.2 ± 1.2	3.7 ± 1.9
Meeting 7 day PA recommendations (%)					
Self-reported PA = 7 days	5.2	7.1	4.1	3.6	8.2
Accelerometer (average method)[c]	16.9	25.0	12.2	25	12.2
Accelerometer (all days method)[e]	1.3	0	2.0	0	2.0

[a] CPM = counts per minute

[b] Self-reported PA: Composite score of the two self-report items for days per week achieving 60 minutes MVPA.

[c] Average method (AM): Proportion achieving an average of 60 minutes or more of MVPA across all valid days.

[d] All days method (ADM ≥ 5 days): Proportion achieving ≥ 60 minutes MVPA on at least 5 days.

[e] All days method (ADM 7 days): Proportion achieving ≥ 60 minutes MVPA on all 7 days.

Table 4.3 Spearman rho correlations between self-reported and accelerometry recorded physical activity levels.

			Self-reported PA[a]	
		(n)	MVPA (mins/day)[b]	Total PA (CPM)[c]
≥ 5 valid accelerometer days				
Total		235	0.34**	0.33**
Sex				
	Male	97	0.27**	0.25*
	Female	138	0.39**	0.38**
School Level				
	Primary	87	0.24*	0.25*
	Post-primary	148	0.39**	0.36**
7 valid accelerometer days				
Total		77	0.27*	0.30**
Sex				
	Male	28	0.10	0.16
	Female	49	0.40**	0.41**
School Level				
	Primary	28	-0.12	-0.10
	Post-primary	49	0.39**	0.39**

[a] Self-reported PA: Days per week achieving 60 minutes of MVPA

[b] Accelerometer derived average minutes of MVPA per day (MVPA mins/day)

[c] Accelerometer counts per minute (CPM)

* $P < 0.05$

** $P < 0.01$

Table 4.4 Agreement, sensitivity and specificity between self-reported physical activity and accelerometer data for compliance with recommendations.

		≥ 5 valid accelerometer days (n = 235)					**7 valid accelerometer days** (n = 77)				
		Agreement (%)	Sensitivity (%)	PPV[c] (%)	Specificity (%)	NPV[d] (%)	Agreement (%)	Sensitivity (%)	PPV[c] (%)	Specificity (%)	NPV[d] (%)
Average Method[a]											
Total		78.7	56.5	30.6	68.8	86.7	77.9	7.7	25.0	95.3	83.6
Sex											
	Male	72.2	66.7	45.5	64.2	81.1	75.0	14.3	50.0	95.2	76.9
	Female	83.3	37.5	14.6	71.3	89.7	79.6	NC	NC	95.3	87.2
School Level											
	Primary	67.8	53.6	40.5	62.7	74.0	71.4	NC	NC	100	75.0
	Post-primary	85.1	61.1	22.9	71.5	93.0	81.6	16.7	25.0	93.0	88.9
All Days Method[b]											
Total		90.2	60.9	16.5	66.5	94.0	90.2	NC	NC	93.4	98.6
Sex											
	Male	88.7	66.7	22.7	58.5	90.6	92.9	NC	NC	92.9	100
	Female	91.3	50.0	9.8	71.5	95.9	89.8	NC	NC	95.8	97.9
School Level											
	Primary	93.1	61.5	21.6	60.8	90.0	96.4	NC	NC	100	100
	Post-primary	88.5	60.0	12.5	69.6	96.0	87.8	NC	NC	91.7	97.8

NC: Not computable as no participants met the PAGL using the all 7 days method.

[a] Average method (AM): Proportion achieving an average of 60 mins or more of MVPA across all valid days.

[b] All days method (ADM): Proportion achieving ≥ 60 mins MVPA on (i) ≥ 5 days (ii) 7 days

[c] PPV: Positive predictive value

[d] NPV: Negative predictive value

4.8 Discussion

The purpose of this study was to examine the validity of a short survey for assessing attainment and non-attainment of the youth PA recommendations among Irish youth.

Overall, the self-report survey was moderately correlated with accelerometer data in terms of MVPA mins/day and CPM. The validity of the instrument was highest in girls and older adolescents. The low correlations in the younger group (primary) are consistent with findings in the literature (Dumith et al., 2011). A systematic review of PA surveys in youth revealed that adolescents' self-report data correlated better with accelerometer scores than children's (Chinapaw et al., 2010). This may be explained by their cognitive maturity and enhanced ability to recall PA with age (Loprinzi & Cardinal, 2011).

The agreement level was high and varied across the different methods of analysis. As expected, the percent agreement was consistently higher using the ADM (≥ 88%) than the AM (68 – 85%). These figures illustrate a strong agreement between self-report and accelerometer data for detecting whether adolescents engage in the recommended levels of PA. Sensitivity results were low using the 7-days criteria, and in many cases it was non-computable. This can be attributed to the small proportions actually meeting the PAGL. Consequently, these results should be viewed with caution. Higher values in boys may be explained by the higher PA levels in boys than girls, and therefore, greater proportions meeting the PAGL. Similar trends were found for PPV. On the contrary, the accuracy of classifying those not meeting the PAGL (specificity) was moderate to high, and the NPV was consistently high. As specificity and sensitivity are inversely proportional (Parikh et al., 2008), it is unsurprising that results for specificity are much higher. Nonetheless, it is important to identify this group for health promoting efforts.

To date, two studies aimed to validate this measurement tool, the first in a U.S. sample (Prochaska et al., 2001) and the second in a sample of Australian youth (Ridgers et al., 2012). In the U.S. study (Prochaska et al., 2001), the overall correlations – based on PAGL on ≥ 5 days per week only - were greater than the current study (0.40 vs. 0.34). Similar ages between the post-primary school students in the current study and the sample in the Australian study allow for direct comparison. Overall correlations were similar for MVPA mins/day (0.40 (Australia) vs. 0.39 (Ireland)) and for CPM (0.42 vs. 0.36) using ≥ 5 valid days. Correlations reported in both the U.S. and Australian papers can be described as moderate.

The overall agreement level was higher in the current study (78 – 90%) than in the other two papers (63% and 72 – 88%). Higher sensitivity values in the Australian study are due to higher proportions meeting the PAGL. In the total sample, specificity was higher in this study compared with the Australian study over 7 days but lower in the ≥ 5 days analysis. Regardless, specificity was good in both.

Furthermore, it is necessary to compare the PACE+ with other available self-report surveys. In the literature, Spearman rho correlations are the most commonly used measure of criterion validity for self-report instruments (Helmerhorst et al., 2012). Review studies on PA surveys developed for use in children and adolescents found that the majority of instruments have acceptable reliability, and validity is low to moderate at best (Adamo et al., 2009). A systematic review found median validity correlations ranged from 0.22 to 0.41 (Helmerhorst et al., 2012). These studies included a range of PA outcome measures including PA summary scores, total minutes of PA, MET minutes and MVPA minutes per day. A separate review of 89 PA measures for population surveillance in youth approved three study surveys, two of which contained the PACE+ (Biddle et al., 2011). In these studies, the PACE+ was used alongside other measures that describe PA behaviour.

The issue of overestimation of PA by subjective recall methods is frequently raised in the literature. A systematic review revealed that of those studied, 72% of indirect PA measures overestimated objectively measured values (Adamo et al., 2009). In this study, the proportion achieving 60 minutes of MVPA on ≥ 5 days per week was higher in self-report than objective measurement. However, a reverse of this occurs when examining 7 days. The averaging of two items to form the self-report score could potentially create a confounding effect by making it harder to achieve 7 days.

In relation to PA levels, the self-reported levels described here are comparable to those found in a nationally representative sample of Irish students (n = 5,397; aged 10 – 18 years) from which these participants are extracted (Woods et al., 2010). The mean days meeting 60 minutes MVPA (4.0 ± 1.7 and 4.0 ± 1.8) were very similar. Likewise, PA was higher in boys than girls and decreased with age. The decline of PA during adolescence is a consistent finding in studies using self-report instruments (Dumith et al., 2011) and has also been found using accelerometers (Trost et al., 2002).

4.8.1 Limitations

Several limitations are present in this study. Firstly, there is no consensus on the most suitable accelerometer cut points to use for classifying MVPA in children or adolescents (Kim et al., 2012). This study used Freedson cut points with moderate intensity ≥ 4METs. However, correlations between self-report and accelerometer data are similar for MVPA derived from cut points and the CPM obtained from raw data (**Table 4.2**), and the correlation strength would be described in the same way. Secondly, lack of compliance with wearing the accelerometer meant relatively high numbers were excluded from the analysis (56.1% compliance for ≥ 5 days and 18% compliance for 7 days). Of note, there was no significant difference in self-reported PA between the final sample and those excluded. A small sample size within certain groups limited the ability to draw definitive conclusions (e.g. male and primary students (n = 28) when using the 7-day criterion). Nonetheless, the final sample size was similar to previous validation studies (Helmerhorst et al., 2012; Prochaska et al., 2001; Ridgers et al., 2012). Third, the attainment of the PAGL was quite low across the study. This influenced the estimation of sensitivity and PPV.

4.8.2 Conclusions

Assessing non-compliance with PAGL is central to public health as it identifies the segment of the population that would benefit from increased PA. The PACE+ survey was developed to identify youth not meeting PA recommendations. This study confirms the validity of the instrument for this purpose. Notably, validity is higher in females and older children. However, a series of different surveys for specific sex or age groups should be avoided, as the interpretation of youth population PA would be compromised. The ease of administration that this tool offers is vital for use at a population level (Biddle et al., 2011). The continued use of the survey is recommended and will allow for comparability between studies, tracking of PA over time including trends in youth population prevalence. For more detailed information, it should be used alongside other measures that describe PA behaviour, e.g. measures for assessing specific types of physical activities.

4.9 References

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4.10 Review of hypotheses

1. The PACE+ instrument is a valid tool for assessing PA and compliance with PAGL in Irish youth.
   Hypothesis accepted.

2. The validity of the PACE+ instrument is higher in older adolescents (post-primary school students) than in younger participants (primary school students).
   Hypothesis accepted.

3. The validity of the PACE+ instrument is similar for males and females.
   Hypothesis rejected.
   Comment: The Spearman rho correlations are moderate in females and small in males. The ability of the instrument to identify those not meeting the PAGL (specificity) and the NPV are also higher in females than males. However, sensitivity and PPV are greater in males than females.

4.11 Chapter conclusions

- Surveillance of population prevalence of PA is vital for directing public health efforts in PA. An instrument that is valid and assesses compliance with PAGL for health at a population level is central to this.
- The PACE+ two-item survey has been used extensively across the world for assessing compliance with PAGL in youth. This paper is the first to validate this instrument in a European sample.
- The validity of the PACE + survey is similar to existing PA surveys.
- The continued use of the PACE+ survey is recommended. It will allow for tracking of PA trends in youth over time and will facilitate comparisons in PA across Europe and the globe.

CHAPTER 5

Physical activity tracking and sports related predictors of physical activity during transitional periods in youth: A 5-year longitudinal study.

Peer review status

The study in this chapter is published in the Journal of Physical Activity and Health, is accepted for an oral presentation at the 2016 Health-Enhancing Physical Activity (HEPA) Europe conference, and was presented orally at the 2015 Institute of Public Health Open Conference.

Citations

1. Hardie Murphy, M., Rowe, D. A. & Woods, C. B. (2016) Sports participation in youth as a predictor of physical activity: A 5-year longitudinal study. *J Phys Act Health*, 13(7), 704-11. DOI**:** 10.1123/jpah.2015-0526.

2. Hardie Murphy, M., Rowe, D. A., Belton, S. & Woods, C. B. (2016) Assessment of the validity of a youth physical activity survey and longitudinal analysis of sports participation in youth as a predictor of later physical activity. *7th Conference of HEPA Europe,* Belfast, Northern Ireland, 28-30 September 2016.

3. Hardie Murphy, M., Rowe, D. A. & Woods, C. B. (2015) Sports participation in youth as a predictor of physical activity. A 5-year longitudinal study. *Institute of Public Health Open Conference,* Dublin, Ireland, 13 October 2015.

Keywords Physical activity, follow-up study, tracking, sports club, adolescent.

Chapter 5 Study 2

The overall objective of this chapter is to examine longitudinal physical activity (PA) trends in youth using the PACE+ instrument validated in Chapter 4. A distinction is made between possible longitudinal and time-dependent or secular trends in PA levels. In addition, the role of sports participation in youth as a predictor of PA levels 5 years later is carried out by examining various aspects of youth sports participation.

5.1 Purpose of the chapter

5.1.1 Rationale

As the premise for promoting PA for public health is based on the assumption that PA tracks over time, it is fundamental to provide evidence for this notion. Past research has shown that sports participation is a PA domain that is popular in young people. Therefore, the potential of this domain to contribute to longitudinal PA levels warrants investigation. A collective examination of different aspects of sports participation will provide a deeper understanding about which characteristics of sport may be long-term predictors of behaviour.

5.1.2 Contribution to new knowledge

This study adds to the literature by evaluating the tracking hypothesis in an Irish sample. The approach taken is distinct from other international research as it assesses tracking across specific periods of transition in the lives of youth. It provides clarity to aspects of sports participation where evidence is unclear. Furthermore, this study addresses a gap in the literature in relation to the role of the standard achieved in sport for predicting later PA.

5.2 Authors' contributions to the publication.

5.2.1 Candidates' contribution to the publication

The lead author (MHM) undertook the following activities:

- Developed the plan for the paper.
- Developed and piloted the follow-up survey (2014).
- Collected all follow-up data. This involved organising all aspects of both the school-based research and the postal-based research.
- Prepared the longitudinal database by matching participants by their ID number.
- Developed a statistical analysis plan in conjunction with the other authors.
- Carried out all statistical analysis.
- Wrote the paper and made changes based on feedback from the other authors.
- Submitted the paper to the journal, managed communication with the journal, responded to and made alterations based on reviewers' comments, and checked the final 'proof' of the paper.

5.2.2 Contribution of other authors to the publication

All authors read, reviewed and approved the final paper and the resubmitted paper.

- DAR assisted with statistical methods and analysis including double-checking results.
- CBW assisted with the development of the concept and methodology, and provided editing assistance for content. CBW also supervised the research team who collected the 2009 data.

5.3 Abstract

Introduction

Public health objectives of promoting PA are based on the concept that PA tracks. Transitional periods in the lives of youth may influence behaviour. Evidence shows that sport is positively correlated with overall PA levels. However, the contribution of sports related factors to predicting long-term PA are unclear. The purpose of this study was to examine tracking of PA during key transition periods in youth and to determine the longitudinal associations between sports club participation (participation frequency, number of sports engaged in, type of sport, standard achieved) and PA.

Methods

Data presented are from 873 young people (baseline age 10 – 18 years) who participated in the Children's Sport Participation and Physical Activity Study in 2009 and 2014. Participants completed self-report surveys that included the PACE+ PA tool and questions relating to sports club participation. Spearman correlations assessed tracking. ANCOVA analyses examined predictors (sports participation at baseline) of PA (follow-up), adjusting for (a) age and sex and (b) age, sex and baseline PA.

Results

Tracking of PA was weak to moderate (ρ = 0.16 – 0.47) across transition groups. Tracking was the same for both sexes (ρ = 0.26) despite higher tracking in males than females in younger groups. Sports club participation frequency had moderate tracking coefficients for males (ρ = 0.45) and females (ρ = 0.36). Greater sports participation frequency and higher standards achieved at baseline significantly predicted PA at follow-up ($P < 0.01$). Involvement in club sports at an elite level had a medium-to-large effect on PA levels 5 years later (d = 0.75 when adjusting for age and sex; d = 0.60 when adjusting for age, sex and baseline PA).

Conclusions

PA should be promoted in youth as tracking coefficients suggest it can, to an extent, continue into later life. Club sport plays a valuable role in sustaining PA involvement. Individuals who frequently participate in club sports and who are involved at an elite standard are more active 5 years later than those who are not. Future PA promotion strategies should include frequent, high quality opportunities for sports participation as part of wider strategies that promote lifelong PA.

5.4 Introduction

Trends in PA show a clear decline with increasing age in adolescence (Woods et al., 2010). Systematic reviews on the correlates of PA and the determinants of change of PA have revealed that boys are more physically active than girls (Sallis et al., 2000; Van Der Horst et al., 2007) and PA reductions in adolescent years are consistently larger in females than males (Craggs et al., 2011). A decline of, on average, 5.9% per year of follow-up (adjusted for baseline age) has been reported (Dumith et al., 2011). Adolescence forms a highly volatile stage in life where transitional periods can influence behaviour (Kremer et al., 1997; Telama, 2009; Telama et al., 2006). It has been highlighted as a critical time for PA participation where habits developed may persist into adulthood (Hallal et al., 2006; Malina, 2001; Telama et al., 2006).

As PA participation in youth can benefit current and future health (Hallal et al., 2006; Khan et al., 2012; World Health Organization, 2010), monitoring of PA over time is imperative (Hallal et al., 2012). Assessment of longitudinal changes in PA requires utilisation of age appropriate measurement instruments that can compare participation from childhood through to adulthood. With this in mind, it is unsurprising that there is limited research that tracks through these transitional phases of the life-cycle (Richards et al., 2007). Longitudinal research can test the stability of behaviours over time. It can discriminate between temporal and sequential mechanisms in PA by disentangling changes attributable to age (longitudinal trends) and time (secular trends), and in turn causal relationships (Nelson et al., 2006).

Behaviour tracking requires observations from a minimum of two time points in the same participants (Jones et al., 2013). The concept of tracking involves maintaining a rank or position within a group over time (Malina, 2001). Pearson or Spearman correlations between repeated measurements are the most commonly used tracking estimates (Malina, 2001). They have the ability to uncover the extent of which PA in youth is a factor of PA in later life (Khan et al., 2012). In truth, public health objectives of promoting PA in youth are based on the assumption that PA is habitual and can become habitual, resultantly tracking into adulthood (Malina, 2001).

Tracking levels can be influenced by the time lapse between measurements. As the time interval increases, the tracking coefficients or inter-age correlations abate (Friedman et al., 2008; Malina, 2001). Weak to moderate tracking has been reported in long-term

longitudinal studies (Anderssen et al., 2005; Perkins et al., 2004; Telama et al., 2005). In young people, a low level of tracking at specific stages may indicate different rates of change across time (Kjonniksen et al., 2008). Nonetheless, evidence suggests a levelling off in the decline of PA into young adulthood (Kjonniksen et al., 2008).

One particular domain of PA, sports participation, ought to be investigated in more detail (Malina, 2001). Sport has been identified as one of the seven "investments that work for physical activity" (GAPA, 2012). In adolescence, sports participation is positively correlated with overall PA levels (Sallis et al., 2000). Moreover, sports participation in childhood and adolescence has been found to be a significant predictor of participation in young adulthood (Malina, 2001; Perkins et al., 2004). Current evidence on the contribution of variety and frequency of sports participation in youth to predicting future PA is unclear (Dumith et al., 2011). It has been suggested that the number of sports performed in youth predispose to later levels of leisure-time PA (Dumith et al., 2012; Kjonniksen et al., 2008). In a Finnish study, participation in a variety of sports provided stability in leisure-time PA (Aarnio et al., 2002). Elsewhere, it has been suggested that the variety of PA type, independent of the specific activity, could provide opportunities for the foundation of lifelong engagement in PA (Kjonniksen et al., 2008). However, this was not supported by another study that found the variety and frequency of sports undertaken by young people did not contribute to PA maintenance (Brooke et al., 2014).

There is a dearth of research investigating the potential role of the highest standard achieved (e.g. elite level) in sports, in predicting PA in later years. The extent of possible long-term benefits of club sports participation remains to be deciphered (Walters et al., 2009). It is crucial to understand trends in PA across influential stages of the life course, such as adolescence, where prospective behaviour patterns are founded. As sports participation tends to decline in adolescent years, longitudinal research is needed to understand the impact of sport over time (Telford et al., 2015).

The Children's Sport Participation and Physical Activity (CSPPA) Plus study tracks a large cohort of youth through the transitional stages of adolescence 5 years after initial contact. The purpose of this study was: (1) to assess tracking of PA in three cohorts of Irish youth; (2) to assess secular PA trends; and (3) to examine predictors (baseline values for the frequency of participation in club sport, total number of sports engaged in, type of sport, and the highest standard achieved) of PA (follow-up). For the purpose of this study,

sports participation refers to community-based club sport that includes dance, gymnastics, weight training and other forms of PA that are conducted in a club outside of school.

5.5 Hypotheses

The following hypotheses were formulated with respect to PA tracking and sports participation as a predictor of subsequent PA:

1. PA tracking is characterised by weak to moderate tracking coefficients.
2. Rates of PA tracking differ across the three transitional cohort groups.
3. Sports participation at baseline positively predicts PA levels at follow-up namely:
    a. Participants with a greater frequency of sports participation at baseline have higher levels of PA at follow-up.
    b. Participants who engage in a greater number of sports at baseline have higher levels of PA at follow-up than those who engage in few or none.
    c. Participants who take part in a variety of sport types (combination of individual and team-based) have higher levels of PA at follow-up than those who do not.
    d. Participants who have achieved a higher standard of sport (e.g. elite level) at baseline have higher levels of PA at follow-up than those who achieved a lower standard.

5.6 Methods

The CSPPA study collected data on a nationally representative sample of 5,397 youth (aged 10 – 18 years; 48% male) from across the Republic of Ireland in 2009 (Woods et al., 2010). Five years on, participants were contacted for follow-up and completed surveys (n = 873; 30.4% male; response rate = 22.3%; **Figure 3.1** in Chapter 3). The longitudinal sample comprises three transitioning cohorts of youth. The cohorts were chosen to represent key periods of change in the lives of young people. In the Primary School Cohort, participants progressed from primary to post-primary education (n = 217). The Post-primary School Cohort includes those who migrated from first to final year in post-primary school (n = 408), and the School Leaver Cohort advanced from post-primary school to school leaver (n = 248).

At time point one (T1) and at follow-up (time point 2: T2), testing took place during the same phase of the year (February – May). Participants completed a multi-section, self-

report survey in school at T1. At follow-up, surveys were administered in the school setting in the Post-primary School Cohort as students continued to attend the same school. All remaining surveys were sent by mail via the postal address supplied at T1. Standardised procedures were adopted in schools, and adaptations were made for the postal component. For inclusion in the study, participants were required to answer the surveys at both time points. Dublin City University's Research Ethics Committee approved the study in 2009 and 2014. Written informed consent was obtained from youth ≥ 18 years while written assent, in addition to parental consent, was gathered from participants < 18 years. Reporting in this paper follows the STROBE guidelines (Vandenbroucke et al., 2014).

5.6.1 Participants

Demographic information (sex, date of birth, urban/rural classification and social class) was extracted from baseline surveys. The place of residence was classified as urban (≥20,000 inhabitants) and rural (<20,000 inhabitants). A proxy of social class was determined by parental (father's and mother's) occupation (Health Promotion Agency of Northern Ireland, 2000). Those who were gainfully occupied and unknown (n = 54, 6.1%) were removed due to a lack of information.

5.6.2 Longitudinal measures

The PACE+ two-item screening tool assessed habitual PA. It has demonstrated acceptable reliability (Prochaska et al., 2001) and validity compared with accelerometer-determined PA in youth (Chapter 4; Hardie Murphy et al., 2015). It asked participants to report the number of days they were physically active for at least 60 minutes per day in (a) the past 7 days and (b) a typical or usual week. Participants were requested only to include activities of moderate or vigorous intensity. An average value of the two items was calculated. A response of 7 days qualified as meeting physical activity guidelines (PAGL) for youth.

Participants were asked to report their frequency of sports participation. Response options included "4 or more days a week," "2 – 3 days a week", "one day a week", and the following options were recoded into "less than once a week" to represent irregular participation; "2 – 3 days a month," "one day a month", "less often" and "never". A modified version of the Self-Administered Physical Activity Checklist (SAPAC) (Sallis et al., 1996), including a list of 21 activities, assessed engagement in non-school sports

clubs. The total number of sports engaged in at least once per week was calculated by adding up all the activities reported per person at T1 and separately at T2. Due to the positive skewness of data, the total number of sports was truncated to a maximum of six. The type (individual, team-based or a combination) of sports participated in were determined using data on current club membership. Participants reported their highest standard achieved, i.e. basic (e.g. for recreation), competitive (e.g. competitive club level) and elite (e.g. county, regional level) (Kremer et al., 1997). Due to a skip logic in surveys, only participants who reported taking part in a club sport (n = 496) answered this question.

5.6.3 Statistical analysis

Descriptive statistics were calculated for demographic data and PA levels. Attrition analysis compared baseline characteristics between those who completed follow-up and those who did not. Secular trends in PA were assessed using participants aged 15 – 18 years at T1 and the same age group at T2 using the Mann-Whitney U test. This age group was selected as it represents the overlap in age ranges present at T1 (10 – 18 years) and T2 (15 – 24 years). Spearman correlations provided an indicator of PA tracking and sports participation frequency tracking. Correlations were interpreted using Cohen's criteria; weak (0.1), moderate (0.3) and large (0.5) (Cohen, 1988). Non-parametric tests assessed differences between T1 and T2 and between sexes due to the non-normal distribution of data. Age and sex were entered as covariates in ANCOVA analyses that examined the associations between PA at follow-up and T1 variables for: (1) sports participation frequency; (2) the number of sports engaged in; (3) the sport type; and (4) the standard achieved. Age and sex were included as covariates as they are known confounders of PA. Additionally, the number of sports engaged in was adjusted for in the analysis of the sport type to control for potential bias in the 'combination' category. The aforementioned ANCOVA analyses were repeated with the addition of baseline PA as a covariate. Social class was not included as a covariate as it was not correlated with PA. The Fisher LSD test was used for post hoc comparisons as the comparisons were planned and orthogonal. Cohen's *d* effect sizes were calculated and interpreted using Cohen's guidelines for *d*; small (0.2), medium (0.5) and large (0.8) (Cohen, 1988). The workings of the Cohen's d effect size calculations are available in **Appendix I.1**. All analyses were performed using SPSS v.21 (IBM Corp, Armonk, NY). Missing data were excluded from analysis. Data were missing for T1 PA (n = 11), T2 PA (n = 5), sports participation frequency (n = 1), and sport type (n = 3).

5.7 Results

5.7.1 Participant characteristics

The longitudinal CSPPA sample (n = 873) is made up of the Primary School (24.9%), Post-primary School (46.7%) and School Leaver (28.4%) Cohorts. The mean baseline ages were 11.2 ± 0.5 years, 12.8 ± 0.5 years and 14.9 ± 1.4 years respectively. Participants belonged to high (44.6%), medium (36.8%), low (12.5%) and unknown (6.1%) social class categories, with similar proportions of males and females in each. **Table 5.1** presents the participant characteristics. The attrition analyses found no significant difference for social class between those who completed follow-up (n = 873) and those who did not (n = 4,524). However, more females than males responded ($\chi^2(1) = 110.89$, $P < 0.01$), respondents were approximately one year younger (13.0 ± 1.6 vs. 13.9 ± 2.1 years; $t(5377) = -12.70$, $P < 0.01$) and were more active by a mean of approximately 0.3 days (4.4 ± 1.7 vs. 4.1 ± 1.8 days; $t(5310) = 5.03$, $P < 0.01$) than non-respondents.

Table 5.1 Baseline descriptive characteristics of study participants.

	Total sample	**Primary School**	**Post-primary School**	**School Leaver**
	n = 873	n = 217	n = 408	n = 248
Baseline age (mean ± SD)	13.0 ± 1.6	11.2 ± 0.5	12.8 ± 0.5	14.9 ± 1.4
Baseline age (range)	10 – 18	10 – 13	12 – 15	12 – 18
Sex (%)				
Male	30.4	30.4	26.7	36.3
Female	69.6	69.6	73.3	63.7
Urban/rural classification (%)				
Urban	35.1	22.1	37.8	41.9
Rural	64.9	77.9	62.2	58.1
Social Class (%)				
Low	12.5	9.2	12.9	14.5
Medium	36.8	32.3	43.1	30.2
High	44.6	49.8	39.3	49.2
Unknown	6.1	8.8	4.7	6.0

5.7.2 Longitudinal physical activity

Table 5.2 compares PA levels by sex and cohort. In the whole sample, the mean number of days meeting the recommended 60 minutes of moderate to vigorous physical activity (MVPA) declined from 4.4 ± 1.7 days in 2009 to 3.5 ± 1.8 days in 2014 ($P < 0.01$). PA declined for males and females ($P < 0.01$) and included a reduction in the proportion meeting PAGL ($P < 0.05$). PA levels and compliance with PAGL were consistently lower in females than males ($P < 0.05$). The secular trend for days meeting MVPA guidelines in 15 – 18 year olds between T1 and T2 was not significant (mean days: T1 = 3.7 ± 1.6, T2 = 3.5 ± 1.8). PA tracking was weak to moderate in males ($\rho = 0.23 – 0.47$) and females ($\rho = 0.16 – 0.36$). Tracking was highest in males from the Post-primary School Cohort ($\rho = 0.47$) and lowest in females from the Primary School Cohort ($\rho = 0.16$).

Table 5.2 Physical activity levels and tracking split by cohort groups.

	Total sample				**Primary School**			**Post-primary School**			**School Leaver**		
	Total	Male	Female		Male	Female		Male	Female		Male	Female	
	n = 873	n = 265	n = 608	*P*	n = 66	n = 151	*P*	n = 109	n = 299	*P*	n = 90	n = 158	*P*
T1 mean days (± *SD*)	4.4 ± 1.7	4.8 ± 1.6	4.3 ± 1.6	**	4.8 ± 1.8	4.5 ± 1.6		5.0 ± 1.6	4.4 ± 1.6	**	4.5 ± 1.5	3.8 ± 1.7	**
T2 mean days (± *SD*)	3.5 ± 1.8 [a]	4.2 ± 1.8 [a]	3.2 ± 1.7 [a]	**	4.5 ± 1.8	3.7 ± 1.7 [a]	**	4.1 ± 1.5 [a]	2.9 ± 1.6 [a]	**	4.0 ± 2.0	3.3 ± 1.7 [a]	**
PA tracking (Spearman rho)	0.28 [††]	0.26 [††]	0.26 [††]		0.23	0.16 [†]		0.47 [††]	0.26 [††]		0.30	0.36 [††]	
T1 meeting PAGL (%)	9.3	13.3	7.5	**	15.2	10.6		17.4	7.2	**	6.8	5.1	
T2 meeting PAGL (%)	5.3 [bb]	7.6 [b]	4.3 [b]	*	10.6	7.3		5.6 [bb]	3.1 [b]		7.8	3.8	

T1 = time point 1 (2009); T2 = time point 2 (2014); PAGL = physical activity guidelines

* Sex difference based on Mann Whitney U test: $P < 0.05$; ** $P < 0.01$

[a] Time difference (T1 and T2) based on Wilcoxon sign rank test: $P < 0.01$

[b] Time difference (T1 and T2) based on McNemar chi-square: $P < 0.05$; [bb] $P < 0.01$

[†] Significance level of Spearman rho correlation $P < 0.05$; [††] $P < 0.01$

5.7.3 Sports participation predictors of physical activity

Descriptive statistics of factors relating to sports participation are presented in **Table 5.3**. Furthermore, a summary of the associations between baseline sports participation factors and follow-up PA are displayed in **Table 5.4**.

The frequency of sports participation was significantly higher in males than females at both time points ($P < 0.01$). Sports participation frequency (T1 to T2) had moderate tracking coefficients for males ($\rho = 0.45$) and females ($\rho = 0.36$; both $P < 0.01$). Baseline sports participation frequency had a medium positive effect ($d = 0.61$) on PA 5 years later when adjusted for age and sex ($F(3, 861) = 20.63$, $P < 0.01$). Post hoc comparisons found that individuals who participated in sport on four or more days a week had significantly higher levels of PA at follow-up than those partaking on 2 – 3 days a week, one day a week or less than once a week (all $P < 0.01$). Those reporting sports participation of 2 – 3 days a week had significantly higher PA levels at T2 than those reporting one day a week ($P < 0.05$). Even after controlling for baseline PA, the relationship between baseline sports participation frequency and 5-year PA persisted, corresponding to a small-to-medium effect ($d = 0.40$).

The number of sports engaged in did not significantly differ between males and females or between baseline and follow-up (mean sports: T1 = 2.2 ± 2.1, T2 = 2.0 ± 2.1). The ANCOVA analyses revealed that the number of sports did not influence PA 5 years on ($P = 0.09$ and $P = 0.59$). A sex difference was evident for the sport type engaged in at T1 and T2 ($P < 0.01$). Higher proportions of females participated in individual-based sports and lower proportions in team-based sports than males at both time points. Sport type at baseline was not related to T2 PA ($F(3, 854) = 2.48$, $P = 0.06$) after adjusting for the baseline number of sports, age and sex. This relationship remained non-significant ($P = 0.22$) when baseline PA was added as an additional covariate in the ANCOVA analysis.

Of those who participated in sports, the majority participated at a competitive level (T1 55.8%; T2 50.0%). At T1 and T2, greater proportions of females engaged in sport at a basic level than males. In contrast, males had higher proportions participating at competitive and elite levels than females. There was a significant medium-to-large effect ($d = 0.75$) of standard achieved (i.e. basic, competitive, elite) at baseline on T2 PA after controlling for age and sex ($F(2, 490) = 14.76$, $P < 0.01$). Post hoc analyses revealed that

the positive associations of standard achieved with T2 PA were highest at the elite level, followed by the competitive level and basic levels (all $P < 0.01$). The effect size maintained a medium strength ($d = 0.60$) when baseline PA was added as an additional covariate to age and sex.

Table 5.3 Descriptive characteristics of factors related to sports participation.

	T1			T2		
	Male	Female		Male	Female	
Sports participation frequency (%)			**			**
4+ days a week	38.1	23.4		27.0	10.6	
2-3 days a week	30.6	35.9		25.9	23.3	
1 day a week	10.6	15.5		6.5	8.8	
Less than once a week	20.8	25.2		40.7	57.3	
Number of sports (mean ± *SD*)	2.1 ± 1.8	2.0 ± 1.8		2.0 ± 1.8	1.9 ± 1.9	
Sport type (%)			**			**
Combination	11.7	18.0		8.1	4.4	
Team	54.3	29.4		39.9	17.7	
Individual	13.6	30.6		15.5	22.4	
None	20.4	22.0		36.4	55.4	
Standard achieved (%)[a]			**			**
Elite	27.6	22.4		34.9	29.7	
Competitive	60.9	53.5		55.6	46.5	
Basic	11.5	24.1		9.5	23.8	

T1 = time point 1 (2009); T2 = time point 2 (2014)

** Sex difference based on chi-square test, $P < 0.01$

[a] Only includes those who participated in club sport at T1 (n = 496; male = 156; female = 340).

Table 5.4 Associations between PA at follow-up and baseline sports participation factors.

	df	*F*	*P*	η_p^2 [a]	Effect size [b]
ANCOVA analyses adjusting for age and sex					
Sports participation frequency	861	20.635	< 0.001	0.07	0.61
Number of sports	855	1.857	0.09	0.01	0.32
Sport type [c]	854	2.484	0.06	0.01	0.30
Standard achieved	490	14.756	< 0.001	0.06	0.75
ANCOVA analyses adjusting for age, sex and baseline PA					
Sports participation frequency	849	25.835	< 0.001	0.03	0.40
Number of sports	844	0.781	0.59	0.01	0.05
Sport type [d]	843	1.477	0.22	0.01	0.17
Standard achieved	482	9.063	< 0.001	0.04	0.60

Note: ANCOVA analyses using LSD post hoc analysis adjusting for age and sex.

[a] η_p^2 = partial eta squared

[b] Cohen's d effect size

[c] Adjusted for number of sports, age and sex.

[d] Adjusted for number of sports, age and sex and baseline PA.

5.8 Discussion

This study supports the tracking hypothesis and provides a unique perspective by assessing tracking in three cohorts of youth transitioning through key phases of their lives. It further develops an understanding of the role of sports participation for long-term PA (in terms of the frequency of participation, the number of sports undertaken and the sport type). It addresses a gap in the literature regarding the role of the standard achieved in sport for predicting later PA.

5.8.1 Longitudinal physical activity

The longitudinal reductions in PA from baseline to follow-up reported in this study are consistent with trends for young people (Evans et al., 2009). The greatest reduction in PA was found in the Post-primary School Cohort and may be explained by school commitments as testing took place one to three months prior to state examinations. Males were more active than females, a finding frequently reported in the literature (Aarnio et al., 2002). Between 2009 and 2014, no secular changes in PA were found in 15 – 18 year

old youth. In a previous comparison of 2004 and 2009 rates of achieving PAGL, no temporal change was found for primary or post-primary school students in Ireland (Woods et al., 2010).

In this study, weak to moderate levels of PA tracking, based on PA measured 5 years apart, were reported. The tracking coefficients (ρ) ranged from 0.16 to 0.47 and are comparable to those found in systematic reviews. In the literature, tracking coefficients are varied and range from weak to moderate (Craigie et al., 2011; Evans et al., 2009; Jones et al., 2013). Tracking coefficients (ρ) varied from 0.27 to 0.57 in a recent review (Jones et al., 2013), ranged from -0.11 to 0.59 in an earlier review (Evans et al., 2009), and ranged from -0.01 to 0.47 in a review of European studies (Craigie et al., 2011). In studies with a follow-up of 5 years or less, moderate tracking was detected (Evans et al., 2009). It is necessary to point out that different follow-up durations may influence tracking as correlations tend to decline with increasing inter-measurement intervals (Craigie et al., 2011; Malina, 2001).

Current results revealed higher PA tracking in males than females in the Primary School and Post-primary School Cohorts but not the School Leaver group. When tracking was assessed in the whole sample, the coefficients were the same for both sexes ($\rho = 0.26$). It is possible that sex differences disappear in early adulthood. This may be unclear in review studies that have a variety of age ranges and follow-up periods. In the literature, analyses of sex differences in tracking are inconclusive. In one systematic review (Craigie et al., 2011) males had stronger coefficients than females while no differences were reported in another (Evans et al., 2009).

5.8.2 Sports participation predictors of physical activity

A systematic review revealed sports participation to have higher tracking than other PA behaviours, even after long follow-up periods (Evans et al., 2009). Moderate tracking levels for sports participation found in both sexes in this study support the concept of sports participation tracking from childhood and adolescence into adulthood. Values in this study ($\rho = 0.45$ in males, $\rho = 0.36$ in females) were higher than those observed in a study following participants from age 7 to 21 years ($\rho = 0.07 – 0.28$) (Richards et al., 2007). Our findings verify previous research that found sports participation at age nine to be associated with participation at age twelve (Basterfield et al., 2015) and time spent in sports participation at age twelve to be a significant predictor of sports participation in

young adulthood (at age 25) (Perkins et al., 2004). Further results from the present study found that baseline sports participation frequency positively predicted PA 5 years on. Results indicate that the relationship holds regardless of baseline levels of PA. However, it is necessary to note that sports participation and PA levels at baseline are correlated so caution should be taken when interpreting analysis that adjusts for baseline PA. The medium effect size of sports participation frequency on later PA (when adjusting for age and sex) found here illustrates the importance of promoting regular participation. Of concern are the declining levels of sports participation between T1 and T2 as potential long-term health benefits of sports participation are most likely attributable to sports participation maintenance (Basterfield et al., 2015).

Current findings revealed that the number of sports performed by young people did not differ between sexes or time points. No evidence was found to suggest that the number of sports engaged in predicted PA 5 years on. Furthermore, the sport type participated in at baseline did not significantly influence PA 5 years later. In the literature, evidence is mixed concerning the association between number of sports engaged in and later PA. In a British study (Brooke et al., 2014), the baseline number of sports participated in each week was not associated with a change in MVPA despite a reduction from 7.9 ± 4.2 to 4.7 ± 2.4 sports. Contrastingly, participation in numerous leisure-time activities was moderately associated with later activity in a 10-year tracking study (Kjonniksen et al., 2008).

To the knowledge of the authors, no research has examined the highest standard achieved in youth sport as a predictor of later PA. Participation at elite or competitive levels at baseline were associated with greater PA at T2. The magnitude of the effect sizes (large and medium-to-large) highlight the benefits of competing at higher levels and merits the promotion of competitive sport. As males had higher proportions participating at elite and competitive levels than females, they reap more long-term benefits from sports participation. Gender inequity in sport is epitomised by reduced participation opportunities, finances and social support for females around the world (Capranica et al., 2013). In Ireland, more variety of sports is offered to males than females and resources are unevenly allocated between sexes (Woods et al., 2007). The extent of the impact of elite sports participation on overall PA levels is unclear as there is a dearth of collective information on youth participation at this level across all sports. However, those participating in club sports in the original CSPPA study reported participation at elite

(25%), competitive (57%) and basic (18%) levels (Woods et al., 2010). These findings suggest that there may be substantial benefits for the majority of Irish youth involved in sports participation. Nonetheless, it is necessary to acknowledge that sport in isolation is not an adequate approach to promoting PA at a population level but it should be included in wider strategies that promote PA throughout the day (Vella et al., 2015).

5.8.3 Limitations

Several limitations are present in this study. Tracking is represented by Spearman correlations, and therefore, refers to within-group rank position over time. This does not take into consideration longitudinal group changes in behaviour (Jones et al., 2013). Although the sample size is large, the proportion of females is significantly greater than males. Baseline characteristics between those who completed follow-up and those who did not, significantly differed in terms of sex, age and PA level (longitudinal respondents: more females, ~1 year younger, ~0.3 more days achieving recommended PA level). A major factor influencing loss to follow-up was the ability to contact participants who were no longer available in the school setting; the postal recruitment strategy was utilised in a greater proportion of older participants from post-primary school at baseline and explains the difference in age between respondents and non-respondents. Caution should be taken with the generalisation of results as the differences may have caused minor underestimation (due to sex) or overestimation (due to age) of PA level. The difference in PA level, although statistically significant, is small and is unlikely to have had a major influence on tracking results. An assessment of the stability of PA behaviour was limited by a single follow-up period. PA is a complex behaviour, and future studies should include other PA domains such as active commuting and physical education as predictors of later PA.

5.8.4 Conclusions

PA should be promoted in youth as tracking coefficients suggest it can continue into later life. Club sport plays a valuable role in sustaining PA involvement as demonstrated by the medium effect size for frequency of sports participation and the medium-to-large effect size for standard achieved found in this study. These results advocate for greater frequency of participation and engagement at a competitive level in sport. However, a gender inequality, which is highlighted by the higher proportions of males participating at elite and competitive levels than females, needs to be addressed. Fewer sports participation opportunities exist for females and are a contributing factor to high inactivity

levels. Schools may play an important role in connecting young people with community based sports participation opportunities. Future promotion strategies should endorse frequent, high quality opportunities for sports participation as part of wider strategies that encourage lifelong PA participation.

5.9 References

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5.10 Review of hypotheses

1. PA tracking is characterised by weak to moderate tracking coefficients.
   Hypothesis accepted.

2. Rates of PA tracking differ across the three transitional cohort groups.
   Hypothesis accepted.
   Comment: In females, tracking coefficients increased from the Primary School Cohort to the Post-primary School Cohort and were highest in the School Leaver Cohort. In males, the tracking coefficient was highest in the Post-primary School Cohort.

3. Sports participation at baseline positively predicts PA levels at follow-up namely:
   a. Participants with a greater frequency of sports participation at baseline have higher levels of PA at follow-up.
      Hypothesis accepted.

   b. Participants who engage in a greater number of sports at baseline have higher levels of PA at follow-up than those who engage in few or none.
      Hypothesis rejected.
      Comment: Evidence in the literature is mixed, and this study found no evidence to support this hypothesis.

   c. Participants who take part in a variety of sport types (combination of individual and team-based) have higher levels of PA at follow-up than those who do not.
      Hypothesis rejected.
      Comment: No evidence was found to support this when adjusting for the number of sports engaged in.

   d. Participants who have achieved a higher standard of sport (e.g. elite level) at baseline have higher levels of PA at follow-up than those who achieved a lower standard.
      Hypothesis accepted.

5.11 Chapter conclusions

- PA in youth can track into later life, and therefore, it's promotion in young people is warranted.
- The levels of PA in youth have remained unchanged over the 5-year period (i.e. there is no secular trend), despite the declines in PA that occur during adolescent years (i.e. longitudinal changes in individual's PA levels).
- Sports participation tracks from childhood into adolescence and young adulthood.
- New research findings illustrate that the level of commitment (the frequency of participation and performance ability achieved) to sport in early years are crucial for shaping future PA. Future promotion strategies should endorse frequent, high-quality opportunities for sports participation.
- Prospective studies should examine numerous PA domains as predictors of later PA to gain a greater understanding of longitudinal behavioural influences on PA.

CHAPTER 6

Impact of physical activity domains on subsequent activity in youth: A 5-year longitudinal study.

Peer review status

The study in this chapter is published in the Journal of Sports Sciences. An analysis of physical activity domains in females was presented (short oral) at the 2015 International Society of Behavioural Nutrition and Physical Activity (ISBNPA) conference. Longitudinal analyses conducted on a subsample of participants (6th year students aged ~18 years at follow-up) were presented at the 2014 Health-Enhancing Physical Activity (HEPA) Europe conference (poster presentation on club sports taken up and dropped) and at the 2014 Physical Education, Physical Activity and Youth Sport (PEPAYS) Research Forum (oral presentation on participation trends in specific sports).

Citations

1 Hardie Murphy, M., Rowe, D. A. & Woods, C. B. (2016) Impact of physical activity domains on subsequent activity in youth: A 5-year longitudinal study. *J Sports Sciences*. Advance online publication. DOI: 10.1080/02640414.2016.1161219

2 Hardie Murphy, M., Belton, S. & Woods, C. B. (2015) Predictors of physical activity in female youth: Longitudinal findings from the Children's Sport Participation and Physical Activity Study. *14th Annual Meeting of the International Society of Behavioural Nutrition and Physical Activity*, Edinburgh, UK, 05 June 2015.

3 Hardie, M., Woods, C. B. & Belton, S. (2014) Trends in physical activity levels over a 5-year period in 6th Year post-primary students. *PEPAYS Research Forum*, Limerick, Ireland, 06 June 2014.

4 Hardie, M., Belton, S. & Woods, C. B. (2014) A longitudinal analysis of uptake and drop out of physical activities during post primary education in Ireland. *5th Conference of HEPA Europe*, Zurich, Switzerland, 28 August 2014.

Keywords Predictors, sport, active commuting, physical education, uptake, dropout.

Chapter 6 Study 3

The overall objective of this chapter is to examine domains of physical activity (PA) in youth as predictors of PA levels 5 years later. PA is measured using the PACE+ instrument validated in Chapter 4. For the remainder of the chapter, the focus shifts to the PA domains that are deemed influential in these analyses. This chapter builds on the evidence from Chapter 5 by investigating additional domains of PA including active commuting and physical education, and by expanding on details of sports participation, specifically, change in sports participation.

6.1 Purpose of the chapter

6.1.1 Rationale

In examining club and extra-curricular sports participation, active commuting and physical education, this study examines potential behavioural determinants of youth PA. Differentiating between the longitudinal impacts of specific PA domains is essential to identify where limited resources should be directed to obtain the greatest PA benefit. With this noted, an in-depth evaluation of change in behaviour and factors influencing behaviour change may inform PA interventions that promote long-term PA.

6.1.2 Contribution to new knowledge

Although there is ample literature on PA domains, research collectively examining youth domains of PA is scarce. This study addresses the gap in the literature. Furthermore, this study utilises tracking of sports participation (both club-based and school-based) within the same individuals over time. Longitudinal analyses more accurately represent sports uptake and dropout in young people than repeated cross-sectional observations by demonstrating movement into and out of sport, as well as, overall participation levels. Current Irish literature uses cross-sectional data. This study provides a deeper understanding of specific factors that influence change in sports participation.

6.2 Authors' contributions to the publication.

6.2.1 Candidates' contribution to the publication

The lead author (MHM) undertook the following activities:

- Developed the plan for the paper in conjunction with the other authors.
- Developed and piloted the follow-up survey (2014). This included assessment of question groupings, order and layout, and the addition of questions to assess changes in behaviour over time.
- Collected all follow-up data. This involved organising all aspects of both the school-based research and the postal-based research.
- Prepared the longitudinal database by matching participants by their ID number.
- Developed a statistical analysis plan.
- Carried out all statistical analysis.
- Wrote the paper and made changes based on feedback from the other authors.
- Submitted the paper to the journal, managed communication with the journal, responded to and made alterations based on reviewers' comments, and checked the final 'proof' of the paper.

6.2.2 Contribution of other authors to the publication

All authors read, reviewed and approved the final paper and the resubmitted paper.

- DAR assisted with the development of the paper concept, and gave advice on statistical methods and analysis.
- CBW assisted with the development of the paper concept, and provided direction and feedback on drafts of the paper. CBW also supervised the research team who collected the 2009 data.

6.3 Abstract

This study evaluates how domains of PA in youth predict later PA, and assesses factors influencing changes in sports participation. Young people from the Children's Sport Participation and Physical Activity study (n = 873; baseline age 10 – 18 years; 30.4% male) completed self-report surveys in 2009 and 2014. In a multiple linear regression analysis, participation frequency in club sport (β = 0.18) and extra-curricular sport (β = 0.13) significantly predicted PA 5 years later, adjusted for age, sex and urban/rural classification ($P < 0.01$). Overall, rates of regular (at least once per week) youth sports participation were high (males 79.3 – 85.5%; females 74.8 – 83.2%). Uptake and dropout of specific sports varied widely. Despite high levels of migration into and out of Gaelic games, they remained popular at follow-up. Weight training was the only sport that increased in both sexes ($P < 0.05$). Fitness, friends and enjoyment were top motivations for taking up a new sport. Other commitments, a lack of interest and time were important factors leading to sports dropout. PA promotion strategies should include youth sport, take into consideration what sports are attractive to young people, and address reasons for uptake and dropout.

6.4 Introduction

Physical inactivity is the fourth leading cause of mortality worldwide (Kohl et al., 2012). To tackle this public health issue, PA promotion strategies often target children and adolescents with the view of promoting lifelong engagement (Dobbins et al., 2013). Despite these efforts, young people across the world are achieving insufficient levels of PA. In adolescents (13 – 15 years) from 105 countries worldwide, 80.3% do not meet the PA guidelines for health of 60 minutes of moderate-to-vigorous physical activity (MVPA) on all days of the week (Hallal et al., 2012). A clear reduction in PA levels is apparent with increasing age in adolescence. Results of a systematic review and pooled analysis indicated that PA levels decline by a mean of 7% per year over this period (Dumith et al., 2011). By the age of 15 years, on average, across thirty-nine countries in the Health Behaviour in School-aged Children study, only 10% of girls and 19% of boys self-reported sufficient MVPA levels (Currie et al., 2012). Global PA decline throughout adolescence, across a range of measurement units, appears as high as 60 – 70% (Dumith et al., 2011).

In young people, domains of PA include sports (extra-curricular and club sport), active commuting and physical education (PE). Cross-sectional data show that adolescent sports participation is positively correlated with overall PA levels (Sallis et al., 2000). One study found that sports participation contributes between 55% and 65% of daily MVPA in youth aged 12 – 14 years (Katzmarzyk & Malina, 1998). Of the time spent participating in extra-curricular sport, up to 50% of this time is spent in MVPA (Curtner-Smith et al., 2007), highlighting the valuable contribution it can make to overall PA levels. Active commuting via walking or cycling provides an opportunity to accrue daily minutes of MVPA. Evidence from a systematic review shows a positive association between active commuting and PA levels (Lee et al., 2008). Individuals who commute actively tend to accumulate more daily PA than those who do not (Cooper et al., 2005). One study reported that 30% of the time spent commuting by foot or bicycle was spent in MVPA, and this amounted to a median of 10 minutes of MVPA daily (Klinker et al., 2014). Of time spent in PE classes, 20.5% was spent in MVPA, and this accounted for a median of 18 minutes of MVPA per class (Klinker et al., 2014). PE classes provide a platform to practice and reinforce skills that are likely to provide a foundation for lifelong PA (European Commission et al., 2013; MacNamara et al., 2011; Seghers et al., 2009).

PA habits developed in childhood are likely to track into adulthood (Telama, 2009). Moreover, PA participation in youth can benefit current (Janssen & LeBlanc, 2010) and future health (Hallal et al., 2006). Consequently, it is essential to examine the potential longitudinal benefits of participating in the different domains of youth PA. Studies examining the different domains of childhood PA as predictors of adult PA are limited and generally have small sample sizes (n < 250) (Cleland et al., 2012). Research articles often focus on one domain only. Tammelin and colleagues (2003) investigated the role of adolescent participation in sports as a predictor of adult PA and concluded that youth sport may provide a basis for lifelong involvement in PA. A recent study found that youth sports participation had a moderate level of tracking over a 5-year period, and individuals who frequently participated in club sports were more active 5 years later than those who were not (Chapter 5; Hardie Murphy et al., 2016). In a longitudinal study, young people (aged 8 to 16 years) engaging in club sport were more active and fitter at all time-points than those who were not participants (Telford et al., 2015). A study focussing on active commuting revealed that increased active commuting in youth was independently associated with higher PA in young adulthood (Yang et al., 2014). A recent 20-year tracking study by Cleland and colleagues (2012) investigated multiple domains of youth PA. They found that leisure PA and school sport in youth demonstrated inconsistent associations with adult PA. Weekly minutes of PE were positively correlated with adult total weekly PA in females (aged 13 – 15 years at baseline) and males (aged 9 – 12 years at baseline).

More evidence is required to understand these relationships and to explain the contribution of the different PA domains to long-term PA. A comprehension of the longitudinal impact of specific domains of PA will help direct future health promotion efforts. Furthermore, an understanding of change and factors that influence change in these domains is essential to inform interventions.

This paper comprises two studies. The purpose of Study One was to evaluate domains of PA in youth (club sport; extra-curricular sport; active commuting; PE) as predictors of PA 5 years later. In Study Two, posteriori analyses were conducted based on significant findings from Study One. Study Two aimed to: (1) assess uptake, dropout and participation levels in youth sports; and (2) determine reasons for change in sports participation. For the purpose of this paper, sport included dance, gymnastics, weight training and other forms of PA conducted either in the community for club sport or in

conjunction with the school (outside of class time) for extra-curricular sport. In Study Two unless otherwise specified, sport refers to any sport performed during leisure time and may include extra-curricular and club sport.

6.5 Hypotheses

1. The following hypotheses were formulated with respect to Study One:
    a. Participation in club-based sports at baseline is positively associated with PA levels at follow-up.
    b. Participation in extra-curricular sports at baseline is positively associated with PA levels at follow-up.
    c. Active commuting to school at baseline is positively associated with PA levels at follow-up.
    d. Participation in PE classes at baseline is positively associated with PA levels at follow-up.

2. The following hypotheses were formulated with respect to Study Two:
    a. Uptake and dropout rates vary by sport.
    b. The popularity of specific sports differs by sex at baseline and follow-up.
    c. Participation levels decrease in most sports from baseline to follow-up.

6.6 Methods

A longitudinal research design was employed in Study One. Study Two incorporated a longitudinal design for assessing uptake, dropout and participation levels in youth sports and a retrospective design for assessing the reasons for change in sports participation.

6.6.1 Participants

The Children's Sport Participation and Physical Activity (CSPPA) study gathered survey data from a nationally representative sample of youth aged 10 – 18 years (N = 5,397) from schools across the Republic of Ireland (Woods et al., 2010). The sampling method documented in Woods, Tannehill and Walsh (2012) was conducted in the final two years of primary school and all secondary school years. Of those eligible to follow-up, 22.3% (n = 873; 30.4% male) completed CSPPA Plus surveys 5 years after the original study. A lack of permission given for follow-up (n = 1,197), missing or incorrect contact details (n

= 289) and death (n = 3) determined ineligibility. The research was conducted between February and May at baseline (time point one: T1) and at follow-up (time point two: T2) using standardised procedures. At T2, surveys were administered either in schools or via a postal survey if participants no longer attended the same school. Dublin City University's Research Ethics Committee approved the study in 2009 and 2014. Written informed consent was gathered from participants ≥ 18 years and adolescents < 18 years provided written assent and parental consent.

Participant Characteristics. Age, sex, urban/rural classification and social class data were extracted from baseline surveys. The place of residence was classified as urban (>20,000 inhabitants) and rural (<20,000 inhabitants). A proxy of social class was appraised using parental occupation (Health Promotion Agency of Northern Ireland, 2000). Those who were gainfully occupied and unknown (n = 54, 6.1%) were removed from analysis due to a lack of information.

6.6.2 Study One measures

Physical activity. Habitual PA was assessed using the PACE+ two-item screening tool (Prochaska et al., 2001) that has been used globally to assess compliance with youth PA guidelines (Currie et al., 2012; Peltzer, 2010; World Health Organization, 2015). This instrument demonstrated acceptable validity compared with accelerometer-determined MVPA in a subsample of participants (n = 235) (Chapter 4; Hardie Murphy et al., 2015). Participants reported the number of days they had accumulated 60 minutes of MVPA during (a) the past 7 days and (b) for a typical or usual week. The average of the two questions was used to represent habitual PA.

Club sport and extra-curricular sport. Participants reported their frequency of participation in (a) club sport (in non-school clubs) and (b) extra-curricular sport (school-based sport outside of curriculum time) from the following options; "4 or more days a week", "2 – 3 days a week", "once a week", "2 – 3 days a month", "one day a month", "less often", and "never". For analysis, response options with a frequency of less than once a week were merged to represent irregular participation.

Active commuting. From a list, participants selected the usual mode of transport - for the longest distance of the journey - for travelling to school. Responses were categorised as active (walking or cycling), mixed mode (bus, train, or tram) and inactive (car, motorcycle

or scooter). As an element of walking or cycling is expected when using public transport, these commuting methods were labelled as mixed mode.

Physical education (PE). Participants reported the frequency and duration of PE classes offered per week.

6.6.3 Study Two measures

Longitudinal sports participation. A modified version of the Self-Administered Physical Activity Checklist (SAPAC) (Sallis et al., 1996) assessed participation in (a) non-school sports clubs and (b) extra-curricular sport. From a list of 21 sports, participants selected any sports that they took part in at least once per week. The list included Irish sports such as Gaelic football and hurling/camogie, in addition to an 'other' option. Cycling and golf were added to the list at T2, as they are popular in adults in Ireland (Ipsos MRBI & Irish Sports Council, 2013). As extra-curricular sport is school-based, school leavers did not undertake it at T2.

Retrospective changes in sports participation. Supplementary questions at T2 assessed changes in sports participation in the interim of T1 and T2. Via open-ended questions, participants retrospectively recalled if they took up a new sport during the previous 5 years and the main reasons for doing so. Additionally, participants recalled if they dropped out of a sport in the previous 5 years and selected the three most pertinent reasons from a list of 20 possible responses. An 'other' option allowed participants to declare an alternate reason for dropping out of the sport. The question on reasons for dropping out of a sport was adopted from the Sports Council of Northern Ireland 1995 Survey et al., 1997).

6.6.4 Statistical analysis

Analyses were completed using SPSS v.21 (IBM Corp, Armonk, NY). Descriptive statistics were calculated for all variables. For Study One, a multiple linear regression was calculated to predict PA at T2 based on T1 variables for club sport, extra-curricular sport, active commuting and PE, adjusting for age, sex and urban/rural classification. Due to their relationship to T2 PA, age and sex were included in the analysis as potential confounders. The urban/rural classification was included in the regression model as it was correlated with the T1 commuting to school variable. The aforementioned regression analyses (excluding sex) were repeated for males and females separately. Social class was

omitted from the analysis, as it was not correlated with the outcome variable. For Study Two, detailed analyses of participation in specific sports, and uptake and dropout of sports over the 5-year period were conducted. McNemar's chi-square test assessed sports engagement at T1, T2, and proportions of uptake and dropout between the two time points. More detailed analyses of participation levels, and uptake and dropout rates in club and extra-curricular sports are detailed in **Appendix J.1**. These analyses include a breakdown of sports participation by the cohort groups described in Chapter 5 (i.e. the Primary School, Post-primary School and School Leaver Cohorts). McNemar's chi-square test was used as data were paired. Responses to the open-ended questions were grouped into categories for analysis. A frequency analysis was carried out on reasons reported for sports adoption and dropout.

6.7 Results

6.7.1 Participant characteristics

CSPPA Plus participants (n = 873; 30.4% male) were aged 15 – 23 years at follow-up. Almost two-thirds of the participants (64.9%) lived in rural areas at baseline, 44.6% were in high, 36.8% in medium, 12.5% in low and 6.1% in unknown social classes.

6.7.2 Study One: Predictors of physical activity

Table 6.1 presents descriptive characteristics of domains of youth PA. Baseline participation of at least once per week in club sport was reported by 79.3% of males and 74.8% of females, and in extra-curricular sport by 85.5% of males and 83.2% of females. Levels of active commuting to school were low for males (25.0%) and females (28.9%) at T1. The duration of PE per week at T1 was a mean of 76.5 ± 37.0 minutes (range: 0 – 285 minutes). The mean (± standard deviation) number of days meeting 60 minutes of MVPA was 4.4 ± 1.7 at T1 (males: 4.8 ± 1.6 days; females: 4.3 ± 1.6 days) and 3.5 ± 1.8 at T2 (males: 4.2 ± 1.8 days; females: 3.2 ± 1.7 days; sex and time differences all significant, $P < 0.01$).

Table 6.1 Descriptive characteristics of domains of youth physical activity.

	Total sample	Male	Female
T1 club sports frequency (%)			**
4+ days a week	27.9	38.1	23.4
2 – 3 days a week	34.3	30.6	35.9
1 day a week	14.0	10.6	15.5
Less than once a week	23.9	20.8	25.2
T1 extra-curricular sports frequency (%)			**
4+ days a week	44.0	58.9	37.5
2 – 3 days a week	27.2	20.5	30.1
1 day a week	12.7	6.1	15.6
Less than once a week	16.1	14.4	16.8
T1 commuting to school (%)			NS
Active	27.7	25.0	28.9
Mixed mode	30.7	32.2	30.0
Inactive	41.6	42.8	41.1
T1 physical education (mean weekly mins ± *SD*)			NS
	76.5 ± 37.0	77.4 ± 41.9	76.1 ± 34.8

** Sex difference based on chi-square test, $P < 0.01$

NS = non-significant sex difference ($P > 0.05$) using chi-square test for T1 commuting to school and an independent samples *t*-test for T1 physical education.

Controlling for the non-modifiable variables age, sex and urban/rural classification, the regression analysis assessed involvement in PA domains at T1 as predictors of T2 PA (**Table 6.2**). The model accounted for 15% of the variance in T2 PA ($P < 0.001$). Sex ($\beta = 0.24$), club sport frequency ($\beta = 0.18$), extra-curricular sport frequency ($\beta = 0.13$) and urban/rural classification ($\beta = 0.11$) were all significant predictors of T2 PA ($P < 0.01$). Specifically, T2 PA was higher for participants who were male, had a higher frequency of participation in club and extra-curricular sport and who lived in an urban area. Active commuting to school and PE at T1 did not predict T2 PA. In the regression analyses split by sex, results were similar for both sexes for club sport frequency (males: $\beta = 0.17$; females: $\beta = 0.18$) and extra-curricular sport frequency (males: $\beta = 0.13$; females: $\beta = 0.14$) but differed for urban/rural classification (males: $\beta = 0.003$; females: $\beta = 0.13$).

Table 6.2 Correlation and linear regression analyses between predictors and follow-up physical activity.

Predictors	Correlation between predictor and T2 PA [a]	Regression analysis	
		β	P
Constant (regression model)			< 0.01
Age	-0.08*	-0.03	0.41
Sex	0.25**	0.24	< 0.01
Urban/rural classification	0.05	0.11	< 0.01
T1 club sport frequency	0.24**	0.18	< 0.01
T1 extra-curricular sport frequency	0.23**	0.13	< 0.01
T1 commuting to school	0.06	0.06	0.10
T1 physical education	0.01	0.011	0.73

Note: $R^2 = 0.15$, adjusted $R^2 = 0.14$; $F(8, 814) = 18.07$, $P < 0.001$

T1 = time point 1 (2009); T2 = time point 2 (2014)

* $P < 0.05$; ** $P < 0.01$

[a] Pearson correlation

6.7.3 Study Two: Longitudinal sports participation

Table 6.3 displays overall participation levels, and uptake and dropout rates in sports over the 5-year timeframe. For club sport, figures presented are proportions of the total sample (males: n = 265; females: n = 608). For extra-curricular sport, the presented figures are calculated for participants still in school at T2 (males: n = 175; females: n = 450). Clear sex differences are evident in sports preferences. Among males, soccer and Gaelic football, followed by hurling and swimming, were the most frequently reported club sports at baseline. At T2, their popularity remained with the exception of hurling. With regards to extra-curricular sport, soccer and Gaelic football were also the most frequently reported sports at both time points. Among females, Gaelic football, athletics, dance and camogie were popular sports both in and out of school at baseline. Dance, swimming, Gaelic football and camogie were the most frequently reported club sports by females at T1 and T2. Gaelic football, basketball, athletics and dance were the top four extra-curricular sports reported by females at baseline.

A decline in participation rates was evident across most club sports for both sexes and in extra-curricular sport for females. In males, a significant decline ($P < 0.05$) in club sports participation occurred in hurling (↓8.3%) and soccer (↓7.6%), and in females for dance (↓6%), basketball (↓2.8%), gymnastics (↓3%) and baseball/rounders (↓3.1%). In males, some extra-curricular sports experienced modest increases while others decreased.

Significant reductions ($P < 0.05$) occurred in the top six extra-curricular sports reported by females at T1. Notably in males, high uptake and dropout rates occurred in Gaelic football and soccer for club and extra-curricular sport. A significant rise in those reporting participation in weight training occurred in males (club ↑26.1%; extra-curricular ↑12%; $P < 0.01$) and females (club ↑11.9%; extra-curricular ↑3.2%; $P < 0.05$). Weight training became the most frequently reported club sport in young men where 33.6% reported engaging in it. Among females, there was a significant increase in those reporting club aerobics (↑7.1%; $P < 0.05$) and in extra-curricular adventure activities (↑3.1%; $P < 0.05$). In relation to the additional club sport response options at T2, cycling was popular with males (12.1% participation) and females (12.7% participation), and golf was reported more frequently by males than females (10.6% versus 4.9%; $P < 0.01$).

Further findings from the cohort analyses of participation levels, and uptake and dropout rates for club and extra-curricular sport are described in **Appendix J.1**.

The main findings for club sport were:

- At baseline among males, soccer and Gaelic football, followed by hurling and swimming, were the most frequently reported club sports in the Primary and Post-primary School Cohorts, and were in the top 5 in the School Leaver Cohort.
- In male School Leavers, uptake and dropout rates were similar within Gaelic football (↑7.8%, ↓8.9%) and soccer (↑13.3%, ↓12.2%) leading to little change overall.
- In males at follow-up, weight training became the second most popular activity overall, the third most popular in the Primary and Post-primary School Cohorts and the most frequently reported sport in the School Leaver Cohort where participation was reported by 43.3% of young men. In females, weight training significantly rose across all cohorts, and aerobics increased from the Post-primary School Cohort onwards ($P < 0.05$).
- Among females, dance, swimming, Gaelic football and camogie were the most frequently reported sports at baseline in all cohorts, and at follow-up in the Primary and Post-primary School Cohorts.

The main findings for extra-curricular sport were:

- Differences in participation rates for sports suggest differences in the availability of sports in the primary versus post-primary school setting. In males, the sports that increased in popularity in the Primary School Cohort had higher participation rates at baseline in the Post-primary School Cohort.

- Among males, increases in participation rates occurred in weight training (↑10.6%), basketball (↑4.6%) and rugby (↑1.5%) in the Primary School Cohort, and in weight training (↑12.9%), Gaelic football (↑6.4%), hurling (↑6.4%), soccer (↑6.4%), basketball (↑5.5%) and cross country running (↑1.9%) in the Post-primary School Cohort.
- Among females, reductions in participation rates occurred in all sports in the Primary School Cohort with the exception of Badminton (↑7.2%), and in the Post-primary School Cohort in all sports but adventure activities (↑4%) and weight training (↑3%).

Table 6.3 Longitudinal participation levels, uptake and dropout of club and extra-curricular sports over a 5-year period.

	Sport	Participation T1 (%)	Participation T2 (%)	Uptake (%)	Dropout (%)
Male club sport (n = 265)[a]					
1	Soccer	40.8	33.2*	10.2	17.7
2	Gaelic football	39.2	37.7	9.8	11.3
3	Hurling [c]	23.4	15.1**	3.0	11.3
4	Swimming	17.4	15.5	9.1	10.9
5	Rugby	12.8	9.1	4.9	8.7
6	Athletics	12.1	14.3	10.6	8.3
7	Tennis	9.4	6.0	4.2	7.5
8	Basketball	9.1	4.9	3.0	7.2
9	Weight training	7.5	33.6**	28.7	2.6
10	Martial arts	6.8	6.0	4.5	5.3
11	Badminton	6.0	3.0	1.5	4.5
12	Cross country running	6.0	5.7	4.5	4.9
13	Adventure activities	5.3	3.4	3.4	5.3
14	Handball	5.3	2.3	1.5	4.5
Female club sport (n = 608)[a]					
1	Dance	29.3	24.3*	11.5	16.4
2	Swimming	27.5	25.0	16.0	18.4
3	Gaelic football	24.0	22.2	8.6	10.4
4	Camogie [c]	16.3	14.1	5.3	7.4
5	Soccer	13.2	10.0	4.9	8.1
6	Athletics	11.2	9.5	7.2	8.9
7	Tennis	10.9	8.6	5.4	7.7
8	Horse riding	10.4	9.2	5.3	6.4

	Sport	Participation T1 (%)	Participation T2 (%)	Uptake (%)	Dropout (%)
Male extra-curricular sport (n = 175)[b]					
1	Soccer	26.9	32.6	22.9	17.1
2	Gaelic football	20.6	21.7	15.4	14.3
3	Athletics	16.0	10.9	9.7	14.9
4	Basketball	13.7	18.9	14.9	9.7
5	Rugby	12.0	10.3	6.3	8.0
6	Hockey	10.3	4.0	1.1	7.4
7	Baseball or rounders	9.7	1.1**	0.6	9.1
8	Hurling [c]	8.0	10.3	8.6	6.3
9	Handball	7.4	4.0	2.3	5.7
10	Swimming	7.4	4.6	3.4	6.3
11	Tennis	7.4	5.1	4.6	6.9
12	Badminton	5.7	5.1	4.0	4.6
13	Cross country running	5.1	6.9	6.3	4.6
14	Weight training	0.6	12.6**	12.6	0.6
Female extra-curricular sport (n = 450)[b]					
1	Gaelic football	22.9	13.8**	6.4	15.6
2	Basketball	17.1	11.3**	6.7	12.4
3	Athletics	15.1	9.3**	6.9	12.7
4	Dance	13.6	6.2**	4.9	12.2
5	Camogie [c]	12.9	8.9*	5.1	9.1
6	Hockey	11.6	6.7*	2.2	7.1
7	Soccer	10.9	9.6	7.1	8.4
8	Swimming	10.9	5.8	4.7	9.8

9	Basketball	9.9	7.1*	3.9	6.7	9	Tennis	8.7	6.4	4.0	6.2
10	Gymnastics	7.4	4.4*	2.3	5.3	10	Baseball or rounders	8.2	2.4**	2.4	8.2
11	Hockey	6.9	5.1	2.6	4.4	11	Cross country running	7.1	5.3	3.8	5.6
12	Aerobics	5.6	12.7**	11.5	4.4	12	Gymnastics	5.6	2.7*	1.6	4.4
13	Cross country running	5.6	4.3	3.6	4.9	13	Adventure activities	1.1	4.2**	4.0	0.9
14	Baseball or rounders	5.1	2.0**	1.5	4.6	14	Weight training	0.4	3.6*	3.6	0.4
15	Adventure activities	3.9	7.1*	6.7	3.6						
16	Weight training	3.6	15.5**	14.5	2.6						

Note: Sports reported by at least 5% of the respondents at baseline or sports with a significant change in participation are represented.
T1 = time point 1 (2009); T2 = time point 2 (2014).
* Time difference (T1 and T2): $P < 0.05$; ** $P < 0.01$

[a] Participants from all cohort groups.

[b] School leavers were excluded as they could not participate in extra-curricular sport at T2.

[c] Hurling (male version) and camogie (female version) are variations of the same Gaelic sport.

6.7.4 Study Two: Retrospective changes in sports participation

Within the previous 5 years, the number of participants taking up a new sport and dropping out of a previous sport was high. Females were significantly more likely to drop a sport than males (rates of 68.9% and 60.6% respectively; $P < 0.05$). Rates of taking up a new sport were lower in females than males (65.9% and 70.8% respectively; $P = 0.09$). These rates refer to the number of participants who reported taking up or dropping out of at least one sport. The rates of taking up a new sport and dropping out of a previous sport are illustrated by cohort group in **Appendix J.2**.

A rank of the top 10 reasons for uptake of a sport over the previous 5 years (**Table 6.4**) placed fitness in the top position for both sexes. Additionally, friends/to socialise and enjoyment rated highly. Males heavily reported taking up a sport to build strength or muscles. Factors relating to body image were more commonly reported reasons for uptake of a sport by females (9.5%) than males (5.1%). Although it is not possible to fully differentiate performance goals from body image goals, in this analysis, building strength/muscles is reported separately to body image as it may be related to performance rather than aesthetics. The top 10 reasons for dropping out of a sport in the previous 5 years are ranked in **Table 6.5**. A lack of interest, other commitments (school/work) and took up too much time were important factors leading to sports dropout in youth. Starting another sport only featured for males and contributed to dropout of a sport in 6.3% of cases.

Table 6.4 The top 10 reasons reported for uptake of a sport in the previous 5 years.

Male (n = 177)			**Female** (n = 370)		
Rank	Reasons for uptake	(%)	Rank	Reasons for uptake	(%)
1	Fitness	19.9	1	Fitness	25.8
2	Build strength/muscles	12.1	2	Enjoyment/fun	10.6
3	Enjoyment/fun	10.5	3	Body image[a]	9.5
4	Friends/to socialise	8.1	4	Friends/to socialise	8.7
5	Like it	5.4	5	To try something new	5.7
6	Body image[a]	5.1	6	Health benefit/stress relief	4.8
7	Interested in it	4.3	7	Interested in it	4.3
8	Health benefit/stress relief	3.5	8	Like it	4.2
9	To try something new	3.5	9	For an event	3.5
10	To develop new skills	3.0	10	Exercise/to get more active	3.4

Note: Figures are calculated using participants who reported taking up a new sport only.
[a] Body image represents a desire to lose weight, get bigger or tone up.

Table 6.5 The top 10 reasons reported for dropping out of a sport in the previous 5 years.

Male (n = 157)			**Female** (n = 413)		
Rank	Reasons for dropout	(%)	Rank	Reasons for dropout	(%)
1	Lack of interest	19.0	1	Other commitments (school/work)	22.5
2	Other commitments (school/work)	16.5	2	Lack of interest	16.0
3	Injury	9.1	3	Took up too much time	14.0
4	Took up too much time	8.9	4	Too expensive	6.3
5	Training was boring	7.6	5	Not good enough	6.1
6	Not good enough	6.6	6	Injury	5.7
7	Started another sport	6.3	7	Coaches were unfriendly	4.5
8	Other commitments (part time job, boy or girl friend)	4.3	8	My friends had stopped	4.5
9	Too expensive	4.1	9	Training was boring	4.0
10	My friends had stopped	3.8	10	Other commitments (part time job, boy or girl friend)	3.6

Note: Figures are calculated using participants who reported dropping out of a previous sport only.

6.8 Discussion

This study contributes to the limited literature pertaining to the impact of specific PA domains in youth on later PA. It develops on these findings by providing an assessment of uptake and dropout rates of specific club and extra-curricular sports, and not just overall trends that may mask individual fluctuations in sport-specific participation. It highlights specific sports that have a potential to recruit participants and that have low dropout during this period, and in doing this, identifies sports to target in PA promotion efforts. Furthermore, it determines the reasons for change in sports participation, evidence that is invaluable for informing PA promotion strategies.

Current findings support previous research that found sports participation in youth to be a predictor of future PA (Basterfield et al., 2015; Tammelin et al., 2003; Telama et al., 2006). Higher levels of MVPA at follow-up (in young adulthood) have been reported in those who participated in organised sports during high school, despite a greater decline in MVPA relative to those who did not participate in sports at baseline (Walters et al., 2009). For a deeper analysis of sports participation, we subdivided it into club and extra-curricular sport, both of which were associated with later PA. Results for club sport and

extra-curricular sport participation were similar for both sexes. Overall, club sport was a slightly stronger predictor of T2 PA than extra-curricular sport ($\beta = 0.18$ versus $\beta = 0.13$). As club sport is performed independently of the school setting, it may have a greater capacity to endure beyond the school years. The majority of participants in this study were still in school, which could downplay potential longer term differences between the two predictors. Of note, living in an urban area positively predicted PA at follow-up in females, but not in males.

Active commuting to school did not predict later PA in this study. This contrasts with the findings of Yang and colleagues (2014) who reported that active commuting in youth was prospectively associated with adult PA. Elsewhere, it was not associated with longitudinal changes in leisure-time PA (Dumith et al., 2012). This PA domain is volatile and susceptible to change from external factors (Carver et al., 2011) which may explain discrepancies in results from different contexts. External factors may include the perceived distance to travel and urban/rural area of residence. Results from a study of over 4,000 adolescents aged 15 – 17 years in Ireland found that over 90% of those who perceived distance as a barrier to actively commuting lived beyond a 2.5 mile radius from school, and adolescents living in more urban areas had greater odds of actively commuting than those in more rural areas (Nelson et al., 2008).

In this study, no evidence was found to suggest that PE was associated with longitudinal PA. Other research found ambiguous results using log-binomial regressions. In females aged 9 – 12 years at baseline, PE (top tertile of mins/week) predicted total weekly PA in adulthood, however, no relationship was found for older females (aged 13 – 15 years at baseline). Additionally, PE did not predict later PA in males (Cleland et al., 2012).

It is unsurprising that leisure activities, i.e. sport, that are under volitional control, were significant predictors of later PA behaviour. Individuals who choose to allocate a portion of their time to regular PA participation may have an increased likelihood of continuing to allocate their time in that manner at a later date (Cleland et al., 2012).

A large proportion of children and adolescents in Ireland may currently be benefiting their future PA through participation in youth sport. Baseline sports participation rates in this study were high for males (79.3% for club; 85.5% for extra-curricular) and females (74.8% for club; 83.2% for extra-curricular). Elsewhere the Irish Sports Monitor 2013

Annual Report (Ipsos MRBI & Irish Sports Council, 2013) revealed that 82.4% of males and 69.1% of females aged 16 – 19 years participated in a leisure-time sport. The proportions presented for the CSPPA Plus study are for youth aged 10 – 18 years, which may explain the differences in participation rates between the two studies as rates tend to decrease across adolescent years (Evans et al., 2009).

The carry-over hypothesis described by Telama (2009) suggests that sports participated in at a young age have an increased participation probability in adulthood. However, research has found variability in uptake, maintenance and dropout of different sports (Brooke et al., 2014). Furthermore, participation in specific sports is dependent on opportunities to engage in the sport, and availability of the sport; either in the community for club sport or offered by the school for extra-curricular sport. The popularity of sports can be influenced by cultural factors and, therefore, differ from country to country (Brooke et al., 2014). In this study, the valuable role of indigenous Irish sports for overall youth sport is noteworthy. The popularity of Gaelic football, hurling and camogie is unsurprising as they are promoted by a national governing body (Gaelic Athletics Association) that aims to increase and support youth involvement. As the popularity of sports differs by country, the promotion of sports should be carried out within the context of that country.

A fall in participation rates across most sports in adolescent years is consistently reported across studies (Belanger et al., 2009; Brooke et al., 2014; Kjonniksen et al., 2008). Significant decreases were found in club sport, for example, in soccer and hurling in males, and dance and basketball in females across the 5-year period. Sports with the highest participation rates tended to have the most migration into and out of the sport, for example, in soccer and Gaelic football in males and dance in females. People may have a tendency to try out popular sports, but at the same time, dropout rates may also be higher as there are more people involved in the first place. The exception to this phenomenon is weight training.

A considerable movement into and out of sports participation has been reported in the literature (Richards et al., 2007). Overall, those retrospectively reporting taking up a new sport within the previous 5 years ranged from 65.9% – 70.8% and rates of dropping a previous sport ranged from 60.6% – 68.9%. This illustrates that young people appear open to taking up new sports, but the issue lies in maintaining participation. The top

reason identified for uptake of a new sport for both sexes was fitness (19.9% of males; 25.8% of females). Respondents listed multiple motives, including enjoyment (~11%) and socialising or spending time with friends (~8%), indicating that a number of factors collectively contribute to the uptake of a sport. Dropout of a previous sport was largely due to psychological barriers (such as other commitments, the sport taking up too much time, a lack of interest and not believing they were good enough) and social reasons (such as friends no longer participating and coaches being unfriendly). School (or work) commitments were a highly reported attrition factor. Sports dropout, for this reason, is counter-productive as evidence from a systematic review shows a significant longitudinal positive relationship between PA and academic performance (Singh et al., 2012). The Sports Council of Northern Ireland 1995 Survey found the same top two reasons for dropout of a sport - other commitments (school/work) and a lack of interest - illustrating that the main influences have not changed in 20 years (Kremer et al., 1997).

6.8.1 Limitations

The limitations of measuring PA by self-report have been widely acknowledged. Nonetheless, the PACE+ instrument demonstrated acceptable validity in a subsample of participants (Chapter 4; Hardie Murphy et al., 2015). The study sample size is large despite low response rates in the postal component of the study. However, it should be noted that there was little difference between T1 PA level between respondents and non-respondents (a mean of approximately 0.3 days meeting 60 minutes of MVPA). Sports are context specific so should not be generalised to other populations.

6.8.2 Conclusions

Of the domains of PA, youth sports participation appears to be the strongest predictor of PA 5 years later. The relationship is slightly stronger for club than for extra-curricular sport. Uptake, maintenance and dropout of specific sports are variable and dependent on cultural factors and opportunities to participate. Gaelic games, and increasingly weight training, are important for males and females in Ireland. Young people appear open to taking up new sports, but preventing dropout is an issue. PA promotion strategies should target youth sport. They should highlight the benefits of sport, such as increased fitness, enjoyment, social aspects, improved body image and strength, that are meaningful to young people and promote uptake. Efforts should be taken to address the role of sport in work/life balance and the benefits of such.

6.9 References

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6.10 Review of hypotheses

1. The following hypotheses were formulated with respect to Study One:
   a. Participation in club-based sports at baseline is positively associated with PA levels at follow-up.
      Hypothesis accepted.

   b. Participation in extra-curricular sports at baseline is positively associated with PA levels at follow-up.
      Hypothesis accepted.

   c. Active commuting to school at baseline is positively associated with PA levels at follow-up.
      Hypothesis rejected.

   d. Participation in PE classes at baseline is positively associated with PA levels at follow-up.
      Hypothesis rejected.

2. The following hypotheses were formulated with respect to Study Two:
   a. Uptake and dropout rates vary by sport.
      Hypothesis accepted.

   b. The popularity of specific sports differs by sex at baseline and follow-up.
      Hypothesis accepted.

   c. Participation levels decrease in most sports from baseline to follow-up.
      Hypothesis accepted.
      Comment: The exceptions are:
      - Males: Modest non-significant increases of participation in soccer, Gaelic football, basketball, hurling and cross country (all extra-curricular).
      - Females: Significant increases in participation in aerobics (club) and adventure activities (extra-curricular).
      - Weight training significantly increased in all cohorts of youth for both males and females.

6.11 Chapter conclusions

- Both community club-based and extra-curricular sports participation in youth are predictors of later PA.
- Active commuting to school & PE did not predict later PA in this study.
- Rates of youth sports participation in Ireland suggest that a large proportion of children and adolescents may be benefiting their future PA through current participation.
- As sports are influenced by cultural factors and differ by country, sports promotion strategies should be context specific.
- Participation rates declined across most sports bar weight training that increased in both sexes.
- Numerous factors collectively contribute to the uptake of a sport while dropout of a sport was largely due to psychological barriers and social reasons.
- Future research should examine the longitudinal influences of psychosocial determinants of PA on subsequent PA thereby building on the information presented in this Chapter on behavioural predictors of longer-term PA

CHAPTER 7

Modelling the psychosocial determinants of physical activity in youth: A 5-year longitudinal study.

Peer review status

The study in this chapter is accepted for presentation as part of the Children and Youth Working Group Symposium at the 2016 Health-Enhancing Physical Activity (HEPA) Europe conference.

Citation

Hardie Murphy, M., Rowe, D. A. & Woods, C. B. (2016) Modelling the psychosocial determinants of physical activity in youth: A 5-year longitudinal study. *7th Conference of HEPA Europe,* Belfast, Northern Ireland, 28-30 September 2016.

Keywords Youth Physical Activity Promotion Model, self-efficacy, social support, perceived barriers, enjoyment.

Chapter 7 Study 4

The overall objective of this chapter is to examine psychosocial determinants of physical activity (PA) in post-primary school-aged youth. Enjoyment of PA, PA self-efficacy, perceived barriers to PA and sources of social support for PA at baseline were entered into a structural model to assess their relationship with PA 5 years later. This chapter builds on Chapter 6 by using theory to investigate and model psychological and social factors that influence long-term PA.

7.1 Purpose of the chapter

7.1.1 Rationale

This chapter identifies differences in the effects of psychosocial determinants on longitudinal PA. It builds on Chapters 5 and 6 by investigating interaction effects of personal factors (PA enjoyment and self-efficacy) and perceived environmental factors (perceived barriers to PA and social support for PA from friends, family and teachers) on later PA. The analytical method of choice is structural equation modelling (SEM) as it facilitates the testing of theoretical relationships through the creation of multiple predictor latent constructs. By utilising confirmatory factor analyses to create these latent constructs, the error is minimised as measurement error is taken into account. SEM permits assessment of moderating and mediating relationships, and calculation of direct, indirect and total effects of constructs on outcomes, a valuable feature as factors do not exist in isolation of each other (Esmaeily et al., 2014; Heitzler et al., 2010). Model development, based on hypothesised interactions between the variables of interest, was informed by the Youth Physical Activity Promotion (YPAP) model (Welk, 1999). To improve the effectiveness of PA interventions, it is crucial to target evidence-based mediators of PA (Bauman et al., 2012). By understanding the mechanisms of PA influences, efficacious interventions that target long-term involvement in PA can be developed.

7.1.2 Contribution to new knowledge

This chapter adds to the literature by evaluating psychosocial factors that influence PA behaviour. Although longitudinal research on this topic exists, it is rare that the interactions are modelled using SEM despite the benefits of this methodology. In one study the effects of a selection of psychosocial variables on PA 1 year later were examined (Dewar et al., 2013). To the knowledge of the authors, this is the first study to examine the longer term (5-year) effect of the psychosocial determinants on PA in youth using

SEM. Similar methods have assessed cross-sectional data. The model presented here was formulated using evidence from these past models, and includes personal and social constructs that are believed to be associated with youth PA.

7.2 Authors' contribution to the chapter

7.2.1 Candidates' contribution to the chapter

The lead author (MHM) undertook the following activities:

- In collaboration with the other authors, developed the plan for the paper.
- Developed and piloted the follow-up survey (2014). This included assessment of question groupings, order and layout, and the addition of questions to assess changes in behaviour over time.
- Collected all follow-up data. This involved organising all aspects of the school-based and postal-based research.
- Prepared the longitudinal database by matching participants by their ID number.
- Developed the statistical analysis plan in conjunction with the other authors.
- Carried out all analyses.
- Wrote the paper and made changes based on feedback from the other authors.
- Prepared the paper for submission in international journals.

7.2.2 Contribution of other authors to the chapter

All authors read, reviewed and approved the final chapter.

- CBW assisted with the development of the concept and methodology, and provided feedback on drafts of the chapter. CBW also supervised the research team who collected the 2009 data.
- CBW and DAR collaborated on the development of the statistical plan including approaches to addressing the research aims.
- DAR provided tuition on structural equation modelling, discussed statistical decisions at each stage (i.e. testing scales, measurement models and structural models) and reviewed all results.

7.3 Abstract

Introduction

To overcome the well-documented decline in PA across the adolescent years, it is necessary to understand the factors that can positively or negatively influence long-term PA behaviour. The purpose of this study was to examine the psychosocial determinants of 5-year PA in youth utilising the theoretical framework of the Youth Physical Activity Promotion (YPAP) model.

Methods

A subsample of post-primary school students (n = 658; baseline age 12 – 18 years; 30.2% male) from the Children's Sport Participation and Physical Activity Study completed surveys at baseline and 5 years after the original study. Structural equation modelling was used to examine the relationships between baseline psychosocial latent constructs (friend and family social support for PA, PA enjoyment, PA self-efficacy, perceived barriers to PA) and the follow-up PA construct.

Results

Friend social support for PA had the greatest direct and total effect on follow-up PA (β = 0.15 and β = 0.18 respectively, $P < 0.05$). PA self-efficacy mediated the role of family social support for PA and perceived barriers to PA on follow-up PA ($P < 0.05$). PA enjoyment, perceived barriers to PA and family social support for PA were not directly associated with 5-year PA.

Conclusions

The YPAP model provided a useful framework for assessing moderators and mediators of youth PA. Future strategies to promote sustainable PA should incorporate methods to increase PA self-efficacy, reduce perceived barriers to PA and to foster a supportive environment for PA from friends and family.

7.4 Introduction

Despite the extensive evidence documenting the benefits to current and future health of regular participation in PA in youth (Khan et al., 2012), over 80% of young adolescents (aged 13 – 15 years) from 105 countries worldwide do not attain the recommended PA levels for health (Hallal et al., 2012). Strategies to overcome this issue should be strengthened by research that tests theoretical relationships (Rowe et al., 2007) and developed using evidence of factors that influence long-term PA behaviour.

The YPAP model (Welk, 1999) provides a framework to systematically investigate the correlates of youth PA (see **Figure 7.1**). It was devised to address the need for a specific model tailored to young people and generated using youth PA research. An integration of existing theoretical frameworks was undertaken in the development of the YPAP model. The theories examined included Social Cognitive Theory (Bandura, 1986), Ecological Theory (Stokols, 1996), and the Theory of Planned Behaviour (Ajzen, 1991). The identified correlates were classified into factors that predispose, enable and reinforce participation in PA.

Predisposing factors are intrapersonal factors that increase the likelihood of regular participation in PA by having a direct effect on PA behaviour (Welk, 1999). Two fundamental questions underlie predisposing factors: (1) Am I able? (e.g. self-efficacy); and (2) Is it worth it? (e.g. enjoyment, perceived barriers). Self-efficacy is one of the most frequently studied correlates of PA as it is a key component of many health behaviour models (Heitzler et al., 2010). Review studies of correlates of PA have found strong evidence of the positive association between self-efficacy and PA (Bauman et al., 2012; Biddle et al., 2005; Van Der Horst et al., 2007; Young et al., 2014) while mixed evidence for the relationship between PA enjoyment and PA have been reported. In adolescent girls, enjoyment of PA was deemed to be a correlate of PA (Biddle et al., 2005) while in a later review, it was concluded that the two variables were not correlated (Van Der Horst et al., 2007). Despite the mixed findings, this cognitive variable should continue to be studied to assist with the comprehension of PA behaviour (Rowe et al., 2007). The relationship between perceived barriers to PA and PA has also demonstrated varying results. In one review, it was deduced that perceived barriers to PA were inversely correlated with PA behaviour in adolescent girls (Biddle et al., 2005). In another review, a small to moderate inverse association was found (Sallis et al., 2000) while no association was inferred in another (Van Der Horst et al., 2007).

In brief, enabling factors enable youth to be physically active and include biological (e.g. physical skills) and environmental factors (e.g. access to facilities). They are not studied in this paper.

Reinforcing factors are interpersonal factors in the social environment that encourage participation in PA (Welk, 1999). Within the literature, there is a consensus that both parental and peer sources of social support are pivotal reinforcing factors in youth PA (Silva et al., 2014). Through a child's lifespan, parental and family influence forms a key origin of social support that has been extensively studied. Many systematic reviews concur about the positive role of parental social support on youth PA behaviour (Beets et al., 2010; Biddle et al., 2005; Edwardson & Gorely, 2010; Gustafson & Rhodes, 2006; Mendonca et al., 2014). A positive relationship has also been reported for social support for PA from friends and increased PA level (Mendonca et al., 2014; Van Der Horst et al., 2007). Further, in a systematic review of friendship networks and PA, higher PA levels among friends was linked with higher PA levels of the individual (Sawka et al., 2013). It is necessary to study the role of parent and peer sources of social support independently to disentangle their effects through the adolescent years (Silva et al., 2014).

Research has supported the hypothesised structural links and measurement models within the YPAP model using SEM (Seabra et al., 2013). Self-efficacy has been shown to mediate the relationship between PA and social support (Heitzler et al., 2010; Silva et al., 2014). Elsewhere, enjoyment and perceived barriers mediated the associations between social variables and PA among youth (Wu et al., 2003). More research on the predisposing and reinforcing factors of the YPAP model is warranted (Crimi et al., 2009). A recent review of adolescent studies highlighted an overdependence on studies with a cross-sectional design (Plotnikoff et al., 2013). Testing of longitudinal determinants of youth PA are required to assess the causal pathways of mediator variables and should be accompanied by more robust statistical methods to gain a definitive understanding of factors influencing PA (Bauman et al., 2012). The identification of these psychosocial correlates and mediators is fundamental to the design of effective public health interventions targeting this high-priority adolescent group (Bauman et al., 2002).

The purpose of this study was to model the associations between social support for PA, PA enjoyment, PA self-efficacy, and perceived barriers to PA with PA levels 5 years later among youth. The research is strengthened by: (1) the longitudinal study design; (2) the

use of SEM; and (3) the organisation of potential predisposing and reinforcing factors of youth PA within the theoretical framework of the YPAP model. In this study, all predictor variables were measured specifically with regard to PA (i.e. social support for PA, PA enjoyment, PA self-efficacy and perceived barriers to PA).

7.5 Hypotheses

1. The hypothesised model developed using the YPAP model explains a substantial amount of variance in 5-year PA.
2. Baseline predisposing factors have a direct effect on PA at follow-up.
3. Baseline reinforcing factors influence PA at follow-up directly and indirectly via baseline predisposing factors.
4. PA self-efficacy at baseline has an effect on follow-up PA directly, and mediates the effects of perceived barriers and social support at baseline on follow-up PA.

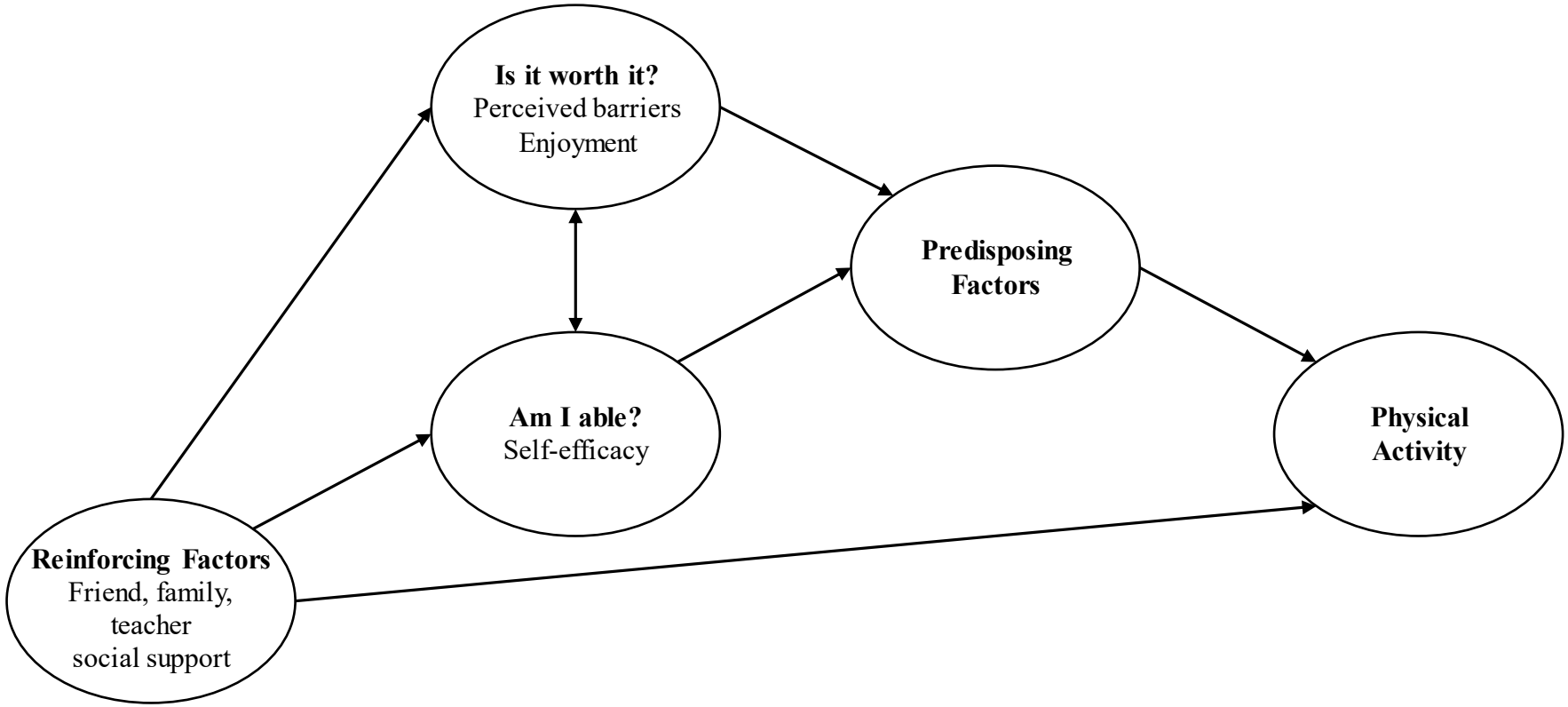

Figure 7.1 A conceptual diagram of the Youth Physical Activity Promotion (YPAP) model. Adapted from Welk (1999).

7.6 Methods

7.6.1 Participants and procedure

A subsample of post-primary school students (n = 658, baseline age 12 – 18 years) from the Children's Sport Participation and Physical Activity (CSPPA) study (Woods et al., 2010) were followed-up 5 years after initial contact. Self-report surveys were administered in schools from across the Republic of Ireland at time point one (T1) and provided data for the psychosocial constructs used in the SEM analysis. The primary school sample from the CSPPA study was excluded from analyses as they did not complete all of the measures (see **Table 3.2**) included in the present investigation. Five years later (time point two: T2), PA data were gathered in schools and by a postal survey for those who could not be contacted through school. To control for seasonal variation in PA participation, data were collected between February and May at both time points. Ethical approval was obtained from Dublin City University's Research Ethics Committee in 2009 and 2014. Participants < 18 years supplied written assent and parental consent. Participants ≥ 18 years provided written informed consent.

7.6.2 Measures

The YPAP model (Welk, 1999) informed the organisation of the psychosocial variables in this study into predisposing and reinforcing factors. The instruments utilised to collect these data were psychometrically sound and developed for use in young people which is a vital prerequisite for testing a youth PA model (Rowe et al., 2007).

Predisposing factors. The *'Am I able?'* component of the YPAP model was assessed using a 10-item self-efficacy for PA measure (Nigg & Courneya, 1998). This measure had been redeveloped for use in adolescents from an earlier five-item version (Marcus et al., 1992). Participants indicated on a Likert scale ranging from 0 – 10, how confident they were to participate in regular PA when faced with specific situations such as being tired, having homework to do or when there is a good show on TV. Zero represented not at all confident, five, somewhat confident, and 10, very confident. The internal consistency of this scale in this study was good ($\alpha = 0.83$).

The '*Is it worth it?'* component of the YPAP model was assessed using measures for perceived barriers to PA and PA enjoyment. A 21-item scale, the Barriers to Physical Activity Quiz (Centers for Disease Control and Prevention, 2001) evaluated perceived barriers to PA. Participants indicated the likelihood of each of 21 statements listed, with

response options ranging from one (very likely) to four (very unlikely). Higher numbers represented lower levels of perceived barriers. The questionnaire comprised seven subscales (each with three questions) namely lack of time, social influence, lack of energy, lack of willpower, fear of injury, lack of skill and lack of resources. The internal consistency of the barriers subscales was fair (α = 0.62 to 0.77), except for 'lack of resources' (α = 0.49) which was excluded from analysis. PA enjoyment was assessed using the 16-item Physical Activity Enjoyment Scale (PACES) (Motl et al., 2001). This instrument is an adaptation of a scale that was developed with college-aged students (Kendzierski & DeCarlo, 1991). The modifications to the original scale included the removal of two items that were not relevant for adolescents and the reduction of response options from a 7-point bipolar scale to a simpler 5-point Likert scale ranging from one (disagree a lot) to five (agree a lot). Negative items were reverse coded for interpretation. PACES displayed high internal consistency (α = 0.89) in this study.

Reinforcing factors. The frequency of social support for PA from friends and family was assessed using 5-item scales developed for the Amherst Health and Activity Study (Sallis et al., 2002). Questions about friend social support referred to encouraging friends, being encouraged by friends, doing PA with friends, friends telling you that you are doing well at PA and being teased for not being good at PA (reverse coded item). Family social support questions referred to family members encouraging PA, providing transport for PA, watching participation and telling you that you are doing well at PA. Response options (coded 1 to 5) included none, once, sometimes, almost every day and every day. A 5-item teacher social support scale, originally developed for the Take Part Study (Woods et al., 2009), replicated the design of the family social support scale detailed above. In this study, social support for PA from friends, family and teachers were analysed separately. The internal consistency for social support from friends (α = 0.63; α = 0.74 after removal of the reverse coded item on teasing), family (α = 0.82) and teachers (α = 0.84) was acceptable.

Physical activity. The PA latent construct comprised of two PA self-report measures; the PACE+ and the International Physical Activity Questionnaire (IPAQ) Short Form. The PACE+ screening tool (Prochaska et al., 2001) is extensively used worldwide and has been validated for use in Irish adolescents (Chapter 4; Hardie Murphy et al., 2015). The instrument assessed the number of days (a) in the past 7 days and (b) for a typical or usual week that participants accumulated at least 60 minutes of moderate to vigorous PA. An

average of (a) and (b) was calculated to represent habitual PA. The IPAQ Short Form (Craig et al., 2003) has displayed acceptable reliability (*ICC* = 0.86 for total PA minutes/week) and validity (ρ = 0.23 for IPAQ total PA and accelerometer-determined total counts/day) for college students (aged 20.8 ± 1.5 years; n = 123) (Dinger et al., 2006). The instrument assessed the frequency (number of days during the last 7 days) and duration (bouts lasting at least 10 minutes) of (a) vigorous PA (b) moderate PA and (c) walking. Within each category, frequency was multiplied by duration to compute weekly time spent in each. A sum of these values gave total weekly time spent in PA (IPAQ mins/week) and represented the first of two IPAQ variables considered in the development of the PA latent construct. An equivalent MET value for each category was multiplied by the weekly time spent in each, i.e. weekly vigorous PA x 8.0 METs, weekly moderate PA x 4.0 METs and weekly walking x 3.3 METs. A sum of these values gave total weekly MET minutes (IPAQ MET-mins/week) and represented a second IPAQ variable. Data were processed, cleaned and truncated based on the guidelines for the data processing and analysis of the IPAQ (available from www.ipaq.ki.se).

7.6.3 Statistical analysis

Descriptive statistics (means, standard deviations) were calculated for participant characteristics and scales using SPSS v.21 (IBM Corp, Armonk, NY).

The evidence of factorial validity that confirmatory factor analysis (CFA) provides is key to distinguishing whether a set of items represent a latent variable and if their inclusion in the SEM analysis is justified (Motl et al., 2000). CFA with maximum likelihood estimation was used to test measurement models for self-efficacy (**Figure 7.2**), enjoyment (**Figure 7.3**) and social support (friend: **Figure 7.4**, family: **Figure 7.5**, teacher: **Figure 7.6** separately). The seven subscale latent constructs of perceived barriers formed a second order CFA model (**Figure 7.7**). The PA measurement model comprised of PACE+, IPAQ mins/week and IPAQ MET-mins/week (**Figure 7.8**). To ensure there were sufficient degrees of freedom to run the 3-item PA measurement model, two of the parameters were fixed to a value of one. As there was less than 5.5% missing data for any of the variables, maximum likelihood estimation was considered to be a valid procedure for dealing with missing data. Results were examined for global and specific fit. As the chi-square test is sensitive to sample size (Bollen & Long, 1993; Byrne, 2010), further model fit indices including the comparative fit index (CFI), Tucker-Lewis index (TLI) and the root means square error of approximation (RMSEA) including its 90% confidence

interval were assessed. Criteria used to denote acceptable model fit were > 0.90 for CFI and TLI, and < 0.08 for RMSEA (Hu & Bentler, 1999).

The factor loadings, factor correlations, standard errors, residual variances and path coefficients were inspected for magnitude and appropriate sign in all models. Modifications to measurement and structural models were made based on empirical evidence (factor loadings, residuals and fit indices) and conceptual reasoning based on evidence in the literature. Weak items were excluded one at a time with a re-evaluation of the model and remaining items at each exclusion. Reductions in the Akaike information criterion (AIC) in subsequent models indicated improved and more parsimonious model fit. The final measurement models utilised in the structural model are illustrated in **Figures 7.2 – 7.8** (items included in the final SEM are displayed in black font). The internal consistency (Cronbach alpha) and normality (univariate and multivariate skewness and kurtosis) of the original and reduced scales were tested. SEM was used to examine the relationships between baseline psychosocial latent constructs and the follow-up PA construct. These latent constructs were arranged according to the YPAP model (**Figure 7.9**). In the case of model B.2, the PACE+ variable had a small statistically nonsignificant negative error variance ($P > 0.05$; it included zero when the standard error was taken into account). The error variance was fixed to a small positive number (i.e. 0.02) which is an acceptable method to overcome situations where non-positive error estimates are due to minor random sampling error (Byrne, 2010). Confirmatory factor analyses and SEM were conducted using AMOS v.21 (IBM Corp, Armonk, NY).

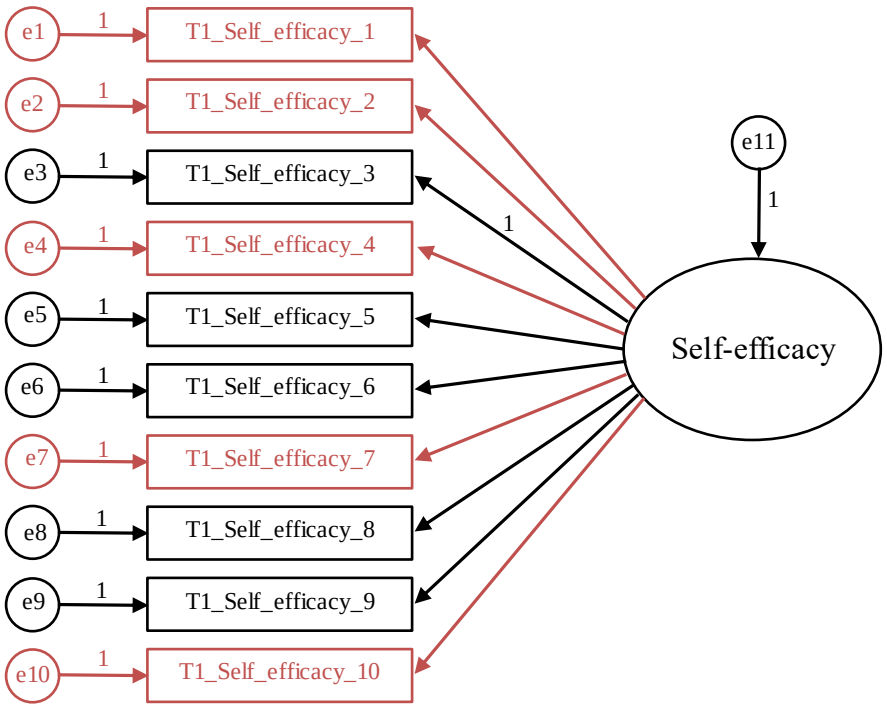

Figure 7.2 Original and final measurement models of T1 self-efficacy for physical activity.

Note: T1 = time point 1. All items were present in the original model. Items excluded from the final model are coloured in red. The items removed from the measurement model included: I am tired, I am in a bad mood, I am on vacation, my friends call me to go out, and I am on my own. Three of the items removed were in the original measure by Marcus and colleagues (1992) and two of the items were from the extended version of the measure by Nigg and Courneya (1998).

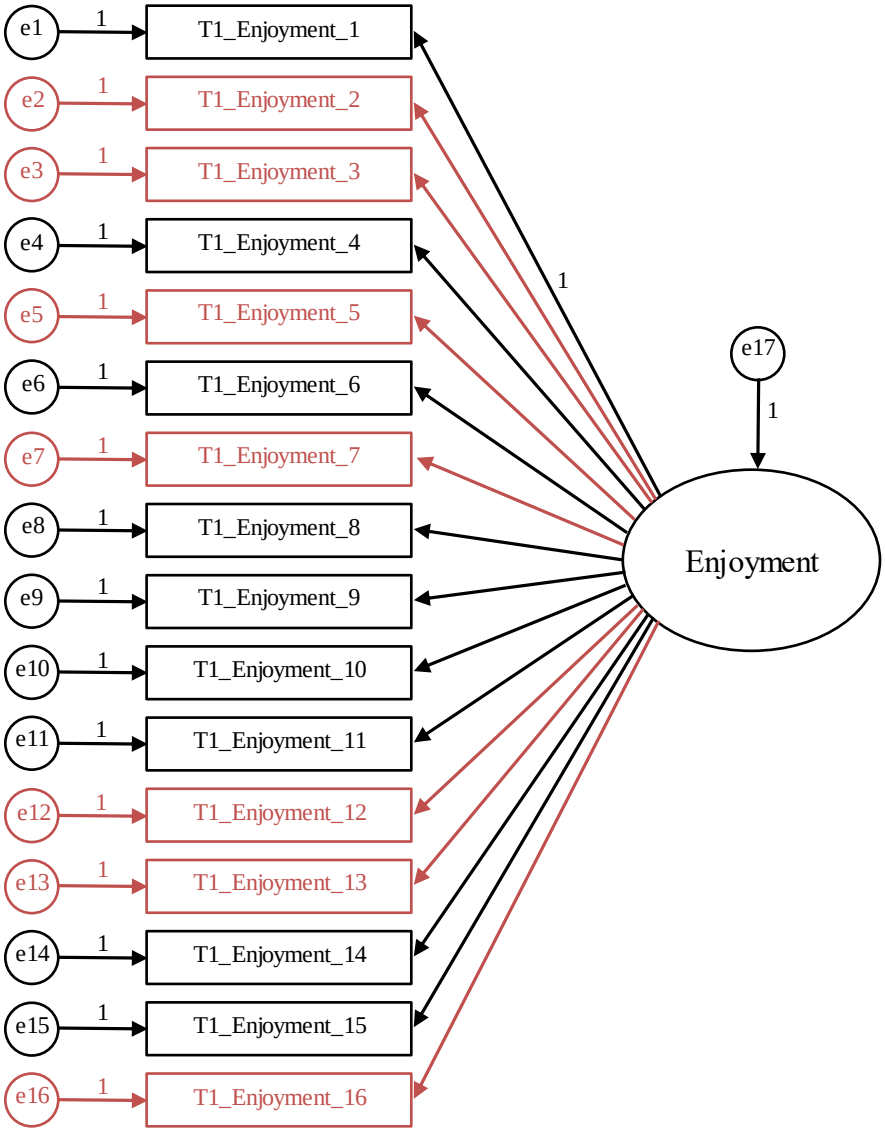

Figure 7.3 Original and final measurement models of T1 enjoyment of physical activity.

Note: T1 = time point 1. All items were present in the original model. Items excluded from the final model are coloured in red. The items removed from the measurement model were all of the reverse coded items in the scale and included: I feel bored, I dislike it, it's no fun at all, it makes me depressed, it frustrates me, it's not at all interesting, I feel as though I would rather be doing something else.

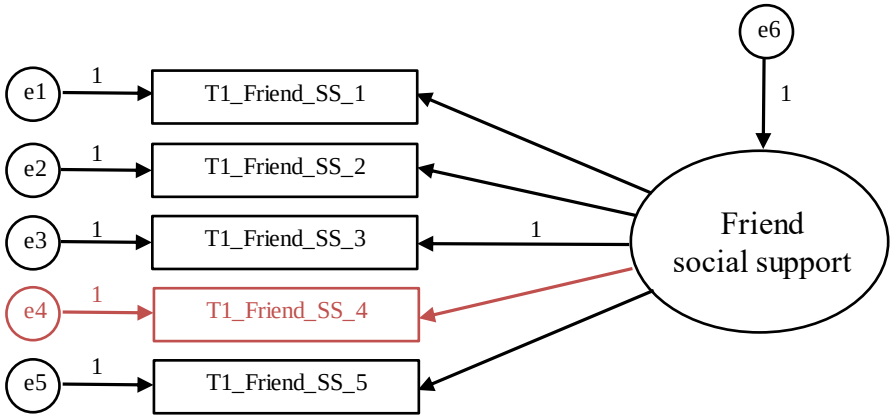

Figure 7.4 Original and final measurement models of T1 social support for physical activity from friends.

Note: T1 = time point 1. All items were present in the original model. The item excluded from the final model is coloured in red. The item removed was the reverse coded item asking if other kids tease you for not being good at PA.

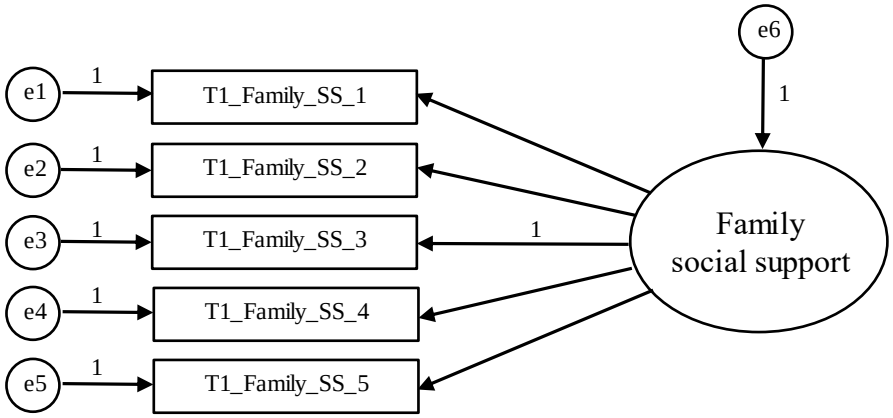

Figure 7.5 Original and final measurement models of T1 social support for physical activity from family.

Note: T1 = time point 1. There were no items removed from the original measurement model.

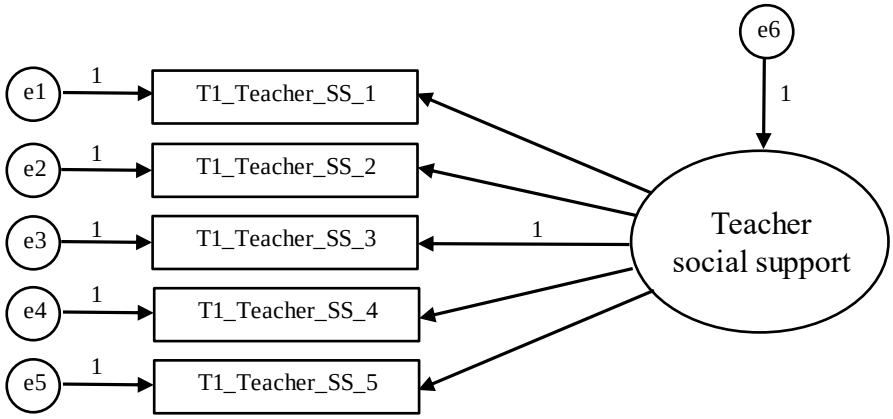

Figure 7.6 Original and final measurement models of T1 social support for physical activity from a teacher.

Note: T1 = time point 1. There were no items removed from the original measurement model.

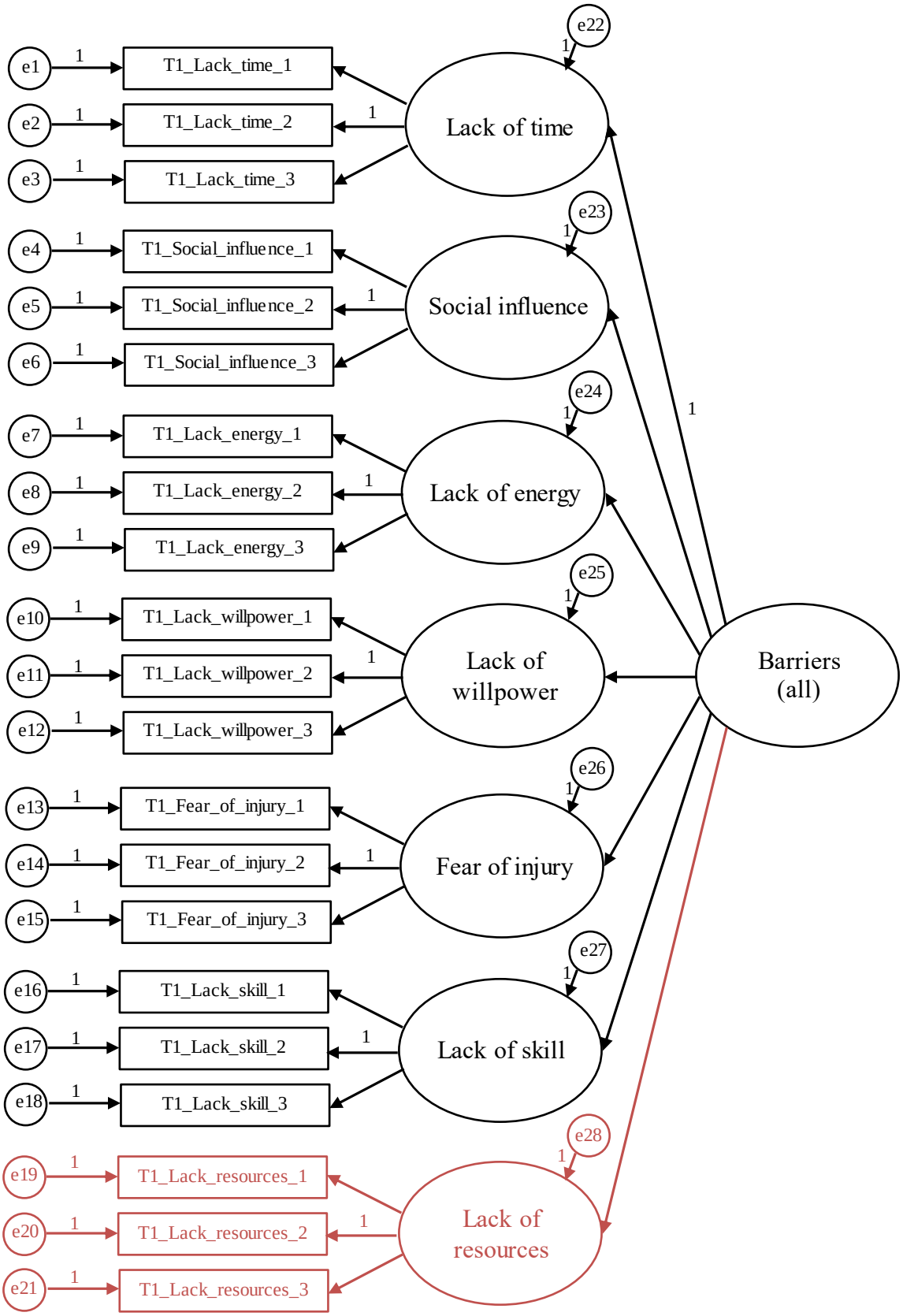

Figure 7.7 Original and final 2nd order confirmatory factor analysis measurement models of T1 perceived barriers to physical activity.

Note: All items (7 latent constructs with 3 items each) were present in the original model. Lack of resources (coloured in red) was removed due to poor scale reliability (final model).

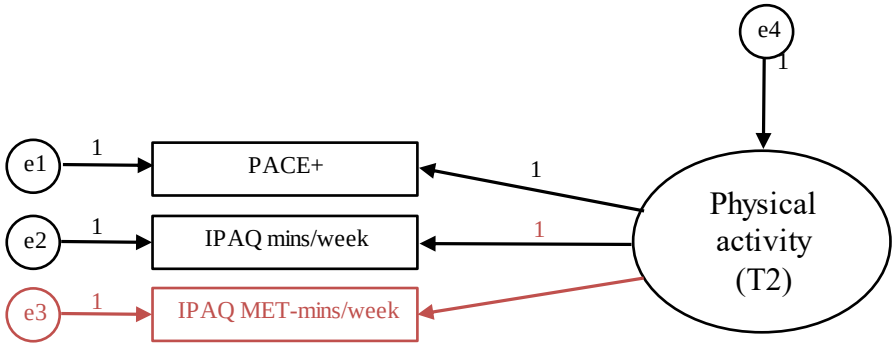

Figure 7.8 Original measurement model of follow-up physical activity.

Note: T2 = time point 2. Two of the item parameters were fixed to a value of one to ensure there were sufficient degrees of freedom to run the model. IPAQ MET-mins/week (coloured in red) was not included in the final structural equation model.

7.7 Results

7.7.1 Descriptive statistics

The sample (n = 658; 30.2% male) was recruited from 65 schools and participants were aged 12 – 18 years (mean = 13.61 ± 1.40 years) at baseline. Results for self-efficacy, enjoyment, social support and perceived barriers are displayed in **Table 7.1**. In general, participants were somewhat confident to be physically active when presented with a number of scenarios (indicated by mean scores around the mid-point), tended to enjoy PA (indicated by mean scores in the highest quartile), to receive some level of social support from friends, family and teachers to be physically active (indicated by mean values that represent at least 'sometimes'), and did not strongly perceive barriers to PA (indicated by mean scores above the mid-point). On average, participants achieved 60 minutes of moderate to vigorous PA on 3.36 ± 1.76 days (based on PACE+ scores), 672.91 ± 546.15 minutes of moderate to vigorous PA per week (based on IPAQ scores) and 3,246.90 ± 2,611.91 MET-minutes of PA per week (also from the IPAQ) at follow-up. Zero-order (Pearson) correlations (ranging from -0.002 to 0.23) among baseline psychosocial scales and follow-up PA are presented in **Table 7.2**. Except for the perceived barriers subscale related to fear of injury, all scales were significantly correlated with T2 PA measured by PACE+. However, PA enjoyment and some perceived barriers to PA (e.g. social influence, fear of injury, lack of skill) were not significantly correlated with T2 PA measured by the IPAQ.

7.7.2 Measurement models

The model fit indices and standardised factor loadings for the original and reduced scales are displayed in **Table 7.3**. Items that had low factor loadings (and were not conceptually essential) were excluded item by item, with the model fit re-examined after each exclusion until an adequate fit was achieved. The self-efficacy scale was reduced from 10 to five items (**Figure 7.2**), the enjoyment scale from sixteen to nine items (**Figure 7.3**) and the friend social support scale from five to four items (**Figure 7.4**). The resulting reduced scales had improved skewness and kurtosis ranges (**Table 7.1**). Skewness and kurtosis values in reduced scales did not indicate any serious violations of normality, with only one item having a value above 2.0 (Fouladi, 2000). The PA measurement model had a poor fit and was reassessed as part of the full structural model to avoid identification issues (minimum three items per construct).

Table 7.1 Summary of item descriptive statistics by scale.

Scale	Number of items	Mean	SD	Univariate		Multivariate	
				Skewness range	Kurtosis range	Skewness range	Kurtosis range
Self-efficacy scale [a]							
Self-efficacy (O)	10	3.95 to 6.40	2.60 to 3.40	-0.51 to 0.47	-1.21 to -0.40	-0.51 to 0.43	-1.17 to -0.33
Self-efficacy (R)	5	3.95 to 5.90	2.60 to 3.29	-0.22 to 0.39	-1.21 to -0.40	-0.23 to 0.40	-1.17 to -0.33
Enjoyment scale [b]							
Enjoyment (O)	16	3.78 to 4.62	0.87 to 1.26	-1.99 to -0.85	-0.18 to 5.70	-2.60 to -0.85	-0.17 to 5.75
Enjoyment (R)	9	3.78 to 4.39	0.94 to 1.26	-1.68 to -0.85	-0.18 to 2.60	-1.68 to -0.85	-0.17 to 2.59
Social support subscales [b]							
Friends (O)	5	2.71 to 4.52	0.96 to 1.19	-2.01 to -0.03	-0.61 to 3.14	-2.01 to -0.03	-0.59 to 3.18
Friends (R)	4	2.71 to 3.35	1.12 to 1.19	-0.21 to -0.03	-0.61 to -0.08	-0.53 to -0.03	-0.59 to -0.05
Family (O)	5	2.87 to 3.52	1.12 to 1.25	-0.52 to -0.12	-0.79 to -0.37	-0.53 to -0.12	-0.68 to -0.35
Teacher (O)	5	1.92 to 2.52	1.10 to 1.22	0.27 to 0.88	-0.76 to -0.20	0.26 to 0.88	-0.75 to 0.18
Perceived barriers subscales [c]							
Lack of time (O)	3	2.77 to 3.04	0.96 to 1.05	-0.67 to -0.21	-1.21 to 0.69	-0.68 to -0.21	-1.19 to -0.66
Social influence (O)	3	2.92 to 3.31	0.90 to 1.02	-1.12 to -0.46	-0.81 to 0.25	-1.12 to -0.47	-0.76 to 0.28
Lack of energy (O)	3	2.79 to 2.99	1.04 to 1.04	-0.61 to -0.26	-1.18 to -0.86	-0.62 to -0.25	-1.14 to -0.83
Lack of willpower (O)	3	2.73 to 3.13	0.97 to 1.08	-0.81 to -0.26	-1.21 to -0.46	-0.81 to 0.25	-1.18 to -0.42
Fear of injury (O)	3	3.15 to 3.31	0.94 to 0.97	-1.22 to -0.81	-0.49 to 0.34	-1.22 to -0.81	-0.45 to 0.39
Lack of skill (O)	3	3.13 to 3.30	0.93 to 1.01	-1.11 to -0.83	-0.55 to 0.11	-1.12 to -0.83	-0.52 to 0.16
Lack of resources (O)	3	2.94 to 3.13	0.96 to 1.10	-0.81 to -0.59	-1.02 to -0.40	-0.82 to -0.60	-0.98 to -0.36

(O) = original scale; (R) = reduced scale

[a] Response range: 0 – 10; [b] Response range: 1 – 5; [c] Response range: 1 – 4.

Table 7.2 Pearson correlations of baseline psychosocial scales with follow-up physical activity.

		1	**2**	**3**
1	T2 PACE+ PA	1		
2	T2 IPAQ mins/week	0.47**	1	
3	T2 IPAQ MET-mins/week	0.56**	0.95**	1
4	T1 self-efficacy (O) 10 items	0.23**	0.13**	0.18**
5	T1 self-efficacy (R) 5 items	0.20**	0.11**	0.16**
6	T1 enjoyment (O) 16 items	0.13**	0.05	0.07
7	T1 enjoyment (R) 9 items	0.17**	0.04	0.05
	T1 social support			
8	Friends (O) 5 items	0.21**	0.12**	0.16**
9	Friends (R) 4 items	0.23**	0.12**	0.15**
10	Family (O)	0.22**	0.09*	0.12**
11	Teacher (O)	0.22**	0.16**	0.17**
	T1 perceived barriers			
12	Lack of time (O)	0.17**	0.05	0.09*
13	Social influence (O)	0.12**	-0.002	0.04
14	Lack of energy (O)	0.18**	0.10*	0.13**
15	Lack of willpower (O)	0.21**	0.08*	0.13**
16	Fear of injury (O)	0.01	0.01	0.03
17	Lack of skill (O)	0.16**	0.02	0.07
18	Lack of resources (O)	0.09*	0.05	0.08*
19	All barriers combined (O)	0.20**	0.09*	0.13**

T1 = time point 1 (2009); T2 = time point 2 (2014)
(O) = original scale; (R) = reduced scale
*$P < 0.05$; ** $P < 0.01$

Table 7.3 Summary of measurement model fit statistics and factor loadings.

Scale	Items	χ^2	*df*	CFI	TLI	RMSEA (90% CI)	AIC	α	α†	Factor loadings (β)
Self-efficacy (O)	10	296.49	35	0.85	0.77	0.11 (0.10-0.12)	362.98	0.83	0.83, 0.83, 0.81, 0.79	0.62*, 0.60*, 0.61, 0.39*, 0.61, 0.66, 0.54*, 0.64, 0.64, 0.50*
Self-efficacy (R)	5	12.18	5	0.99	0.97	0.05 (0.01-0.08)	42.18	0.77		0.53, 0.59, 0.73, 0.70, 0.62
Enjoyment (O)	16	1,151.37	104	0.73	0.65	0.12 (0.12-0.13)	1,247.37	0.89	0.88, 0.88, 0.88, 0.88, 0.88, 0.87	0.68, 0.49*, 0.52*, 0.54, 0.53*, 0.50, 0.45*, 0.62, 0.74, 0.69, 0.66, 0.41*, 0.47*, 0.66, 0.72, 0.44*
Enjoyment (R)	9	118.99	27	0.96	0.93	0.07 (0.06-0.09)	172.99	0.88		0.64, 0.53, 0.50, 0.65, 0.78, 0.73, 0.69, 0.71, 0.77
Social support subscales										
Friends (O)	5	42.65	5	0.94	0.80	0.11 (0.08-0.14)	72.65	0.63		0.78, 0.58, 0.61, -0.04*, 0.62
Friends (R)	4	27.63	2	0.96	0.77	0.14 (0.10-0.19)	51.63	0.74		0.78, 0.58, 0.61, 0.62
Family (O)	5	33.09	5	0.98	0.93	0.09 (0.06-0.12)	63.09	0.82		0.49, 0.55, 0.77, 0.84, 0.80
Teacher (O)	5	20.50	5	0.99	0.96	0.07 (0.04-0.10)	50.50	0.84		0.65, 0.67, 0.72, 0.74, 0.78
Perceived barriers subscales										
Lack of time (O)	3	1.62	1	0.998	0.99	0.03 (0.00-0.11)	17.62	0.66		0.53, 0.59, 0.76
Social influence (O)	3	0.83	1	1	1.01	0.00 (0.00-0.10)	16.83	0.62		0.60, 0.53, 0.65
Lack of energy (O)	3	0.02	1	1	1.01	0.00 (0.00-0.50)	16.02	0.74		0.66, 0.66, 0.78
Lack of willpower (O)	3	0.30	1	1	1.01	0.00 (0.00-0.08)	16.30	0.74		0.63, 0.68, 0.76
Fear of injury (O)	3	0.37	1	1	1.01	0.00 (0.00-0.09)	16.37	0.77		0.72, 0.71, 0.72
Lack of skill (O)	3	1.50	1	0.999	0.99	0.03 (0.00-0.11)	17.50	0.74		0.70, 0.67, 0.73
Lack of resources (O)	3	0.21	1	1	1.04	0.00 (0.00-0.08)	16.21	0.49		0.57, 0.64, 0.32

χ^2 = chi-square; *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index;
RMSEA = root mean square error of approximation; AIC = Akaike information criterion; α = Cronbach's alpha

†Cronbach's alpha of the scale after the removal of 1 item at a time

*Items removed in reduced models; (O) = original scale; (R) = reduced scale

7.7.3 Structural equation models

The SEM model fit indices are presented in **Table 7.4**. The PA construct was assessed in the 'A' models. The original model (A.1) included PACE+, IPAQ mins/week and IPAQ MET-mins/week in the PA latent construct. The model fit was poor (χ^2 = 2,708.22, *df* = 1104, CFI = 0.88, TLI = 0.87, RMSEA = 0.05, AIC = 3,048.22) and the IPAQ MET-mins/week item had a large negative error variance ($P < 0.001$). The IPAQ MET-mins/week variable was removed from the PA construct and the model was re-run. Model A.2, with PACE+ and IPAQ mins/week, had improved model fit (χ^2 = 2,597.93, *df* = 1057, CFI = 0.87, TLI = 0.86, RMSEA = 0.05, AIC = 2,931.93). Regardless of which combination of measures were used for the PA construct, the same paths were significant.

After the best PA construct had been determined (Model A.2), this model was used to assess the structural paths in the successive 'B' models. In Model B.1, the social influence barrier was removed as it had a negative error variance and a squared multiple correlation greater than one. Elsewhere in the model, social influence in a positive context (i.e. social support) was represented. PA social support from a teacher had incoherent paths, and therefore, was omitted from the model (Model B.2). Specifically, it had negative paths with perceived barriers, self-efficacy and enjoyment but a positive path for T2 PA. The PACE+ item had a small non-significant negative error variance ($P = 0.83$) that contained a zero value when considering the standard error.

The final model (Model B.3; **Figure 7.9**) was formed by assigning a value of 0.02 to the negative error variance on the PACE+ item. Model B.3 exhibited acceptable fit indices (χ^2 = 1,820.98, *df* = 723, CFI = 0.89, TLI = 0.87, RMSEA = 0.05, AIC = 2,094.98). Of the proposed pathways in the model, eight of the twelve were supported including the interactions among the predisposing factors ($P < 0.05$). Perceived barriers had a direct effect on self-efficacy ($\beta = 0.32$), and self-efficacy had a direct effect on enjoyment ($\beta = 0.14$). Self-efficacy was the only predisposing factor to directly predict T2 PA ($\beta = 0.14$, $P < 0.05$). The effect of perceived barriers on T2 PA was mediated through self-efficacy ($\beta = 0.05$, $P < 0.05$). The model partially supported the role of the reinforcing factors. Friend social support directly influenced enjoyment ($\beta = 0.25$) and T2 PA ($\beta = 0.15$, both $P < 0.05$) but not perceived barriers or self-efficacy. Family social support was a moderator of T2 PA through the predisposing factors but it did not have a direct effect on T2 PA. Overall, social support from friends and self-efficacy had the greatest effects on longitudinal PA (total effects, $\beta = 0.18$ and $\beta = 0.15$ respectively; **Table 7.5**).

Table 7.4 Fit indices of the original model and alternative models.

Model		χ^2	*df*	CFI	TLI	RMSEA (90% CI)	AIC
Model A.1	(original model)	2,708.22	1,104	0.88	0.87	0.05 (0.045-0.049)	3,048.22
Model A.2	(PACE+ & IPAQ mins/ week)	2,597.93	1,057	0.87	0.86	0.05 (0.045-0.049)	2,931.93
Model B.1	(social influence barrier removed)	2,341.67	923	0.87	0.86	0.05 (0.046-0.051)	2,655.67
Model B.2	(teacher social support removed)	1,820.90	722	0.89	0.87	0.05 (0.045-0.051)	2,096.90
Model B.3	(small negative error variance fixed to 0.02)	1,820.98	723	0.89	0.87	0.05 (0.045-0.051)	2,094.98

χ^2 = chi-square; *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; AIC = Akaike information criterion

Table 7.5 Total, direct and indirect effects of psychosocial predictors on follow-up physical activity in the final structural equation model.

Construct	Total effect	Direct effect	Indirect effect
Self-efficacy	0.15	0.14	0.004
Enjoyment	0.03	0.03	0.00
Friends social support	0.18	0.15	0.03
Family social support	0.14	0.07	0.07
Perceived barriers	0.11	0.07	0.05

Note: Standardised effects reported.

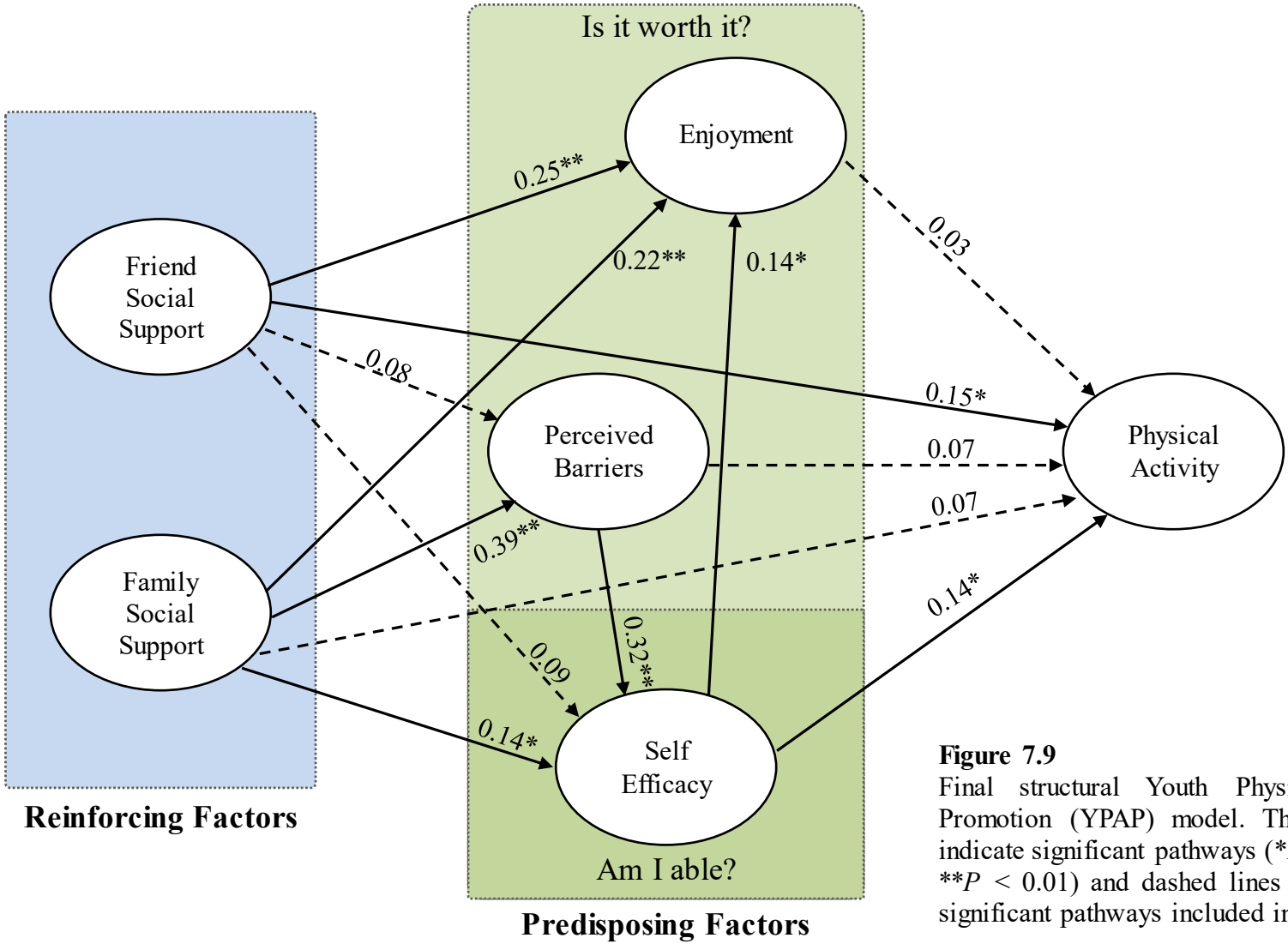

Figure 7.9
Final structural Youth Physical Activity Promotion (YPAP) model. The solid lines indicate significant pathways (*$P < 0.05$, **$P < 0.01$) and dashed lines indicate non-significant pathways included in the model.

7.8 Discussion

Longitudinal research that is guided by evidence-based theory and aims to model the moderators and mediators of youth PA is rare. This study develops on the findings of cross-sectional research that used SEM to model the effects of various psychosocial constructs on PA behaviour. To the knowledge of the authors, this is the first study to examine the longer term (5-year) effects of psychosocial determinants on PA in youth using SEM and the theoretical framework of the YPAP model. In this discussion, unless otherwise specified, the outcome construct PA refers to 5-year follow-up PA for this study and cross-sectional PA for other studies.

7.8.1 The Youth Physical Activity Promotion model

Current findings support the utility of the YPAP model for assessing psychosocial predictors and mediators of PA. Acceptable model fit indices for the YPAP model were attained in this sample of 12 – 18 year old adolescents (baseline age) and have previously been reported in cross-sectional studies with participant groups varying in age between 8 and 17 years (Chen et al., 2014; Heitzler et al., 2010; Rowe et al., 2007; Seabra et al., 2013; Silva et al., 2014). Although not all the constructs examined in these studies are the same, the paths are organised into predisposing and reinforcing factors as described in the YPAP model (Welk, 1999).

7.8.2 Predisposing factors of physical activity

According to the YPAP model, predisposing factors should have a direct influence on PA. This concept is partially supported in this study as results differed for the 'Am I able?' (i.e. self-efficacy) and 'Is it worth it?' (i.e. perceived barriers, enjoyment) components of predisposing factors.

Self-efficacy. Evidence consistently supports the instrumental role self-efficacy plays on PA. Our findings corroborate previous models that identify the direct effect of self-efficacy on cross-sectional PA (Silva et al., 2014; Wu et al., 2003) and subsequent PA at 12 months (Dewar et al., 2013). Among the constructs assessed in each of these studies, self-efficacy had either the greatest direct effect on PA (Dewar et al., 2013; Wu et al., 2003) or the second greatest direct effect (Silva et al., 2014). In this study, the magnitude of the direct effect was second only to friends' social support ($\beta = 0.14$ versus $\beta = 0.15$) illustrating the long-term influence it may have on PA behaviour. Contrastingly, one study did not find a significant effect of self-efficacy on PA (Heitzler et al., 2010).

However, the authors hypothesised this finding could be due to limitations of the survey instrument used.

Perceived barriers. The direct relationship between perceived barriers to PA at baseline and follow-up PA is not supported in the current study or with cross-sectional PA in a study of adolescents (n = 350) aged 11 – 13 years from the U.S.A (Hsu et al., 2011) or for either sex (assessed separately) in a cross-sectional study of Taiwanese adolescents (n = 832) aged 12 – 15 years (Wu et al., 2003). The role perceived barriers plays, if any, appears to be indirectly through self-efficacy (Wu et al., 2003). In this study, perceived barriers to PA had a small indirect effect ($\beta = 0.05$) on follow-up PA as mediated by self-efficacy.

Enjoyment. Modelled pathways between PA enjoyment and PA persistently did not demonstrate any significant findings in SEM literature (Heitzler et al., 2010; Silva et al., 2014). Therefore, it is unsurprising that our findings indicated low non-significant total effects of PA enjoyment on PA at follow-up.

7.8.3 Reinforcing factors of physical activity

Under the guidance of the YPAP model, reinforcing factors (i.e. social support) are hypothesised to influence PA both directly and indirectly through individual-level perceptions and cognitions, such as self-efficacy, perceived barriers and enjoyment, that form the predisposing factors.

Social support. Silva and colleagues (2014) noted that as children age, peer influence surpasses parental influence and that parental and peer social support for PA operate through slightly different mechanisms. As part of separate parent and peer social support models, they found that the direct effects of both sources of social support were similar (parent: $\beta = 0.30$; peer: $\beta = 0.33$; $P < 0.05$) but the indirect pathways differed. The models generated by Silva and colleagues (2014), using data from 203 adolescents aged 13 – 17 years, were similar to the current study where enjoyment and self-efficacy were included as mediators of social support.

Firstly, we will discuss evidence utilising SEM of the direct effects of social support on PA behaviour. In the case of parental social support, its documented influence is mixed. In pre-adolescents (n = 683) aged 8 – 10 years (Seabra et al., 2013) and in adolescents (n

= 832) aged 12 – 15 years (Wu et al., 2003) parental influence was not directly associated with current PA. Further, the direct path between parental/family support was not significant for PA at 12 months (n = 235) (Dewar et al., 2013) or 5 years in the present study. Elsewhere, in youth aged 12 – 16 years (n = 380), parental support acted positively and directly on PA (Trost et al., 2003). In a study of middle school students (mean age of 12.6 ± 0.7 years, n = 350), social support by family, but not by peers, was significantly related to PA participation (Hsu et al., 2011). In contrast, evidence from multiple studies indicates that peer social support directly influences PA (Silva et al., 2014; Wu et al., 2003). Our findings identified social support from friends as the strongest factor related to 5-year PA, a characteristic in common with the findings from the cross-sectional analyses of the IDEA and ECHO studies (n = 720) (Heitzler et al., 2010).

Secondly, we address the hypothesised indirect effects of social support on PA through predisposing factors. Much evidence points to the role of self-efficacy as a mediator of both parental social support (Silva et al., 2014; Trost et al., 2003) and peer social support (Wu et al., 2003) on PA. The magnitude of these relationships may differ. Silva and colleagues (2014) found that the peer social support/self-efficacy pathway almost doubled the size of the parent social support/self-efficacy pathway. However, our findings illustrated self-efficacy as a mediator of family social support but not friend social support. With regards to other predisposing factors, parental social support was a proximal correlate of PA mediated by enjoyment in one study (Silva et al., 2014) and by perceived barriers in another study (Wu et al., 2003). Although family social support had an effect on all the predisposing factors in this study, only self-efficacy mediated the role with 5-year PA while friend social support only had a direct influence on follow-up PA.

7.8.4 A review of current knowledge on psychosocial correlates of physical activity

Undisputedly, self-efficacy has a positive influence on PA as demonstrated by systematic reviews (Bauman et al., 2012; Van Der Horst et al., 2007) and SEM (Silva et al., 2014; Wu et al., 2003). This study adds to the strength of the evidence by adding a longitudinal dimension. Further, our findings support the mediator role it plays between parental/family social support and PA. These two factors were identified in a review of reviews as consistent correlates of PA in youth studies (Bauman et al., 2012). A systematic review of determinants of PA change revealed that higher levels of social support for PA and self-efficacy were associated with smaller declines in PA over time (Craggs et al., 2011). In a systematic review of friendship networks and PA, evidence

from longitudinal studies found that individuals were influenced by the PA levels of their friends (Sawka et al., 2013). In this study, friend social support had the greatest positive direct and total effects on 5-year PA. Concerning enjoyment and perceived barriers, our lack of findings are congruent with the conclusions of Van Der Horst and colleagues (2007). However, our results show an indirect effect of perceived barriers on PA via self-efficacy indicating that there may be value in reducing perceived barriers to promote PA behaviour.

7.8.5 Limitations

The reliance on self-reported data in PA research is a universally accepted limitation. Naturally, the psychosocial factors investigated herein must be self-reported. However, utilisation of objective measures of follow-up PA would have enhanced the study. Nonetheless, the PA construct is strengthened by the use of two diverse PA measurement instruments that have been validated for use in youth. Furthermore, measurement error is modelled as part of the SEM analyses, i.e., in SEM, the observed correlations more likely represent the relationships between the underlying constructs than between observed scores and are therefore less likely to represent common method covariance. While interpreting the study findings, the sample characteristics should be considered. In this study, the proportion of females substantially exceeds the proportion of males (70% vs. 30% respectively) influencing the generalisability of results. Future studies should model the sex similarities and differences in predisposing and reinforcing factors of longitudinal PA. Although the examined constructs are useful for assessing significant moderating and mediating predictors of PA, the list of predisposing and reinforcing factors studied here is not exhaustive. Further research should build on the presented evidence and incorporate environmental factors into wider SEM analyses.

7.8.6 Conclusions

The YPAP model provided a useful framework for assessing psychosocial determinants of youth PA including the moderating and mediating interactions amongst determinants. Our results indicate that higher levels of self-efficacy positively influence long-term PA in youth. Young people who reported higher levels of perceived support from family reported stronger self-belief in their ability to perform PA (self-efficacy) and in turn had higher levels of PA 5 years later. Similarly, lower levels of perceived barriers to PA directly improved levels of self-efficacy and impacted on long-term PA. Friend social support had the greatest direct and total effects on 5-year PA, illustrating the instrumental

role it plays in sustaining PA involvement. When designing PA interventions, methods to increase PA self-efficacy, reduce perceived barriers to PA and to foster a supportive environment for PA from friends and family should be undertaken to ensure PA is tenable.

7.9 References

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7.10 Review of hypotheses

1. The hypothesised model developed using the YPAP model explains a substantial amount of variance in 5-year PA.

   Hypothesis accepted.

2. Baseline predisposing factors have a direct effect on PA at follow-up.

   Hypothesis partially accepted.

   Comment: The 'Am I able?' component (i.e. PA self-efficacy) of the predisposing factors had a direct effect on PA at follow-up but the 'Is it worth it?' component (i.e. perceived barriers to and enjoyment of PA) did not.

3. Baseline reinforcing factors influence PA at follow-up directly and indirectly via baseline predisposing factors.

   Hypothesis partially accepted.

   Comment: Social support from friends had a direct effect on PA at follow-up. It also had a direct effect on PA enjoyment but this did not in turn have an effect on PA at follow-up. Despite social support from family having a direct effect on all of the predisposing factors, it only had an indirect effect on PA at follow-up through self-efficacy.

4. PA self-efficacy at baseline has an effect on follow-up PA directly, and mediates the effects of perceived barriers and social support at baseline on follow-up PA.

   Hypothesis partially accepted.

   Comment: PA self-efficacy at baseline had a direct effect on follow-up PA and mediated the effects of perceived barriers and family social support at baseline on follow-up PA. It did not act as a mediator of social support from friends at baseline on follow-up PA.

7.11 Chapter conclusions

- The YPAP model provides a useful framework for assessing determinants of youth PA. Paired with SEM, it facilitates a greater understanding of the interactions amongst constructs. Combined, they enable us to unearth the most influential psychosocial determinants of PA by revealing the direct, indirect and total effects of each construct studied.
- Our results identified social support from friends as the strongest psychosocial determinant of 5-year PA in youth.
- Higher levels of PA self-efficacy positively influenced long-term PA in youth.
- PA self-efficacy was greater in those with higher levels of social support from family and lower levels of perceived barriers to PA.
- Future PA promotion strategies should aim to cultivate an environment of positive social support for PA and include both friends and family in its efforts. Further, they should be designed to increase PA self-efficacy and reduce perceived barriers to PA

CHAPTER 8

Conclusions and recommendations

Chapter 8 Conclusions and Recommendations

The sole recommendation of the Children's Sport Participation and Physical Activity (CSPPA) study was "to significantly increase participation levels of all children and youth in sport and physical activity in Ireland" (Woods et al., 2010, p5). The research contained within this thesis provides an evidence-base to support the development and progression of policy, interventions and efforts to promote physical activity (PA) participation in young people in Ireland.

In this chapter, the Behavioral Epidemiology Framework (BEF) proposed by Sallis, Owen and Fotheringham (2000) is adopted to conceptualise the research untaken throughout this thesis. The systematic sequence of research phases outlined in the BEF (see **Figure 8.1**) provides a useful structure for developing evidence-based guidelines for designing policy and interventions that promote sustained PA in young people. The five phases of the BEF are:

1. To establish links between behaviours and health.
2. To develop methods for measuring the behaviour.
3. To identify factors that influence the behaviour.
4. To evaluate interventions to change behaviour.
5. To translate research into practice.

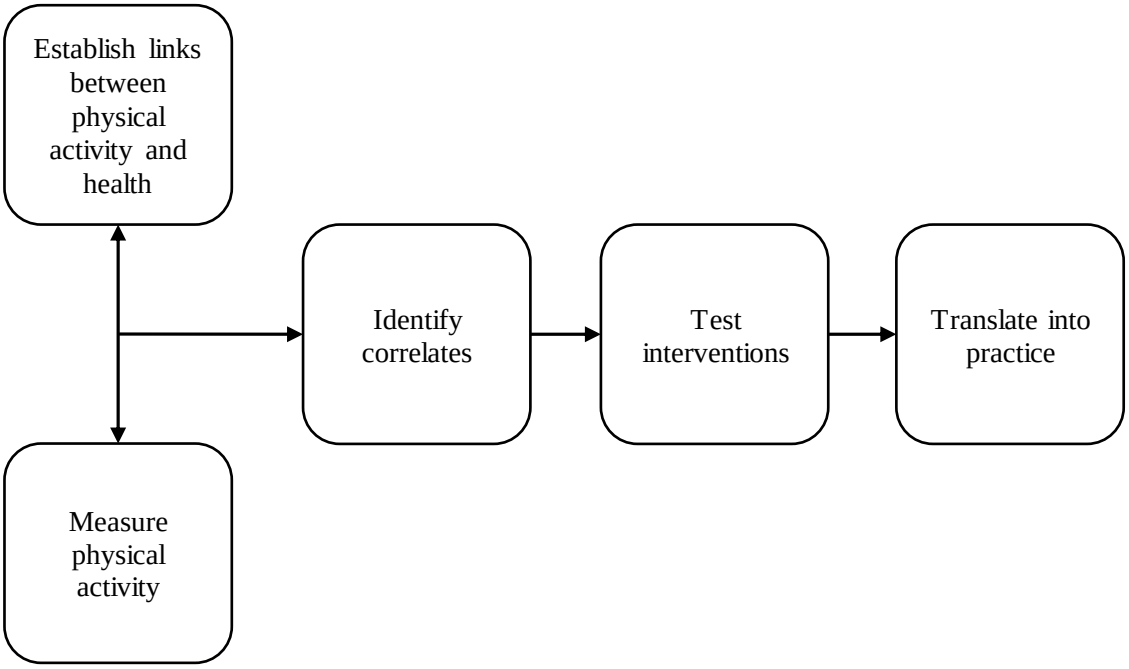

Figure 8.1 The Behavioral Epidemiology Framework. Adapted from Sallis and Owen (1999).

The discussion of the BEF bridges the conclusions and recommendations sections of this chapter to reflect work completed as part of this thesis and future directions leading on from this research. Within phases 2 and 3, the aims of this thesis are revisited. The research findings are subsequently contextualised within the action areas of Ireland's National PA Plan (Healthy Ireland, 2016). Recommendations for policy and further research are then delineated, along with a discussion of the strengths and limitations of the thesis.

8.1 Conclusions

Firstly, the link between PA behaviour and health-related outcomes (i.e. Phase 1 of the BEF; Sallis et al., 2000) is documented in Chapter 1. Most notably, youth PA has long-term protective effects on major non-communicable diseases including coronary heart disease, type 2 diabetes and cancers (World Health Organization, 2010) and short-term benefits on bone health, mental health and cholesterol (Janssen & LeBlanc, 2010). The evolution of the youth population-based PA guidelines for health are described, and epidemiological data on rates of compliance with the guidelines are elucidated. Figures for Ireland demonstrate higher proportions of adolescents not attaining the PA recommendations compared with their international peers (86% versus 80% non-compliance with guidelines based on an average from 105 countries) (Hallal et al., 2012; Woods et al., 2010).

Phase 2 of the BEF (Sallis et al., 2000) sets out to "develop methods for measuring the behaviour". It ties in with the primary aim of this thesis; *"to conduct longitudinal research on youth PA in the Republic of Ireland"*. The methodology undertaken to achieve this aim is detailed in Chapter 3. The multi-centre CSPPA study provided the foundation and baseline data for this longitudinal research. In order to access CSPPA participants 5 years after the initial study, a combination of school-based and postal-based recruitment methods was utilised. In preparation for the longitudinal study, follow-up surveys were developed with the research aims in mind and included repeated measures, as well as, new questions to assess changes in PA over time. The surveys were psychometrically valid and developmentally appropriate for use in adolescents. They were piloted in one school in advance of data collection, and consequently, alterations were made to improve the design and constituents. The content of the surveys was underpinned by Social Cognitive Theory (SCT) (Bandura, 1986) and Ecological Theory (ET) (Stokols, 1996) and informed by the review of literature in Chapters 1 and 2.

Key preliminary work within this thesis involved ensuring the main measure of PA was valid for use in the study population. In Chapter 4, the PACE+ two-item instrument was validated against accelerometer-determined moderate-to-vigorous physical activity (MVPA) with results illustrating small-to-moderate (ρ = 0.27 – 0.34) Spearman correlations between the two variables. These results are comparable to other PA instruments for use in young people with a systematic review indicating that median validity correlations ranged from 0.22 to 0.41 (Helmerhorst et al., 2012). Although results in this thesis indicated that the validity of the instrument was higher in females and increased with age, the continued use of the tool is recommended for study comparisons and tracking of PA over time. This study was the first to assess the criterion validity of the PACE+ instrument in a European sample and across all adolescent years, despite it being frequently used in this region.

Phase 3 of the BEF (Sallis et al., 2000) involves identifying correlates or determinants of PA behaviour and is central to the work undertaken in Chapters 5 to 7. Phase 3 requires the application and evaluation of theoretical models for determining modifiable behavioural, psychological and social factors that influence behaviour (Sallis et al., 2000). The guiding framework for this thesis is the Youth Physical Activity Promotion (YPAP) Model (Welk, 1999), which integrates SCT (Bandura, 1986), ET (Stokols, 1996) and the Theory of Planned Behaviour (Ajzen, 1991). The focus in Chapters 5 and 6 is on examining the behavioural determinants of youth PA. Advancements in the latter stage of Chapter 6 include psychological and social attributes for PA uptake and dropout. Developing on this work, the YPAP Model is utilised in Chapter 7 to investigate interaction effects of personal and perceived environmental determinants of 5-year PA in youth.

The second, third and fourth aims of this thesis are linked to Phase 3 of the BEF. The second aim of this thesis is *"to gain a deeper understanding of PA behaviour from adolescent years into young adulthood, a period of transition in the lives of youth"*. With the validity of the PA instrument established at this point, it was possible to assess tracking of PA during three key periods of transition in the lives of young people in Ireland. In Chapter 5, the sample groups represented children and adolescents progressing from primary to post-primary school (Primary School Cohort), migrating from first to final year in post-primary school (Post-primary School Cohort) and advancing from post-primary school to school leaver (School Leaver Cohort). The approach taken is distinct

from other international research as it assesses tracking across specific periods of transition in the lives of youth. Results elucidated that tracking of PA was weak to moderate (ρ = 0.16 – 0.47) across cohort groups and was comparable to the levels of tracking reported in systematic reviews (Craigie et al., 2011; Evans et al., 2009; Jones et al., 2013). These results justify the promotion of PA in young people as it may, to an extent, track into later life. It is necessary to point out that PA tracking can be negatively influenced by successful interventions where improvements in PA reduce tracking. Therefore, indicators of tracking should be interpreted with reference to other factors that may influence PA such as public health initiatives, PA interventions and in consideration of overall PA trends. It should be noted that Ireland's National PA Plan (Healthy Ireland, 2016) was launched after the follow-up study was completed, and therefore, it would not have influenced findings within this study.

Four tracking hypotheses proposed by Telama (2009) are described in Chapter 2 Section 2.3.2. In light of results from Chapters 5 and 6, it is possible to revisit and comment on these hypotheses:

1. The carry-over hypothesis (proposes that physical activities participated in at a young age are maintained into adulthood): In this thesis, high levels of migration into and out of different sports was found. Despite this, a proportion sustained engagement in the same sport, providing a degree of support for this hypothesis (Chapter 6).
2. The habit formation hypothesis (where automatic repeated behaviour results from habits): This hypothesis is best represented by tracking coefficients (Spearman correlations) and is somewhat supported due to the small to moderate levels of tracking identified in this thesis (Chapter 5).
3. The ability and readiness hypothesis (where previous PA experiences support PA uptake after a break period. The activities taken up may be different to those dropped out of): This hypothesis is supported by findings of this thesis where overall rates of sports uptake and dropout across different sports are high (Chapter 6).
4. The self-selection hypothesis (those with a genetic disposition for sports participation are more likely to participate): Not examined in this study.

The third aim of this thesis is *"to identify and model behavioural and psychosocial determinants of later PA behaviour in youth"*. Although there is ample literature on PA domains (e.g. club and extra-curricular sports participation, active commuting and physical education (PE)), research collectively examining youth domains of PA are scarce

with longitudinal analyses even rarer. In Chapter 6, a selection of domains of youth PA are examined as predictors of 5-year PA. Results indicate that both community club-based and extra-curricular sports participation in youth are predictors of later PA. Club sport was a slightly stronger predictor of follow-up PA than extra-curricular sport, and neither active commuting to school nor PE predicted 5-year PA. The volitional control that children and adolescents have over certain domains of PA (i.e. sport) may influence their role in longer term PA participation. Although active commuting to school and PE were not significant predictors of later PA in this study, the promotion of these PA domains should not be suspended or omitted from future PA interventions due to the valuable role they have in contributing to cross-sectional PA levels. This highlights that PA promotion strategies should include the wider domains of youth PA to stimulate concurrent PA participation and should specifically target youth sports to augment sustained PA behaviour.

In Chapter 5, different elements of sports participation were investigated to provide a deeper understanding of which sports characteristics emanate sport as a determinant of future PA. Current evidence in the literature is unclear concerning the variety and frequency of sports participation for predicting later PA, and there is a dearth of research investigating the potential long-term role of the standard achieved in youth sport. Research findings illustrate that a higher frequency of participation and a higher performance ability achieved in sport in the early years are crucial for shaping later PA engagement. However, a gender inequality, which is highlighted by higher proportions of male participation, needs to be addressed. PA promotion strategies should advocate for frequent, high-quality opportunities for sports participation as part of wider strategies that encourage lifelong PA participation.

An appraisal of psychosocial factors as determinants of later PA in youth was conducted in Chapter 7 using structural equation modelling (SEM). Although, longitudinal research on this topic exists, it is rare that the interactions are modelled using SEM despite the benefits of this methodology. The YPAP model (Welk, 1999) provided a useful framework for assessing moderators and mediators of 5-year PA in youth. Potential psychosocial determinants, discussed in Chapter 2 Section 2.6, were arranged into predisposing (PA self-efficacy, PA enjoyment, perceived barriers to PA) and reinforcing (friend social support and family social support for PA) factors. The hypothesised model developed using the YPAP model explained a substantial amount of variance in 5-year

PA. It revealed that social support is instrumental for long-term PA adherence, both through the direct influence it has on PA and as a moderator through self-efficacy. Of the determinants assessed, PA social support from friends was the strongest psychosocial determinant of later PA. PA self-efficacy at baseline had a direct effect on follow-up PA and mediated the effects of perceived barriers to PA and family social support for PA at baseline on follow-up PA. PA interventions should aim to foster an environment of positive social support from family and friends, undertake efforts to increase PA self-efficacy and reduce perceived barriers to PA.

The fourth aim of this thesis is *"to assess factors influencing youth sports uptake and dropout over a 5-year period"*. Chapter 6 utilises retrospective recall as an approach to gathering information on activities taken up or dropped out of in the previous 5 years. The high uptake (65.9% – 70.8%) and dropout (60.6% - 68.9%) rates reported illustrate that young people appear open to taking up new sports, but an issue lies with the maintenance of participation. There are numerous self-reported reasons that collectively contribute to the uptake of sport including increased fitness, enjoyment, improved body image and strength, and social aspects. These factors may be utilised to draw more children and adolescents into taking up a new sport. On the other hand, dropout of sport was largely due to psychological barriers (such as a lack of interest, other commitments, taking up too much time and not believing they were good enough) and social reasons (such as friends no longer participating and coaches being unfriendly).

Phase 4 of the BEF (Sallis et al., 2000), to evaluate behaviour change interventions, is beyond the scope of this thesis. Nonetheless, evidence-based guidelines for policy and designing interventions may be derived from modifiable factors of PA identified in Phase 3. These recommendations are described in Section 8.2.

Leading on from the evaluation of interventions to change behaviour in Phase 4, Phase 5 of the BEF (Sallis et al., 2000) refers to the translation of research into practice. Research in this phase may involve identifying determinants of programme/intervention adoption. Phase 5, i.e. translational research, is rare in the literature (Biddle & Fuchs, 2009).

8.2 Recommendations

8.2.1 Recommendations for physical activity intervention

PA promotion strategies should strive to (1) increase present PA participation by promoting uptake of PA and reducing dropout of PA, and (2) sustain PA engagement over time. Approaches to attaining these goals differ. Firstly, to increase present PA participation, numerous domains of youth PA should be incorporated into PA promotion activities. Evidence shows that young people who travel by active modes are more likely to attain the PA guidelines than their peers who do not (Davison et al., 2008). Regarding PE, the contribution to overall PA levels differs by region due to disparities in provision (European Commission et al., 2013). Nevertheless, PE provides a platform for lifelong PA via knowledge, skills and confidence imparted on students (Sallis et al., 2012). Sport is a critical contributor to youth PA participation and may account for between 23% and 65% of total youth PA (Katzmarzyk & Malina, 1998; Wickel & Eisenmann, 2007). Current evidence also supports the longitudinal benefits of sport participation to PA (Chapter 5; Hardie Murphy et al., 2016a; Chapter 6; Hardie Murphy et al., 2016b).

The promotion of specific sports that are attractive to young people presents an opportunity for higher PA participation rates when coupled with efforts to negate dropout that occurs within these activities. It is essential to note that the popularity of sports differ from country to country so recommendations for particular sports should be context specific (Brooke, et al., 2014). Within Ireland, sports such as soccer and Gaelic football are prominent in males, and dance and Gaelic football are favoured in females. Over the 5-year period of this study, weight training proved to be increasingly popular among males and females. This PA can contribute to the often forgotten about muscle-strengthening and bone-strengthening aspects of the PA guidelines for health. Although these activities are important for the health of a young person, it must be noted that the activities undertaken should be developmentally appropriate for the participant.

Secondly, strategies should incorporate key influencers of sports uptake and dropout that young people have identified in this research. Factors including fitness, enjoyment, improved body image and strength, and social aspects may be exploited to recruit new individuals into a sport while psychological barriers and negative social reasons may be minimised to reduce PA dropout. Prior to promoting these messages, it is critical to weigh up potential benefits and risks, and appraise best practice of adopting them. For example, the potential benefit of emphasising improved body image for youth sports participation

is clear. The evidence presented here is supported by findings of a systematic review that identified body image, appearance and self-worth as important for PA decision making for girls (Biddle et al., 2005). More recently, body image was uncovered as a stronger predictor of moderate-to-vigorous PA in adolescent girls and boys (n = 2,249) than body mass index (Kantanista et al., 2015). However, advocating for body image as a motive for PA should be managed in a responsible manner as it poses a danger for the development of disordered eating patterns to control weight (Butt et al., 2011; Furnham et al., 2002). Furthermore, Self-Determination Theory (Deci & Ryan, 2000) suggests that PA resulting from external motives or goals such as physical appearance may be less sustainable than from intrinsic goals such as fun/enjoyment (Seghers et al., 2014). With these points in mind, it is clear that key influencers of sports uptake may be useful for PA recruitment purposes. However, different strategies may be needed for PA maintenance. This is exhibited in Chapter 6 where high sports uptake rates illustrate successes in recruitment but high dropout rates suggest these approaches are not sufficient for preventing dropout.

Finally, PA promotion strategies that strive to maintain PA engagement over time should shift towards promoting determinants of long-term PA behaviour. Findings in this thesis demonstrate that the level of commitment (i.e. the frequency of participation and performance ability achieved) to sport in early years is crucial for shaping future PA. Resultantly, PA promotion strategies should advocate for frequent, high-quality opportunities for sports participation as part of wider strategies that encourage lifelong PA participation. Within these strategies, relevant psychosocial determinants of youth PA highlighted in this research should be incorporated into their design. An environment of positive social support from family and friends should be fostered, in addition to, actions to increase PA self-efficacy and minimise perceived barriers to PA.

8.2.2 Review of national physical activity policy

The National PA Plan set overarching targets for three population groups: children (aged 0 – 18 years); adults (aged 18 – 64 years); and older people (aged 65+ years). The targets for children comprise of an "increase by 1% per annum in the proportion of children undertaking at least 60 minutes of moderate-to-vigorous physical activity every day" and a "decrease by 0.5% per annum in the proportion of children who do not take any weekly physical activity" (Healthy Ireland, 2016: 13). The base indicator of PA levels for these targets is sourced from the CSPPA study and includes 19% of primary and 12% of post-

primary school-aged children meeting these PA guidelines, and 11% of primary and 34% of post-primary students not achieving 60 minutes of MVPA on any day of the week (Woods et al., 2010). The aim of this thesis is not to assess whether these targets are being met or not but rather to uncover factors that influence long-term behaviour that may assist in ensuring these targets are met. Nevertheless, findings for temporal trends in PA in older adolescents aged 15 – 18 years between the years 2009 and 2014, noted in Chapter 5, showed nonsignificant differences in days meeting the MVPA guideline (decrease by a mean of 0.2 days between time 1 and time 2).

In the context of the research in this thesis, a number of action areas of the National PA Plan are reviewed. Firstly, action area two – children and young people – specifies that opportunities for active living should form an integral part of a normal day for all young people. It identifies three contexts where PA can occur: the school class, school extra-curricular and the community settings. Within these settings, the domains of youth PA, investigated in this thesis, take place. Based on the findings of this research, the promotion of sports participation (both community club-based and extra-curricular) is warranted to encourage future PA. Although active commuting to school and PE were not significant predictors of later PA, they should not be ruled out of PA promotion strategies as they exhibit cross-sectional benefits to overall PA levels (Larouche et al., 2014; Sallis et al., 2012). Actions 11 and 12 of the National PA Plan specifically refer to the implementation of PE guidelines at all school levels and that the quality of PE is assessed annually. Evidence from the literature review conducted in Chapter 2 illustrate not only the low minimum time recommendations for PE in schools, but also, the small proportion of primary (35%) and post-primary (10%) students who are provided with opportunities to meet these recommendations (Woods et al., 2010). The successful implementation of Action 11 is questionable in the absence of mandatory PE guidelines and unless additional supports are provided to schools to enable them to adhere to the standards. Action 15 of the Plan specifies the requirement to review the National Recreation Policy ("*Teenspace. A National Recreation Policy*" (Office of the Minister for Children, 2007). Evidence from this thesis can provide up to date information on youth PA, leisure-time activities and methods to encourage participation that can inform new strategic directions as part of this review process. Specific policy recommendations based on the findings of this research are described in Section 8.2.3.

Action area six of Ireland's National PA Plan targets sport and PA in the community. In this action area, National Governing Bodies (NGBs) of Sport and Local Sports Partnerships (LSPs) are mentioned for the work and programmes they implement in the community setting. The findings of this thesis relate to two main facets of this action area. Firstly, a clear sex inequity for PA and sports participation was identified. Linking with the second objective of the National Recreation Policy, it is recommended that NGBs and LSPs develop increased opportunities for PA and tackle gender issues around provision in sport. It is clear that increased efforts are needed to address this issue. These efforts can include an impartial variety of sports offered, resources allocated and opportunities to participate at competitive and elite levels. Secondly, Action 48 states the plan to "develop programmes to address transitions and drop out from physical activity and sport". Research findings from Chapter 5 on the PA transitions and Chapter 6 on uptake and dropout from sport will undoubtedly provide an evidence-base for the development of these programmes. Within this research, sports with high levels of dropout, which may have been masked by minimal fluctuations in absolute participation rates, have been identified. This data may be helpful to NGBs by increasing their awareness of the issue of dropout within their sport, and thereby, opening the channels for action against it. By highlighting which sports have low and high rates of uptake and dropout, a dialogue may be created between NGBs on strategies that enhance participation levels or counteract dropout. Advancements in Action 48 are possible within the lifetime of the Plan provided collaborative working between NGBs takes place.

Action area eight of Ireland's National PA Plan connects all previous action areas by highlighting that Plan implementation and PA promoting efforts should be done through collaborations and partnerships. Action 56 states that a cross-sectoral group, jointly led by the Department of Health and the Department of Transport, Tourism and Sport, be established to oversee the implementation of the Plan. This high-level coordinated approach is essential for the successful implementation of the Plan. However, working at a more local level, there is an action of implementation through partnership that has not been specified in the Plan. There is a need for increased links between schools, local clubs, LSPs and NGBs to increase opportunities for PA engagement both in and out of the school setting. A two-way collaboration could increase the variety of sports available in schools and the opportunities to participate, and could serve as a method of recruitment for local clubs, LSPs and NGBs. It is important that these connections are either made or strengthened as community club sports participation is the strongest predictor of 5-year

PA, of all domains of PA studied in this thesis. The school/community collaborations would negate barriers in adapting sports participation to a new setting, and therefore, facilitate PA participation beyond the school years.

Action area seven of Ireland's National PA Plan refers to research, monitoring and evaluation. In Section 8.2.4, recommendations for future research are made based on the work undertaken as part of this thesis. It is necessary to note that constant research is needed to provide a continuous feedback loop to inform national policy.

8.2.3 Recommendations for policy

The following recommendations are made for future policy:

- Policy approaches to improving PA at a population level should incorporate known determinants of PA into their actions. At present, policy documents (such as the Ireland's National PA Plan) focus actions on actual PA behaviour. They would benefit from specifying characteristics of actions to be taken. For example, the promotion of PA self-efficacy or social support for PA.
- The approaches required to target PA uptake, maintenance and dropout differ. This needs to be acknowledged in future policy documents.
- Key performance indicators for policy actions should include a quality assessment of actions taken. The outcomes of policy actions are dependent on whether actions are completed or not, but also, on the standards of implementation.
- Plans for the monitoring and evaluation of PA are often included in PA policy. Standalone levels of PA participation are insufficient to assess policy effects. Data on the determinants of PA are necessary to establish if outcomes in behaviour are expected to be short-term or long-term.

8.2.4 Recommendations for future research

The following recommendations are made for future research:

- A longitudinal research design is recommended for future research. In particular, further measurement of the CSPPA participants is recommended as multiple data collection points provide a greater understanding of the stability, or otherwise, of behaviours. The information gained through this research would contribute to Action 52 of the National PA Plan as it can inform policies aimed at improving PA levels.
- The surveys developed as part of the CSPPA and CSPPA Plus studies should be used for monitoring of PA at a national level. Firstly, this would allow comparisons with

existing research, and secondly, monitoring of changes in predictors of long-term PA would facilitate projections of future trends in PA.

- The PACE+ self-report PA instrument, validated in this thesis for use in Irish adolescents, is used globally in youth. It is recommended that this instrument is used for assessing compliance with the PA guidelines and in future studies to facilitate comparisons nationally, across Europe and the globe.
- Sports participation was investigated in detail in this thesis, and future research should explore other domains (active commuting to school and other destinations, unstructured PA and PE) of youth PA more thoroughly.
- Structural equation modelling facilitates the testing of moderating and mediating relationships between correlates and determinants of PA. It is recommended that future studies should use this analytical method to model sex similarities and differences in psychosocial factors related to longitudinal PA. Additionally, further research should incorporate environmental factors into wider SEM analyses.

8.3 Thesis strengths and limitations

8.3.1 Thesis strengths

A longitudinal research design is the prime strength of this thesis. This research design can test the stability or changes in behaviour over time and investigate causal relationships that would not be possible through cross-sectional work. Further strengths of this thesis include the theoretical underpinning of the research components, the large sample size and the use of psychometrically valid instruments. The following points depict niches within the literature that have been addressed in this thesis:

- An assessment of the criterion validity of the PACE+ instrument in a European sample and across all adolescent years.
- An appraisal of PA tracking across specific periods of transition in the lives of youth.
- An evaluation of the long-term influence of youth sports participation on PA and which sports-related factors (i.e. participation frequency, the number of sports engaged in, type of sport, standard achieved) are most efficacious at sustaining PA.
- A collective examination of the contribution of different PA domains in youth on later PA.
- An investigation into the longer term (5-year) effect of psychosocial determinants on PA in youth using SEM and the use of two diverse PA measurement instruments (PACE+ and IPAQ) in the formation of the PA construct.

8.3.2 Thesis limitations

Several limitations are present in this study. The generalisability of results to other populations and groups is affected by the higher proportion of female than male participants in the longitudinal sample. Within the postal component of the study, there were low response rates (see Figure 3.1) despite a large follow-up sample overall. Nonetheless, it should be noted that there was little difference between baseline PA level between respondents and non-respondents (a mean of approximately 0.3 days meeting 60 minutes of MVPA). The limitations of measuring PA by self-report have been widely acknowledged and are detailed in Chapter 2 Section 2.8. To overcome this issue, the main measure of self-reported PA was validated against accelerometer-determined PA in a subsample of participants (Chapter 4). Other aspects of PA such as domains, specific physical activities, psychosocial determinants and reasons for uptake and dropout must naturally be captured through self-report. A final limitation is that it is not possible to address all determinants of youth PA in one thesis. Recommendations for further research are discussed in Section 8.2.3 while reviewing the "research, monitoring and evaluation" action area of Ireland's National PA Plan.

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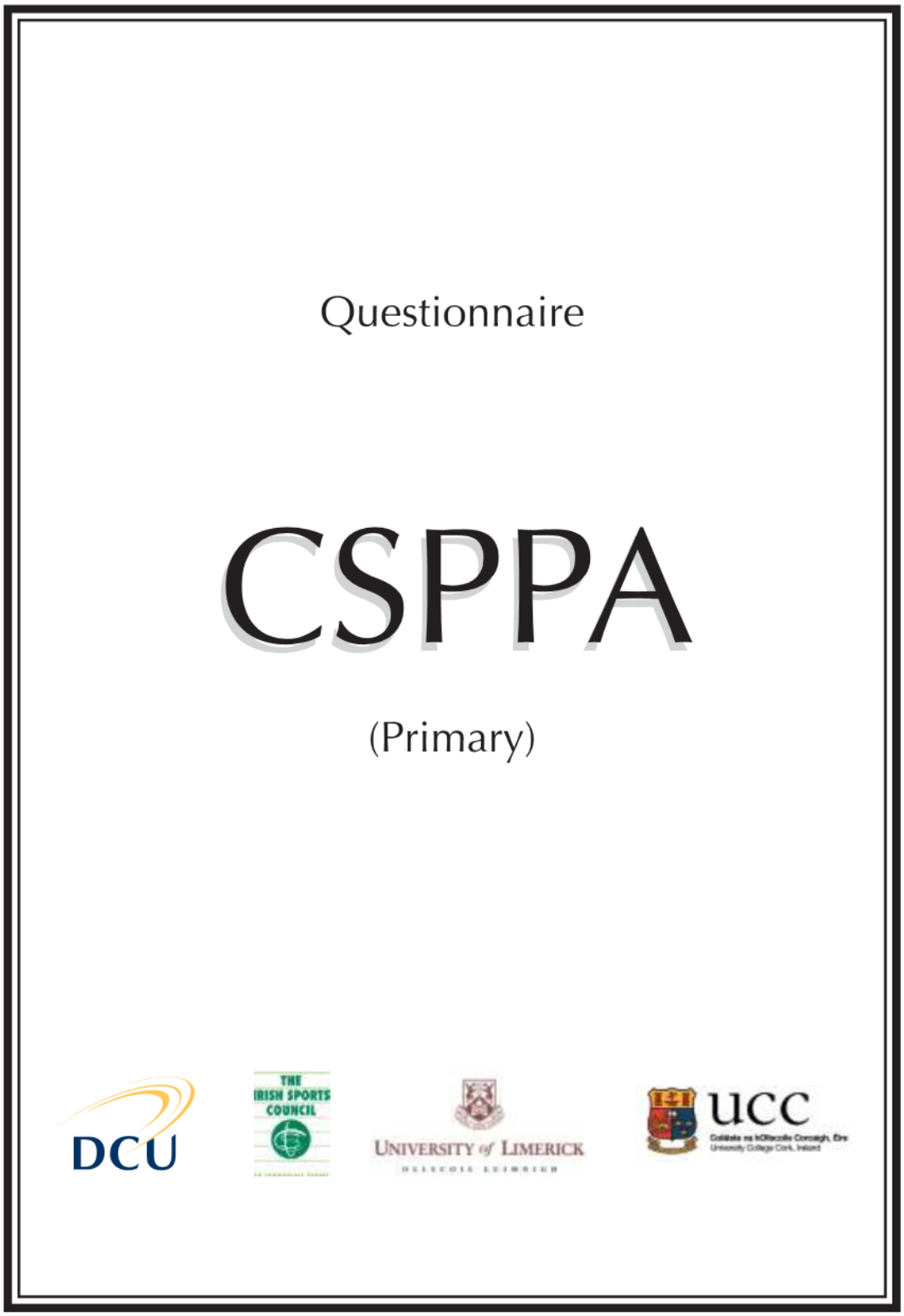
APPENDICES

Appendices contents

Appendix A Surveys

A.1 Primary Questionnaire (CSPPA 2009)



Please read and tick (✓) ONE box only

1. I gave the permission form to my parents/guardian NO ❑ YES ❑
2. My parents/guardian have talked to me about taking part in the research project. NO ❑ YES ❑
3. I have been told that being part of this project will involve me filling out a questionnaire and may involve health measurements. NO ❑ YES ❑
4. I know that I am free to decide not to take part in this study or change my mind if I wish. NO ❑ YES ❑

SIGNED: _____ DATE: _____

Please PRINT all information in CAPITALS

1. Are you a Boy 1❑ Girl 2❑

2. Age: _____

3. First Name:_____ 4. Surname: _____

5. Date of Birth: __/ ____/ _____ (dd/mm/year)

6. Home Address: _____

7. What is the name of your school? _____

8. Are you in? 5th 7❑ 6th 8❑ class

9. Do you have a physical disability, a learning or sensory disability or a special education need which affects your ability to do physical activity?
   NO 1❑ YES 2❑

(If YES, Please specify or describe) _____

10. Sometime in the future we may want to:
    a) Contact you to follow up on this research. Would that be OK ? NO 1❑ YES 2❑

OFFICE USE ONLY: 1 Actigraph ID CODE

Section 1:

Physical activity is any body movement.

It can be done at different levels of effort:

- **Moderate Effort** makes your heart rate and breathing rate faster than normal. You may also sweat a little. Brisk walking and jogging are good examples.
- **Vigorous Effort** makes your heart rate much faster and you have to breathe deeper and faster than normal. You will probably sweat. Playing football or tennis are good examples.
- Physical activity includes:

Exercise	Running, dancing, etc.
Sports	Basketball, football, athletics, swimming, etc.
General	Brisk walking, washing the car, walking or cycling to school, etc.

Please try to think carefully and be as accurate as possible with your answers. For these next two questions, add up all the time you spend in physical activity each day.

Only include activities of either MODERATE or VIGOROUS effort.

Q1. Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q2. Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day? Please circle one number.

0 days 1 2 3 4 5 6 7 days

Section 2: In this section we want to know about things you have done in the last seven days that involve sitting down.

For each activity listed, answer three questions:

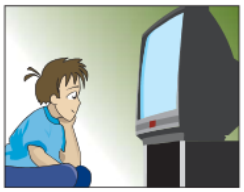
1. Did you do this activity in the past 7 days? **Tick NO ☑ or YES ☑**
2. **If YES**, on how many days did you do the activity?
3. On average, how many minutes did you do this activity on the days that you did it?

Q1. Please answer this section for the past 7 days.

SITTING DOWN ACTIVITIES	Have you done this activity in the last 7 days? NO	YES	Number of **Days** in last 7 days	**Minutes** per day
1. Computer /Internet	❑ 1	❑ 2		
2. Sitting playing video games	❑ 1	❑ 2		
3. Homework, studying	❑ 1	❑ 2		
4. Reading (not for school)	❑ 1	❑ 2		
5. Sitting during school breaks	❑ 1	❑ 2		
6. Sitting and talking with friends (not on phone),listening to music	❑ 1	❑ 2		
7. Talking on the phone	❑ 1	❑ 2		
8. Television or DVD watching	❑ 1	❑ 2		
9. Other (specify):	❑ 1	❑ 2		

Q2. Do you watch much sport on TV? Please tick (✓) ONE box only

I never watch sport on TV ❑ 1
I occasionally watch sports programmes ❑ 2
I frequently watch sports programmes ❑ 3



Q3. How many hours per week do you spend at music, singing, drama, or dance classes (including time spent practising)?

I don't attend any such class ❑ 1
About 0-2 hours per week ❑ 2
About 3-4 hours per week ❑ 3
About 5 or more hours per week ❑ 4

Q4a. How do you usually travel to school?
Please tick one box only – for the LONGEST distance of your usual journey **to school**.


Walk 1 ❑


Cycle 2 ❑


Car 3 ❑

Bus 4 ❑

Q4b. How long does your journey **to school** usually take?

_____ **Minutes**

Q4c. How do you usually travel home from school?
Please tick one box only – for the LONGEST distance of your usual journey **home from school**.


Walk 1 ❑


Cycle 2 ❑


Car 3 ❑

Bus 4 ❑

Q4d. How long does your journey **home from school** usually take?

_____ **Minutes**

Q4e. If you travel by car or bus give reasons why you choose not to walk or cycle.

_____

_____

SECTION 3: This section is about what you do in PE/Games class at school

Q1. Please tick (✓) all the sports you have done at school in your P.E. and games classes since the beginning of the school year. This includes indoor and outdoor sports.

Since the beginning of the school year I have...	Participated in
1. Adventure activities*	❑
* This includes orienteering, canoeing, abseiling and mountaineering	
2. Aerobics	❑
3. Athletics	❑
4. Badminton	❑
5. Baseball or Rounders	❑
6. Basketball	❑
7. Camogie	❑
8. Cross country running	❑
9. Dance	❑
10. Gaelic Football	❑
11. Gymnastics	❑
12. Handball	❑
13. Hockey	❑
14. Horse riding	❑
15. Hurling	❑
16. Martial Arts	❑
17. Rugby	❑
18. Soccer	❑
19. Squash	❑
20. Swimming	❑
21. Tennis	❑
22. Weight training	❑
23. Any other sport	❑
24. I don't do PE at school	❑

Q2a. How many times do you have PE per week?
Please tick (✓) ONE box only

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 times ❑

Q2b. And on average, how long is each PE class? _____ hours and _____ minutes

SECTION 4: This section is about sports that you might play at lunch time or after school with the help of a teacher

Q1. Please tick (✓) any sports/activities you have played at lunch time, after school since the beginning of this school year in each of the following situations

(a) Played each sport/activity **at least once** WITH the help of a teacher since the beginning of this school year
(b) Played each sport/activity **at least once a week** WITH the help of a teacher since the beginning of this school year
Please exclude sports played in PE classes

Since the beginning of the school year I have...	(a) Played at least **once** with help of **teacher**	(b) Played at least **once a week** with the help of **teacher**
1. Adventure activities*	❑ 1	❑ 1
* This includes orienteering, canoeing, abseiling and mountaineering		
2. Aerobics	❑ 1	❑ 1
3. Athletics	❑ 1	❑ 1
4. Badminton	❑ 1	❑ 1
5. Baseball or Rounders	❑ 1	❑ 1
6. Basketball	❑ 1	❑ 1
7. Camogie	❑ 1	❑ 1
8. Cross country running	❑ 1	❑ 1
9. Dance	❑ 1	❑ 1
10. Gaelic Football	❑ 1	❑ 1
11. Gymnastics	❑ 1	❑ 1
12. Handball	❑ 1	❑ 1
13. Hockey	❑ 1	❑ 1
14. Horse riding	❑ 1	❑ 1
15. Hurling	❑ 1	❑ 1
16. Martial Arts	❑ 1	❑ 1
17. Rugby	❑ 1	❑ 1
18. Soccer	❑ 1	❑ 1
19. Squash	❑ 1	❑ 1
20. Swimming	❑ 1	❑ 1
21. Tennis	❑ 1	❑ 1
22. Weight training	❑ 1	❑ 1
23. Any other sport	❑ 1	❑ 1
24. Did not play any sport with help of teacher	❑ 1	

Q2. About how often do you play sports and physical activities at lunch-time or after school with your friends WITHOUT the help of a teacher? Please tick (✓) ONE box only

- 4 or more days a week ❑
- 2-3 days a week ❑
- One day a week ❑
- Less often ❑
- Never ❑

Q3. About how often do you take part in sports and physical activities at lunch-time or after school WITH the help of a teacher? Please tick (✓) ONE box only

- 4 or more days a week ❑
- 2-3 days a week ❑
- One day a week ❑
- Less often ❑
- Never ❑

Q4. Why don't you take part in more sports and activities at lunch-time or after school? Please tick (✓) any of the boxes that are a reason for you.

- I already do enough sports outside class time ❑
- I don't like playing sports ❑
- I haven't got enough spare time ❑
- I'm not good enough at sport ❑
- I've never been asked to take part ❑
- It's difficult to get home if I stay late after school ❑
- My school doesn't offer any sports outside class time that I like ❑

Q5. Have you had any coaching during lunch-time or after school to help you get better at any of these sports?
Please tick (✓) ONE box only.

- NO ❑
- YES ❑
- I don't play sports at school outside class time ❑

Q6. During the past 12 months on how many school sports or dance teams did you play?

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑ 7 or more ❑

SECTION 5: This section is about sports which you might play with sports clubs that are not school clubs.

Q1. Please tick (✓) any sports/activities you have played with a club, which is not a school club, since the beginning of this school year in each of the following situations

(a) Played each sport/activity in a club **at least once** since the beginning of this school year
(b) Played each sport/activity in a club **at least once a week** since the beginning of this school year
Please exclude sports/activities played in PE classes

Since the beginning of the school year I have...	(a) Played in a club at least once	(b) Played in a club at least once a week
1. Adventure activities*	❑	❑
* This includes orienteering, canoeing, abseiling and mountaineering		
2. Aerobics	❑	❑
3. Athletics	❑	❑
4. Badminton	❑	❑
5. Baseball or Rounders	❑	❑
6. Basketball	❑	❑
7. Camogie	❑	❑
8. Cross country running	❑	❑
9. Dance	❑	❑
10. Gaelic Football	❑	❑
11. Gymnastics	❑	❑
12. Handball	❑	❑
13. Hockey	❑	❑
14. Horse riding	❑	❑
15. Hurling	❑	❑
16. Martial Arts	❑	❑
17. Rugby	❑	❑
18. Soccer	❑	❑
19. Squash	❑	❑
20. Swimming	❑	❑
21. Tennis	❑	❑
22. Weight training	❑	❑
23. Any other sport	❑	❑
24. I did not play any sport/activity in a club	❑	

Q2. How often do you take part in sports and physical activities with a sports club, which is not a school club? Please tick (✓) one box only.

- 4 or more days a week ❑ 1
- 2-3 days a week ❑ 2
- One day a week ❑ 3
- 2-3 days a month ❑ 4
- One day a month ❑ 5
- Less often ❑ 6
- Never ❑ 7

Q3. Have you had any coaching at your club to help you get better at any of these sports?
Please tick (✓) one box only.

- NO ❑ 1
- YES ❑ 2
- I don't play sports in a club ❑ 3

Q4. How often do you go to a sports field/ground or sports/leisure centre to take part in some form of sports or physical activity? Please tick (✓) one box only.

- 4 or more days a week ❑ 1
- 2-3 days a week ❑ 2
- One day a week ❑ 3
- 2-3 days a month ❑ 4
- One day a month ❑ 5
- Less often ❑ 6
- Never ❑ 7

Q5. In the past 7 days, how much physical activity did you do on?
Please tick (✓) one box only.

	None	Up to 30 minutes	Between 30minutes and 1 hour	Between 1 hour and 1 1/2 hours	Between 1 1/2 hours and 2 hours	Greater than 2 hours
(a) An average weekday Mon-Fri	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6
(b) An average weekend day Sat-Sun	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6

Section 6:

Q1. SWIMMING ABILITY please mark your swimming level below.
Please tick (✓) ONE box only

Non-Swimmer ☐ Beginner ☐ Intermediate ☐ Competitive ☐

If non-swimmer please go to section 7.

If swimmer please mark your swimming level at the following skills. Please tick (✓) ONE box only

	Beginner	Intermediate	Competitive	Unable to do this stroke
1. Treading water	☐	☐	☐	☐
2. Front crawl	☐	☐	☐	☐
3. Back stroke	☐	☐	☐	☐
4. Butterfly	☐	☐	☐	☐
5. Breast stroke	☐	☐	☐	☐

What is your favourite swimming stroke? _____

Section 7:

Q1. Physical Activity Enjoyment Scale

When I am active...	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1. I enjoy it	☐	☐	☐	☐	☐
2. I feel bored	☐	☐	☐	☐	☐
3. I dislike it	☐	☐	☐	☐	☐
4. I find it pleasurable	☐	☐	☐	☐	☐
5. It's no fun at all	☐	☐	☐	☐	☐
6. It gives me energy	☐	☐	☐	☐	☐
7. It makes me depressed	☐	☐	☐	☐	☐
8. It's very pleasant	☐	☐	☐	☐	☐
9. My body feels good	☐	☐	☐	☐	☐
10. I get something out of it	☐	☐	☐	☐	☐
11. It's very exciting	☐	☐	☐	☐	☐
12. It frustrates me	☐	☐	☐	☐	☐
13. It's not at all interesting	☐	☐	☐	☐	☐
14. It gives me a strong feeling of success	☐	☐	☐	☐	☐
15. It feels good	☐	☐	☐	☐	☐
16. I feel as though I would rather be doing something else	☐	☐	☐	☐	☐

Q2. DURING A TYPICAL WEEK, how often: Please tick (✓) ONE box only

	None	Once	Sometimes	Almost every day	Every day
1. Do you **encourage your friends** to do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. Do your friends **encourage you** to do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. Do your friends do physical activities or play sports **with you**?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. Do other kids **tease you** for not being good at physical activity or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. Do friends **tell you** that you are doing well in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

Q3. DURING A TYPICAL WEEK, how often has someone in your house/member of your family:
(For example, your father, mother, guardian, brother, sister, grandparent, or other relative)
Please tick (✓) ONE box only

	None	Once	Sometimes	Almost every day	Every day
1. **Encouraged you** to do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. Done a physical activity or played sports **with you?**	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. **Provided transportation** to a place where you can do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. **Watched you** participate in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. **Told you** that you are doing well in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

Q4. DURING A TYPICAL WEEK, how often has a teacher in your school:
Please tick (✓) ONE box only

	None	Once	Sometimes	Almost every day	Every day
1. **Encouraged you** to do physical activities or play sports?	1❑	2❑	3❑	4❑	5❑
2. Done a physical activity or played sports **with you?**	1❑	2❑	3❑	4❑	5❑
3. **Provided transportation** to a place where you can do physical activities or play sports?	1❑	2❑	3❑	4❑	5❑
4. **Watched you** participate in physical activities or sports (not including supervision)?	1❑	2❑	3❑	4❑	5❑
5. **Told you** that you are doing well in physical activities or sports?	1❑	2❑	3❑	4❑	5❑

Q.5 At present are you on a diet or doing something else to lose weight?

No, my weight is fine ..... 1❑
No, but I should lose some weight ..... 2❑
No, because I need to put on weight ..... 3❑
Yes ..... 4❑

Q.6 Do you think your body is…?

Much too thin ..... 1❑
A bit too thin ..... 2❑
About the right size ..... 3❑
A bit too fat ..... 4❑
Much too fat ..... 5❑

SECTION 8:

Q1. FATHER/GUARDIAN

a. Does your father/male guardian do exercise or play sports regularly? (For example gym, swimming, golf) Please tick (✓) one box ONLY

- Yes ..... 1 ❑
- No ..... 2 ❑
- Don't Know ..... 2 ❑
- Don't have or see father ..... 4 ❑

b. Does your father/male guardian volunteer or help out with any sports clubs? (For example coaching, refereeing, provide transportation) Please tick (✓) one box ONLY

- Yes ..... 1 ❑
- No ..... 2 ❑
- Don't Know ..... 2 ❑
- Don't have or see father ..... 4 ❑

c. Does your father have a job?

- Yes ..... 1 ❑
- No ..... 2 ❑
- Don't know ..... 3 ❑
- Don't have or see father ..... 4 ❑

d. If yes, say in what place he works: (For example hospital, bank, restaurant…)

_____

e. Please write down exactly what job he does (For example doctor, clerk, manager…)

_____

f. If no, why does your father not have a job?

- He is sick, or retired or a student ..... 1 ❑
- He is looking for a job ..... 2 ❑
- He takes care of others, or is full time in the home ..... 3 ❑
- I don't know ..... 4 ❑

2. MOTHER/GUARDIAN

a. Does your mother/female guardian do exercise or play sports regularly? (For example gym, swimming, golf) Please tick (✓) one box ONLY

- Yes ..... 1 ❑
- No ..... 2 ❑
- Don't Know ..... 2 ❑
- Don't have or see mother ..... 4 ❑

b. Does your mother/female guardian volunteer or help out with any sports clubs? (For example coaching, refereeing, provide transportation) Please tick (✓) one box ONLY

- Yes ..... 1 ❑
- No ..... 2 ❑
- Don't Know ..... 2 ❑
- Don't have or see mother ..... 4 ❑

c. Does your mother have a job?

- Yes ..... 1 ❑
- No ..... 2 ❑
- Don't know ..... 3 ❑
- Don't have or see mother ..... 4 ❑

d. If yes, say in what place she works: (For example hospital, bank, restaurant…)

_____

e. Please write down exactly what job she does (For example doctor, clerk, manager…)

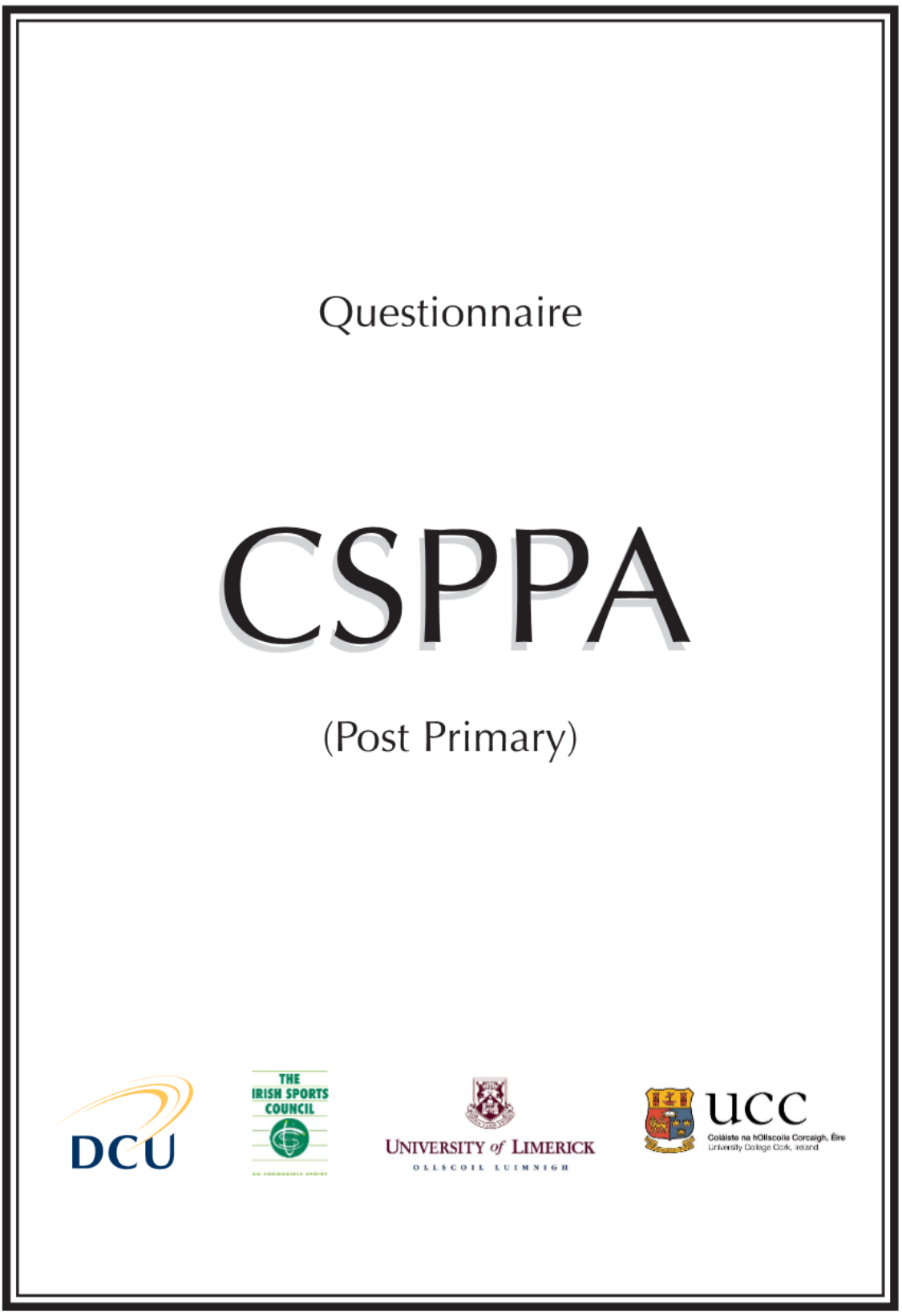
_____

f. If no, why does your mother not have a job?

- She is sick, or retired or a student ..... 1 ❑
- She is looking for a job ..... 2 ❑
- She takes care of others, or is ..... full time in the home ..... 3 ❑
- I don't know ..... 4 ❑

You're finished! Well done!
Thank you for your time and effort!

A.2 Post-Primary Questionnaire (CSPPA 2009)



ASSENT FORM FOR CHILDREN

Please tick (✓) ONE box only

1. I have given the informed consent form to my parents/guardian — **No** ❑ **Yes** ❑
2. My parents/guardian have talked to me about being part of a research study. — **No** ❑ **Yes** ❑
3. It has been explained to me that the study will involve me completing a physical activity questionnaire and may involve physical measures. — **No** ❑ **Yes** ❑
4. I know that I am free to decide not to take part in this study or change my mind if I wish. — **No** ❑ **Yes** ❑

SIGNED: _____ **DATE:** _____

Demographics

Please **PRINT** all information in **CAPITALS**

1. Gender (please tick one): **Male** ❑ **Female** ❑

2. Age: _____

3. First Name: _____ **4. Surname:** _____

5. Date of Birth: ____/_____/_____ (dd/mm/year) **6. Nationality:** _____

7. Home Address: _____

8. Area of Residence: This question refers to the permanent area of residence you live in. Would you describe the place that you live in as?

- ❑ A big city (more than than 70, 000 inhabitants)
- ❑ Suburbs, large town or outskirts of city (less than 70, 000 inhabitants.)
- ❑ Town (less than 20, 000 inhabitants)
- ❑ Village / Rural area (less than 3,000 inhabitants)

9. What is the name of your school? _____

10. Are you in? **1st** ❑ **2nd** ❑ **3rd** ❑ **4th** ❑ **5th** ❑ **6th** ❑ **year**

11. Do you have a physical disability, a learning or sensory disability or a special education need which affects your capacity to participate in certain physical activities?
No ❑ **Yes** ❑

(If **YES**, Please specify or describe) _____

12. Sometime in the future we may want to:

a) Contact you to follow up on this research. Would that be OK ? **No** ❑ **Yes** ❑

b) Contact your school to obtain your exam results. Would that be OK? **No** ❑ **Yes** ❑

This information will be treated with the strictest confidence; it will be anonymous, that means your name will not be associated with it in any way.

OFFICE USE ONLY: **Actigraph ID CODE** [ ]

1

Section 1:

Physical activity is any body movement.

It can be done at different levels of effort:

- **Moderate Effort** makes your heart rate and breathing rate faster than normal. You may also sweat a little. Brisk walking and jogging are good examples.
- **Vigorous Effort** makes your heart rate much faster and you have to breathe deeper and faster than normal. You will probably sweat. Playing football or tennis are good examples.
- Physical activity includes:

Exercise	Weight training, aerobics, jogging, dancing, etc.
Sports	Hurling, football, athletics, swimming, etc.
General	Brisk walking, washing the car, walking or cycling to school, etc.

Please try to think carefully and be as accurate as possible with your answers. For these next two questions, add up all the time you spend in physical activity each day. **Only include activities of either MODERATE or VIGOROUS effort.**

Q1. Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q2. Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day? Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3a. What distance is your journey to school and how long does it usually take?

_____**km*** _____**Minutes**

* 1 km = 1000 metres

Q3b. How do you usually travel to school?
Please tick one box only – for the **LONGEST** distance of your usual journey to school.

By foot ❑ Bicycle ❑ Car ❑ Bus ❑ Train ❑

Q3c How do you usually travel home from school?
Please tick one box only – for the **LONGEST** distance of your usual journey to school.

By foot ❑ Bicycle ❑ Car ❑ Bus ❑ Train ❑

Q3d If you travel by car, bus or train give reasons why you choose not to walk or cycle.

_____

_____

Q4. **Outside of school P.E. classes,**
Please read through all games/activities and tick either the NO or YES box for each activity you have taken part in during the **past 7 days**.

There are no right or wrong answers. No one does all these activities.
Please be as accurate and honest as possible.

For each activity listed:

1. Did you do this activity in the **past 7 days?** Tick NO ☑ or YES ☑ for each activity.

ACTIVITY	Have you done this activity in **the past 7 days?**	
Sports & Dance	**NO**	**YES**
1. Athletics	1☐	2☐
2. Badminton	1☐	2☐
3. Basketball	1☐	2☐
4. Boxing	1☐	2☐
5. Cricket	1☐	2☐
6. Cue games (pool and snooker)	1☐	2☐
7. Cycling (Mountain Biking, Road Racing)	1☐	2☐
8. Dance (Irish, ballet, jazz, modern, tap)	1☐	2☐
9. Dancing (social, recreational)	1☐	2☐
10. Gaelic Football	1☐	2☐
11. Golf/Pitch 'n' putt	1☐	2☐
12. Gymnastics, trampoline	1☐	2☐
13. Hockey (field, ice, or roller)	1☐	2☐
14. Hurling/Camogie	1☐	2☐
15. Judo	1☐	2☐
16. Karate	1☐	2☐
17. Skating (ice, roller, in-line, skate boarding)	1☐	2☐
18. Skiing (downhill, cross-country, water)	1☐	2☐
19. Soccer	1☐	2☐
20. Softball/rounders	1☐	2☐
21. Squash	1☐	2☐
22. Swimming	1☐	2☐
23. Tennis	1☐	2☐
24. Rugby	1☐	2☐
25. Volleyball	1☐	2☐
26. Water sports: sailing, rowing, canoeing	1☐	2☐
27. Other (specify):	1☐	2☐

Exercise	NO	YES
28. Aerobics/aerobic dancing/step aerobics	1❑	2❑
29. Push-ups, sit-ups, jumping jacks	1❑	2❑
30. Jogging	1❑	2❑
31. Skipping	1❑	2❑
32. Swimming laps	1❑	2❑
33. Walking for exercise	1❑	2❑
34. Weight lifting/weight training	1❑	2❑
35. Exercise machine: cycle, treadmill, rower, climber	1❑	2❑
36. Other (specify):	1❑	2❑

General Physical Activities	NO	YES
37. Bicycling	1❑	2❑
38. Hiking	1❑	2❑
39. Walking to get places	1❑	2❑
40. Water play: in pool, lake, or ocean	1❑	2❑
41. Outdoor chores: mowing, raking, gardening	1❑	2❑
42. Indoor chores: mopping, vacuuming, sweeping	1❑	2❑
43. Physically demanding part-time work: stacking shelves, newspaper round	1❑	2❑
44. Play guitar/drums etc:	1❑	2❑
45. Free running/ Parkours:	1❑	2❑
46. Other (specify):	1❑	2❑

Q5. In the last 7 days, how much physical activity did you do on? Please tick (✓) one box only.

	None	Up to 30 minutes	Between 30minutes and 1 hour	Between 1 hour and 1½ hours	Between 1½ hours and 2 hours	Greater than 2 hours
(a) An average weekday Mon-Fri	1❑	2❑	3❑	4❑	5❑	6❑
(b) An average weekend day Sat-Sun	1❑	2❑	3❑	4❑	5❑	6❑

Q6. A. Looking back on all your answers, was the amount of physical activity you did in the last 7 days **typical** of the amount that you would **normally** do? Please tick one box

Yes 1❑ No, I usually do more 2❑ No, I usually do less 3❑

B. If no, why was this week unusual?

_____

Section 2:

There are no right or wrong answers. No one does all these activities. Please be as accurate and honest as possible.

For each activity listed, answer three questions:

1. Did you do this activity in the past 7 days? Tick NO ☑ or YES ☑
2. **If yes**, on how many days did you do the activity?
3. On average, how many minutes did you do this activity on the days that you did it?

Q1. Please answer this section relating to sitting activities for the past 7 days.

ACTIVITY	Have you done this activity in the last 7 days? NO	YES	Number of **Days** in last 7 days	**Minutes** per day
1. Computer /Internet	❑ 1	❑ 2		
2. Sitting playing video games	❑ 1	❑ 2		
3. Homework, studying	❑ 1	❑ 2		
4. Reading (not for school)	❑ 1	❑ 2		
5. Sitting during school breaks	❑ 1	❑ 2		
6. Sitting and talking with friends (not on phone),listening to music	❑ 1	❑ 2		
7. Talking on the phone	❑ 1	❑ 2		
8. Television or dvd watching	❑ 1	❑ 2		
9. Other (specify):	❑ 1	❑ 2		

Q2. Do you watch much sport on TV? Please tick (✓) ONE box only

I never watch sport on TV ❑ 1
I occasionally watch sports programmes ❑ 2
I frequently watch sports programmes ❑ 3

Q3. How many hours per week do you spend at music, singing, drama, or dance classes (including time spent practising? Please tick (✓) ONE box only

I don't attend any such class ❑ 1
About 0-2 hours per week ❑ 2
About 3-4 hours per week ❑ 3
About 5 or more hours per week ❑ 4

Good effort, keep it going

Section 3:

Q1. PLEASE TICK (✓) ANY SPORT/ACTIVITY THAT YOU MIGHT
[1] HAVE DONE AT SCHOOL IN YOUR TIMETABLED P.E. OR GAMES CLASSES
[2] PLAY AT YOUR SCHOOL AT **LUNCH TIME** OR **AFTER SCHOOL** WITH THE HELP OF A TEACHER
[3] PLAY WITH SPORTS OR ACTIVITY CLUBS

Section 4:

Q1a. How many times do you have a Single PE class per week? Please tick (✓)ONE box only

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 times ❑

Q1b. How many times do you have a Double PE class per week?

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 times ❑

Q1c. How many times do you have a Triple PE class per week?

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 times ❑

Q1d. And on average, how long is a single PE class? _____ hours and _____ minutes

Q2a. How many times do you have Games* Classes per week? Please tick (✓)ONE box only

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 times ❑

*Games classes means sport or activity classes that are not part of PE

Q2b. And on average, how long is each Games Class? _____ hours and _____ minutes

Q3. Factors Influencing Enjoyment of Physical Education, Please tick (✓) ONE box only

When I am in PE class...	**(1) Dislike a lot**				**Enjoy a lot (5)**
1. Learning new skills is something that I	❑	❑	❑	❑	❑
2. Changing clothes is something that I	❑	❑	❑	❑	❑
3. Working out with other students is something that I	❑	❑	❑	❑	❑
4. Doing different types of physical activities is something that I	❑	❑	❑	❑	❑
5. Getting warmed up and breaking a sweat is something that I	❑	❑	❑	❑	❑
6. Being with the other students in the class is something that I	❑	❑	❑	❑	❑
7. Getting a break from the other classes is something that I	❑	❑	❑	❑	❑
8. Being in the gym or on the playing field is something that I	❑	❑	❑	❑	❑
9. Showering after class is something that I	❑	❑	❑	❑	❑
10. Learning about physical fitness and health is something that I	❑	❑	❑	❑	❑
11. Being with the PE teacher is something that I	❑	❑	❑	❑	❑
12. Getting some exercise is something that I	❑	❑	❑	❑	❑

Section 5:

Q1. About how often do you take part in sports and physical activities at school lunch-time and after school (exclude PE class)? Please tick (✓) ONE box only

4 or more days a week	❑ 1	2-3 days a week	❑ 3	One day a week	❑ 5		
2-3 days a month	❑ 2	One day a month	❑ 4	Less often	❑ 6	Never	❑ 7

Q2. During the past 12 months on how many school sports or dance teams did you play?

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑ 7 or more ❑

Q3. In your opinion, how adequate are the sports facilities (courts, fields, equipment) for the pupils in your school?

Please tick (✓) the box that best describes the sports facilities at your school

very adequate	❑ 1	Not at all adequate	❑ 3
Fairly adequate	❑ 2	Not sure/don't know	❑ 4

Section 6:

Q1. Are you currently participating in a club that is organised for a purpose of doing one particular sport or activity?

Exclude youth club which may sometimes offer a number of sports

NO ❑ 1 If **NO** go to question 8.

YES ❑ 2 If **YES** please list: (i) _____ (ii) _____ (iii) _____

Q2.What was <u>the most important</u> reason why you took up <u>EACH</u> sport/activity?
Please tick (✓) ONE box only

	(i)	(ii)	(iii)
Something to do	❑ 1	❑ 1	❑ 1
Because of my friends	❑ 2	❑ 2	❑ 2
Because of my father	❑ 3	❑ 3	❑ 3
Because of my mother	❑ 4	❑ 4	❑ 4
Because of elder brother/sister	❑ 5	❑ 5	❑ 5
To keep fit	❑ 6	❑ 6	❑ 6
Because of school	❑ 7	❑ 7	❑ 7
Seemed interesting	❑ 8	❑ 8	❑ 8
Seemed challenging	❑ 9	❑ 9	❑ 9
To practise skills	❑ 10	❑ 10	❑ 10
To learn new skills	❑ 11	❑ 11	❑ 11
I thought I would be good	❑ 12	❑ 12	❑ 12
Saw it on the TV/Video etc.	❑ 13	❑ 13	❑ 13
Don't know/can't remember	❑ 14	❑ 14	❑ 14
Other _____	❑ 15	❑ 15	❑ 15

Q3. At what age did you try sport or activity for the first time? Please tick (✓) ONE box only

4 or under ❑ 1 5-7 years ❑ 2 8-9 years ❑ 3 10-11 years ❑ 4 12 or Older ❑ 5

Q4a. What is your current involvement? Please tick (✓) all that apply

Active participant ❑ Administrator ❑ Coach ❑ Official (e.g. referee, judge) ❑

Q4b. If active participant, what is the highest standard that you achieved?
Please tick (✓) ONE box only

1. Basic (family recreation; play; school clubs open to all) ❑
2. Competitive (Competitive club level, selected school team) ❑
3. Elite (country; regional and nationally recognised standard) ❑

Q5. If active participant, what is the most important reason for continuing to participate?
Please tick (✓) ONE box only

Something to do ❑	Because of school ❑
Because of my friends ❑	Seemed interesting ❑
Because of my father ❑	Seemed challenging ❑
Because of my mother ❑	To practise skills ❑
Because of elder brother/sister ❑	To learn new skills ❑
To keep fit ❑	Other _____ ❑

Q6. Since the start of the school year have you represented your school in a competition or match against another school? Please tick (✓) ONE box only

NO ❑ YES ❑ Don't Know ❑

Q7. About how often do you take part in sports and physical activities in non-school sports clubs? Please tick (✓) ONE box only

4 or more days a week ❑	2-3 days a week ❑
One day a week ❑	2-3 days a month ❑
One day a month ❑	Less often ❑
Never ❑	

Q8. Thinking about sports and activities that might be offered by local clubs or organised by your school outside of class time. Why don't you take part in more of this type of activity?
Please tick (✓) any of the boxes that are a reason for you.

I don't like playing sports ❑
I haven't got enough spare time ❑
I'm not good enough at sport ❑
I've never been asked to take part ❑
Transport difficulties prevent me playing/exercising more ❑
No suitable sports/activities that I like ❑
I already do enough sports/exercise ❑
It's too expensive ❑
I don't know about local clubs ❑
No particular reason ❑

Section 7:

Q1. How common are detached single-family residences in your immediate neighbourhood?
None ❑ A few ❑ Some ❑ Most ❑ All ❑

Q2. How common are townhouses or row houses of 1-3+ stories in your immediate neighbourhood?
None ❑ A few ❑ Some ❑ Most ❑ All ❑

Q3. How common are apartments or flats 1-3+ stories in your immediate neighbourhood?
None ❑ A few ❑ Some ❑ Most ❑ All ❑

Neighbourhood/community Surroundings and Safety

Please tick the box that best applies to you and your neighbourhood.

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
Q4. There are trees along the streets in my neighbourhood	❑	❑	❑	❑
Q5. There are many interesting things to look at while walking in my neighbourhood	❑	❑	❑	❑
Q6. There are many attractive natural sights in my neighbourhood (such as landscapes, views)	❑	❑	❑	❑
Q7. There are attractive buildings / homes in my neighbourhood	❑	❑	❑	❑
Q8. There is so much traffic on nearby streets that it makes it difficult to walk in my neighbourhood	❑	❑	❑	❑
Q9. The speed of traffic on the street I live on is usually slow – about 30mph/50kmph or less	❑	❑	❑	❑
Q10. Most drivers exceed the speed limits while driving in my neighbourhood	❑	❑	❑	❑
Q11. My neighbourhood streets are well lit at night	❑	❑	❑	❑
Q12. Walkers and bikers on the streets in my neighbourhood can be easily seen by people in their homes	❑	❑	❑	❑
Q13. There are pedestrian crossings and signals to help walkers cross busy streets	❑	❑	❑	❑
Q14. There is a high crime rate in my neighbourhood	❑	❑	❑	❑
Q15. The crime rate in my neighbourhood makes it unsafe to go walking during the day	❑	❑	❑	❑
Q16. The crime rate in my neighbourhood makes it unsafe to go walking at night	❑	❑	❑	❑
Q17. The pedestrian crossings in my neighbourhood help walkers feel safe crossing busy streets	❑	❑	❑	❑

Places for Walking and cycling

Please tick the box that best applies to you and your neighbourhood.

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
Q18. There are pathways on most of the streets in my neighbourhood	❑ 1	❑ 2	❑ 3	❑ 4
Q19. The pathways in my neighbourhood are well maintained (paved, even and not a lot of cracks)	❑ 1	❑ 2	❑ 3	❑ 4
Q20. There are bicycle or pedestrian paths in or near my neighbourhood that are easy to get to	❑ 1	❑ 2	❑ 3	❑ 4
Q21. Pathways are separated from the road/traffic by parked cars	❑ 1	❑ 2	❑ 3	❑ 4
Q22. There is a grass/dirt strip that separates the streets from the pathways in my neighbourhood	❑ 1	❑ 2	❑ 3	❑ 4
Q23. It is safe to ride a bike in or near my neighbourhood	❑ 1	❑ 2	❑ 3	❑ 4

Streets in my neighbourhood

Q24. The streets in my neighbourhood do not have many cul-de-sacs (dead end streets)	❑ 1	❑ 2	❑ 3	❑ 4
Q25. The distance between crossroads in my neighbourhood is usually short (the length of a football field or less)	❑ 1	❑ 2	❑ 3	❑ 4
Q26. There are many alternative routes for getting from place to place in my neighbourhood (I don't have to go the same way every time)	❑ 1	❑ 2	❑ 3	❑ 4

Access to Services

Both local and within walking distance mean within a 10 – 15 minute walk from your home.

Q27. Shops are within easy walking distance of my home	❑ 1	❑ 2	❑ 3	❑ 4
Q28. Parking is difficult in local shopping areas	❑ 1	❑ 2	❑ 3	❑ 4
Q29. There are many places to go within easy walking distance of my home	❑ 1	❑ 2	❑ 3	❑ 4
Q30. It is easy to walk to a bus or train stop from my home	❑ 1	❑ 2	❑ 3	❑ 4
Q31. The streets in my neighbourhood are hilly, making my neighbourhood difficult to walk in	❑ 1	❑ 2	❑ 3	❑ 4
Q32. There are many valleys/hills in my neighbourhood that limit the number of routes for getting from place to place	❑ 1	❑ 2	❑ 3	❑ 4

Shops, facilities and other things in your neighbourhood

About how long would it take to get from your home to the nearest businesses or facilities listed below if you walked to them? Please put only one tick mark (✓) for each business or facility.

	1-5 min	6-10 min	11-20 min	21-30 min	30+ min	Don't know
Example: petrol station	☐ 5	☐ 4	☑ 3	☐ 2	☐ 1	☐ 1
Q33. Newsagents	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q34. Supermarket	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q35. Hardware shop	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q36. Fruit/vegetable market	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q37. Laundry/dry cleaners	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q38. Clothing shop	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q39. Post office	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q40. Library	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q41. Primary school	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q42. Other schools	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q43. Bookshop	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q44. Fast food restaurant	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q45. Coffee place	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q46. Bank/credit union	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q47. Non-fast food restaurant	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q48. Video shop	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q49. Pharmacy	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q50. Salon/Barber shop	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q51. Your school	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q52. Bus or train stop	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q53. Aerobic dance studio	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q54. Basketball court	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q55. Bike lane	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q56. Bowling alley	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q57. Golf course/Pitch & Putt	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q58. Health spa/gym	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q59. Public park	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q60. Community Centre	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q61. Handball/Squash court	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q62. Running track	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q63. Skating rink	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q64. Soccer or football field	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q65. Sporting goods store	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q66. Swimming pool	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q67. Tennis court	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q68. All weather pitch	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q69. Sea/beach	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1
Q70. Walking Trail	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 1

Section 8:

PHYSICAL ACTIVITY is any body movement. It includes

EXERCISE	e.g. Gym, aerobics, jogging, dance, etc.
SPORT	e.g. Hurling, football, athletics, swimming, etc.
GENERAL	e.g. P.E., brisk walking, washing the car, walking to school, etc

Q1. Please read through all statements listed below and tick either the NO or YES box for each section:

		NO	YES
1	I am currently **physically active**	❑ 1	❑ 2
2	I intend to become more **physically active** in the next 6 months	❑ 1	❑ 2

For activity to be **regular**, it must equal **60 mins** of moderate and/or vigorous physical activity on most or all days of the week

		NO	YES
3	I currently engage in **regular physical activity**	❑ 1	❑ 2
4	I have been **regularly physically active** for the past 6 months	❑ 1	❑ 2

Q2. Physical Activity Enjoyment Scale

When I am active...	(1) Disagree a lot				Agree a lot (5)
1. I enjoy it	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. I feel bored	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. I dislike it	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. I find it pleasurable	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. It's no fun at all	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
6. It gives me energy	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
7. It makes me depressed	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
8. It's very pleasant	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
9. My body feels good	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
10. I get something out of it	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
11. It's very exciting	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
12. It frustrates me	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
13. It's not at all interesting	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
14. It gives me a strong feeling of success	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
15. It feels good	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
16. I feel as though I would rather be doing something else	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

Q3. DURING A TYPICAL WEEK, how often: Please tick (✓) ONE box only

	None	Once	Sometimes	Almost every day	Every day
1. **Do you** encourage your friends **to do physical activities or play sports?**	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. Do your **friends encourage** you to do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. Do your **friends do physical activities** or play sports with you?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. **Do** other kids tease you **for not being** good at physical activity or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. **Do friends** tell you **that you are doing** well in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

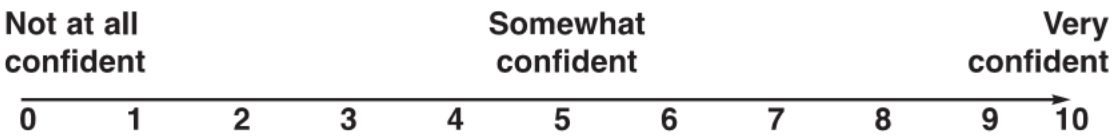
Q4. DURING A TYPICAL WEEK, how often has a member of your household:
(For example, your father, mother, guardian, brother, sister, grandparent, or other relative)
Please tick (✓) ONE box only

	None	Once	Sometimes	Almost every day	Every day
1. **Encouraged you** to do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. Done a physical activity or played sports **with you?**	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. **Provided transportation** to a place where you can do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. **Watched you** participate in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. **Told you** that you are doing well in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

Q5. DURING A TYPICAL WEEK, how often has a teacher in your school:
Please tick (✓) ONE box only

	None	Once	Sometimes	Almost every day	Every day
1. **Encouraged you** to do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. Done a physical activity or played sports **with you?**	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. **Provided transportation** to a place where you can do physical activities or play sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. **Watched you** participate in physical activities or sports (not including supervision)?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. **Told you** that you are doing well in physical activities or sports?	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

Q.6 Use the scale below (0-10) to indicate how confident you are that you could be physically active in each of the following situations:



I am confident I can participate in regular physical activity when…

1. I am tired ..... _____
2. I am in a bad mood ..... _____
3. I feel I don't have time ..... _____
4. I am on vacation ..... _____
5. It is raining or snowing ..... _____
6. I have homework to do ..... _____
7. My friends call me to go out ..... _____
8. I need to do house chores ..... _____
9. There is a good TV show on ..... _____
10. I am on my own ..... _____

Q.7 At present are you on a diet or doing something else to lose weight?

No, my weight is fine ..... 1 ❑
No, but I should lose some weight ..... 2 ❑
No, because I need to put on weight ..... 3 ❑
Yes ..... 4 ❑

Q.8 Do you think your body is…?

Much too thin ..... 1 ❑
A bit too thin ..... 2 ❑
About the right size ..... 3 ❑
A bit too fat ..... 4 ❑
Much too fat ..... 5 ❑

Q9. What keeps you from being more active?

Directions: Listed below are reasons that people give to describe why they do not get as much physical activity as they think they should. Please read each statement and indicate how likely you are to say each of the following statements:

How likely are you to say?	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely
1. My day is so busy now, I just don't think I can make the time to include physical activity in my regular schedule	❑ 1	❑ 2	❑ 3	❑ 4
2. None of my family members or friends like to do anything active, so I don't have a chance to be physically active	❑ 1	❑ 2	❑ 3	❑ 4
3. I'm just too tired after school/work to be active	❑ 1	❑ 2	❑ 3	❑ 4
4. I've been thinking about becoming more physically active, but I just can't seem to get started	❑ 1	❑ 2	❑ 3	❑ 4
5. Participating in physical activities can be risky	❑ 1	❑ 2	❑ 3	❑ 4
6. I don't get enough exercise because I have never learned the skills for any one sport	❑ 1	❑ 2	❑ 3	❑ 4
7. I don't have access to jogging trails, swimming pools, bike paths, etc.	❑ 1	❑ 2	❑ 3	❑ 4
8. Physical activity takes too much time away from other commitments - like work, family, etc.	❑ 1	❑ 2	❑ 3	❑ 4
9. I'm embarrassed about how I will look when I participate in physical activity with others	❑ 1	❑ 2	❑ 3	❑ 4
10. I don't get enough sleep as it is. I just couldn't get up early or stay up late to be physically active	❑ 1	❑ 2	❑ 3	❑ 4
11. It's easier for me to find excuses not to be physically active than to go out and do something	❑ 1	❑ 2	❑ 3	❑ 4
12. I know of too many people who have hurt themselves by overdoing it when they are physically active	❑ 1	❑ 2	❑ 3	❑ 4
13. I really can't see myself learning a new sport	❑ 1	❑ 2	❑ 3	❑ 4
14. It's just too expensive. You have to take a class or join a club or buy the right equipment	❑ 1	❑ 2	❑ 3	❑ 4
15. My free times during the day are too short to include physical activity	❑ 1	❑ 2	❑ 3	❑ 4
16. My usual social activities with family or friends do not include physical activity	❑ 1	❑ 2	❑ 3	❑ 4
17. I'm too tired during the week and I need the weekend to catch up on my rest	❑ 1	❑ 2	❑ 3	❑ 4
18. I want to be more physically active, but I just can't seem to make myself stick to anything	❑ 1	❑ 2	❑ 3	❑ 4
19. I'm afraid I might injure myself	❑ 1	❑ 2	❑ 3	❑ 4
20. I'm not good enough at any physical activity to make it fun	❑ 1	❑ 2	❑ 3	❑ 4
21. If we had exercise facilities and showers at school, then I would be more likely to be physically active	❑ 1	❑ 2	❑ 3	❑ 4

Q10. SWIMMING ABILITY please mark your swimming level below.
Please tick (✓) ONE box only

Non-Swimmer ☐ Beginner ☐ Intermediate ☐ Competitive ☐

If non-swimmer please go to section 9.

If swimmer please mark your swimming level at the following skills. Please tick (✓) ONE box only

	Beginner	Intermediate	Competitive	Unable to do this stroke
1. Treading water	☐	☐	☐	☐
2. Front crawl	☐	☐	☐	☐
3. Back stroke	☐	☐	☐	☐
4. Butterfly	☐	☐	☐	☐
5. Breast stroke	☐	☐	☐	☐

What is your favourite swimming stroke? _____

Section 9:

Q1. FATHER/GUARDIAN
a. Does your father have a job?

No ☐
Yes ☐
Don't know ☐
Don't have or see father ☐

b. If yes, say in what place he works:
(For example hospital, bank, restaurant…)

_____

c. Please write down exactly what job he does
(For example doctor, clerk, manager…)

_____

d. If no, why does your father not have a job?

He is sick, or retired or a student ☐
He is looking for a job ☐
He takes care of others, or is full time in the home ☐
I don't know ☐

2. MOTHER/GUARDIAN
a. Does your mother have a job?

No ☐
Yes ☐
Don't know ☐
Don't have or see mother ☐

b. If yes, say in what place she works:
(For example hospital, bank, restaurant…)

_____

c. Please write down exactly what job she does
(For example doctor, clerk, manager…)

_____

d. If no, why does your mother not have a job?

She is sick, or retired or a student ☐
She is looking for a job ☐
She takes care of others, or is full time in the home ☐
I don't know ☐

You're finished! Well done!
Thank you for your time and effort!

A.3 School Survey (CSPPA Plus 2014)

CSPPA Study
Follow-Up

School Survey

Thank you for taking part in our study in 2009 and again today. By answering these questions you will help us understand more about the lifestyle of young people like yourself.

- If you are unsure about how to answer any questions, please ask the facilitator to explain.
- There are no right or wrong answers, it is ***not a test***. If you are uncertain, please do the best you can.
- While many of the questions appear quite similar, there are subtle differences between them and you should treat each one as a separate question.

Your answers are strictly confidential so try to answer all questions as honestly as you can.

Thank you

If you would like to contact us, please email michelle.hardie2@mail.dcu.ie or call Michelle on 01-7007441

Please turn over

ASSENT FORM FOR YOUTH

Please tick one box only

1. I have given the informed consent form to my parents/guardian. No ☐ Yes ☐
2. My parents/guardian have talked to me about being part of the study. No ☐ Yes ☐
3. I am aware that this study will involve me completing a physical activity questionnaire and may involve my physical measurements being taken. No ☐ Yes ☐
4. I know that I am free to decide not to take part in this study or change my mind if I wish. No ☐ Yes ☐

SIGNED: _____ **DATE:**

Demographics

Please PRINT all information in CAPITALS

Q1. **First Name**_____ **Q2** **Surname**_____

Q3 **Gender** (Please tick (✓) one box): Male ☐ Female ☐

Q4 **Date of Birth**_____/_____/_____ (day/month/year)

Q5 **Home address**_____

Q6 **What is the name of your school?**_____

Q7 **Are you in?** 4th Year ☐ 5th Year ☐ 6th Year ☐

Q8 **In general would you say your health is?** Please tick (✓) one box.

Poor ☐ Fair ☐ Good ☐ Very Good ☐ Excellent ☐

Q9 **Do you have a physical disability or a learning disability, which prevents you from participating in physical activities or sport?**

No ☐ Yes ☐

If **YES**, please specify or describe_____

Q10 **Sometime in the future we may want to:**

a) Contact you to follow up on this research. Would that be ok? No ☐ Yes ☐
If **YES**, please provide a telephone number _____
And / or an email address _____

b) Contact your school to obtain your exam results. Would that be ok? No ☐ Yes ☐

This information will be treated with the strictest confidence; it will be anonymous, that means your name will not be associated with it in any way.

Office use only: ☐

SECTION 1:

Physical activity is any body movement.

It can be done at different levels of effort:

- **Vigorous Effort** makes your heart rate much faster and you have to breathe deeper and faster than normal. You will probably sweat.
  E.g. playing football, squash, heavy lifting, digging or fast bicycling.
- **Moderate Effort** makes your heart rate and breathing rate faster than normal. You may also sweat a little. E.g. brisk walking, jogging or vacuuming.
- Physical activity includes:
  Exercise Weight training, aerobics, jogging, dancing, etc.
  Sports Hurling, football, athletics, swimming, etc.
  General Brisk walking, washing the car, walking or cycling to school, etc.

Please try to think carefully and be as accurate as possible with your answers. For these next two questions, add up all the time you spend in physical activity each day.
Only include activities of either moderate or vigorous effort.

Q1 **During the last 7 days, on how many days were you physically active for a total of at least 60 minutes per day?** Please circle one number.

0days 1 2 3 4 5 6 7 days

Q2 **Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?** Please circle one number.

0days 1 2 3 4 5 6 7 days

Now think about **only** those physical activities that you did for **at least 10 minutes** at a time.

Q3a **During the last 7 days, on how many days did you do vigorous physical activities?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3b **How much time in total did you usually spend on one of those days doing vigorous physical activities?**

____hours___minutes

Q4a **During the last 7 days, on how many days did you do moderate physical activities?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q4b **How much time in total did you usually spend on one of those days doing moderate physical activities?**

_____hours____minutes

Office use only: ☐

Q5a **During the last 7 days, on how many days did you do exercises that may strengthen your muscles, such as push-ups, sit-ups, weight lifting or heavy yard work?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q5b **How much time did you usually spend on one of those days doing exercises that may strengthen your muscles?**

____hours___minutes

Q6a **Looking back on all your answers (Q1 - Q5), was the amount of physical activity you did in the last 7 days typical of the amount that you would normally do?**

Yes ☐ 1
No, I usually do more ☐ 2
No, I usually do less ☐ 3

Q6b. If **NO,** why was this week unusual? _____

SECTION 2:

Now think about travelling to and from school, to a friend's house, the shop or going from place to place.

Q1a **During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q1b **How much time did you usually spend on one of those days walking from place to place?**

____hours___minutes

Q2a **How do you usually travel TO school?**
Please tick one box – for the longest distance of your journey.

By Foot ☐ 1 Bicycle ☐ 2 Car ☐ 3 Bus ☐ 4 Train, LUAS or DART ☐ 5 Motorcycle or Scooter ☐ 6

Q2b **How long does this journey usually take?** ____hours_____minutes

Q2c **How do you usually travel home FROM school?**
Please tick one box – for the longest distance of your journey.

By Foot ☐ 1 Bicycle ☐ 2 Car ☐ 3 Bus ☐ 4 Train, LUAS or DART ☐ 5 Motorcycle or Scooter ☐ 6

Q2d **How long does this journey usually take?** ____hours_____minutes

Q2e **If you travel by car, bus, train or motorcycle, give reasons why you choose not to walk or cycle.** _____

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure.

Think about the time you spent **walking for recreation** (not walking to go from place to place).

Q3a **During the last 7 days, on how many days did you walk for recreation for at least 10 minutes in your leisure (*or free*) time?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3b **How much time did you usually spend on one of those days walking for recreation?**

_____hours____minutes

Q3c **Which of the following best describes your usual walking pace?** Please tick (✓) one box.

A slow pace	A steady average pace	A fairly brisk pace	A fast pace (at least 4mph)
1 ☐	2 ☐	3 ☐	4 ☐

Q4a **During the last 7 days, on how many days did you run or jog for recreation for at least 10 minutes at a time?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q4b **How much time did you usually spend on one of those days running or jogging for recreation?** _____hours_____minutes

Q5a **During the last 7 days, on how many days did you attend a leisure centre or a fitness club?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q5b Please consider activities you may have done in fitness classes and include time spent in these classes in the following questions. **How much time did you usually spend on one of those days on:**

1) **Cardiovascular training** (e.g. treadmill, crosstrainer, bicycle)
_____hours____minutes

2) **Weight or strength training** (e.g. free weights or weight machines)
_____hours____minutes

You are making great progress.

Please continue as your responses are really important to us.

SECTION 3:

Q1a **How many times per week do you have** (please circle one number for each class type)**:**

A Single PE class?	0 times	1	2	3	4	5 times
A Double PE class?	0 times	1	2	3	4	5 times
A Triple PE class?	0 times	1	2	3	4	5 times

Q1b **On average, how long is a single PE class?** _____hours and _____minutes

Q2 **About how often do you take part in sports and physical activities at school lunch-time and after school (exclude PE class)?** Please tick (✓) one box.

4 or more days a week ☐ 1 | 2-3 days a week ☐ 2 | One day a week ☐ 3
2-3 days a month ☐ 4 | One day a month ☐ 5 | Less often ☐ 6 | Never ☐ 7

Q3 **During the last 12 months, on how many school sports or dance teams did you play?** Please circle one number.

0 1 2 3 4 5 6 7 or more

SECTION 4:

Q1 **Are you currently participating in a club that is organised for a purpose of doing one particular sport or activity?**

No ☐ 1 If **No**, please go to Q4a

Yes ☐ 2 If **Yes**, please list **(1)**_____
(2)_____
(3)_____

Q2 **About how often do you take part in sports and physical activities in non-school sports clubs?** Please tick (✓) one box.

4 or more days a week ☐ 1 | 2-3 days a week ☐ 2 | One day a week ☐ 3
2-3 days a month ☐ 4 | One day a month ☐ 5 | Less often ☐ 6 | Never ☐ 7

Q3a **For your primary or main sport, what is your current involvement?**
Tick (✓) all that apply.

Active participant ☐ 1 | Administrator ☐ 2 | Coach ☐ 3 | Official (e.g. referee, judge) ☐ 4

Q3b **If active participant, what is the highest standard that you achieved?**
Please tick (✓) one box.

1. Basic (family recreation, play, school clubs open to all) ..... ☐ 1
2. Competitive (competitive club level, selected school team) ..... ☐ 2
3. Elite (country, regional and nationally recognised standard) ..... ☐ 3

Q3c **If active participant, what is the most important reason for continuing to participate?** Please tick (✓) one box.

Something to do	1 ☐	Because of school	7 ☐
Because of my friends	2 ☐	Seemed interesting	8 ☐
Because of my father / male guardian	3 ☐	Seemed challenging	9 ☐
Because of my mother/female guardian	4 ☐	To practice skills	10 ☐
Because of my elder brother/sister	5 ☐	To learn new skills	11 ☐
To keep fit	6 ☐	Other (specify)_____	12 ☐

Q4a **During the last 5 years (since you were in 1st year), have you <u>taken up</u> any new physical activities?**

No 1 ☐ If **No**, please go to Q5a

Yes 2 ☐

Q4b

If **YES**, please list the physical activities	**What were your main reasons for taking up the activity?**	**Are you still involved?**	
		NO	**YES**
(1)_____		1 ☐	2 ☐
(2)_____		1 ☐	2 ☐
(3)_____		1 ☐	2 ☐

Q5a **During the last 5 years (since you were in 1st year), have you have <u>dropped out</u> of any sport or stopped participating in an activity?**

No 1 ☐ If **NO**, please go to Section 5

Yes 2 ☐ If **Yes**, please list **(1)**_____
(2)_____
(3)_____

Q5b If **YES**, please select from the list what the **three most important reasons for no longer being involved** were? Please place a **1** beside the most important reason, a **2** beside the 2nd most important reason and a **3** beside the third most important reason.

Injury	1 ☐	Coaches were unfriendly	11 ☐
Lack of interest	2 ☐	Other players my age were unfriendly	12 ☐
Other commitments (school)	3 ☐	Older players were unfriendly	13 ☐
Other commitments (part time job, boy or girl friend)	4 ☐	Started another sport	14 ☐
Not good enough	5 ☐	My friends had stopped	15 ☐
No encouragement from family	6 ☐	Training was boring	16 ☐
Not big / strong enough	7 ☐	Mainly for boys / girls	17 ☐
Too expensive	8 ☐	Wasn't allowed	18 ☐
Lack of resources	9 ☐	Not played at school	19 ☐
Took up too much time	10 ☐	Other _____	20 ☐

SECTION 5:

Q1 Please tick any sport/activity that you might:
(1) Have done at school in your **timetabled P.E.** or games classes.
(2) Play at your school at **lunch time** or **after school** with the help of a teacher (or school coach).
(3) Play with sports or activity **clubs** (outside of school).

Tick (✓) all that apply	In School		In a Club
In the last 12 months I have...	**(1) P.E. or Games Classes** Participated in	**(2) Lunch time or after school** Played with help of a teacher **once a week**	**(3) (Not School Club)** Played in club **once a week**
1. Adventure activities	☐	☐	☐
2. Aerobics	☐	☐	☐
3. Athletics	☐	☐	☐
4. Badminton	☐	☐	☐
5. Baseball or Rounders	☐	☐	☐
6. Basketball	☐	☐	☐
7. Camogie or Hurling	☐	☐	☐
8. Cross country running	☐	☐	☐
9. Cycling	☐	☐	☐
10. Dance	☐	☐	☐
11. Gaelic Football	☐	☐	☐
12. Golf	☐	☐	☐
13. Gymnastics	☐	☐	☐
14. Handball	☐	☐	☐
15. Hockey	☐	☐	☐
16. Horse riding	☐	☐	☐
17. Martial Arts	☐	☐	☐
18. Rugby	☐	☐	☐
19. Soccer	☐	☐	☐
20. Squash	☐	☐	☐
21. Swimming	☐	☐	☐
22. Tennis	☐	☐	☐
23. Weight training	☐	☐	☐
24. Any other sport (specify)_____ _____	☐	☐	☐
	☐	☐	☐
Not participated in:	☐	☐	☐

SECTION 6:

Q1 **Which of these statements best expresses your view?** Please tick (✓) one box.

a. I take enough physical activity to keep healthy..... ☐ 1

b. I ought to take more physical activity to keep healthy ..... ☐ 2

c. Don't know ..... ☐ 3

Q2 **How would you rate your level of physical activity compared to other people the same age and sex as yourself?** Please tick (✓) one box.

Much less than others	Somewhat less than others	About the same	Somewhat more than others	Much more than others
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q3 **What is your height without shoes?** _____Feet_____ Inches (or_____cm)

Q4 **What is your weight?** _____Stone_____Pounds (or_____kg)

Q5 Think about any sports / nutritional supplements you may take.

For each supplement listed, answer:
(1) Did you take this **supplement**? Tick NO or YES.
(2) **How often** do you usually take the supplement?
(3) What is your **main reason** for taking the supplement?

	(1) **Do you take?** NO	YES	(2) **How often do you usually take?** E.g. 3 times per week	(3) **Main reason for taking supplement** E.g. increase energy, improve health, build muscle
1. Sports Drinks	☐ 1	☐ 2		
2. Protein Shakes	☐ 1	☐ 2		
3. Creatine	☐ 1	☐ 2		
4. Multivitamin	☐ 1	☐ 2		
5. Diet Pills	☐ 1	☐ 2		
6. Other (specify)_____	☐ 1	☐ 2		

SECTION 7:

SEDENTARY HABITS are things that don't use a lot of physical energy. E.g. watching TV, sitting talking on the phone or listening to music, or playing games on the computer or general sitting activities.

Q1 **I enjoy doing sitting activities like watching TV or playing computer/video games.** Please tick (✓) one box.

Dislike a lot				Enjoy a lot
1	2	3	4	5
☐	☐	☐	☐	☐

Q2 **What do you usually do when you have a choice about how to spend your recreational (*or free*) time?** Please tick (✓) one box.

Almost always choose activities like TV, reading, listening to music, or computers..... 1 ☐

Usually choose activities like TV, reading listening to music or computers..... 2 ☐

Just as likely choose active or inactive recreation ..... 3 ☐

Usually choose activities like bicycling, dancing, outdoor games or active sports..... 4 ☐

Almost always choose activities like bicycling, dancing, outdoor games or active sports..... 5 ☐

Q3 **In the last 7 days, about how many hours per day did you spend sleeping?** Please tick (✓) one box.

	3 or less hours	4 hours	5 hours	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 or more hours
Weekdays	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Weekends	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q4 **During the past week, how would you rate your <u>sleep quality</u> overall (how well you sleep)?** Please tick (✓) one box.

Very Bad 1 ☐ Fairly Bad 2 ☐ Fairly Good 3 ☐ Very Good 4 ☐

This section is about **sitting activities** during the **last 7 days**. There are no right or wrong answers. No one does all these activities. Please be as accurate and honest as possible.

Q5 For each activity listed, answer:
(1) Did you do this **activity**? Tick NO or YES.
(2) On **how many days** did you do the activity?
(3) **How much time** did you usually spend on one of those days doing the activity?

In the last 7 days...	(1) Have you done this activity on **Weekdays?** (Mon – Fri) **NO**	**YES**	(2) **Number of Weekdays** (max 5)	(3) **Minutes** per **weekday**	(1) Have you done this activity at the **Weekend?** (Sat + Sun) **NO**	**YES**	(2) **Number of weekend days** (max 2)	(3) **Minutes** per **weekend** day
Computer/internet (not games)	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting playing video games E.g. Xbox, Playstation	☐	☐	____days	___mins	☐	☐	___days	___mins
Playing games on a portable device E.g. mobile phone, iPad, DS, Gameboy	☐	☐	____days	___mins	☐	☐	___days	___mins
Homework, studying	☐	☐	____days	___mins	☐	☐	___days	___mins
Reading (not for school)	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting during school breaks	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting around and talking with friends (not on the phone), **listening to music**	☐	☐	____days	___mins	☐	☐	___days	___mins
Talking on the phone	☐	☐	____days	___mins	☐	☐	___days	___mins
Television or DVD watching	☐	☐	____days	___mins	☐	☐	___days	___mins
Practicing a musical instrument (not drums)	☐	☐	____days	___mins	☐	☐	___days	___mins
Other (specify)_____ _____	☐	☐	____days	___mins	☐	☐	___days	___mins

Great effort, keep it going!

SECTION 8:

Q1 **All things considered, how happy are you right now?** Please tick (✓) one box.

Not happy at all	Not very happy	Neither happy nor unhappy	Somewhat happy	Very happy
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

Q2 Use the scale below (0-10) to indicate how confident you are that you could be physically active in each of the following situations:

Please tick (✓) one box only for each question.

I am confident I can participate in regular physical activity when...	**Not at all confident** → **Somewhat confident** → **Very confident**										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. I am tired	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. I am in a bad mood	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. I feel I don't have time	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. I am on holidays	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. It is raining or snowing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. I have homework to do	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. My friends call me to go out	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. I need to do house chores	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. There is a good TV show on	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. I am on my own	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q3 **At present are you on a diet or doing something else to lose weight?**
Please tick (✓) one box.

No, my weight is fine ..... 1 ☐
No, but I should lose some weight ..... 2 ☐
No, because I need to put on weight ..... 3 ☐
Yes ..... 4 ☐

Q4 **Do you think your body is...?** Please tick (✓) one box.

Much too thin ..... 1 ☐
A bit too thin ..... 2 ☐
About the right size ..... 3 ☐
A bit too fat ..... 4 ☐
Much too fat ..... 5 ☐

Q5

If I was to be physically active during my free time on most days... Please tick (✓) one box for each question.	**Disagree a lot**	**Disagree a little**	**Neither disagree or agree**	**Agree a little**	**Agree a lot**
It would help me spend more time with my friends	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would help get me in shape	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would help me control my weight	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would put me in a better mood	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would make me better in sports, dance and other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would be fun	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would make me look better	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I would make new friends	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I would feel good	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would give me a sense of personal accomplishment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would help me to be physically fit	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It would help me maintain physical health and well being	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

SECTION 9:

Q1 DURING A TYPICAL WEEK, how often: Please tick (✓) one box for each question.	**None**	**Once**	**Sometimes**	**Almost Everyday**	**Everyday**
A. Do you **encourage your friends** to do **physical activities or play sports**?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
B. Do your **friends encourage you** to do **physical activities or play sports?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
C. Do your **friends do physical activities** or play sports with you?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
D. Do **other kids tease you** for not being good at physical activity or sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
E. Do friends **tell you** that you are doing well in physical activities or sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
F. Do your **friends encourage you** to spend **less time** being **sedentary?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
G. Do **your friends do sedentary habits** like watch TV or play computer/video games **with you**?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q2 How many of your five closest friends:	**0**	**1**	**2**	**3**	**4**	**5**
A. Spend **at least 30 minutes** per day being **physically active**?	☐	☐	☐	☐	☐	☐
B. Spend **more than 2 hours** a day on **sedentary habits**?	☐	☐	☐	☐	☐	☐

Q3 DURING A TYPICAL WEEK, how often has a <u>member of your household</u>:
(For example, your father, mother, guardian, brother, sister, grandparent, or other relative).
Please tick (✓) one box for each question.

	None	**Once**	**Sometimes**	**Almost Everyday**	**Everyday**
A. **Encouraged you** to do physical activities or play sports?	1☐	2☐	3☐	4☐	5☐
B. Done a physical activity or played sports **with you?**	1☐	2☐	3☐	4☐	5☐
C. **Provided transportation** to a place where you can do physical activities or play sports?	1☐	2☐	3☐	4☐	5☐
D. **Watched you** participate in physical activities or sports?	1☐	2☐	3☐	4☐	5☐
E. **Told you** that you are doing well in physical activities or sports?	1☐	2☐	3☐	4☐	5☐
F. **Encouraged you** to spend **less time** being **sedentary?**	1☐	2☐	3☐	4☐	5☐
G. **Discussed** with you how **sedentary habits** can be unhealthy?	1☐	2☐	3☐	4☐	5☐
H. **Helped you** think of ways to **reduce** the time you spend on **sedentary habits?**	1☐	2☐	3☐	4☐	5☐
I. **Told you** that you are doing a good job reducing your sedentary habits?	1☐	2☐	3☐	4☐	5☐

Q4 DURING A TYPICAL WEEK, how often has a <u>teacher</u> in your school:
Please tick (✓) one box for each question.

	None	**Once**	**Sometimes**	**Almost Everyday**	**Everyday**
A. **Encouraged you** to do physical activities or play sports?	1☐	2☐	3☐	4☐	5☐
B. Done a physical activity or played sports **with you?**	1☐	2☐	3☐	4☐	5☐
C. **Provided transportation** to a place where you can do physical activities or play sports?	1☐	2☐	3☐	4☐	5☐
D. **Watched you** participate in physical activities or sports (not including supervision)?	1☐	2☐	3☐	4☐	5☐
E. **Told you** that you are doing well in physical activities or sports?	1☐	2☐	3☐	4☐	5☐
F. **Encouraged you** to spend **less time** being **sedentary?**	1☐	2☐	3☐	4☐	5☐
G. **Discussed** with you how **sedentary habits** can be unhealthy?	1☐	2☐	3☐	4☐	5☐
H. **Helped you** think of ways to **reduce** the time you spend on **sedentary habits?**	1☐	2☐	3☐	4☐	5☐
I. **Told you** that you are doing a good job reducing your sedentary habits?	1☐	2☐	3☐	4☐	5☐

Q5 Think about how it feels when you are doing physical activities.

Please tick (✓) one box for each question.

When I am active...	Disagree a lot 1	2	3	4	Agree a lot 5
1. I enjoy it	☐	☐	☐	☐	☐
2. I feel bored	☐	☐	☐	☐	☐
3. I dislike it	☐	☐	☐	☐	☐
4. I find it pleasurable	☐	☐	☐	☐	☐
5. It's no fun at all	☐	☐	☐	☐	☐
6. It gives me energy	☐	☐	☐	☐	☐
7. It makes me depressed	☐	☐	☐	☐	☐
8. It's very pleasant	☐	☐	☐	☐	☐
9. My body feels good	☐	☐	☐	☐	☐
10. I get something out of it	☐	☐	☐	☐	☐
11. It's very exciting	☐	☐	☐	☐	☐
12. It frustrates me	☐	☐	☐	☐	☐
13. It's not at all interesting	☐	☐	☐	☐	☐
14. It gives me a strong feeling of success	☐	☐	☐	☐	☐
15. It feels good	☐	☐	☐	☐	☐
16. I feel as though I would rather be doing something else	☐	☐	☐	☐	☐

Nearly there, just two pages left…

Q6 What keeps you from being more active?

Directions: Listed below are reasons that people give to describe why they do not get as much physical activity as they think they should. Please read each statement and indicate how likely you are to say each of the following statements:

How likely are you to say?	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely
1. My day is so busy now, I just don't think I can make the time to include physical activity in my regular schedule.	☐ 1	☐ 2	☐ 3	☐ 4
2. None of my family members or friends like to do anything active, so I don't have a chance to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4
3. I'm just too tired after school/work to be active.	☐ 1	☐ 2	☐ 3	☐ 4
4. I've been thinking about becoming more physically active, but I just can't seem to get started.	☐ 1	☐ 2	☐ 3	☐ 4
5. Participating in physical activities can be risky.	☐ 1	☐ 2	☐ 3	☐ 4
6. I don't get enough exercise because I have never learned the skills for any one sport.	☐ 1	☐ 2	☐ 3	☐ 4
7. I don't have access to jogging trails, swimming pools, bike paths, etc.	☐ 1	☐ 2	☐ 3	☐ 4
8. Physical activity takes too much time away from other commitments – like work, family, etc.	☐ 1	☐ 2	☐ 3	☐ 4
9. I'm embarrassed about how I will look when I participate in physical activity with others.	☐ 1	☐ 2	☐ 3	☐ 4
10. I don't get enough sleep as it is. I just couldn't get up early or stay up late to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4
11. It's easier for me to find excuses not to be physically active than to go out and do something.	☐ 1	☐ 2	☐ 3	☐ 4
12. I know of too many people who have hurt themselves by overdoing it when they are physically active.	☐ 1	☐ 2	☐ 3	☐ 4
13. I really can't see myself learning a new sport.	☐ 1	☐ 2	☐ 3	☐ 4
14. It's just too expensive. You have to take a class or join a club or buy the right equipment.	☐ 1	☐ 2	☐ 3	☐ 4
15. My free times during the day are too short to include physical activity.	☐ 1	☐ 2	☐ 3	☐ 4
16. My usual social activities with family or friends do not include physical activities.	☐ 1	☐ 2	☐ 3	☐ 4
17. I'm too tired during the week and I need the weekend to catch up on my rest.	☐ 1	☐ 2	☐ 3	☐ 4
18. I want to be more physically active, but I just can't seem to make myself stick to anything.	☐ 1	☐ 2	☐ 3	☐ 4
19. I'm afraid I might injure myself.	☐ 1	☐ 2	☐ 3	☐ 4
20. I'm not good enough at any physical activity to make it fun.	☐ 1	☐ 2	☐ 3	☐ 4
21. If we had exercise facilities and showers at school, then I would be more likely to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4

SECTION 10:

Q1 **Area of Residence: This question refers to the area of residence you live in MOST or ALL days of the week. Would you describe the place that you live in as?** Please tick (✓) one box.

A big city (more than 70,000 inhabitants) ..... ☐ 1

Suburbs, large town or outskirts of city (less than 70,000 inhabitants) ☐ 2

Town (less than 20,000 inhabitants) ..... ☐ 3

Village / Rural area (less than 3,000 inhabitants) ..... ☐ 4

Q2 For the purpose of this survey your **neighbourhood** is defined as the area within **approx 1 kilometer / half a mile** of your home, or about a **10 minute walk**. Please tick (✓) one box only for each question.

In my neighbourhood.....	**Strongly Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Strongly Agree**
1. The pathways are well maintained (paved, even and not a lot of cracks).	☐ 1	☐ 2	☐ 3	☐ 4
2. There are many places to go within easy walking distance of my home.	☐ 1	☐ 2	☐ 3	☐ 4
3. The crime rate in my neighbourhood makes it unsafe to go walking during the day.	☐ 1	☐ 2	☐ 3	☐ 4
4. The crime rate in my neighbourhood makes it unsafe to go walking at night.	☐ 1	☐ 2	☐ 3	☐ 4
5. While walking, there are places that I avoid.	☐ 1	☐ 2	☐ 3	☐ 4
6. The speed of traffic on the street I live on is usually slow – about 30mph/50kmph or less.	☐ 1	☐ 2	☐ 3	☐ 4
7. There are badly maintained, unoccupied or unattractive buildings or houses.	☐ 1	☐ 2	☐ 3	☐ 4
8. There are large car parks in front of shops and businesses.	☐ 1	☐ 2	☐ 3	☐ 4

Q3 **Overall, how would you rate your neighbourhood as a place to walk? Walkable means pedestrian friendly.** Please tick (✓) one box.

Not at all walkable	Not very walkable	Neither walkable nor unwalkable	Somewhat walkable	Very walkable
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

THE QUESTIONNAIRE IS NOW COMPLETE,
THANK YOU VERY MUCH FOR YOUR TIME.

DCU

A.4 Adolescent Survey (CSPPA Plus 2014)

CSPPA STUDY

follow-up

Adolescent Survey

DCU

Thank you for taking part in our study in 2009 and again today.

By answering these questions you will help us understand more about the lifestyle of young people like yourself.

- There are no right or wrong answers, it is **not a test**. If you are uncertain, please do the best you can.
- While many of the questions appear quite similar, there are subtle differences between them and you should treat each one as a separate question.
- Time to complete: 20 minutes.
- All completed surveys received before May 9th will be entered into a **prize draw for €100**. Draw to take place on May 12th.

Your answers are strictly confidential so try to answer all questions as honestly as you can. Thank you.

SurveyMonkey

You can complete this survey:

Online at
http://www.surveymonkey.com/s/CSPPAAdolescentSurvey
OR
At your leisure you can post it back using the envelope provided. The postage has already been paid.

If you would like to contact us, please email michelle.hardie2@mail.dcu.ie or call Michelle on 01-7007441

ASSENT FORM FOR YOUTH

Please tick (✓) one box for each question.

1. I have given the informed consent form to my parents/guardian. No ☐ Yes ☐
2. My parents/guardian have talked to me about being part of the study. No ☐ Yes ☐
3. I am aware that this study will involve me completing a physical activity questionnaire. No ☐ Yes ☐
4. I know that I am free to decide not to take part in this study or change my mind if I wish. No ☐ Yes ☐

SIGNED: _____ **DATE:** _____

Please PRINT all information in CAPITALS

Q1 **Gender** (Please tick (✓) one box): Male ☐ Female ☐

Q2 **Date of Birth**_____/_____/_____ (day/month/year)

Q3 **Occupation:** Please tick (✓) one box.

Student (full time).....	☐	Looking after the home / family ...	☐
Apprentice	☐	Unemployed	☐
Working for payment or profit	☐	Unable to work due to permanent sickness or disability	☐
Looking for first regular job	☐	Other, (write in)_____	☐

Q4 **What is the highest level of education/training (full time or part time) which you have completed?** Please tick (✓) one box.

- ☐ **Primary Education**
- ☐ **Secondary Education** (Leaving Cert. including Applied or Vocational programmes)
- ☐ **Further Education** (FETAC Level 4 or higher, HETAC Cert.)
- ☐ **Completed Apprenticeship** (FETAC Advanced Cert., Teagasc Cert, or equivalent)
- ☐ **Third Level Education** (Degree or National Diploma)

Q5 **Do you have a physical disability or a learning disability, which prevents you from participating in physical activities or sport?**

No ☐ Yes ☐

If **YES**, please specify or describe_____

Q6 **Sometime in the future we may want to:**

a) Contact you to follow up on this research. Would that be ok? No ☐ Yes ☐
If **YES**, please provide a telephone number _____
And / or an email address _____

b) Contact your school to obtain your exam results. Would that be ok? No ☐ Yes ☐

This information will be treated with the strictest confidence; it will be anonymous, that means your name will not be associated with it in any way.

2

Office use only: ☐

SECTION 1

Physical activity is any body movement.

It can be done at different levels of effort:

- **Vigorous Effort** makes your heart rate much faster and you have to breathe deeper and faster than normal. You will probably sweat.
  E.g. playing football, squash, heavy lifting, digging or fast bicycling.

- **Moderate Effort** makes your heart rate and breathing rate faster than normal. You may also sweat a little. E.g. brisk walking, jogging or vacuuming.

- Physical activity includes:
  Exercise Weight training, aerobics, jogging, dancing, etc.
  Sports Hurling, football, athletics, swimming, etc.
  General Brisk walking, washing the car, walking or cycling to school, etc.

Please try to think carefully and be as accurate as possible with your answers. For these next two questions, add up all the time you spend in physical activity each day.
Only include activities of either moderate or vigorous effort.

Q1 **During the last 7 days, on how many days were you physically active for a total of at least 60 minutes per day?** Please circle one number.

0days 1 2 3 4 5 6 7 days

Q2 **Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?** Please circle one number.

0days 1 2 3 4 5 6 7 days

Now think about **only** those physical activities that you did for **at least 10 minutes** at a time.

Q3a **During the last 7 days, on how many days did you do vigorous physical activities?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3b **How much time in total did you usually spend on one of those days doing vigorous physical activities?**

____hours___minutes

Q4a **During the last 7 days, on how many days did you do moderate physical activities?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q4b **How much time in total did you usually spend on one of those days doing moderate physical activities?**

_____hours____minutes

Office use only: ☐

Q5a **During the last 7 days, on how many days did you do exercises that may strengthen your muscles, such as push-ups, sit-ups, weight lifting or heavy yard work?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q5b **How much time did you usually spend on one of those days doing exercises that may strengthen your muscles?**

____hours___minutes

Q6a **Looking back on all your answers (Q1 - Q5), was the amount of physical activity you did in the last 7 days typical of the amount that you would normally do?**

Yes ☐ 1
No, I usually do more ☐ 2
No, I usually do less ☐ 3

Q6b. If **NO,** why was this week unusual? _____

SECTION 2

Now think about travelling to and from school / college / work, to a friend's house, the shop or going from place to place.

Q1a **During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q1b **How much time did you usually spend on one of those days walking from place to place?**

____hours___minutes

Q2a **How do you usually travel TO school / college / work?**
Please tick one box – for the longest distance of your journey.

By Foot ☐ 1 Bicycle ☐ 2 Car ☐ 3 Bus ☐ 4 Train, LUAS or DART ☐ 5 Motorcycle or Scooter ☐ 6

Q2b **How long does this journey usually take?** ____hours_____minutes

Q2c **How do you usually travel home FROM school / college / work?**
Please tick one box – for the longest distance of your journey.

By Foot ☐ 1 Bicycle ☐ 2 Car ☐ 3 Bus ☐ 4 Train, LUAS or DART ☐ 5 Motorcycle or Scooter ☐ 6

Q2d **How long does this journey usually take?** ____hours_____minutes

Q2e **If you travel by car, bus, train or motorcycle, give reasons why you choose not to walk or cycle.** _____

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure.

Think about the time you spent **walking for recreation** (not walking to go from place to place).

Q3a **During the last 7 days, on how many days did you walk for recreation for at least 10 minutes in your leisure (*or free*) time?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3b **How much time did you usually spend on one of those days walking for recreation?**

_____hours____minutes

Q3c **Which of the following best describes your usual walking pace?** Please tick (✓) one box.

A slow pace	A steady average pace	A fairly brisk pace	A fast pace (at least 4mph)
1 ☐	2 ☐	3 ☐	4 ☐

Q4a **During the last 7 days, on how many days did you run or jog for recreation for at least 10 minutes at a time?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q4b **How much time did you usually spend on one of those days running or jogging for recreation?** _____hours_____minutes

SECTION 3

Q1 **Have you finished or ceased your full time education?** Please tick (✓) one box.

No 1 ☐

Yes 2 ☐ If **YES**, please go to Section 4, page 6.

Q2 **Are you in?** Secondary School 1 ☐ Further Education 2 ☐

Q3 **What is the name of your school / place of study?**_____

Q4a **How many times per week do you have** (please circle one number for each class type)**:**

A Single PE class?	0 times	1	2	3	4	5 times
A Double PE class?	0 times	1	2	3	4	5 times
A Triple PE class?	0 times	1	2	3	4	5 times

Q4b **On average, how long is a single PE class?** _____hours and _____minutes

Q5 **About how often do you take part in sports and physical activities at school lunch-time and after school (exclude PE class)?** Please tick (✓) one box.

4 or more days a week 1 ☐ 2-3 days a week 2 ☐ One day a week 3 ☐

2-3 days a month 4 ☐ One day a month 5 ☐ Less often 6 ☐ Never 7 ☐

SECTION 4

Q1 **Note:** if you are **not in school**, please tick '**not participated in**' in the last row for (1) and (2).

Please tick any sport/activity that you might:
(1) Have done at school in your **timetabled P.E.** or games classes.
(2) Play at your school at **lunch time** or **after school** with the help of a teacher (or school coach).
(3) Play with sports or activity **clubs** (outside of school).

Tick (✓) all that apply.	In School		In a Club
In the last 12 months I have...	**(1) P.E. or Games Classes** Participated in	**(2) Lunch time or after school** Played with help of a teacher **once a week**	**(3) (Not School Club)** Played in club **once a week**
1. Adventure activities	☐	☐	☐
2. Aerobics	☐	☐	☐
3. Athletics	☐	☐	☐
4. Badminton	☐	☐	☐
5. Baseball or Rounders	☐	☐	☐
6. Basketball	☐	☐	☐
7. Camogie or Hurling	☐	☐	☐
8. Cross country running	☐	☐	☐
9. Cycling	☐	☐	☐
10. Dance	☐	☐	☐
11. Gaelic Football	☐	☐	☐
12. Golf	☐	☐	☐
13. Gymnastics	☐	☐	☐
14. Handball	☐	☐	☐
15. Hockey	☐	☐	☐
16. Horse riding	☐	☐	☐
17. Martial Arts	☐	☐	☐
18. Rugby	☐	☐	☐
19. Soccer	☐	☐	☐
20. Squash	☐	☐	☐
21. Swimming	☐	☐	☐
22. Tennis	☐	☐	☐
23. Weight training	☐	☐	☐
24. Any other sport (write in)_____ _____	☐ ☐	☐ ☐	☐ ☐
Not participated in:	☐	☐	☐

SECTION 5

Q1 **Are you currently participating in a club that is organised for a purpose of doing one particular sport or activity?**

No ☐ If **NO**, please go to Q4a.

Yes ☐ If **YES**, please list **(1)**_____
(2)_____
(3)_____

Q2 **About how often do you take part in sports and physical activities in non-school sports clubs?** Please tick (✓) one box.

4 or more days a week ☐ 2-3 days a week ☐ One day a week ☐
2-3 days a month ☐ One day a month ☐ Less often ☐ Never ☐

Q3a **For your primary or main sport, what is your current involvement?**
Tick (✓) all that apply.

Active participant ☐ Administrator ☐ Coach ☐ Official (e.g. referee, judge) ☐

Q3b **If active participant, what is the highest standard that you achieved?**
Please tick (✓) one box.

Basic (family recreation, play, school clubs open to all) ..... ☐
Competitive (competitive club level, selected school team) ..... ☐
Elite (country, regional and nationally recognised standard) ..... ☐

Q3c **If active participant, what is the most important reason for continuing to participate?**
Please tick (✓) one box.

Something to do.....	☐	Because of school/work.....	☐
Because of my friends	☐	Seemed interesting	☐
Because of my father / male guardian...	☐	Seemed challenging	☐
Because of my mother/female guardian	☐	To practice skills	☐
Because of my elder brother/sister	☐	To learn new skills	☐
To keep fit	☐	Other (write in)_____	☐

Q4a **During the last 5 years, have you <u>taken up</u> any new physical activities?**

No ☐ If **NO**, please go to Q5a.
Yes ☐

Q4b

If **YES**, please list the physical activities	**What were your main reasons for taking up the activity?**	**Are you still involved?**	
		No	**Yes**
(1)_____		☐	☐
(2)_____		☐	☐
(3)_____		☐	☐

Q5a **During the last 5 years, have you <u>dropped out</u> of any sport or stopped participating in an activity?**

No ☐ 1 If **NO**, please go to Section 6.

Yes ☐ 2 If **YES**, please list **(1)**_____
(2)_____
(3)_____

Q5b If **YES**, please select from the list what the **three most important reasons for no longer being involved** were? Please place a **1** beside the most important reason, a **2** beside the 2nd most important reason and a **3** beside the third most important reason.

Injury	☐ 1	Coaches were unfriendly	☐ 11
Lack of interest	☐ 2	Other players my age were unfriendly	☐ 12
Other commitments (school/work)	☐ 3	Older players were unfriendly	☐ 13
Other commitments (part time job, boy or girl friend)	☐ 4	Started another sport	☐ 14
Not good enough	☐ 5	My friends had stopped	☐ 15
No encouragement from family	☐ 6	Training was boring	☐ 16
Not big / strong enough	☐ 7	Mainly for boys / girls	☐ 17
Too expensive	☐ 8	Wasn't allowed	☐ 18
Lack of resources	☐ 9	Not played at school	☐ 19
Took up too much time	☐ 10	Other (write in)_____	☐ 20

SECTION 6

Q1 **Which of these statements best expresses your view?** Please tick (✓) one box.

I take enough physical activity to keep healthy ☐ 1

I ought to take more physical activity to keep healthy ☐ 2

Don't know ☐ 3

Q2 **How would you rate your level of physical activity compared to other people the same age and sex as yourself?** Please tick (✓) one box.

Much less than others	Somewhat less than others	About the same	Somewhat more than others	Much more than others
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q3 **What is your height without shoes?** _____Feet_____ Inches (or_____cm)

Q4 **What is your weight?** _____Stone_____Pounds (or_____kg)

Great effort, keep it going!

SECTION 7

SEDENTARY HABITS are things that don't use a lot of physical energy. E.g. watching TV, sitting talking on the phone or listening to music, playing games on the computer or general sitting activities.

Q1 **I enjoy doing sitting activities like watching TV or playing computer/video games.** Please tick (✓) one box.

Dislike a lot				Enjoy a lot
1	2	3	4	5
☐	☐	☐	☐	☐

Q2 **What do you usually do when you have a choice about how to spend your recreational (*or free*) time?** Please tick (✓) one box.

Almost always choose activities like TV, reading, listening to music, or computers..... 1 ☐

Usually choose activities like TV, reading, listening to music or computers..... 2 ☐

Just as likely choose active or inactive recreation ..... 3 ☐

Usually choose activities like bicycling, dancing, outdoor games or active sports..... 4 ☐

Almost always choose activities like bicycling, dancing, outdoor games or active sports..... 5 ☐

Q3 **In the last 7 days, about how many hours per day (24 hours) did you spend sleeping?** Please tick (✓) one box.

	3 or less hours	4 hours	5 hours	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 or more hours
Weekdays	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Weekends	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q4 **During the past week, how would you rate your <u>sleep quality</u> overall (how well you sleep)?** Please tick (✓) one box.

Very Bad 1 ☐ Fairly Bad 2 ☐ Fairly Good 3 ☐ Very Good 4 ☐

This section is about **sitting activities** during the **last 7 days**. There are no right or wrong answers. No one does all these activities. Please be as accurate and honest as possible.

Q5 For each activity listed, answer:
(1) Did you do this **activity**? Tick NO or YES.
(2) On **how many days** did you do the activity?
(3) **How much time** did you usually spend on one of those days doing the activity?

In the last 7 days...	(1) Have you done this activity on **Weekdays?** (Mon – Fri) **NO**	**YES**	(2) **Number of Weekdays** (max 5)	(3) **Minutes** per **weekday**	(1) Have you done this activity at the **Weekend?** (Sat + Sun) **NO**	**YES**	(2) **Number of weekend days** (max 2)	(3) **Minutes** per **weekend** day
Computer/internet (not games)	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting playing video games E.g. Xbox, Playstation	☐	☐	____days	___mins	☐	☐	___days	___mins
Playing games on a portable device E.g. mobile phone, iPad, DS, Gameboy	☐	☐	____days	___mins	☐	☐	___days	___mins
Homework, studying	☐	☐	____days	___mins	☐	☐	___days	___mins
Reading (not for school)	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting during school /work breaks	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting around and talking with friends (not on the phone), **listening to music**	☐	☐	____days	___mins	☐	☐	___days	___mins
Talking on the phone	☐	☐	____days	___mins	☐	☐	___days	___mins
Television or DVD watching	☐	☐	____days	___mins	☐	☐	___days	___mins
Practicing a musical instrument (not drums)	☐	☐	____days	___mins	☐	☐	___days	___mins
Other (write in)____	☐	☐	____days	___mins	☐	☐	___days	___mins

You are making great progress.

Please continue as your responses are really important to us.

SECTION 8

Q1 **In general would you say your health is?** Please tick (✓) one box.

Poor ☐ Fair ☐ Good ☐ Very Good ☐ Excellent ☐

Q2 **All things considered, how happy are you right now?** Please tick (✓) one box.

Not happy at all	Not very happy	Neither happy nor unhappy	Somewhat happy	Very happy
☐	☐	☐	☐	☐

Q3

If I was to be physically active during my free time on most days... Please tick one box for each question.	**Disagree a lot**	**Disagree a little**	**Neither disagree or agree**	**Agree a little**	**Agree a lot**
1. It would help me spend more time with my friends	☐	☐	☐	☐	☐
2. It would help get me in shape	☐	☐	☐	☐	☐
3. It would help me control my weight	☐	☐	☐	☐	☐
4. It would put me in a better mood	☐	☐	☐	☐	☐
5. It would make me better in sports, dance and other activities	☐	☐	☐	☐	☐
6. It would be fun	☐	☐	☐	☐	☐
7. It would make me look better	☐	☐	☐	☐	☐
8. I would make new friends	☐	☐	☐	☐	☐
9. I would feel good	☐	☐	☐	☐	☐
10. It would give me a sense of personal accomplishment	☐	☐	☐	☐	☐
11. It would help me to be physically fit	☐	☐	☐	☐	☐
12. It would help me maintain physical health and well being	☐	☐	☐	☐	☐

Q4 **At present are you on a diet or doing something else to lose weight?** Please tick (✓) one box.

No, my weight is fine ☐
No, but I should lose some weight ☐
No, because I need to put on weight ☐
Yes ☐

Q5 **Do you think your body is...?** Please tick (✓) one box.

Much too thin ☐
A bit too thin ☐
About the right size ☐
A bit too fat ☐
Much too fat ☐

Q6 **Think about how it feels when you are doing physical activities.**
Please tick (✓) one box for each question.

When I am active...	Disagree a lot 1	2	3	4	Agree a lot 5
1. I enjoy it	☐	☐	☐	☐	☐
2. I dislike it	☐	☐	☐	☐	☐
3. It's no fun at all	☐	☐	☐	☐	☐
4. It's very exciting	☐	☐	☐	☐	☐
5. It feels good	☐	☐	☐	☐	☐

SECTION 9

Q1 DURING A TYPICAL WEEK, how often: Please tick (✓) one box for each question.	None	Once	Sometimes	Almost Everyday	Everyday
A. Do you **encourage your friends** to do **physical activities or play sports**?	☐	☐	☐	☐	☐
B. Do your **friends encourage you** to do **physical activities or play sports?**	☐	☐	☐	☐	☐
C. Do your **friends do physical activities** or play sports with you?	☐	☐	☐	☐	☐
D. Do **others tease you** for not being good at physical activity or sports?	☐	☐	☐	☐	☐
E. Do friends **tell you** that you are doing well in physical activities or sports?	☐	☐	☐	☐	☐
F. Do your **friends encourage you** to spend **less time** being **sedentary?**	☐	☐	☐	☐	☐
G. Do **your friends do sedentary habits** like watch TV or play computer/video games **with you**?	☐	☐	☐	☐	☐

Q2 How many of your five closest friends:	0	1	2	3	4	5
A. Spend **at least 30 minutes** per day being **physically active**?	☐	☐	☐	☐	☐	☐
B. Spend **more than 2 hours** a day on **sedentary habits**?	☐	☐	☐	☐	☐	☐

Q3 DURING A TYPICAL WEEK, how often has a member of your household:
(For example, your father, mother, guardian, brother, sister, grandparent, or other relative).

Please tick (✓) one box for each question.

	None	Once	Sometimes	Almost Everyday	Everyday
A. **Encouraged you** to do physical activities or play sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
B. Done a physical activity or played sports **with you?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
C. **Provided transportation** to a place where you can do physical activities or play sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
D. **Watched you** participate in physical activities or sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
E. **Told you** that you are doing well in physical activities or sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
F. **Encouraged you** to spend **less time** being **sedentary?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
G. **Discussed** with you how **sedentary habits** can be unhealthy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
H. **Helped you** think of ways to **reduce** the time you spend on **sedentary habits?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I. **Told you** that you are doing a good job reducing your sedentary habits?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q4 Use the scale below (0-10) to indicate how confident you are that you could be physically active in each of the following situations:

Please tick (✓) one box only for each question.

I am confident I can participate in regular physical activity when...	**Not at all confident** → **Somewhat confident** → **Very confident**										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. I am tired	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
2. I am in a bad mood	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
3. I feel I don't have time	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
4. I am on holidays	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
5. It is raining or snowing	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
6. I have homework/college work to do	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
7. My friends call me to go out	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
8. I need to do house chores	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
9. There is a good TV show on	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
10. I am on my own	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10

Nearly there, just two pages left…

Q5 What keeps you from being more active?

Directions: Listed below are reasons that people give to describe why they do not get as much physical activity as they think they should. Please read each statement and indicate how likely you are to say each of the following statements:

How likely are you to say?	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely
1. My day is so busy now, I just don't think I can make the time to include physical activity in my regular schedule.	☐ 1	☐ 2	☐ 3	☐ 4
2. None of my family members or friends like to do anything active, so I don't have a chance to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4
3. I'm just too tired after school/work to be active.	☐ 1	☐ 2	☐ 3	☐ 4
4. I've been thinking about becoming more physically active, but I just can't seem to get started.	☐ 1	☐ 2	☐ 3	☐ 4
5. Participating in physical activities can be risky.	☐ 1	☐ 2	☐ 3	☐ 4
6. I don't get enough exercise because I have never learned the skills for any one sport.	☐ 1	☐ 2	☐ 3	☐ 4
7. I don't have access to jogging trails, swimming pools, bike paths, etc.	☐ 1	☐ 2	☐ 3	☐ 4
8. Physical activity takes too much time away from other commitments – like work, family, etc.	☐ 1	☐ 2	☐ 3	☐ 4
9. I'm embarrassed about how I will look when I participate in physical activity with others.	☐ 1	☐ 2	☐ 3	☐ 4
10. I don't get enough sleep as it is. I just couldn't get up early or stay up late to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4
11. It's easier for me to find excuses not to be physically active than to go out and do something.	☐ 1	☐ 2	☐ 3	☐ 4
12. I know of too many people who have hurt themselves by overdoing it when they are physically active.	☐ 1	☐ 2	☐ 3	☐ 4
13. I really can't see myself learning a new sport.	☐ 1	☐ 2	☐ 3	☐ 4
14. It's just too expensive. You have to take a class or join a club or buy the right equipment.	☐ 1	☐ 2	☐ 3	☐ 4
15. My free times during the day are too short to include physical activity.	☐ 1	☐ 2	☐ 3	☐ 4
16. My usual social activities with family or friends do not include physical activities.	☐ 1	☐ 2	☐ 3	☐ 4
17. I'm too tired during the week and I need the weekend to catch up on my rest.	☐ 1	☐ 2	☐ 3	☐ 4
18. I want to be more physically active, but I just can't seem to make myself stick to anything.	☐ 1	☐ 2	☐ 3	☐ 4
19. I'm afraid I might injure myself.	☐ 1	☐ 2	☐ 3	☐ 4
20. I'm not good enough at any physical activity to make it fun.	☐ 1	☐ 2	☐ 3	☐ 4
21. If we had exercise facilities and showers at school / work, then I would be more likely to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4

SECTION 10

Q1 **Area of Residence: This question refers to the area of residence you live in MOST or ALL days of the week. Would you describe the place that you live in as?**
Please tick (✓) one box.

A big city (more than 70,000 inhabitants) ..... ☐ 1
Suburbs, large town or outskirts of city (less than 70,000 inhabitants) ☐ 2
Town (less than 20,000 inhabitants) ..... ☐ 3
Village / Rural area (less than 3,000 inhabitants) ..... ☐ 4

Q2 For the purpose of this survey your **neighbourhood** is defined as the area within **approx 1 kilometre / half a mile** of your home, or about a **10 minute walk**.
Please tick (✓) one box only for each question.

In my neighbourhood.....	**Strongly Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Strongly Agree**
1. The pathways are well maintained (paved, even and not a lot of cracks).	☐ 1	☐ 2	☐ 3	☐ 4
2. There are many places to go within easy walking distance of my home.	☐ 1	☐ 2	☐ 3	☐ 4
3. The crime rate in my neighbourhood makes it unsafe to go walking during the day.	☐ 1	☐ 2	☐ 3	☐ 4
4. The crime rate in my neighbourhood makes it unsafe to go walking at night.	☐ 1	☐ 2	☐ 3	☐ 4
5. While walking, there are places that I avoid.	☐ 1	☐ 2	☐ 3	☐ 4
6. The speed of traffic on the street I live on is usually slow – about 30mph/50kmph or less.	☐ 1	☐ 2	☐ 3	☐ 4
7. There are badly maintained, unoccupied or unattractive buildings or houses.	☐ 1	☐ 2	☐ 3	☐ 4
8. There are large car parks in front of shops and businesses.	☐ 1	☐ 2	☐ 3	☐ 4

Q3 **Overall, how would you rate your neighbourhood as a place to walk? Walkable means pedestrian friendly.** Please tick (✓) one box.

Not at all walkable	Not very walkable	Neither walkable nor unwalkable	Somewhat walkable	Very walkable
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

You're finished!
Thank you for your time and effort!

Please put the questionnaire in the freepost envelope provided and return it as soon as possible. You do not need to put a stamp on the envelope.

If you have mislaid the return envelope, please post the questionnaire to:

CSPPA Study
School of Health and Human Performance
Dublin City University
Dublin 9

Remember to return your survey by May 9th to be entered into the prize draw!

DCU

A.5 Young Adult Survey (CSPPA Plus 2014)

CSPPA STUDY

follow-up

Young Adult Survey

DCU

Thank you for taking part in our study in 2009 and again today.

By answering these questions you will help us understand more about the lifestyle of young people like yourself.

- There are no right or wrong answers, it is **not a test**. If you are uncertain, please do the best you can.
- While many of the questions appear quite similar, there are subtle differences between them and you should treat each one as a separate question.
- Time to complete: 20 minutes.
- All completed surveys received before May 9th will be entered into a **prize draw for €100**. Draw to take place on May 12th.

Your answers are strictly confidential so try to answer all questions as honestly as you can. Thank you.

SurveyMonkey

You can complete this survey:

Online at http://www.surveymonkey.com/s/CSPPAYoungAdult

OR

At your leisure you can post it back using the envelope provided. The postage has already been paid.

If you would like to contact us, please email michelle.hardie2@mail.dcu.ie or call Michelle on 01-7007441

ASSENT FORM FOR YOUTH

Please tick (✓) one box for each question.

1. I am aware that this study will involve me completing a physical activity questionnaire. No ☐ Yes ☐

2. I know that I am free to decide not to take part in this study or change my mind if I wish. No ☐ Yes ☐

SIGNED: _____ **DATE:** _____

Please PRINT all information in CAPITALS

Q1 **Gender** (Please tick (✓) one box): Male ☐ Female ☐

Q2 **Date of Birth**_____/_____/_____ (day/month/year)

Q3 **Occupation:** Please tick (✓) one box.

Student (full time).....	☐	Looking after the home / family ...	☐
Apprentice	☐	Unemployed	☐
Working for payment or profit	☐	Unable to work due to permanent sickness or disability	☐
Looking for first regular job	☐	Other, (write in)_____	☐

Q4 **What is the highest level of education/training (full time or part time) which you have completed?** Please tick (✓) one box.

☐ **Primary Education**

☐ **Secondary Education** (Leaving Cert. including Applied or Vocational programmes)

☐ **Further Education** (FETAC Level 4 or higher, HETAC Cert.)

☐ **Completed Apprenticeship** (FETAC Advanced Cert., Teagasc Cert, or equivalent)

☐ **Third Level Education** (Degree or National Diploma)

Q5 **Have you finished or ceased your full time education?** Please tick (✓) one box.

No ☐

Yes ☐ If **YES**, please go to Q8

Q6 **Are you in?** Secondary School ☐ Further Education ☐

Q7 **What is the name of your school / place of study?**_____

Q8 **Do you have a physical disability or a learning disability, which prevents you from participating in physical activities or sport?**

No ☐ Yes ☐

If **YES**, please specify or describe_____

Q9 **Sometime in the future we may want to:**

a) Contact you to follow up on this research. Would that be ok? No ☐ Yes ☐

If **YES**, please provide a telephone number _____

And / or an email address _____

b) Contact your school to obtain your exam results. Would that be ok? No ☐ Yes ☐

This information will be treated with the strictest confidence; it will be anonymous, that means your name will not be associated with it in any way.

Office use only: ☐

SECTION 1

Physical activity is any body movement.

It can be done at different levels of effort:

- **Vigorous Effort** makes your heart rate much faster and you have to breathe deeper and faster than normal. You will probably sweat.
  E.g. playing football, squash, heavy lifting, digging or fast bicycling.

- **Moderate Effort** makes your heart rate and breathing rate faster than normal. You may also sweat a little. E.g. brisk walking, jogging or vacuuming.

- Physical activity includes:
  Exercise Weight training, aerobics, jogging, dancing, etc.
  Sports Hurling, football, athletics, swimming, etc.
  General Brisk walking, washing the car, walking or cycling to school, etc.

Please try to think carefully and be as accurate as possible with your answers. For these next two questions, add up all the time you spend in physical activity each day.
Only include activities of either moderate or vigorous effort.

Q1 **During the last 7 days, on how many days were you physically active for a total of at least 60 minutes per day?** Please circle one number.

0days 1 2 3 4 5 6 7 days

Q2 **Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?** Please circle one number.

0days 1 2 3 4 5 6 7 days

Now think about **only** those physical activities that you did for **at least 10 minutes** at a time.

Q3a **During the last 7 days, on how many days did you do vigorous physical activities?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3b **How much time in total did you usually spend on one of those days doing vigorous physical activities?**

____hours____minutes

Q4a **During the last 7 days, on how many days did you do moderate physical activities?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q4b **How much time in total did you usually spend on one of those days doing moderate physical activities?**

_____hours____minutes

Office use only:

Q5a **During the last 7 days, on how many days did you do exercises that may strengthen your muscles, such as push-ups, sit-ups, weight lifting or heavy yard work?**
Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q5b **How much time did you usually spend on one of those days doing exercises that may strengthen your muscles?**

____hours___minutes

Q6a **Looking back on all your answers (Q1 - Q5), was the amount of physical activity you did in the last 7 days typical of the amount that you would normally do?**

Yes ☐ 1
No, I usually do more ☐ 2
No, I usually do less ☐ 3

Q6b. If **NO,** why was this week unusual? _____

SECTION 2

Now think about travelling to and from school / college / work, to a friend's house, the shop or going from place to place.

Q1a **During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q1b **How much time did you usually spend on one of those days walking from place to place?**

____hours___minutes

Q2a **How do you usually travel TO school / college / work?**
Please tick one box – for the longest distance of your journey.

By Foot ☐ 1 Bicycle ☐ 2 Car ☐ 3 Bus ☐ 4 Train, LUAS or DART ☐ 5 Motorcycle or Scooter ☐ 6

Q2b **How long does this journey usually take?** ____hours_____minutes

Q2c **How do you usually travel home FROM school / college / work?**
Please tick one box – for the longest distance of your journey.

By Foot ☐ 1 Bicycle ☐ 2 Car ☐ 3 Bus ☐ 4 Train, LUAS or DART ☐ 5 Motorcycle or Scooter ☐ 6

Q2d **How long does this journey usually take?** ____hours_____minutes

Q2e **If you travel by car, bus, train or motorcycle, give reasons why you choose not to walk or cycle.** _____

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure.

Think about the time you spent **walking for recreation** (not walking to go from place to place).

Q3a **During the last 7 days, on how many days did you walk for recreation for at least 10 minutes in your leisure (*or free*) time?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q3b **How much time did you usually spend on one of those days walking for recreation?**

_____hours____minutes

Q3c **Which of the following best describes your usual walking pace?** Please tick (✓) one box.

A slow pace	A steady average pace	A fairly brisk pace	A fast pace (at least 4mph)
1 ☐	2 ☐	3 ☐	4 ☐

Q4a **During the last 7 days, on how many days did you run or jog for recreation for at least 10 minutes at a time?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q4b **How much time did you usually spend on one of those days running or jogging for recreation?** _____hours_____minutes

Q5a **During the last 7 days, on how many days did you attend a leisure centre or a fitness club?** Please circle one number.

0 days 1 2 3 4 5 6 7 days

Q5b Please consider activities you may have done in fitness classes and include time spent in these classes in the following questions. **How much time did you usually spend on one of those days on:**

1) **Cardiovascular training** (e.g. treadmill, crosstrainer, bicycle)
_____hours____minutes

2) **Weight or strength training** (e.g. free weights or weight machines)
_____hours____minutes

You are making great progress.

Please continue as your responses are really important to us.

SECTION 3

Q1 Please tick any sport/activity that you might have played with sports or activity **clubs**.

Tick (✓) all that apply

In the last 12 months I have...	In a Club Played in club **once a week**
1. Adventure activities	☐
2. Aerobics	☐
3. Athletics	☐
4. Badminton	☐
5. Baseball or Rounders	☐
6. Basketball	☐
7. Camogie or Hurling	☐
8. Cross country running	☐
9. Cycling	☐
10. Dance	☐
11. Gaelic Football	☐
12. Golf	☐
13. Gymnastics	☐
14. Handball	☐
15. Hockey	☐
16. Horse riding	☐
17. Martial Arts	☐
18. Rugby	☐
19. Soccer	☐
20. Squash	☐
21. Swimming	☐
22. Tennis	☐
23. Weight training	☐
24. Any other sport (write in) _____ _____	☐ ☐
Not participated in a club:	☐

SECTION 4

Q1 **Are you currently participating in a club that is organised for a purpose of doing one particular sport or activity?**

No ☐ If **NO**, please go to Q4a.

Yes ☐ If **YES**, please list **(1)**_____
(2)_____
(3)_____

Q2 **About how often do you take part in sports and physical activities in non-school sports clubs?** Please tick (✓) one box.

4 or more days a week ☐ 2-3 days a week ☐ One day a week ☐
2-3 days a month ☐ One day a month ☐ Less often ☐ Never ☐

Q3a **For your primary or main sport, what is your current involvement?**
Tick (✓) all that apply.

Active participant ☐ Administrator ☐ Coach ☐ Official (e.g. referee, judge) ☐

Q3b **If active participant, what is the highest standard that you achieved?**
Please tick (✓) one box.

Basic (family recreation, play, school clubs open to all) ..... ☐
Competitive (competitive club level, selected school team) ..... ☐
Elite (country, regional and nationally recognised standard) ..... ☐

Q3c **If active participant, what is the most important reason for continuing to participate?**
Please tick (✓) one box.

Something to do.....	☐	Because of school/work.....	☐
Because of my friends	☐	Seemed interesting	☐
Because of my father / male guardian...	☐	Seemed challenging	☐
Because of my mother/female guardian	☐	To practice skills	☐
Because of my elder brother/sister	☐	To learn new skills	☐
To keep fit	☐	Other (write in)_____	☐

Q4a **During the last 5 years, have you <u>taken up</u> any new physical activities?**

No ☐ If **NO**, please go to Q5a.
Yes ☐

Q4b

If **YES**, please list the physical activities	**What were your main reasons for taking up the activity?**	**Are you still involved?** **No**	**Yes**
(1)_____		☐	☐
(2)_____		☐	☐
(3)_____		☐	☐

Q5a **During the last 5 years, have you <u>dropped out</u> of any sport or stopped participating in an activity?**

No ☐ (1) If **NO**, please go to Section 5.

Yes ☐ (2) If **YES**, please list **(1)**_____
(2)_____
(3)_____

Q5b If **YES**, please select from the list what the **three most important reasons for no longer being involved** were? Please place a **1** beside the most important reason, a **2** beside the 2nd most important reason and a **3** beside the third most important reason.

Injury	☐ 1	Coaches were unfriendly	☐ 11
Lack of interest	☐ 2	Other players my age were unfriendly	☐ 12
Other commitments (school/work)	☐ 3	Older players were unfriendly	☐ 13
Other commitments (part time job, boy or girl friend)	☐ 4	Started another sport	☐ 14
Not good enough	☐ 5	My friends had stopped	☐ 15
No encouragement from family	☐ 6	Training was boring	☐ 16
Not big / strong enough	☐ 7	Mainly for boys / girls	☐ 17
Too expensive	☐ 8	Wasn't allowed	☐ 18
Lack of resources	☐ 9	Not played at school	☐ 19
Took up too much time	☐ 10	Other (write in)_____	☐ 20

SECTION 5

Q1 **Which of these statements best expresses your view?** Please tick (✓) one box.

I take enough physical activity to keep healthy ☐ 1

I ought to take more physical activity to keep healthy ☐ 2

Don't know ☐ 3

Q2 **How would you rate your level of physical activity compared to other people the same age and sex as yourself?** Please tick (✓) one box.

Much less than others	Somewhat less than others	About the same	Somewhat more than others	Much more than others
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q3 **What is your height without shoes?** _____Feet_____ Inches (or_____cm)

Q4 **What is your weight?** _____Stone_____Pounds (or_____kg)

SECTION 6

SEDENTARY HABITS are things that don't use a lot of physical energy. E.g. watching TV, sitting talking on the phone or listening to music, playing games on the computer or general sitting activities.

Q1 **I enjoy doing sitting activities like watching TV or playing computer/video games.** Please tick (✓) one box.

Dislike a lot				Enjoy a lot
1	2	3	4	5
☐	☐	☐	☐	☐

Q2 **What do you usually do when you have a choice about how to spend your recreational (*or free*) time?** Please tick (✓) one box.

Almost always choose activities like TV, reading, listening to music, or computers..... 1 ☐

Usually choose activities like TV, reading, listening to music or computers..... 2 ☐

Just as likely choose active or inactive recreation ..... 3 ☐

Usually choose activities like bicycling, dancing, outdoor games or active sports..... 4 ☐

Almost always choose activities like bicycling, dancing, outdoor games or active sports..... 5 ☐

Q3 **In the last 7 days, about how many hours per day (24 hours) did you spend sleeping?** Please tick (✓) one box.

	3 or less hours	4 hours	5 hours	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 or more hours
Weekdays	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Weekends	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q4 **During the past week, how would you rate your <u>sleep quality</u> overall (how well you sleep)?** Please tick (✓) one box.

Very Bad 1 ☐ Fairly Bad 2 ☐ Fairly Good 3 ☐ Very Good 4 ☐

This section is about **sitting activities** during the **last 7 days**. There are no right or wrong answers. No one does all these activities. Please be as accurate and honest as possible.

Q5 For each activity listed, answer:
(1) Did you do this **activity**? Tick NO or YES.
(2) On **how many days** did you do the activity?
(3) **How much time** did you usually spend on one of those days doing the activity?

In the last 7 days...	(1) Have you done this activity on **Weekdays?** (Mon – Fri) **NO**	**YES**	(2) **Number of Weekdays** (max 5)	(3) **Minutes** per **weekday**	(1) Have you done this activity at the **Weekend?** (Sat + Sun) **NO**	**YES**	(2) **Number of weekend days** (max 2)	(3) **Minutes** per **weekend** day
Computer/internet (not games)	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting playing video games E.g. Xbox, Playstation	☐	☐	____days	___mins	☐	☐	___days	___mins
Playing games on a portable device E.g. mobile phone, iPad, DS, Gameboy	☐	☐	____days	___mins	☐	☐	___days	___mins
Homework, studying	☐	☐	____days	___mins	☐	☐	___days	___mins
Reading (not for school)	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting during school /work breaks	☐	☐	____days	___mins	☐	☐	___days	___mins
Sitting around and talking with friends (not on the phone), **listening to music**	☐	☐	____days	___mins	☐	☐	___days	___mins
Talking on the phone	☐	☐	____days	___mins	☐	☐	___days	___mins
Television or DVD watching	☐	☐	____days	___mins	☐	☐	___days	___mins
Practicing a musical instrument (not drums)	☐	☐	____days	___mins	☐	☐	___days	___mins
Other (write in) ___ _____	☐	☐	____days	___mins	☐	☐	___days	___mins

Great effort, keep it going!

SECTION 7

Q1 **In general would you say your health is?** Please tick (✓) one box.

Poor ☐ Fair ☐ Good ☐ Very Good ☐ Excellent ☐

Q2 **All things considered, how happy are you right now?** Please tick (✓) one box.

Not happy at all	Not very happy	Neither happy nor unhappy	Somewhat happy	Very happy
☐	☐	☐	☐	☐

Q3

If I was to be physically active during my free time on most days... Please tick one box for each question.	**Disagree a lot**	**Disagree a little**	**Neither disagree or agree**	**Agree a little**	**Agree a lot**
1. It would help me spend more time with my friends	☐	☐	☐	☐	☐
2. It would help get me in shape	☐	☐	☐	☐	☐
3. It would help me control my weight	☐	☐	☐	☐	☐
4. It would put me in a better mood	☐	☐	☐	☐	☐
5. It would make me better in sports, dance and other activities	☐	☐	☐	☐	☐
6. It would be fun	☐	☐	☐	☐	☐
7. It would make me look better	☐	☐	☐	☐	☐
8. I would make new friends	☐	☐	☐	☐	☐
9. I would feel good	☐	☐	☐	☐	☐
10. It would give me a sense of personal accomplishment	☐	☐	☐	☐	☐
11. It would help me to be physically fit	☐	☐	☐	☐	☐
12. It would help me maintain physical health and well being	☐	☐	☐	☐	☐

Q4 **At present are you on a diet or doing something else to lose weight?**
Please tick (✓) one box.

No, my weight is fine ..... ☐
No, but I should lose some weight ..... ☐
No, because I need to put on weight ..... ☐
Yes ..... ☐

Q5 **Do you think your body is...?** Please tick (✓) one box.

Much too thin ..... ☐
A bit too thin ..... ☐
About the right size ..... ☐
A bit too fat ..... ☐
Much too fat ..... ☐

Q6 **Think about how it feels when you are doing physical activities.**
Please tick (✓) one box for each question.

When I am active...	Disagree a lot 1	2	3	4	Agree a lot 5
1. I enjoy it	☐	☐	☐	☐	☐
2. I dislike it	☐	☐	☐	☐	☐
3. It's no fun at all	☐	☐	☐	☐	☐
4. It's very exciting	☐	☐	☐	☐	☐
5. It feels good	☐	☐	☐	☐	☐

SECTION 8

Q1 DURING A TYPICAL WEEK, how often: Please tick (✓) one box for each question.	None	Once	Sometimes	Almost Everyday	Everyday
A. Do you **encourage your friends** to do **physical activities or play sports**?	☐	☐	☐	☐	☐
B. Do your **friends encourage you** to do **physical activities or play sports?**	☐	☐	☐	☐	☐
C. Do your **friends do physical activities** or play sports with you?	☐	☐	☐	☐	☐
D. Do **others tease you** for not being good at physical activity or sports?	☐	☐	☐	☐	☐
E. Do friends **tell you** that you are doing well in physical activities or sports?	☐	☐	☐	☐	☐
F. Do your **friends encourage you** to spend **less time** being **sedentary?**	☐	☐	☐	☐	☐
G. Do **your friends do sedentary habits** like watch TV or play computer/video games **with you**?	☐	☐	☐	☐	☐

Q2 How many of your five closest friends:	0	1	2	3	4	5
A. Spend **at least 30 minutes** per day being **physically active**?	☐	☐	☐	☐	☐	☐
B. Spend **more than 2 hours** a day on **sedentary habits**?	☐	☐	☐	☐	☐	☐

Q3 DURING A TYPICAL WEEK, how often has a <u>member of your household</u>:
(For example, your father, mother, guardian, brother, sister, grandparent, or other relative).
Please tick (✓) one box for each question.

	None	Once	Sometimes	Almost Everyday	Everyday
A. **Encouraged you** to do physical activities or play sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
B. Done a physical activity or played sports **with you?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
C. **Provided transportation** to a place where you can do physical activities or play sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
D. **Watched you** participate in physical activities or sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
E. **Told you** that you are doing well in physical activities or sports?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
F. **Encouraged you** to spend **less time** being **sedentary?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
G. **Discussed** with you how **sedentary habits** can be unhealthy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
H. **Helped you** think of ways to **reduce** the time you spend on **sedentary habits?**	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I. **Told you** that you are doing a good job reducing your sedentary habits?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q4 Use the scale below (0-10) to indicate how confident you are that you could be physically active in each of the following situations:

Please tick (✓) one box only for each question.

I am confident I can participate in regular physical activity when...	**Not at all confident** → **Somewhat confident** → **Very confident**										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. I am tired	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
2. I am in a bad mood	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
3. I feel I don't have time	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
4. I am on holidays	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
5. It is raining or snowing	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
6. I have homework/college work to do	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
7. My friends call me to go out	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
8. I need to do house chores	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
9. There is a good TV show on	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10
10. I am on my own	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10

Nearly there, just two pages left...

Q6 What keeps you from being more active?

Directions: Listed below are reasons that people give to describe why they do not get as much physical activity as they think they should. Please read each statement and indicate how likely you are to say each of the following statements:

How likely are you to say?	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely
1. My day is so busy now, I just don't think I can make the time to include physical activity in my regular schedule.	☐ 1	☐ 2	☐ 3	☐ 4
2. None of my family members or friends like to do anything active, so I don't have a chance to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4
3. I'm just too tired after school/work to be active.	☐ 1	☐ 2	☐ 3	☐ 4
4. I've been thinking about becoming more physically active, but I just can't seem to get started.	☐ 1	☐ 2	☐ 3	☐ 4
5. Participating in physical activities can be risky.	☐ 1	☐ 2	☐ 3	☐ 4
6. I don't get enough exercise because I have never learned the skills for any one sport.	☐ 1	☐ 2	☐ 3	☐ 4
7. I don't have access to jogging trails, swimming pools, bike paths, etc.	☐ 1	☐ 2	☐ 3	☐ 4
8. Physical activity takes too much time away from other commitments – like work, family, etc.	☐ 1	☐ 2	☐ 3	☐ 4
9. I'm embarrassed about how I will look when I participate in physical activity with others.	☐ 1	☐ 2	☐ 3	☐ 4
10. I don't get enough sleep as it is. I just couldn't get up early or stay up late to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4
11. It's easier for me to find excuses not to be physically active than to go out and do something.	☐ 1	☐ 2	☐ 3	☐ 4
12. I know of too many people who have hurt themselves by overdoing it when they are physically active.	☐ 1	☐ 2	☐ 3	☐ 4
13. I really can't see myself learning a new sport.	☐ 1	☐ 2	☐ 3	☐ 4
14. It's just too expensive. You have to take a class or join a club or buy the right equipment.	☐ 1	☐ 2	☐ 3	☐ 4
15. My free times during the day are too short to include physical activity.	☐ 1	☐ 2	☐ 3	☐ 4
16. My usual social activities with family or friends do not include physical activities.	☐ 1	☐ 2	☐ 3	☐ 4
17. I'm too tired during the week and I need the weekend to catch up on my rest.	☐ 1	☐ 2	☐ 3	☐ 4
18. I want to be more physically active, but I just can't seem to make myself stick to anything.	☐ 1	☐ 2	☐ 3	☐ 4
19. I'm afraid I might injure myself.	☐ 1	☐ 2	☐ 3	☐ 4
20. I'm not good enough at any physical activity to make it fun.	☐ 1	☐ 2	☐ 3	☐ 4
21. If we had exercise facilities and showers at school / work, then I would be more likely to be physically active.	☐ 1	☐ 2	☐ 3	☐ 4

SECTION 9

Q1 **Area of Residence: This question refers to the area of residence you live in MOST or ALL days of the week. Would you describe the place that you live in as?**
Please tick (✓) one box.

A big city (more than 70,000 inhabitants) ..... ☐ 1
Suburbs, large town or outskirts of city (less than 70,000 inhabitants) ☐ 2
Town (less than 20,000 inhabitants) ..... ☐ 3
Village / Rural area (less than 3,000 inhabitants) ..... ☐ 4

Q2 For the purpose of this survey your **neighbourhood** is defined as the area within **approx 1 kilometre / half a mile** of your home, or about a **10 minute walk**.
Please tick (✓) one box only for each question.

In my neighbourhood.....	**Strongly Disagree**	**Somewhat Disagree**	**Somewhat Agree**	**Strongly Agree**
1. The pathways are well maintained (paved, even and not a lot of cracks).	☐ 1	☐ 2	☐ 3	☐ 4
2. There are many places to go within easy walking distance of my home.	☐ 1	☐ 2	☐ 3	☐ 4
3. The crime rate in my neighbourhood makes it unsafe to go walking during the day.	☐ 1	☐ 2	☐ 3	☐ 4
4. The crime rate in my neighbourhood makes it unsafe to go walking at night.	☐ 1	☐ 2	☐ 3	☐ 4
5. While walking, there are places that I avoid.	☐ 1	☐ 2	☐ 3	☐ 4
6. The speed of traffic on the street I live on is usually slow – about 30mph/50kmph or less.	☐ 1	☐ 2	☐ 3	☐ 4
7. There are badly maintained, unoccupied or unattractive buildings or houses.	☐ 1	☐ 2	☐ 3	☐ 4
8. There are large car parks in front of shops and businesses.	☐ 1	☐ 2	☐ 3	☐ 4

Q3 **Overall, how would you rate your neighbourhood as a place to walk? Walkable means pedestrian friendly.** Please tick (✓) one box.

Not at all walkable	Not very walkable	Neither walkable nor unwalkable	Somewhat walkable	Very walkable
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

You're finished!
Thank you for your time and effort!

Please put the questionnaire in the freepost envelope provided and return it as soon as possible. You do not need to put a stamp on the envelope.

If you have mislaid the return envelope, please post the questionnaire to:

CSPPA Study
School of Health and Human Performance
Dublin City University
Dublin 9

Remember to return your survey by May 9th to be entered into the prize draw!

DCU

Appendix B Ethical approval Sample demographic characteristics

B.1 Letter of confirmation of ethical approval

Ollscoil Chathair Bhaile Átha Cliath
Dublin City University

DCU

Dr Catherine Woods
School of Health and Human Performance

17th January 2014

REC Reference: DCUREC/2013/211

Proposal Title: **A 5-year Follow Up Study of Children's Sport Participation and Physical Activity**

Applicants: Dr Catherine Woods, Ms Michelle Hardie

Dear Catherine,

Further to expedited review, the DCU Research Ethics Committee approves this research proposal. Materials used to recruit participants should note that ethical approval for this project has been obtained from the Dublin City University Research Ethics Committee. Should substantial modifications to the research protocol be required at a later stage, a further submission should be made to the REC.

Yours sincerely,

DCU Research & Innovation

Dónal O'Mathúna

Dr. Donal O'Mathuna
Chairperson
DCU Research Ethics Committee

Taighde & Nuálaíocht Tacaíocht
Ollscoil Chathair Bhaile Átha Cliath,
Baile Átha Cliath, Éire

Research & Innovation Support
Dublin City University,
Dublin 9, Ireland

T +353 1 700 8000
F +353 1 700 8002
E research@dcu.ie
www.dcu.ie

Appendix C Sample demographic characteristics

C.1 Baseline demographics of the CSPPA and CSPPA Plus study participants

Table C.1 Baseline demographics of the full CSPPA and CSPPA Plus study participants.

	CSPPA sample n = 5,397	**CSPPA Plus sample** n = 873
Baseline age (mean ± SD)	13.9 ± 2.1	13.0 ± 1.6[a]
Baseline age (range)	10 – 18	10 – 18
Sex (%)		
Male	46.8	30.4[b]
Female	53.2	69.6
School level (%)		
Primary	23.6	24.9
Post-primary	76.4	75.1
Urban/rural classification (%)		
Urban	35.9	35.1
Rural	64.1	64.9
Social Class (%)		
Low	14.4	12.5
Medium	36.9	36.8
High	42.3	44.6
Unknown	6.4	6.1

[a] $\chi^2(1) = 110.89$, $P < 0.01$

[b] $t(5377) = -12.70$, $P < 0.01$

Appendix D Pilot study

D.1 CSPPA Plus pilot study procedure

1. Meet with teacher and thank them for allowing us to use their class time.
2. Go to classroom.
3. Speak with Form Teachers about parental consent – take note of any students who do not have permission to take part in the study and exclude them from the study.
4. Introduce yourself to the students.
5. Hand out the Participant Information Sheet.
6. Allow 5 minutes for reading this.
7. Give brief information about the survey
   - Remind students that participation is voluntary and they may withdraw at any stage without being penalised.
   - All information is confidential and will be seen only by the research team. Each participant will be given an ID number to ensure anonymity.
   - Advise that they are welcome to ask any questions should they not understand any question or require any clarification about what is meant by any question.
8. Allow students to ask questions at this point.
9. Give the following instructions to students:
   - Do not rush the survey. Take the time to read each question and make sure to give the most accurate answers they can. Remember it is not a test, and there are no right or wrong answers.
   - Request that students wait until all surveys have been handed out before starting.
   - Request that students sit quietly with their booklets closed in front of them when they have completed them.
10. Survey administration:
    - Hand out surveys.
    - Time how long it takes for students to complete survey. Take note of the shortest and longest times taken.
    - Take note of any questions that students asked about the survey and any difficulties encountered.
    - When all students have completed their surveys, commence a discussion about any thoughts they had.
11. Leave the surveys on student's desks throughout the discussion. Please see attached for questions to ask.

12. If there is still time left over, then create a discussion about physical activity. E.g. what are the recommendations, do they think that their physical activity has changed over the last 5 years and what are the reasons for this?
13. Thank students for their time and participation.
14. Thank the teacher for allowing us to use their class time and for distributing and collecting the parental consent forms.

Questions to ask post survey completion.

1. What do you think about the questions? Did you find any of them difficult to understand? Reassure them that if they find it difficult to understand then it is likely that many others would too.
2. Are there any questions / topics that haven't been asked that should have been?
3. Are there any questions that stood out to you and why?
4. In your opinion, what is the most important question/section of the survey?
5. Do you think the questions are ordered in a way that makes sense? Would you change it and how?
6. Is the language used appropriate? i.e. not too simple and not too complicated
7. What do you think about the length of the survey? Did you get bored and skip through some of the answers without really reading the questions?
8. If this survey came addressed to you in the post, would you complete it?
   - Why?
   - What is the maximum amount of time you would spend completing a postal survey?
   - What would increase the likelihood of you completing and returning it?
9. What are the main barriers to PA – look through the list, are any missing?

Pilot survey overview:

Cover Page:	Study introduction & survey completion instructions
Page 1:	Assent form & demographics
Section A:	General health
Section B:	Physical activity including active transport
Section C:	Leisure time activities
Section D:	Physical activities engaged in
Section E:	School based physical activity
Section F:	Community based physical activity
Section G:	Social support
Section H:	Self-efficacy, motivation & enjoyment
Section I:	Barriers
Section J:	Environment
Section K:	Self-perceptions of physical activity & body
Section L:	Socio-demographics

Appendix E School based research

E.1 School recruitment letter

School Address

03/01/2014

Dear Principal <insert name>,

In 2009, DCU attended your school as part of the national Children's Sport Participation and Physical Activity (CSPPA) study. This study provided valuable information about the physical activity patterns of Irish youth, and has contributed to policy development in this area over the last five years.

We now wish to conduct a **5-year follow up**, the **CSPPA Plus** study. Each child in 2009 was asked if they would agree to be contacted in the future as part of a follow-up study. Over 4,000 (78%) agreed. In your school, <insert number> students who were in 1st year in 2009 agreed to follow up, these individuals may now be in 6th year. We are asking your permission to visit your school early this year, to meet these students and administer a short 35 minute questionnaire. A research team from the School of Health and Human Performance will collaborate with your teachers, and be responsible for all of the work involved.

As a thank you for taking part, we would like to offer a presentation on the importance of a healthy lifestyle (i.e. regular physical activity (from a brisk walk to playing sport), healthy nutrition, good quality sleep and stress management) in preparation for the examination period ahead. Additionally, your school will be entered into a prize draw for €200.

We will follow up this letter with a phone call next week to answer any questions and confirm if you would be willing to further participate in this study. Finally, we would like to take this opportunity to wish you, your staff and all of your students a healthy and happy new year.

Yours sincerely,

Dr. Catherine Woods
Principal Investigator, CSPPA Study.
Senior Lecturer in Physical Activity Psychology and Health
School of Health and Human Performance (SHHP).

Ms. Michelle Hardie
Research Officer
CSPPA Plus Study
SHHP, DCU.

E.2 Parental letter, information sheet and consent form

CSPPA PLUS STUDY

A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

13th February, 2014

Dear Parent/Guardian,

I am contacting you with regards to the Children's Sport Participation and Physical Activity (**CSPPA**) **Plus** research study which is being conducted by Dublin City University. This is a follow up of the 2009 CSPPA study which provided valuable information about the physical activity patterns of Irish youth, and has contributed to policy development in this area over the last five years.

Each participant in 2009 was asked if they would agree to be contacted in the future as part of a follow-up study. Over 4,000 (78%) agreed and I am contacting you as your child is one of these participants. We will be visiting <insert school name> school at the end of February. At this time, your child will be invited to complete a physical activity questionnaire, which will ask them about their lifestyle and their views on physical education, physical activity and youth sport. Your child will also be asked to wear a small motion sensor for one week. All participants will be provided with information about the study and given the option of participation.

Please find overleaf an Information Sheet and Informed Consent Form for your child's participation in the "CSPPA Plus" study.

1. In order for your child to **participate** in this study, please read and discuss the study with your child. If you would like them to participate **NO further action is necessary**.
2. If you would prefer that your child **did not take part** in the study, please **sign the attached form and return it to the teacher**.

Thank you for your time.

Yours sincerely,

Michelle Hardie, BSc. MPH

Researcher, CSPPA Plus study

DUBLIN CITY UNIVERSITY

Information Sheet

(Please read with your child)

CSPPA Plus: A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

Investigators: The study will be carried out by the School of Health and Human Performance in Dublin City University. The principal investigators are Dr. Catherine Woods and Ms. Michelle Hardie.

Introduction to the Study

The Children's Sport Participation and Physical Activity study was carried out by Dublin City University, the University of Limerick and University College Cork in 2009. It collected data on over 5,300 Irish children and youth aged 10-18 years.

As physical activity has been shown to be extremely beneficial to youth, this study will add to the information gathered in 2009. The purpose of the study is to understand the reasons behind why Irish youth are either physically active or not, and the reasons why this may change over time.

The study will involve completing a questionnaire during class time. The questions ask about lifestyle and views on participation in physical activity and sedentary behaviour (for example, watching TV and other sitting activities). In addition, participants will be asked to wear a small device that measures how quickly and often they move in one week (7 days). The device is the size of a match box and is worn around the waist.

Confidentiality of Data

The information obtained from testing will be treated as private and confidential – no one will get to look at it except the research team. Research ID numbers will be used so that no person will be identifiable from the information. Data will be destroyed 5 years after completion of the study. Confidentiality of information is only possible within the limitations of the law. It is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

Involvement in the Research Study is Voluntary

Consent is voluntary and participants may withdraw from the study at any time. No one will be penalised in any way for doing this.

For questions on the study, please contact one of the researchers.

NAME	PHONE	EMAIL
Dr. Catherine Woods	01-7008008	catherine.woods@dcu.ie
Ms. Michelle Hardie	01-7007441	michelle.hardie2@mail.dcu.ie

If participants have concerns about this study and wish to contact an independent person, please contact:
The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000

DUBLIN CITY UNIVERSITY

Informed Consent Form

CSPPA Plus: A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

Investigators: The study will be carried out by the School of Health and Human Performance in Dublin City University. The principal investigators are Dr. Catherine Woods and Ms. Michelle Hardie.

Introduction to the Study

Physical activity has been shown to be extremely beneficial to youth, however in order to develop effective physical activity programmes for children of different ages, it is important to understand what influences them to become and remain active.

What Will Happen During the Study?

- Your child will be asked to complete a physical activity questionnaire. This will take place during normal school hours, and will take about 30-35 minutes to complete. The questionnaire will ask them about their lifestyle and their views on physical education, physical activity and youth sport. These questions have been used with other young people.
- Your child will be asked to wear a small device that measures how quickly and often I move in one week (7 days). This device is worn around the waist.
- All information gathered will be treated in the strictest of confidence. To ensure this, your name will be removed from all data and replaced with an ID number. Only the researcher will know your ID number. Confidentiality of information provided can only be protected within the limitations of the law. It is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

Please read Option 1 and Option 2 below and complete as appropriate.

Option 1: Child to be **INCLUDED** in the study

I have read and understood the information in this form. I have read and discussed the information in the form with my child. I have a copy of the Information Sheet. I understand that my child **will be included** in this study.

ACTION: No further action necessary. Please file this consent form.

Option 2: Child to be **REMOVED** from the study

I have read and understood the information in this form. I have read and discussed the information in the form with my child. I have a copy of the Information Sheet. I request that my child is **not** included in the study. I understand that my child will not be penalised in any way for doing this.

Parent/Guardian Signature: _____

Name in Block Capitals: _____

Childs Name in Block Capitals: _____

Date: _____

ACTION: To advise the research team of your decision please sign and return this form to your child's teacher for attention of Dr. Catherine Woods.

E.3 School visit checklist

Checklist <insert school name>

2014 sample: <insert number (#)>

	Item	Quantity	Checked
1	School details sheet: contact, requests etc.	1	
2	Directions to the school	1	
3	List of names & ID numbers from 2009	1	
4	Copy of Parent Consent Forms & Letter	1	
5	Information Sheet (survey & accelerometers)	#	
6	Informed Consent Form (survey & accelerometers)	#	
7	Surveys (pre-coded)	#	
8	Surveys (spare)	20	
9	Envelope for assent forms & personal details	1	
10	Height & weight data collection form	1	
11	Stadiometer	2	
12	Weighing scales	2	
13	Accelerometers	#	
14	Accelerometer Record Cards	#	
15	Accelerometer Record Sheet (with accelerometer ID)	2	
16	Accelerometer Contact Details Form	2	
17	Spare accelerometer straps	15	
18	Pens	Box	
19	Highlighter	1	

E.4 Participant information sheet

DUBLIN CITY UNIVERSITY
Information Sheet

Project Title: CSPPA Plus: A 5-year Follow Up Study.

Investigators: The study will be carried out by the School of Health and Human Performance, Dublin City University. The principal investigators are Dr. Catherine Woods, Dr. Sarahjane Belton and Ms. Michelle Hardie.

Introduction to the Study
The Children's Sport Participation and Physical Activity study was carried out by Dublin City University, the University of Limerick and University College Cork in 2009. It collected data on over 5,300 Irish children and youth aged 10-18 years. This study follows up with the young people involved in the original study. The purpose of the study is to understand the reasons behind why Irish youth are either physically active or not, and the reasons why this may change over time.

What Will Happen During the Study?
- The study will involve completing a questionnaire. This questionnaire will be filled out in class with the help of a researcher from DCU. The questions ask about lifestyle and views on participation in physical activity and sedentary behaviour (for example, watching TV and other sitting activities).
- I will be given the option of having my height and weight measurements taken by a research assistant.
- I will be asked to wear a small device that measures how quickly and often I move in one week (7 days). This device is worn around the waist and I will be shown how to put it on. If I can't put it on, another adult and my teacher will be there to help me.
- I may be selected to take part in an interview or group discussion. These interviews will be recorded on an audio tape. There will be at least two other people in the room including the researcher during the interview.

Participation in the questionnaire should not result in any risks greater than would be encountered in everyday life. To maintain privacy and confidentiality, measurements of height and weight will be taken in a separate room with the option of having a teacher present.

Potential Benefits
In order to develop physical activity programmes that work well, it is important that researchers understand what influences adolescents and young people in Ireland to become and remain active. The results of this study will be supplied to policy makers in Ireland and therefore may help inform healthy public policy and future physical activity interventions.

Confidentiality of Data
The information obtained from testing will be treated as private and confidential – no one will get to look at it except the research team. Data will be analysed but no person will be identifiable from this information as ID numbers will be used. Data will be destroyed 5 years after completion of the study. Confidentiality of information is only possible within the limitations of the law. It is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

Involvement in the Research Study is voluntary
Consent is voluntary and participants may withdraw from the study at any time. No one will be penalised in any way for doing this.

For questions on the study, please contact one of the researchers.

TITLE	SURNAME	FIRST NAME	PHONE	EMAIL
DR	WOODS	CATHERINE	01 - 7008008	catherine.woods@dcu.ie
DR	BELTON	SARAHJANE	01 - 7007393	sarahjane.belton@dcu.ie
MS	HARDIE	MICHELLE	01 - 7007441	michelle.hardie2@mail.dcu.ie

If participants have concerns about this study and wish to contact an independent person, please contact:
The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000

E.5 Assent form for youth (survey and physical measures)

DUBLIN CITY UNIVERSITY
Informed Consent Form

Project Title: CSPPA Plus: A 5-year Follow Up Study.

Investigators: The study will be carried out by the School of Health and Human Performance, Dublin City University. The principal investigators are Dr. Catherine Woods, Dr. Sarahjane Belton and Ms. Michelle Hardie.

Introduction to the Study
As physical activity has been shown to be extremely beneficial to youth, this study follows up with the young people involved in the Children's Sport Participation and Physical Activity study in 2009. The purpose of the study is to understand the reasons behind why Irish youth are either physically active or not, and the reasons why this may change over time.

What Will Happen During the Study?
- I will be asked to fill out a questionnaire in class with the help of a researcher from DCU. The questions ask about lifestyle and views on participation in physical activity and sedentary behaviour (for example, watching TV and other sitting activities).
- I will be given the option of having my height and weight measurements taken by a research assistant.
- I will be asked to wear a small device that measures how quickly and often I move in one week (7 days). This device is worn around the waist and I will be shown how to put it on. If I can't put it on, another adult and my teacher will be there to help me.
- I may be selected to take part in an interview or group discussion. These interviews will be recorded on an audio tape. There will be at least two other people in the room including the researcher during the interview.

Please tick (✓) ONE box only for each of the questions on this page.

1.	I have read the Information Sheet (or had it read to me).	No 1 ☐	Yes 2 ☐
2.	I understand the information provided.	No 1 ☐	Yes 2 ☐
3.	I am aware that this study will involve me completing a physical activity questionnaire and my physical measurement may be taken.	No 1 ☐	Yes 2 ☐
4.	I know that I am free to decide not to take part in this study or change my mind if I wish.	No 1 ☐	Yes 2 ☐

All information gathered will be treated in the strictest of confidence. To ensure this, your name will be removed from all data and replaced with an ID number. Only the researcher will know your ID number. 'Confidentiality of information provided can only be protected within the limitations of the law. It is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.'

I have read and understand the information on this form. The researchers have answered all my questions. I consent to participate in this study. I understand that I can withdraw from the study at any stage should I choose to do so. I will not be penalised in any way for doing this.

Student Signature: _____
Printed Name: _____
Date: _____

Appendix F Physical measures

F.1 Height and weight protocol

Height:

Equipment:

1. Standard collapsible portable stadiometer
2. Data collection sheets

Set-up:

1. Construct stadiometer following instructions.
2. Place it on a level, flat, hard surface with the stabilizing bar against a vertical surface such as a wall or door.

Instructions to participant:

1. Remove shoes
2. If the hairstyle affects their height, ask them to adjust it for the test
3. Stand with heels and toes together on the base plate
4. Arms loosely by their side
5. Back straight against the vertical measuring rods
6. Look straight ahead
7. Take a deep breath and stand as straight as possible without their heels lifting off the ground.

Note: These can be difficult instruction for children/youth to follow – make sure the head is not tilted or the shoulders raised, breath normally. Check posture before measuring.

Record in metres to nearest 0.1 of a centimetre

Weight:

Equipment:

1. Standard portable calibrated scales (mechanical)
2. Data collection sheets

Set-up:

1. Ensure scales are pre-calibrated with a known weight.
2. Place scales on a hard, level surface.

Instructions to participant:

1. Wear only light garments.
2. Remove items such as keys and money from pockets.
3. Remove shoes.
4. Stand on the scales, with both feet fully on the weighing platform, heels towards the back edge, and their arms loosely by their side.
5. Remain as still as possible with their head facing forward.
6. Step down from the scale.

Record in kilograms to nearest 0.5 kilogram

Height and weight will be used to calculate Body Mass Index (BMI)

$$BMI = \text{Weight (kg)} / \text{Height } (m^2)$$

BMI measurements help classify the weight of an individual as underweight, normal, overweight or obese. Formulas used are age and gender specific.

References

American College of Sports Medicine (2000), Ch 11. E, Johnson. (6th Ed). ACSM's Guidelines For Exercise Testing and Prescription (pp217-219) USA. Lippincott Williams and Wilkins.

Canadian Society for Exercise Physiology (1996), Ch1. D Docherty. Measurement in Paediatric Exercise Science. (pp18-55) Canada. Human Kinetics

F.2 Height and weight record sheet

HEIGHT AND WEIGHT

School:_____
Date: _____
Group number: _____
Researcher: _____

	ID number	Height (cm)	Weight (kg)
1			
2			
3			
4			
5			
6			
7			
8			
9			
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11			
12			
13			
14			
15			
16			
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27			
28			
29			
30			

Record weight in kilograms to the nearest 0.5 kilogram.
Record height in metres to the nearest 0.1 cm.

F.3 Accelerometer record sheets

ACCELEROMETER RECORD SHEET

School:_____

Date: _____

Group number: _____

Researcher: _____

	ID Number	ActiID	Telephone Number
1			
2			
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4			
5			
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Appendix G Postal based research

G.1 Participant recruitment letter (adolescent)

CSPPA PLUS STUDY

A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

15th April 2014

Dear

Thank you for taking part in the Children's Sport Participation and Physical Activity (CSPPA) research study in school in 2009. The information we received from over 5,300 young people, like you, was so valuable that we are now conducting a 5 year follow up, the **CSPPA Plus** study. In fact, the information is currently being used to inform national policy. My team and I, here at Dublin City University would love to get you involved again.

The CSPPA Plus study involves completing a questionnaire similar to the one you did 5 years ago. It includes questions about your lifestyle and views on physical activity and sport. There are two options of ways to complete it. You can fill it out online at http://www.surveymonkey.com/s/CSPPAAdolescentSurvey or you can answer the survey supplied and post it back to us using the freepost envelope provided.

In this pack, you will find an Information Sheet that tells you more about the study. You will also find a letter for your parents or guardians. Please pass this on and discuss taking part in the study with them before completing the survey. If you have any questions, please feel free to contact me.

One last thing, all completed surveys received before May 9th will be entered into a **prize draw for €100** so try get it done early.

Thank you for your time.

Yours sincerely,

Michelle Hardie, BSc. MPH
Research Officer, CSPPA Plus Study
Dublin City University
Tel: 01-7007441

G.2 Participant recruitment letter (young adult)

CSPPA PLUS STUDY

A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

15th April 2014

Dear

Thank you for taking part in the Children's Sport Participation and Physical Activity (CSPPA) research study in school in 2009. The information we received from over 5,300 young people, like you, was so valuable that we are now conducting a 5 year follow up, the **CSPPA Plus** study. In fact, the information is currently being used to inform national policy. My team and I, here at Dublin City University would love to get you involved again.

The CSPPA Plus study involves completing a questionnaire similar to the one you did 5 years ago. It includes questions about your lifestyle and views on physical activity and sport. There are two options of ways to complete it. You can fill it out online at http://www.surveymonkey.com/s/CSPPAYoungAdult or you can answer the survey supplied and post it back to us using the freepost envelope provided.

In this pack, you will find an Information Sheet that tells you more about the study. If you have any questions, please feel free to contact me.

One last thing, all completed surveys received before May 9th will be entered into a **prize draw for €100** so try get it done early.

Thank you for your time.

Yours sincerely,

Michelle Hardie, BSc. MPH
Research Officer, CSPPA Plus Study
Dublin City University
Tel: 01-7007441

G.3 Parental letter of recruitment

CSPPA PLUS STUDY

A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

15th April 2014

Dear Parent/Guardian,

I am contacting you with regards to the Children's Sport Participation and Physical Activity (**CSPPA**) **Plus** research study which is being conducted by Dublin City University. This is a follow up of the 2009 CSPPA study which provided valuable information about the physical activity patterns of Irish youth, and has contributed to policy development in this area over the last five years.

Each participant in 2009 was asked if they would agree to be contacted in the future as part of a follow-up study. Over 4,000 (78%) agreed and I am contacting you as your child is one of these participants. I have enclosed a letter to your child explaining information about the study. We would like to take this opportunity to invite your child to complete a physical activity questionnaire. The questions are similar to those asked 5 year ago and ask them about their lifestyle and their views on physical activity and youth sport.

Please find overleaf an Informed Consent Form for your child's participation in the "CSPPA Plus" study. In this pack you will also find an Information Sheet that tells you more about the study.

1. In order for your child to **participate** in this study, please read and discuss the study with your child. If you would like them to participate **please allow your child to complete and return the survey to us**.

2. If you would prefer that your child **did not take part** in the study, **no further action is necessary**.

Thank you for your time.

Yours sincerely,

Dr. Catherine Woods
Principal Investigator, CSPPA Study.
Senior Lecturer in Physical Activity Psychology and Health
School of Health and Human Performance (SHHP).

Ms. Michelle Hardie
Research Officer
CSPPA Plus Study
SHHP, DCU.

G.4 Informed consent form for parents / guardians

DUBLIN CITY UNIVERSITY
Informed Consent Form for Parents/Guardians

CSPPA Plus:
A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

Investigators: The study is being carried out by the School of Health and Human Performance in Dublin City University. The principal investigators are Dr. Catherine Woods, Dr. Sarahjane Belton and Ms. Michelle Hardie.

Introduction to the Study
Physical activity has been shown to be extremely beneficial to youth, however in order to develop effective physical activity programmes for children of different ages, it is important to understand what influences them to become and remain active.

What Will Happen During the Study?

- Your child will be asked to complete a physical activity questionnaire. It will ask them about their lifestyle and their views on physical activity and sport.
- All information gathered will be treated in the strictest of confidence. To ensure this, their name will be removed from all data and replaced with an ID number. Only the researcher will know their ID number. Confidentiality of information provided can only be protected within the limitations of the law. It is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

I have read and understood the information in this form. I have read and discussed the information in the form with my child. I have a copy of the Information Sheet. I understand that my child will be included in this study.

ACTION: Please allow your child to complete and return the survey to us.

G.5 Postal information sheet

DUBLIN CITY UNIVERSITY
Information Sheet

CSPPA Plus:
A 5-year Follow Up Study of Children's Sport Participation and Physical Activity.

Investigators: The study is being carried out by the School of Health and Human Performance in Dublin City University. The principal investigators are Dr. Catherine Woods, Dr. Sarahjane Belton and Ms. Michelle Hardie.

Introduction to the Study
The Children's Sport Participation and Physical Activity study was carried out by Dublin City University, the University of Limerick and University College Cork in 2009. It collected data on over 5,300 Irish children and youth aged 10-18 years. This study follows up with the young people involved in the original study. The purpose of the study is to understand the reasons behind why Irish youth are either physically active or not, and the reasons why this may change over time.

The study will involve completing a questionnaire. The questions ask about lifestyle and views on participation in physical activity and sedentary behaviour (for example, watching TV and other sitting activities).

Potential Benefits
The results of this study will be supplied to policy makers in Ireland and therefore may help inform healthy public policy and future physical activity interventions.

Confidentiality of Data
The information obtained from testing will be treated as private and confidential – no one will get to look at it except the research team. Data will be analysed but no person will be identifiable from this information as ID numbers will be used. Data will be destroyed 5 years after completion of the study. Confidentiality of information is only possible within the limitations of the law. It is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

Involvement in the Research Study is voluntary
Consent is voluntary and participants may withdraw from the study at any time. No one will be penalised in any way for doing this.

For questions on the study, please contact one of the researchers.

NAME	PHONE	EMAIL
Dr. Catherine Woods	01-7008008	catherine.woods@dcu.ie
Dr. Sarahjane Belton	01-7007393	sarahjane.belton@dcu.ie
Ms. Michelle Hardie	01-7007441	michelle.hardie2@mail.dcu.ie

If participants have concerns about this study and wish to contact an independent person, please contact:
The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000.

Appendix H Study 1 supporting documents

H.1 Freedson cut point calculations

Freedson (2005) Age Specific Accelerometer Cut-points

Equation

METs = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])

Moderate intensity = 4 METs

Vigorous intensity = 7 METs

cnts.min^{-1} = counts per minute or CPM

Table H.1 Freedson cut points corresponding to moderate physical activity (Freedson, 2005).

	Moderate Intensity (4 – 6.99 METs)
Age (years)	**Counts / min**
10	1910
11	2059
12	2220
13	2393
14	2580
15	2781
16	3000
17	3239
18	3499

Calculations

AGE 10

Moderate Intensity

4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])

4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*10) - (0.000038*cnts.min^{-1}*10)

4 = 2.757 - 0.8957 + (0.0015*cnts.min^{-1} – 0.00038*cnts.min^{-1})

4 = 1.8613 + (0.00112*cnts.min^{-1})

cnts.min^{-1} = (4 – 1.8613) / 0.00112

cnts.min^{-1} = 1909.55

AGE 11

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*11) - (0.000038*cnts.min^{-1}*11)$

$4 = 2.757 - 0.98527 + (0.0015*cnts.min^{-1} - 0.000418*cnts.min^{-1})$

$4 = 1.77173 + (0.001082*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.77173) / 0.001082$

$cnts.min^{-1} = 2059.39$

AGE 12

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*12) - (0.000038*cnts.min^{-1}*12)$

$4 = 2.757 - 1.07484 + (0.0015*cnts.min^{-1} - 0.000456*cnts.min^{-1})$

$4 = 1.68216 + (0.001044*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.68216) / 0.001044$

$cnts.min^{-1} = 2220.15$

AGE 13

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*13) - (0.000038*cnts.min^{-1}*13)$

$4 = 2.757 - 1.16441 + (0.0015*cnts.min^{-1} - 0.000494*cnts.min^{-1})$

$4 = 1.59259 + (0.001006*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.59259) / 0.001006$

$cnts.min^{-1} = 2393.05$

AGE 14

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*14) - (0.000038*cnts.min^{-1}*14)$

$4 = 2.757 - 1.25398 + (0.0015*cnts.min^{-1} - 0.000532*cnts.min^{-1})$

$4 = 1.50302 + (0.000968*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.50302) / 0.000968$

$cnts.min^{-1} = 2579.52$

AGE 15

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*15) - (0.000038*cnts.min^{-1}*15)$

$4 = 2.757 - 1.34355 + (0.0015*cnts.min^{-1} - 0.00057*cnts.min^{-1})$

$4 = 1.41345 + (0.00093*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.41345) / 0.00093$

$cnts.min^{-1} = 2781.24$

AGE 16

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*16) - (0.000038*cnts.min^{-1}*16)$

$4 = 2.757 - 1.43312 + (0.0015*cnts.min^{-1} - 0.000608*cnts.min^{-1})$

$4 = 1.32388 + (0.000892*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.32388) / 0.000892$

$cnts.min^{-1} = 3000.13$

AGE 17

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*17) - (0.000038*cnts.min^{-1}*17)$

$4 = 2.757 - 1.52269 + (0.0015*cnts.min^{-1} - 0.000646*cnts.min^{-1})$

$4 = 1.23431 + (0.000854*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.23431) / 0.000854$

$cnts.min^{-1} = 3238.51$

AGE 18

Moderate Intensity

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*age[yr]) - (0.000038*cnts.min^{-1}*age[yr])$

$4 = 2.757 + (0.0015*cnts.min^{-1}) - (0.08957*18) - (0.000038*cnts.min^{-1}*18)$

$4 = 2.757 - 1.61226 + (0.0015*cnts.min^{-1} - 0.000684*cnts.min^{-1})$

$4 = 1.14474 + (0.000816*cnts.min^{-1})$

$cnts.min^{-1} = (4 - 1.14474) / 0.000816$

$cnts.min^{-1} = 3499.09$

H.2 Wear time criteria options

Table H.2 Summary of participants meeting various accelerometer wear time criteria (2009 & 2014 included).

	10 Hours Wear Time				9 Hours Wear Time				8 Hours Wear Time			
	Total	**Sex**	**Age**		**Total**	**Sex**	**Age**		**Total**	**Sex**	**Age**	
	(n)	Male (%)	(years)	(n)	(n)	Male (%)	(years)	(n)	(n)	Male (%)	(years)	(n)
7 days	24	41.7	10	0	49	59.2	10	2	77	37.2	10	3
			11	4			11	1			11	25
			12	0			12	0			12	1
			13	0			13	1			13	3
			14	0			14	0			14	0
			15	2			15	5			15	7
			16	3			16	8			16	11
			17	5			17	11			17	13
			18	0			18	1			18	15
			19	0			19	0			19	0
6+ days	78	41.0	10	3	125	55.2	10	4	173	39.9	10	4
			11	2			11	9			11	64
			12	2			12	3			12	4
			13	2			13	4			13	7
			14	0			14	1			14	1
			15	9			15	12			15	15
			16	9			16	14			16	18
			17	5			17	3			17	26
			18	5			18	3			18	32
			19	1			19	2			19	2
5+ days	157	52.8	10	4	208	47.6	10	4	235	41.1	10	4
			11	1			11	1			11	85
			12	4			12	4			12	4
			13	9			13	1			13	12
			14	1			14	1			14	1
			15	3			15	6			15	16
			16	5			16	0			16	26
			17	5			17	0			17	34
			18	3			18	9			18	57
			19	2			19	2			19	2

Appendix I Study 2 supporting documents

I.1 Cohen's *d* effect size calculation

$$\text{Cohen's } d = \frac{\text{mean difference between the contrasts (pairs)}}{\text{Average or pooled variability}}$$

$$d = \frac{\overline{Xi} - \overline{Xk}}{\sqrt{MS'error}}$$

Cohen's d based on ANCOVA analyses adjusting for age and sex:

Sports participation frequency: $d = \frac{1.012}{\sqrt{2.783}} = \frac{1.012}{1.668} = 0.61$ = medium effect

Number of sports: $d = \frac{0.551}{\sqrt{2.951}} = \frac{0.551}{1.718} = 0.32$ = small effect

Sport type*: $d = \frac{0.551}{\sqrt{2.937}} = \frac{0.551}{1.714} = 0.30$ = small effect

Standard achieved: $d = \frac{1.236}{\sqrt{2.733}} = \frac{1.236}{1.653} = 0.75$ = medium-to-large effect

Cohen's d based on ANCOVA analyses adjusting for age, sex and baseline physical activity:

Sports participation frequency: $d = \frac{0.652}{\sqrt{2.722}} = \frac{0.652}{1.649} = 0.40$ = small-to-medium effect

Number of sports: $d = \frac{0.077}{\sqrt{2.799}} = \frac{0.077}{1.673} = 0.05$ = no effect

Sport type*: $d = \frac{0.292}{\sqrt{2.797}} = \frac{0.292}{1.672} = 0.17$ = no effect

Standard achieved: $d = \frac{0.962}{\sqrt{2.563}} = \frac{0.962}{1.601} = 0.60$ = medium effect

Note: MS' error = mean square error

*Also adjusting for number of sports.

Appendix J Study 3 supporting documents

J.1 Longitudinal participation in club and extra-curricular sport split by sex and cohort group

Table J.1 Longitudinal participation in club sport over a 5-year period in males.

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
All males (n = 265)					
1	Soccer	40.8	33.2*	10.2	17.7
2	Gaelic football	39.2	37.7	9.8	11.3
3	Hurling	23.4	15.1**	3.0	11.3
4	Swimming	17.4	15.5	9.1	10.9
5	Rugby	12.8	9.1	4.9	8.7
6	Athletics	12.1	14.3	10.6	8.3
7	Tennis	9.4	6.0	4.2	7.5
8	Basketball	9.1	4.9	3.0	7.2
9	Weight training	7.5	33.6**	28.7	2.6
10	Martial arts	6.8	6.0	4.5	5.3
11	Badminton	6.0	3.0	1.5	4.5
12	Cross country running	6.0	5.7	4.5	4.9
13	Adventure activities	5.3	3.4	3.4	5.3
14	Handball	5.3	2.3	1.5	4.5
Primary School Cohort (n = 66)					
1	Soccer	53.0	33.3*	7.6	27.3
2	Gaelic football	51.5	40.9	7.6	18.2
3	Hurling	42.4	24.2**	0	18.2
4	Swimming	21.2	13.6	7.6	15.2
5	Rugby	16.7	7.6	3.0	12.1
6	Athletics	13.6	6.1	3.0	10.6
7	Basketball	10.6	4.5	3.0	9.1
8	Badminton	9.1	4.5	3.0	7.6
9	Martial arts	9.1	3.0	1.5	7.6
10	Tennis	9.1	7.6	6.1	7.6
11	Adventure activities	7.6	3.0	3.0	7.6
12	Cross country running	7.6	4.5	4.5	7.6
13	Handball	7.6	0	0	7.6
14	Horse riding	7.6	1.5	1.5	7.6
15	Dance	6.1	6.1	4.5	4.5
16	Weight training	4.5	28.8**	25.8	1.5
17	Aerobics	3.0	6.1	6.1	3.0

Table continued on the next page

Table J.1 Continued

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
Post-primary School Cohort (n = 109)					
1	Soccer	40.4	33.0	9.2	16.5
2	Gaelic football	37.6	41.3	12.8	9.2
3	Swimming	18.3	14.7	9.2	12.8
4	Hurling	17.4	11.9	5.5	11.0
5	Athletics	12.8	19.3	14.7	8.3
6	Rugby	11.9	6.4	1.8	7.3
7	Basketball	9.2	6.4	3.7	6.4
8	Tennis	9.2	6.4	4.6	7.3
9	Cross country running	8.3	7.3	4.6	5.5
10	Badminton	7.3	4.6	1.8	4.6
11	Baseball or rounders	6.4	0.9*	0	5.5
12	Adventure activities	5.5	3.7	3.7	5.5
13	Hockey	5.5	1.8	0.9	4.6
14	Horse riding	5.5	2.8	1.8	4.6
15	Martial arts	5.5	8.3	5.5	2.8
16	Weight training	3.7	28.4**	26.6	1.8
17	Aerobics	2.8	6.4	5.5	1.8
School Leaver Cohort (n = 90)					
1	Gaelic football	32.2	31.1	7.8	8.9
2	Soccer	32.2	33.3	13.3	12.2
3	Hurling	16.7	12.2	2.2	6.7
4	Weight training	14.4	43.3**	33.3	4.4
5	Swimming	13.3	17.8	10.0	5.6
6	Rugby	11.1	13.3	10.0	7.8
7	Athletics	10.0	14.4	11.1	6.7
8	Tennis	10.0	4.4	2.2	7.8
9	Basketball	7.8	3.3	2.2	6.7
10	Martial arts	6.7	5.6	5.6	6.7
11	Handball	5.6	4.4	2.2	3.3

Note: Sports reported by at least 5% of the respondents at baseline or follow-up are presented.

T1 = time point 1 (2009); T2 = time point 2 (2014).

* Time difference (T1 and T2): $P < 0.05$; ** $P < 0.01$

Table J.2 Longitudinal participation in extra-curricular sport over a 5-year period in males.

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
All school-aged males (n = 175)[a]					
1	Soccer	26.9	32.6	22.9	17.1
2	Gaelic football	20.6	21.7	15.4	14.3
3	Athletics	16.0	10.9	9.7	14.9
4	Basketball	13.7	18.9	14.9	9.7
5	Rugby	12.0	10.3	6.3	8.0
6	Hockey	10.3	4.0	1.1	7.4
7	Baseball or rounders	9.7	1.1**	0.6	9.1
8	Hurling	8.0	10.3	8.6	6.3
9	Handball	7.4	4.0	2.3	5.7
10	Swimming	7.4	4.6	3.4	6.3
11	Tennis	7.4	5.1	4.6	6.9
12	Badminton	5.7	5.1	4.0	4.6
13	Cross country running	5.1	6.9	6.3	4.6
14	Weight training	0.6	12.6**	12.6	0.6
Primary School Cohort (n = 66)					
1	Soccer	31.8	36.4	25.8	21.2
2	Gaelic football	28.8	21.2	13.6	21.2
3	Hurling	15.2	10.6	9.1	13.6
4	Baseball or rounders	13.6	0.0	0.0	13.6
5	Swimming	12.1	4.5	3.0	10.6
6	Athletics	10.6	12.1	12.1	10.6
7	Basketball	10.6	15.2	13.6	9.1
8	Badminton	6.1	4.5	4.5	6.1
9	Rugby	6.1	7.6	7.6	6.1
10	Weight training	0.0	10.6	10.6	0.0

Table continued on the next page

Table J.2 Continued

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
Post-primary School Cohort (n = 109)					
1	Soccer	23.9	30.3	21.1	14.7
2	Athletics	19.3	10.1	8.3	17.4
3	Basketball	15.6	21.1	15.6	10.1
4	Gaelic football	15.6	22.0	16.5	10.1
5	Rugby	15.6	11.9	5.5	9.2
6	Hockey	13.8	4.6*	1.8	11.0
7	Handball	11.0	4.6	1.8	8.3
8	Tennis	10.1	5.5	4.6	9.2
9	Baseball or rounders	7.3	1.8	0.9	6.4
10	Cross country running	6.4	8.3	7.3	5.5
11	Badminton	5.5	5.5	3.7	3.7
12	Gymnastics	5.5	0.9	0.0	4.6
13	Hurling	3.7	10.1	8.3	1.8
14	Weight training	0.9	13.8**	13.8	0.9

Note: Sports reported by at least 5% of the respondents at baseline or follow-up are presented.

T1 = time point 1 (2009); T2 = time point 2 (2014).

* Time difference (T1 and T2): $P < 0.05$; ** $P < 0.01$

[a] The School Leaver Cohort was excluded as they could not participate in extra-curricular sport at T2.

Table J.3 Longitudinal participation in club sport over a 5-year period in females.

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
All females (n = 608)					
1	Dance	29.3	24.3*	11.5	16.4
2	Swimming	27.5	25.0	16.0	18.4
3	Gaelic football	24.0	22.2	8.6	10.4
4	Camogie	16.3	14.1	5.3	7.4
5	Soccer	13.2	10.0	4.9	8.1
6	Athletics	11.2	9.5	7.2	8.9
7	Tennis	10.9	8.6	5.4	7.7
8	Horse riding	10.4	9.2	5.3	6.4
9	Basketball	9.9	7.1*	3.9	6.7
10	Gymnastics	7.4	4.4*	2.3	5.3
11	Hockey	6.9	5.1	2.6	4.4
12	Aerobics	5.6	12.7**	11.5	4.4
13	Cross country running	5.6	4.3	3.6	4.9
14	Baseball or rounders	5.1	2.0**	1.5	4.6
15	Adventure activities	3.9	7.1*	6.7	3.6
16	Weight training	3.6	15.5**	14.5	2.6
Primary School Cohort (n = 151)					
1	Dance	39.1	23.2**	9.9	25.8
2	Swimming	36.4	19.9**	11.3	27.8
3	Gaelic football	32.5	23.2*	9.3	18.2
4	Camogie	20.5	15.2	4.0	9.3
5	Soccer	18.5	12.6	5.3	11.3
6	Athletics	17.2	10.6	7.3	13.9
7	Basketball	14.6	7.3*	2.0	9.3
8	Cross country running	11.3	4.6*	3.3	9.9
9	Horse riding	10.6	9.9	6.0	6.6
10	Tennis	10.6	6.6	4.6	8.6
11	Gymnastics	9.9	4.6	2.6	7.9
12	Hockey	6.0	3.3	1.3	4.0
13	Aerobics	3.3	6.6	6.0	2.6
14	Weight training	3.3	15.2**	14.6	2.6
15	Adventure activities	2.0	6.6	6.6	2.0

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Table J.3 Continued

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
Post-primary School Cohort (n = 299)					
1	Dance	30.4	25.8	10.7	15.4
2	Swimming	25.1	25.1	17.1	17.1
3	Gaelic football	21.1	23.1	8.7	6.7
4	Camogie	12.4	13.4	7.0	6.0
5	Tennis	12.4	10.0	5.1	7.7
6	Soccer	11.7	7.0*	3.3	8.0
7	Athletics	11.0	8.4	7.0	9.7
8	Horse riding	10.7	11.0	6.7	6.4
9	Basketball	9.0	5.4	3.3	7.0
10	Hockey	9.0	7.4	3.7	5.4
11	Gymnastics	7.4	4.7	2.3	5.0
12	Adventure activities	5.7	7.0	6.4	5.0
13	Badminton	5.7	6.4	4.0	3.3
14	Aerobics	5.4	11.0*	10.0	4.3
15	Baseball or rounders	5.4	2.0*	1.7	5.0
16	Weight training	3.0	12.7**	12.4	2.7
School Leaver Cohort (n = 158)					
1	Swimming	23.4	29.7	18.4	12.0
2	Gaelic football	21.5	19.6	7.6	9.5
3	Camogie	19.6	14.6	3.2	8.2
4	Dance	17.7	22.8	14.6	9.5
5	Soccer	10.8	13.3	7.6	5.1
6	Horse riding	9.5	5.1	1.9	6.3
7	Aerobics	8.2	21.5**	19.6	6.3
8	Tennis	8.2	7.6	6.3	7.0
9	Basketball	7.0	10.1	7.0	3.8
10	Athletics	5.7	10.8	7.6	2.5
11	Baseball or rounders	5.1	2.5	1.3	3.8
12	Gymnastics	5.1	3.8	1.9	3.2
13	Weight training	5.1	20.9**	18.4	2.5
14	Adventure activities	2.5	7.6	7.6	2.5
15	Badminton	2.5	6.3	5.1	1.3
16	Rugby	1.9	5.1	5.1	1.9

Note: Sports reported by at least 5% of the respondents at baseline or follow-up are presented.

T1 = time point 1 (2009); T2 = time point 2 (2014).

* Time difference (T1 and T2): $P < 0.05$; ** $P < 0.01$

Table J.4 Longitudinal participation in extra-curricular sport over a 5-year period in females.

	Sport	Participation T1 (%)	Participation T2 (%)	Uptake (%)	Dropout (%)
All school-aged females (n = 450)[a]					
1	Gaelic football	22.9	13.8**	6.4	15.6
2	Basketball	17.1	11.3**	6.7	12.4
3	Athletics	15.1	9.3**	6.9	12.7
4	Dance	13.6	6.2**	4.9	12.2
5	Camogie	12.9	8.9*	5.1	9.1
6	Hockey	11.6	6.7*	2.2	7.1
7	Soccer	10.9	9.6	7.1	8.4
8	Swimming	10.9	5.8	4.7	9.8
9	Tennis	8.7	6.4	4.0	6.2
10	Baseball or rounders	8.2	2.4**	2.4	8.2
11	Cross country running	7.1	5.3	3.8	5.6
12	Gymnastics	5.6	2.7*	1.6	4.4
13	Adventure activities	1.1	4.2**	4.0	0.9
14	Weight training	0.4	3.6*	3.6	0.4
Primary School Cohort (n = 151)					
1	Gaelic football	38.4	12.6**	2.6	28.5
2	Dance	23.2	10.6*	7.3	19.9
3	Basketball	21.2	11.9*	6.6	15.9
4	Soccer	19.9	13.2	7.9	14.6
5	Swimming	19.2	3.3**	2.6	18.5
6	Camogie	17.2	8.6*	5.3	13.9
7	Athletics	15.9	14.6	11.9	13.2
8	Baseball or rounders	13.2	2.6**	2.6	13.2
9	Hockey	11.9	6.6	3.3	8.6
10	Handball	8.6	0.0	0.0	8.6
11	Gymnastics	5.3	2.6	2.0	4.6
12	Badminton	0.7	7.9**	7.9	0.7

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Table J.4 Continued

	Sport	Participation		Uptake	Dropout
		T1 (%)	T2 (%)	(%)	(%)
Post-primary School Cohort (n = 299)					
1	Basketball	15.1	11.0	6.7	10.7
2	Gaelic football	15.1	14.4	8.4	9.0
3	Athletics	14.7	6.7**	4.3	12.4
4	Hockey	11.4	6.7**	1.7	6.4
5	Tennis	11.0	7.4	4.3	8.0
6	Camogie	10.7	9.0	5.0	6.7
7	Dance	8.7	4.0*	3.7	8.4
8	Cross country running	8.4	5.7	3.7	6.4
9	Swimming	6.7	7.0	5.7	5.4
10	Badminton	6.4	4.7	4.0	5.7
11	Soccer	6.4	7.7	6.7	5.4
12	Baseball or rounders	5.7	2.3	2.3	5.7
13	Gymnastics	5.7	2.7	1.3	4.3
14	Adventure activities	0.3	4.3**	4.3	0.3
15	Weight training	0.3	3.3*	3.3	0.3

Note: Sports reported by at least 5% of the respondents at baseline or follow-up, or with a significant increase in participation are presented.

T1 = time point 1 (2009); T2 = time point 2 (2014).

* Time difference (T1 and T2): $P < 0.05$; ** $P < 0.01$

[a] The School Leaver Cohort was excluded as they could not participate in extra-curricular sport at T2.

J.2 Rates of uptake of a new sport or drop out of a previous sport

Within the previous five years, rates of uptake of a new sport and dropout of a previous sport were high (**Figure J.1**) and ranged from 59.6% to 72.1% for sport uptake and from 56.3% to 72.4% for sport dropout. Levels of both uptake and dropout peaked in the Post-primary Cohort for both sexes. Overall, there was a significant difference in dropout ($P < 0.05$) with females (68.9%) more likely to drop out of a previous sport than males (60.6%). Dropout consistently outweighed uptake in females across the whole sample in contrast to males where uptake was steadily higher.

Figure J.1 Proportion of the sample taking up a new sport or dropping out of a past sport over the previous five years.