

**Adolescents' Patterns of Physical Activity and Psychosocial  
Factors Associated with Maintenance, Drop Out and Uptake of  
Physical Activity over Twelve Months**

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for the degree of  
Doctor of Philosophy

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## **Declaration**

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## Summary

This thesis sought to quantitatively explore patterns of physical activity among adolescents and the psychosocial factors associated with physical activity maintenance and behaviour change over twelve months. The research is underpinned by self-determination theory (Deci & Ryan, 1985a, 2000), which provides a conceptual framework within which to investigate motivational and social-contextual processes underpinning physical activity behaviour. It has also been widely evidenced that significant others can play an important role in young people's physical activity and as such parental and friend influences reflecting perceived support, role modelling of physical activity, acceptance from the wider peer group and negative experiences of pressure and teasing were examined. In addition, given that adolescence plays a decisive role in the development of body image, aesthetic, functional and perceptual dimensions of body image were considered alongside BMI to facilitate a greater understanding of youth physical activity.

Current national estimates in line with international findings indicate that the majority of adolescents in Ireland are not sufficiently active to meet daily recommended physical activity guidelines (Woods et al., 2010). More worryingly, physical activity levels demonstrate an age-related decline, with dropout occurring earlier for girls than boys (Nader et al., 2008). Prior research has typically focused on overall levels of physical activity, thus fundamental differences pertaining to the type of physical activity underpinning total involvement has not been considered, resulting in a limited understanding of the patterns of physical activity in which young people engage. Therefore, a primary aim of this thesis was to identify profiles of adolescents' physical activity participation using multiple indicators of physical activity (moderate-to-vigorous physical activity, non-organised physical activity (e.g. walk, jog), organised team sport, organised individual sport, and organised non-sport physical activity (e.g. dance, fitness classes). A sample of young people recruited from secondary schools completed a physical activity recall seven day diary and questionnaires tapping into motivation, competence, relatedness, autonomy, autonomy support, parental and peer support and role modelling, parental pressure, peer acceptance, teasing, body dissatisfaction and body image at two points in time, approximately one year apart. In addition, height and weight was measured objectively at each time point to obtain a measure of BMI.

Latent class analysis results revealed five distinct classes among the overall sample ( $N = 995$ ; Males = 386, Females = 609) at Time 1 that reflected active team sport, active individual sport, active non-organised physical activity, organised dance & fitness, and non-participation. Multiple group models indicated that the structure and prevalence of physical activity classes differed as a function of gender and age. Thus, patterns of involvement in physical activity were subsequently explored separately for male and female, and younger and older adolescents. A secondary aim of this research was to examine

whether adolescents' profiles of physical activity participation differed on a range of psychosocial and individual characteristics, given that previous studies have tended to address correlates of overall physical activity without consideration of the context or type of activity performed. The results indicated that active participation in team sport was consistently associated with more adaptive psychosocial characteristics relative to other patterns of adolescents' physical activity.

This research also addressed critical gaps in the literature by examining stability and changes in adolescents' physical activity patterns over one year and identifying psychosocial characteristics related to physical activity dropout, uptake and maintained participation. Participants ( $N = 803$ , Males = 301, Females = 502) were followed up approximately twelve months after baseline and latent class analysis was repeated. Overall, the findings demonstrated some stability in patterns of physical activity from Time 1 to Time 2, with the most prevalent patterns of participation among each adolescent cohort replicated at follow-up. However, variations in profiles of physical activity participation also emerged at Time 2 reflecting changing patterns of youth physical activity involvement. Adolescents were then grouped longitudinally into one of four possible physical activity trajectories based on latent class membership at Time 1 and Time 2 that reflected maintained physical activity participation, dropout, continued non-participation or uptake of physical activity. The results revealed that a greater proportion of males than females, and older than younger adolescents dropped out of physical activity over twelve months. In addition, irrespective of age or gender those who engaged in team sport as compared to individual-type activities at baseline were least likely to transition into the non-participation class at follow-up.

Adopting a prospective longitudinal design, mixed between-within ANOVA models were subsequently conducted to assess changes in motivational, social and body-related characteristics across adolescents' physical activity trajectory groups from Time 1 to Time 2. The results underscore the importance of fostering self-determined motivation, autonomy, autonomy support, maternal and friend support, and functional aspects of body image for reducing dropout and promoting uptake of physical activity and continued participation during the teenage years. These psychosocial characteristics also varied in terms of relative importance for physical activity maintenance and behaviour change among male and female, and younger and older adolescents. The findings may be used to inform gender- and age-specific physical activity interventions targeting physical activity dropout across adolescence. The present research offers important advances to the physical activity literature by furthering our understanding of the different patterns of physical activity in which adolescents engage, in addition to identifying psychosocial characteristics associated with continued participation and physical activity change over twelve months.

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## Chapter 1: Introduction

The focus of this study is adolescents' physical activity patterns, which are investigated from two different perspectives that each correspond to a separate phase of research. Phase one is cross-sectional in nature and examines distinct *sub-groups* of physical activity involvement that are subsequently compared on a range of psychosocial factors. The second phase employs a prospective longitudinal design and explores how profiles of involvement in physical activity *change* over one year and in turn, the psychosocial mechanisms underpinning broader patterns of physical activity maintenance and behaviour change (i.e. dropout, adoption of physical activity).

National guidelines on physical activity recommend that young people accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) every day (Department of Health and Children, 2009). Adherence to physical activity guidelines is associated with a range of positive outcomes including decreased risk of excess weight and cardiovascular disease, increased psychological well-being and enhanced cognitive performance (Andersen, Harro, Sardinha, Froberg & Ekelund, 2006; Martinez-Gomez et al., 2010; Motl, Birnbaum, Kubik, & Dishman, 2004; Trudea & Shephard, 2008; Twisk, 2001). However, despite the many benefits associated with daily MVPA participation, current estimates, in line with national self-report school based survey findings from the US, Australia and Europe, indicate that the majority of adolescents in Ireland are insufficiently active to meet recommended physical activity guidelines (Borraccino et al., 2009; Fakhouri et al., 2014; Kalman et al., 2015; NaSSDA, 2010). Based on the Health Behaviour in School-Aged Children study (HBSC, 2010), which comprises a large-scale international research survey conducted in collaboration with the World Health Organisation, the self-reported prevalence of meeting physical activity guidelines on the last seven days for Irish adolescents aged between 12 and 14 years was 32.8% for males and 19.6% for females. The figures further decreased to 24.0% for boys and 9.1% for girls between the ages of 15 and 17 years (Kelly, Gavin, Molcho, & Nic Gabhainn, 2012). These findings highlight a clear gender discrepancy in respect to physical activity levels and also suggest that physical activity participation decreases as teenagers get older. Longitudinal research further supports this age-related decline in physical activity across adolescence, and indicates that the drop-off occurs earlier for females than males (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008).

Thus, it is widely accepted that boys are more physically active than girls, and older adolescents demonstrate lower levels of physical activity than their younger counterparts. However, empirical research has typically focused on total physical activity levels (e.g. Kelly et al., 2012), therefore fundamental differences pertaining to the nature and type of physical activity that constitute overall involvement have not been considered, which has resulted in a limited understanding of the patterns of physical activity in which young people engage. The present research therefore aims to address these shortcomings by implementing a person orientated approach to identify *subgroups* of adolescents that



are characterised by participation in similar patterns of physical activity. In an effort to address the complex nature of physical activity behaviour, multiple dimensions were assessed including type (e.g. team sport, individual sport, non-sport physical activity (e.g. dance, circuit class) and context of participation (organised v non-organised) in addition to frequency, intensity and duration of activity.

Multiple developmental and psychosocial characteristics have been identified as playing an influential role in adolescents' physical activity behaviours. Theoretically based research is therefore necessary to investigate determinants of physical activity, which can inform intervention efforts addressing behaviour change and maintenance. The present research is grounded in self-determination theory (SDT; Deci & Ryan, 1985a; Ryan & Deci, 2000), which provides a conceptual framework from which to explore motivational processes underpinning physical activity behaviour. Self-determination theory posits that individuals have different underlying reasons for engaging in physical activity, and satisfaction of psychological needs for competence, relatedness and autonomy by the social environment will foster optimal motivation and behaviour. Additional research further indicates the potential role of other key factors influencing adolescent physical activity that are not explicitly stated in self-determination theory such as social support, role modelling, peer acceptance, pressure and teasing. Recent attempts to integrate these constructs within the self-determination framework however, have proved successful indicating that interpersonal influences can impact motivation by supporting or diminishing psychological needs for competence, relatedness and autonomy (Amado, Sanchez-Oliva, Gonzalez-Ponce, Pilido-Gonzalez & Sanchez-Miguel, 2015; George et al., 2013; Li, Iannotti, Haynie, Perlus, & Simons-Morton, 2014). Peer and parental influences will therefore be assessed in the present study as they reflect significant agents in adolescents' lives that have the potential to directly and indirectly influence physical activity participation and behaviour change over time.

Previous research however, has typically examined the psychosocial determinants of overall youth physical activity without consideration of the underlying type or context of physical activity undertaken (Biddle, Atkin, Cavill & Foster, 2011; Sallis, Prochaska, & Taylor, 2000; Van der Horst, Paw, Twisk, & Van Mechelen, 2007). Therefore, the impact of variations in social and individual factors on different patterns of physical activity may have gone unnoticed. Indeed, limited research undertaken in this area indicates that adolescents' participation in organised and non-organised physical activity is differentially associated with psychosocial factors (Heitzler, Martin, Duke, & Huhman, 2006; Rosenkranz, Welk, Hastman, & Dzewaltowski, 2011; Spink et al., 2006). The present research attempts to extend the existing literature by comparing distinct profiles of physical activity participation that vary in respect to type, context and MVPA across a range of motivational, social and body related characteristics. Identification of psychosocial factors associated with different patterns of physical activity would consequently prove useful for informing physical activity interventions targeting specific

subgroups of adolescents.

The present research is additionally contextualised within the developmental period of adolescence; a time characterised by heightened preoccupation with one's appearance owing to rapid physical changes accompanying puberty, and social changes contributing to enhanced salience of peer relationships (Ata, Ludden, & Lally, 2007; Hartup & Stevens, 1997). The increased awareness of body and weight concerns during adolescence also parallels the declining levels of physical activity evidenced among boys and girls (Cash & Pruzinsky, 1990; Ingledew & Sullivan, 2002). Moreover, previous research indicates that body image concerns can impact motivation to be physically active, with higher body dissatisfaction associated with decreased self-determined motivation for physical activity among adolescents (Markland & Ingledew, 2007). Thus body mass, in addition to body image, which comprises aesthetic and functional dimensions that reflect feelings about how one looks and what the body can do, are also explored within the present study as determinants of physical activity behaviour. The combined assessment of self-determination theoretical constructs and additional interpersonal and individual characteristics facilitates a comprehensive examination of variations in adolescents' physical activity behaviours and possible mechanisms underpinning behaviour change and maintenance over time.

The second focus of the present study is on physical activity behaviour *change*, specifically how patterns of involvement in physical activity change over one year among adolescents. In addition, the mechanisms underpinning broader patterns of sustained physical activity, dropout, continued non-participation and uptake of physical activity over twelve months are examined separately for male and female, and younger and older adolescents. While it is widely accepted that physical activity levels decline across adolescence, limited research has explored the nature of physical activity behaviour change. Focusing solely on quantitative differences in total physical activity levels over time may have resulted in changes in underlying patterns of involvement in physical activity being overlooked. In accordance, a longitudinal investigation of children's and adolescents' participation in organised and non-organised physical activity, revealed that decreased participation in daily non-organised physical activity coincided with an increased prevalence of participation in organised physical activity among girls (Wall, Carlson, Stein, Lee, & Fulton, 2011). In contrast, Eime and colleagues (2013) found that non-organised physical activity (e.g. jogging) increased among older adolescents whereas involvement in organised sport declined. Thus, it appears that discontinuation in physical activity may not necessarily result in inactivity but rather one form of activity may be replaced with another. Findings from the literature are mixed however, regarding types of physical activity that are changed over time.

In addition, certain patterns of physical activity behaviour may be more likely to be continued during adolescence than others. Bélanger, Gray-Donald, O'Loughlin, Paradis and Hanley (2009) found that boys were more likely than girls to remain involved in team activities throughout secondary school

whereas teenagers overall had a higher likelihood of sustaining participation in individual as compared to team-based activities. Research pertaining to changes in involvement in particular types or patterns of physical activity remains limited. The present study attempts to address this gap by exploring adolescents' profiles of physical activity participation one year later and examining whether similar patterns of involvement are evidenced, and if these baseline patterns are likely to be maintained, discontinued or replaced with alternative physical activity pursuits. Gender and age-related differences in physical activity maintenance and dropout will also be explored. Delineating preferred forms of physical activity that are sustained across adolescence could prove useful for developing interventions directed at promoting continued involvement in physical activity among male and female, and younger and older teenagers.

Broader patterns of physical activity behaviour change are subsequently explored, with adolescents grouped longitudinally on the basis of their patterns of involvement in physical activity at baseline and follow-up into one of four trajectory groups representing maintained physical activity, dropout, continued non-participation and adoption of physical activity. While different psychosocial factors have been implicated in physical activity behaviour, for the most part it remains unclear as to how these variables relate to changes in physical activity over time. Prospective longitudinal research is therefore needed to gain a greater insight into the determinants of physical activity behaviour change during adolescence (Biddle, Whitehead, O'Donovan & Nevill, 2005). Prior research suggests that decreased perceptions of autonomy support, competence, relatedness, autonomy, self-determined motivation, support, role modelling, and body concerns underpin dropout whilst higher levels of the aforementioned variables support continued physical activity involvement (Dowda, Dishman, Pfeiffer & Pate, 2007; Gillison, Standage & Skevington, 2011; Jõesaar & Hein, 2011; Rangul et al., 2011).

It is unknown whether such predictors exert a similar influence over male and female, or younger and older adolescents' continued or changing physical activity behaviours as previous studies have typically emphasised female participation (e.g. Dowda et al., 2007) or failed to discriminate results in respect to overall gender (e.g. Jõesaar & Hein, 2011) or age-related (e.g. Rangul et al., 2011) characteristics. In addition, little is known about the factors that contribute to adoption of physical activity with most studies preferring to focus on physical activity dropout or discontinuation. A primary goal of this study is therefore to address these limitations by grounding the research within the framework of self-determination theory and examining how psychosocial factors are related to sustained physical activity in addition to dropout and uptake of physical activity among male and female, and younger and older adolescents over a twelve month period. The findings will contribute to the development of gender-and-age-specific interventions targeting physical activity behaviour change and continued participation across adolescence.

The present study therefore comprises two phases of research which represent a cross-sectional and longitudinal approach to exploring physical activity participation among male and female, and younger and older adolescents. The study addresses the following questions:

#### *Phase One*

1. Are there subgroups of adolescents that are characterised by distinct patterns of involvement in physical activity?
2. Do patterns of involvement in physical activity differ between male and female adolescents?
3. Do patterns of involvement in physical activity differ between younger and older adolescents?
4. Do profiles of physical activity participation differ on motivational, social and body-related characteristics?
5. How do these psychosocial characteristics vary across gender and age-specific profiles of adolescents' physical activity participation?

#### *Phase Two*

6. Do patterns of involvement in physical activity change over twelve months among male and female, and younger and older adolescents?
7. Are there gender and age-related differences in physical activity maintenance and dropout over time?
8. Are changes in motivational, social and body related characteristics associated with physical activity maintenance and behaviour change (dropout, physical activity adoption) over twelve months among adolescents?
9. Do psychosocial factors associated with physical activity maintenance and behaviour change differ between male and female adolescents?
10. Do psychosocial factors associated with physical activity maintenance and behaviour change differ between younger and older adolescents?

#### **Outline of the Thesis**

Chapter 2 provides a review of the literature pertaining to physical activity behaviour, focusing on distinct dimensions of physical activity and how physical activity participation changes across adolescence. An overview of theoretical frameworks and conceptual models relevant to physical activity are also addressed with a particular emphasis on self-determination theory. Additional social and individual characteristics that are purported to play a central role in adolescent physical activity behaviour are outlined and discussed. The chapter concludes with an overview of the study, and a description of the overall research aims is provided.

Chapter 3 presents an overview of the methodology of Phase One and Phase Two. The chapter outlines the design of the study, participants, ethical considerations, procedures and material used for data collection. In addition, a description of the process involved in the development of the physical activity survey is provided.

Chapter 4 and 5 constitute the results of Phase One of the study, which comprises a cross-sectional approach to exploring patterns of involvement in physical activity among adolescents. Chapter 4 commences with an overview of latent class analysis, a person orientated approach that is used to identify sub-groups of adolescents that engage in similar patterns of physical activity behaviour. This procedure is replicated for male and female, and younger and older adolescents and differences across these cohorts are explored. Chapter 5 follows up with an examination of the psychosocial factors that distinguish participation in the discrete patterns of physical activity identified in Chapter 4.

Chapter 6 and 7 subsequently comprises the results for Phase Two of the study, which implements a prospective longitudinal design to explore changes in physical activity over one year. In Chapter 6, latent class analysis is conducted on data collected at Time 2 (12 months after Time 1) to identify discrete sub-groups of physical activity involvement. The analysis investigates whether adolescents maintain similar patterns of involvement in physical activity over time, and if certain profiles of physical activity participation are discontinued or replaced with alternative physical activity behaviours. In turn, adolescents are grouped longitudinally into broader patterns of physical activity behaviour change and maintenance on the basis of their physical activity profiles at baseline and follow-up. Gender and age-related differences in physical activity maintenance and dropout over time are explored. Chapter 7 presents the results of mixed-design ANOVAs, which examine whether changes in distinct motivational, social and body related characteristics are associated with sustained physical activity, dropout, continued non-participation or adoption of physical activity and whether these psychosocial factors differ between male and female, and younger and older adolescents.

Chapter 8 concludes the thesis by discussing the findings of both phases of the study and how the research fulfils the predetermined objectives. Following this, the theoretical and methodological issues are considered, the implications of the findings for prevention and intervention initiatives are outlined, and avenues for future research are highlighted.

## **Chapter 2. Literature Review**

### **2.1 Aim of the Chapter**

The purpose of this chapter is to review the literature examining physical activity, theories of behaviour change and determinants of physical activity among adolescents. The multidimensional nature of physical activity is initially addressed with emphasis on various types of participation, gender and age-related differences, and change over time. Self-determination theory is subsequently presented as a conceptual framework within which to explore the motivational processes underpinning physical activity behaviour following a review of alternative models. Additional influences pertaining to the role of significant others in youth physical activity are also highlighted and these interpersonal interactions are discussed in turn. Moreover, as adolescence is a period of development characterised by many physical, social and cognitive changes that result in heightened appearance concerns, body image is considered as a central factor underpinning physical activity participation. The chapter concludes with an overview of the aims of the present research.

### **2.2 Physical Activity**

#### **2.2.1 Conceptualising Physical Activity**

Physical activity may be defined as “any bodily movement produced by skeletal muscles that result in energy expenditure” (Caspersen, Powell, & Christensen, 1985, p. 126). Thus, physical activity encompasses a repertoire of behaviours that range from minimal to maximal movement such as sport, exercise, active travel, free play, and activities of daily living (e.g. housework, bathing). Comprising multiple dimensions, physical activity is a complex behaviour characterised in terms of frequency, duration, intensity, type, or domain (Booth, 2000). Frequency refers to the number of times an activity is undertaken over a given period (e.g. bouts per week) whilst duration reflects the length of time (e.g. minutes) over which the activity is performed. In turn, physical activity intensity corresponds to the rate of energy expenditure during the activity session, which can be quantified as the rate of oxygen consumption, kilocalories or metabolic equivalents (METs) (Harrell et al., 2003). Owing to the many challenges related to the direct assessment of basal metabolic rate, alternative methods have been implemented to provide an indirect measure of intensity such as physiological proxies (e.g. heart rate), or subjective ratings of perceived difficulty (e.g. light, moderate, hard).

Information pertaining to activity type and intensity can be used to derive associated MET values from the Compendium of Energy Expenditures for Youth (Ridley, Ainsworth, & Olds, 2008), a list containing commonly performed activities and the corresponding energy costs. One MET corresponds to the metabolic rate or energy required to sustain sitting, while moderate and vigorous physical activities are assigned a value of at least 4, or 7 METs, respectively (Troiano et al., 2008; Trost et al., 2002). Moderate intensity physical activity is typically described as a feeling of medium effort

characterised by increased heart rate and breathing. In contrast, vigorous intensity physical activity refers to activity that feels hard, in which heart rate is much higher than normal, breathing is deeper and faster, and there is an enhanced likelihood of perspiration (Woods et al., 2010). Estimates of time spent in various physical activity intensities subsequently enable comparison of adolescent activity levels with physical activity guidelines (Ridley et al., 2008). Consistent with international recommendations, The National Guidelines on Physical Activity for Ireland (DOHC, 2009) indicate that children and adolescents should accumulate at least 60 minutes of moderate-to-vigorous intensity physical activity every day. Various types of physical activity, as defined by the features of the behaviour itself (e.g. walking, soccer, swimming), or the organised or non-organised context in which it occurs, may contribute to recommended levels of moderate-to-vigorous physical activity (MVPA).

The final dimension of physical activity reflects the domain or circumstance under which physical activity occurs, including active transportation, leisure time physical activity and specific to youth, in-school physical activity (Booth, 2000). Taking into consideration the broad definition of physical activity which captures incidental activities of daily living alongside more purposive behaviours, the discussion of physical activity going forth, will consider only a subset of physical activity behaviours characteristic of volitional adolescent engagement such as sport, exercise and free play, all of which can contribute to health enhancing levels of physical activity. In turn, leisure time physical activity is generally considered the domain that has the greatest potential for behaviour change (Booth, 2000). Thus, physical activities undertaken out of a sense of volition represent a salient area of investigation among adolescents given the potential implications for enhancing overall levels of MVPA.

### **2.2.2 Measures of Physical Activity**

Physical activity can be assessed using a variety of different techniques including objective measures such as direct observation, accelerometers, pedometers and heart rate monitoring, in addition to subjective methods that comprise self-report surveys, physical activity recalls, diaries, activity logs, and proxy reports (Trost, 2007). Differences in physical activity outcomes evidenced across studies may subsequently be attributable in part, to the method used to evaluate physical activity, as well as actual differences pertaining to level of physical activity (Slootmaker, Schuit, Chinapaw, Seidell, & Van Mechelen, 2009).

Self-report is the most commonly used method of physical activity assessment among adolescents. This approach is typically favoured as it provides a relative inexpensive means of collecting data from a large sample of individuals whilst simultaneously maintaining low levels of investigator and participant burden, with such instruments being easy to administer and typically only requiring a once-off completion (Dollman et al., 2009; Sirard & Pate, 2001; Trost, 2007). In addition, survey methods facilitate habitual physical activity behaviours to be recorded and provide rich contextual

information regarding type of activity performed. Nonetheless, the benefits of surveys, logs and diaries must be considered in view of their limitations. Notably, self-report methods are wholly subjective with most lacking validation against a more stringent physical activity criterion (Sirard & Pate, 2001). In addition, physical activity estimates are solely dependent on individuals' perception of their own physical activity behaviours, which can lead to under or over-estimation of duration or perceived intensity of activity, resulting in inaccurate reports of physical activity levels. Moreover, self-report may be influenced by socially desirable responses (Sallis & Saelens, 2000; Sirard & Pate, 2001; Slootmaker et al., 2009; Welk, Corbin, & Dale, 2000).

In contrast, objective measures of physical activity such as accelerometer based motion sensors represent an increasingly popular means of assessment for use with adolescents as they facilitate more accurate estimates of behaviour than self-report tools. These instruments offer real-time data storage and enable physical activity intensity and duration to be recorded objectively over a specified time frame. Accelerometer methods have also typically been validated against other criterion measures such as direct observation, which is typically used as the gold standard in physical activity research. Furthermore, these tools provide a nonreactive and reusable instrument for measuring physical activity (Sirard & Pate, 2001). Thus, accelerometers provide a valid and reliable means of estimating current physical activity levels and changes over time (Dollman et al., 2009).

It is important to note however, that while the rate of error is low for these objective instruments, they are both time and cost intensive, with specialised training required to activate and interpret data from such devices (Dollman et al., 2009). Thus, accelerometers may not represent a feasible option for evaluating physical activity levels when resources are limited. Furthermore, accelerometers do not capture certain activities such as cycling and climbing and cannot be worn during water or contact sports, which can result in underestimations of total physical activity energy expenditure (Troost, 2001; Welk et al., 2000). These issues can be overcome by asking participants to record when the device has not been worn, however this places additional burden on the individual (Dollman et al., 2009). Irrespective of these shortcomings, objective measures are also vulnerable to inaccuracies arising from methodological inconsistencies such as number of data collection days, equipment tampering and non-compliance among young people (Troost, 2001)

Thus, it is evident that subjective and objective measures of physical activity each comprise unique strengths and limitations. In order to gain a greater insight into youth physical activity patterns measures are required that provide accurate and reliable assessment of physical activity (Sirard & Pate, 2001). The purpose of the study, type of information required and the resources available should therefore dictate the most suitable method of physical activity assessment (Dollman et al., 2009). Within the present study, a greater understanding of young people's physical activity behaviour patterns and change over time is of primary concern. While self-reports surveys provide cost effective



means of measuring youth physical activity they lack objectivity and are subject to errors regarding physical activity levels whereas accelerometers provide objective measures of physical activity that demonstrate high validity but with increased participant burden. In contrast, survey methods have the capacity to elicit information about many dimensions of physical activity behaviour, whilst accelerometers do not provide any information about the type or context in which physical activity is undertaken (Sirard & Pate, 2001; Dollman et al., 2009). In view of these considerations alongside more pragmatic concerns of cost and available resources, self-report surveys were deemed the most suitable means of gathering descriptive information from a large sample of adolescents regarding habitual patterns of physical activity.

### **2.2.3 Health-Related Outcomes of Physical Activity**

Adherence to recommended moderate-to-vigorous physical activity (MVPA) guidelines is associated with many direct and indirect benefits for children's and adolescents' current and future health. Of key significance is the central role that regular MVPA can play in diminishing risk of excess weight among young people (Martinez-Gomez et al., 2010). This is a particularly favourable outcome given that increased prevalence of overweight and obesity has been identified as an area of significant concern for adolescent health. In accordance, objective BMI prevalence estimations from the United States (Hedley et al., 2004), Australia (Haby, Markwick, Peeters, Shaw, & Vos, 2012) and Europe (Lobstein & Frelut, 2003), indicate that approximately 20 – 30% of young people are currently overweight or obese. The problem is of similar magnitude in Ireland with recent findings from a national based research study, *Growing up in Ireland (2012)*, revealing that 20% of 13-year-olds are overweight and a further 6% obese, which equates to more than one in four Irish adolescents currently exhibiting an unhealthy body weight.

These findings are of concern owing to the many associated health risks linked to excess adiposity including an increased risk of developing type-2 diabetes, hypertension, atherosclerosis, metabolic syndrome and cardiovascular disease (Daniels, 2006; Harper, 2006). Such obesity related outcomes once only evident among adults are now displaying origins in childhood and adolescence, which has serious implications for future health. Indeed, present estimates suggest that adolescent obesity will be responsible for a 5% to 16% increase in adult coronary heart disease over the next 25 years (Daniels, 2006). Physical activity however, can independently exert a protective function over cardiovascular risk factors in childhood (Janssen & LeBlanc, 2010; Strong et al., 2005). Prior research has consistently evidenced a negative relation between degree of physical activity and clusters of cardiovascular risk factors such as systolic blood pressure, ratio of total to high density lipoprotein or “good” cholesterol, insulin resistance, skinfold thickness and aerobic fitness. Cardiovascular risk is therefore reduced with increased moderate-to-vigorous physical activity participation among young people (Andersen, Harro, Sardinha, Froberg & Ekelund, 2006).

In addition, regular weight bearing exercise is vital during childhood and adolescence for normal skeletal and bone development (Vicente-Rodriguez, 2006). Physical activity participation also has implications for future health as it protects against low bone density and bone loss associated with aging, in addition to a decreased risk of developing colon and breast cancer (Warburton, Nicol, & Bredin, 2006; Yannakoulia, Keramopoulos & Matalas, 2004). Many adaptive psychosocial outcomes have also been linked to physical activity among young people. In relation to mental health, the existing literature demonstrates that moderate-to-vigorous physical activity is associated with enhanced self-esteem, greater quality of life and reduced symptoms of depression, stress and anxiety (Motl, Birnbaum, Kubik, & Dishman, 2004; Strong et al., 2005; Twisk, 2001). In addition, participation in physical activity can assist in the social development of youth by providing opportunities for self-expression, social interaction and self-confidence (WHO, 2011).

Recent reports also indicate that physical activity can enhance cognitive performance, with improvements in concentration and classroom behaviour associated with physical activity participation among children and adolescents (Sibley & Etnier, 2003; Trudeau & Shephard, 2008). Moreover, a systematic review of quasi-experimental studies revealed that an additional hour of physical education per day resulted in small increases in students' academic achievement despite less time assigned for academic tuition. Physical fitness levels also increased as a consequence of the additional time provided for physical education underscoring the many associated direct and indirect benefits of physical activity (Trudeau & Shephard, 2008).

In short, participation in moderate-to-vigorous physical activity has the potential to positively influence young people's lives at many levels, enhancing physiological, psychological and cognitive outcomes. Promotion and maintenance of physical activity is therefore important for adolescents' overall health and well-being. Moreover, many of the values and beliefs that influence and regulate health-related behaviour are learned during adolescence. Activity patterns developed during this period may therefore set the precedence for adult life. In accordance, studies tracking physical activity from adolescence into adulthood demonstrate low to moderate stability over time, suggesting that physically active adolescents are more likely to become physically active adults (Kjønniksen, Torsheim, & Wold, 2008; Malina, 1996; Telema, Yang, Viikari, Wanne, & Raitakari, 2005). Adolescence therefore represents an opportune period for developing and promoting positive physical activity behaviours that can be maintained throughout the life course.

#### **2.2.4 Gender and Age-related Differences in Physical Activity**

Despite the many physical, psychological and cognitive benefits associated with regular moderate-to-vigorous physical activity (MVPA), national self-report school based surveys conducted across Europe, USA and Australia indicates that the majority of adolescents are insufficiently active with less than one third currently achieving recommended daily physical activity guidelines (Borracino et

al., 2009; Fakhouri et al., 2014; Kalman et al., 2015; NaSSDA, 2010). Moreover, the total proportion of youth classified as sufficiently active further differs when gender and age are taken into consideration, with female and older adolescents performing less favourably. In accordance, findings from the Health Behaviours in School Aged-Children study (HBSC, 2010), a cross-national survey undertaken in conjunction with the World Health Organisation, revealed that 28% of Irish adolescent males met recommended MVPA guidelines during the previous seven days whilst only 14% of females were similarly active (Kelly et al., 2012). Differences were also noted across age-groups with 26% of adolescents aged between 12 and 14 years achieving health enhancing physical activity levels, which decreased to 17% for those between the ages of 15 and 17 years. In addition, pronounced gender differences were evidenced in relation to age with less than 1 in 4 males and 1 in 10 females aged between 15 and 17 years indicating that they participated in recommended levels of MVPA on each day over the previous week (Kelly et al., 2012).

Comprising a national sample of post-primary students in Ireland, the Children's Sport Participation and Physical Activity Study (CSPPA), which included both subjective and objective measures of physical activity, also reported similar findings pertaining to the disproportionately higher levels of moderate-to-vigorous physical activity evidenced among male and younger adolescents. The results revealed that twice as many boys relative to girls were sufficiently active. In addition, younger adolescents aged between 12 and 13 years were three times more likely to engage in recommended levels of MVPA than their older peers (Woods, Tannehill, Quinlan, Moyna, & Walsh, 2010). Thus, these findings consistent with prior research indicate that boys are more physically active than girls, and older adolescents are less active than their younger counterparts (Borraccino et al., 2009; Brooks et al., 2015; Currie et al., 2015; Kalman et al., 2015; Troiano et al., 2008).

Longitudinal research offers additional support for the proposed age-related decline evidenced in respect to physical activity behaviour. Comprising a large sample of children who were followed up from age 9 until 15 years, Nader and colleagues (2008) revealed that the critical age at which objectively measured moderate-to-vigorous physical activity levels begins to decline is somewhere between 12 and 14 years, with girls dropping below recommended daily levels approximately one year earlier than boys. However, even though males were reported to be more physically active than females, similar rates of moderate-to-vigorous physical activity decline were evidenced, indicating that adolescents, irrespective of gender, are especially vulnerable to age-related decreases in physical activity. In addition, differences were also noted in respect to weekday and weekend MVPA, with reductions in recommended levels of MVPA occurring one year earlier for weekend in comparison to weekday activity. This discrepancy between weekday and weekend physical activity behaviour is further demonstrated by findings from the European Youth Heart Study, which indicated that young people engaged in lower levels of objectively assessed activity on weekend as opposed to weekdays (Kristensen et al., 2008). These findings underscore the importance of collecting data on several days in order to obtain an accurate

picture of adolescents overall physical activity patterns.

While these studies provide information on the proportion of adolescents within the population that are at risk of inactivity, focusing on total physical activity levels without taking account of the types of activities that constitute overall involvement has resulted in a limited understanding of the distinct patterns of physical activity in which young people engage. Moreover, it is plausible to suggest that variations in types and patterns of physical activity behaviour may contribute to gender and age-related disparities consistently evidenced in respect to levels of MVPA participation. A multidimensional approach to evaluating physical activity is therefore needed to achieve a greater insight into the various components underpinning overall patterns of physical activity behaviour. In the next section, the context of organised and non-organised physical activity will be considered alongside participation in team and individual type physical activities.

### **2.2.5 Organised and Non-Organised Physical Activity**

Some attempts have been made within the empirical literature to investigate underlying types of physical activity involvement. Much of this research has focused on discriminating the context of participation, which is broadly defined in terms of organised and non-organised physical activity behaviour. Organised physical activity reflects participation in team and individual sports (e.g. basketball, martial arts) or structured physical activity lessons (e.g. dance, aerobics) guided by a coach or instructor that are typically undertaken after school or within a supervised community club setting. In contrast, non-organised physical activity comprises unstructured forms of exercise such as walking, cycling, and jogging, in addition to informal games and sports (e.g. skipping, tip-the-can, football), that are performed in the absence of a coach or instructor (Bengoechea, Sabiston, Ahmed, & Farnoush, 2009).

Most studies examining young people's physical activity have tended to focus on organised participation or alternatively addressed total levels of physical activity without discriminating the context in which activity is performed. As such there is a lack of research available regarding the relative extent to which non-organised physical activity contributes to overall levels of physical activity. One exception to date however reflects a study undertaken by Santos, Esculcas and Mota (2004), which examined the underlying characteristics of organised and non-organised physical activity participation among adolescents. They revealed that organised physical activity was characterised by participation in moderate-to-vigorous intensity activities that were typically team-based in nature whereas non-organised physical activity reflected involvement in individual type activities undertaken at lower levels of intensity.

In contrast to non-organised physical activity, organised sport has been widely researched with empirical studies indicating that participation is associated with higher levels of physical activity among

young people. In accordance, Machado-Rodrigues and colleagues (2012) found that adolescent male sport participants subjected to self-report and objective physical activity assessments demonstrated a higher likelihood of achieving recommended moderate-to-vigorous physical activity guidelines on five or more days than those that did not engage in organised sport. In addition, Pfeiffer et al. (2006) revealed that females who maintained involvement in organised sport between the ages of 12 and 18 years were more than twice as likely to report vigorous physical activity involvement as non-sport participants. These results highlight the significant contribution of sport as a source of both moderate and vigorous physical activity for young people, which is a particularly encouraging finding given the declining levels evidenced across adolescence.

It is plausible to suggest however, that the emphasis on organised sport within these studies may have precluded an investigation into the role of other organised non-sport physical activities lessons such as dance or fitness (e.g. aerobics, circuits) classes, which may also contribute to total physical activity levels among youth. Findings from the US National Health and Nutrition Examination Survey (NHANES) revealed that dance represented a prevalent form of physical activity participation among teenagers with approximately one in five reporting involvement in this activity over the past month (O'Neill, Pate & Liese, 2011). Gender differences were also evidenced in respect to participation with just over one third of adolescent females demonstrating involvement as compared to less than one in ten males. In addition, girls who reported participating in dance over the last 30 days demonstrated significantly higher levels of mean total MVPA than those who did not partake, which suggests that dance physical activities make a significant contribution to girls recommended MVPA levels. In another study investigating the influence of structured dance classes on daily female physical activity, O'Neill, Pate and Hooker (2011) found that teenage girls accumulated significantly more accelerometer assessed minutes of MVPA on a dance class day as compared to a non-class day. Moreover, dance class activities comprised 29% of teenage girls' total weekly moderate-to-vigorous physical activity. Thus, the findings indicate that failing to address organised physical activity participation alongside sport may result in underestimation of overall youth physical activity levels whilst also overlooking an important source of moderate-to- vigorous physical activity among girls in particular.

To date, only one study has longitudinally addressed the contribution of organised and non-organised physical activity participation to adolescents' MVPA levels. Bélanger, Gray-Donald, O'Loughlin, Paradis, Hutcheon et al. (2009) followed an active sample of students that engaged in at least five self-reported sessions of MVPA per week at baseline over a five year period. They found that boys and girls who engaged in organised and non-organised physical activity reported similar decreases in the number of MVPA sessions undertaken per week, which equated to an average of 1.4 fewer weekly sessions reported each year. However, despite both groups demonstrating comparable age-related declines in physical activity, organised sport and physical activity participants continued to report an increased number of MVPA sessions five years later in comparison to non- organised physical activity

participants. Thus it appears that while non-organised physical activity can contribute to overall MVPA levels among adolescents, organised physical activity behaviour is associated with higher levels of MVPA participation and this relation is maintained over time.

### *Socioeconomic differences*

Previous research has also indicated that demographic factors such as socioeconomic status, gender and age are differentially associated with organised and non-organised physical activity, which underscores the significance of delineating context or type of physical activity behaviour when addressing adolescents' physical activity patterns. Empirical studies indicate that lower levels of maternal education are related to young people's participation in non-organised physical activity whereas higher levels are associated with organised physical activity behaviour (Bengoechea et al., 2010; Santos et al., 2004; Woods et al., 2010). The results highlight inequalities in physical activity participation contexts indicating that young people from more socially disadvantaged backgrounds may have diminished opportunities to partake in organised physical activity as a consequence of the costs pertaining to fees and equipment.

### *Gender differences*

Gender differences have also been evidenced in respect to organised and non-organised physical activity. Male adolescents demonstrate higher rates of organised sport participation than females, who in turn report higher levels of involvement in organised physical activities such as dance classes (Fahey, Delaney, & Gannon, 2005; Lunn, Kelly, Fitzpatrick, 2013; O'Neill et al., 2011; Woods et al., 2010). Considering organised and non-organised physical activity contexts simultaneously, Bengoechea et al. (2010) found that adolescent boys' self-reported higher levels of participation in non-organised physical activity than girls, although no differences emerged for organised physical activity. In agreement with these findings, using self-report and objective accelerometer physical activity measures, Bruner and colleagues (2009) revealed that male secondary school students were more active in comparison to their female counterparts with gender differences attributed to the higher levels of non-organised physical activity undertaken by males. These findings suggest that the gender disparity consistently evidenced for young people's overall levels of physical activity may reflect different levels of non-organised physical activity participation between girls and boys. Given that non-organised physical activity (e.g. jogging and walking) can be undertaken with little cost and equipment, it represents a possible focus for intervention efforts targeting increased levels of physical activity among girls. Therefore taking account of organised and non-organised physical activity contexts concurrently provides a more detailed insight into adolescent physical activity behaviour and may further contribute to our understanding of gender differences in physical activity.

### *Age differences*

It has consistently been reported that participation in organised sport and physical activity decreases with age, with younger adolescents demonstrating higher rates of self-reported participation than their older counterparts (Bailey, Wellard & Dishmore, 2005; Eime et al., 2013; Lunn et al., 2013; Woods et al., 2010). However, for organised physical activities like aerobics and circuit classes, empirical

studies indicate that participation rates are higher among older adolescents relative to younger peers (Aaron, Storti, Robertson, Kriska & LaPorte, 2002; Eime et al., 2013; Fahey et al., 2005). These findings underscore the importance of discriminating multiple types of participation among adolescents and further taking account of age and gender characteristics. In respect to non-organised physical activity however, mixed findings have been reported in respect to age. Bruner et al. (2009) found that level of non-organised physical activity participation did not differ between students aged between 14 and 18 years of age. In contrast, Mota and Esculas (2002) found that older adolescents reported lower levels of involvement in non-organised physical activity relative to their younger counterparts. The discrepant findings may be attributed however to the wide ranging age-groups adopted within the latter study which contained an older cohort of individuals aged between 18 and 20 years.

Additional differences in organised and non-organised physical activity participation have been found when gender and age of adolescent was considered simultaneously using survey reports. Wall, Carlson, Stein, Lee, & Fulton (2011) followed a sample of children aged between 9 and 13 years over a five year period, and found that free time physical activity involvement defined as participation in seven or more weekly sessions of non-organised physical activity decreased among girls between 10 and 11 years of age, while the drop off occurred at a later age for boys between 14 and 15 years. In addition, the reduction in non-organised leisure time physical activity among girls coincided with an increased prevalence of participation in organised physical activity. Contradicting these findings however, Eime and colleagues (2013) found that older adolescent girls reported higher levels of participation in non-organised physical activity such as jogging, running and walking than their younger counterparts. Retrospective reports obtained in relation to past year involvement in physical activity further revealed that non-organised physical activity increased as girls got older indicating that this participation context represents a preferred form of activity among older girls.

The inconsistent findings regarding female participation in non-organised physical activity may be attributed to the way in which participation was evaluated across studies. While Eime et al. (2013) asked adolescents to indicate if they currently engaged in non-organised physical activity or had previously done so in the past year, Wall et al. (2011) defined non-organised behaviour on the basis of daily participation. Thus, it is possible that many girls continued to engage in non-organised physical activity over time albeit at a less frequent pace within the latter study, however participation was overlooked owing to the high cut-off point implemented. In support of this contention, a longitudinal investigation into male and female adolescents' physical activity throughout secondary school revealed that

participation in light-to-moderate intensity physical activities like walking, running and jogging were more likely to be initiated and sustained over time (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009).

In summary, participation in organised sport and physical activity is associated with higher levels of MVPA among adolescents whilst non-organised physical appears to yield less MVPA overall (Bélanger, Gray-Donald, O'Loughlin, Paradis, Hutcheon et al., 2009); Pfeiffer et al., 2006; Trilk et al., 2012; Woods et al., 2010). Males report higher rates of organised sport participation than girls who demonstrate higher levels of involvement in organised physical activity like dance classes (Fahey et al., 2005; Woods et al., 2010). For non-organised physical activity there are some conflicting findings in the literature owing to differences in how physical activity is measured across studies and samples comprising non-comparable age-ranges. However, the broad consensus from this research is that boys report higher levels of non-organised physical activity than girls and this pattern of activity is undertaken by both younger and older adolescents and maintained throughout adolescence (Bengoechea et al., 2010; Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009; Bruner et al., 2009; Eime et al., 2013). It is evident that taking account of the different contexts of physical activity that underpin overall involvement can provide a greater understanding of youth physical activity behaviour. Moreover, it is important to understand how organised and non-organised physical activity contexts relate specifically to recommended MVPA levels among adolescents, which is related to a host of physical and psychological benefits.

### **2.2.6 Team and Individual Physical Activity**

Although the context of physical activity participation (such as organised v non-organised) has frequently been used to distinguish underlying behaviour, another means of characterising physical activity adopted within the empirical literature pertains to activity format, which may comprise a team or individual layout. This classification is typically applied within the organised sport setting to discriminate different types of participation. Team sport refers to activities involving multiple athletes working interdependently that are generally practiced competitively between opposing teams (e.g. soccer), whilst individual sports reflect those in which competitive results are based on individual performance (e.g. swimming) (Evans, Eys, & Bruner, 2012). National research undertaken in Ireland indicates that organised team sport represents a more prevalent form of participation among adolescent boys whereas girls participate in a range of organised team and individual sports (Fahey et al., 2005; Lunn et al., 2013; Woods et al., 2010). However, other studies have also discriminated adolescent physical activity participation on the basis of team and individual type activities without taking account of the context (e.g. organised v non-organised) in which it occurs. For the most part there is strong overlap between team activities and organised team sport whereas individual physical activities may be equally likely to reflect involvement in organised sport and physical activity (e.g. badminton, karate,



dance) or non-organised types of behaviour (e.g. jogging). While implementing such a distinction may result in a limited understanding of the context of adolescent participation, it nonetheless contributes to our understanding of the type of activities that adolescents engage in, with research indicating that preferred format of activity differs as a function of gender and age.

Longitudinal studies examining type of physical activities undertaken among children and adolescents over time indicate that boys were more likely to partake in vigorous team activities such as football, basketball and soccer, whereas girls' physical activity participation was characterised by moderately intense individual type activities including dance, walking, and cycling (Aaron et al., 2002; Bradley, McMurray, Harrell & Deng, 2000). Bélanger, Gray-Donald, O Loughlin, Paradis & Hanley (2009) further examined whether participation in team or individual physical activities were more likely to be maintained among adolescents from 12 to 17 years of age. The results indicated that approximately 90% of adolescents who engaged in individual activities at baseline continued to sustain participation in this type of activity for the duration of the study. In contrast, while involvement in team sport and physical activity was high in early adolescence, such behaviour was less likely to be maintained over time with approximately 60% of girls and 30% of boys discontinuing participation. Thus, while individual physical activity was most likely to be sustained among adolescents overall, gender differences were evidenced for team sport with boys demonstrating higher rates of persistence than girls.

In summary, physical activity participation may be discriminated on the underlying type of activity performed (team v individual). Whilst boys are more likely to engage in higher intensity team activities, girls demonstrate higher levels of engagement in moderate intensity individual physical activities (Aaron et al., 2002; Bradley et al., 2000). In addition, both males and females are more likely to sustain participation in individual as compared to team activities across adolescence. Girls however, report higher levels of dropout from team activities over time than boys (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009). Thus far we have examined how adolescents may be characterised based on context or type of physical activity participation. However, physical activity is a multidimensional construct and as such these characteristics should be considered simultaneously to facilitate a greater understanding of adolescent's physical activity behaviour. The next section will therefore focus on adolescents' physical activity patterns using person-orientated approaches.

### **2.2.7 Person orientated approaches**

Physical activity is a complex behaviour characterised by participation in a number of activity types or combinations, however these may be overlooked when adolescents are discriminated on the basis of a single physical activity dimension. Thus in more recent times, person-orientated approaches, which seek to identify subgroups of individuals that engage in similar patterns of behaviours, have been adopted to explore profiles of adolescents' physical activity involvement. Liu and colleagues (2010) explored patterns of sedentary and physical activity behaviour among adolescents using data from the

US National Longitudinal Study of Adolescent Health (1995-2002). While five different classes emerged, the majority of adolescents were characterised by three distinct patterns of behaviour, with prevalence rates differing by gender. The low physical activity and sedentary class, which reflected low levels of participation in all activities surveyed, comprised over half of the female sample and just less than a third of males. Adolescents within this class were more likely to be older. In contrast, the moderate physical activity and low sedentary group, in addition to the high physical activity and low sedentary group (which reflected moderate and high probabilities of engaging in active sport and exercise respectively) represented a greater proportion of boys. Consistent with prior research, the results indicate that males are more physically active than females, whilst older adolescents are more likely to evidence a sedentary profile of behaviour than their younger counterparts (Patnode et al., 2011). By incorporating measures of both sedentary and physical activity behaviour however, this study failed to uncover more nuanced patterns of physical activity, instead broadly classifying participants as low, moderate or high physically active.

Only two studies to date to the author's knowledge have focused exclusively on physical activity patterns among adolescents using a person-orientated approach. Liu, Sun, Beets, and Probst (2013) explored prevalent leisure time physical activity behaviours that contributed most strongly to total adolescents' MVPA using data arising from a national US survey. Five distinct groupings of MVPA emerged for each gender, reflecting the most popular types of physical activity undertaken by boys and girls. The majority of the female sample comprised the 'dancers/walkers/runners' profile with just less than 80% of girls characterised by this pattern of activity. The remaining classes reflected female participation in aerobic exercise, swimming, volleyball and soccer. For males, approximately three quarters of the overall sample were represented by a pattern of engagement in 'basketball and running'. In turn, the other four groups were characterised by participation in football, cycling, soccer and walking. The results indicate that girls demonstrate a preference for individualised exercise forms whereas boys are more likely to engage in team based sports alongside more individual type activities (Liu et al., 2013). While this study provides a greater insight into adolescents' preferred patterns of physical activity involvement and how this may differ across gender, it does not address the context of participation thus it remains unclear whether activities are engaged as part of an organised or non-organised setting. Previous research revealed that psychosocial factors may be differentially related to organised and non-organised physical activity participation, therefore this information is pertinent for subsequent intervention targeting promotion of physical activity among adolescents (Spink et al., 2006).

Agans and Geldhof (2012) in contrast focused exclusively on the context of organised sport, grouping adolescents aged between 15 and 18 years on the basis of their involvement in different types of physical activity. They identified five distinct clusters which reflected participation in team sport, individual sport, a combination of team and individual sports, dance performed alongside or in the absence of other

sports, and a non-participation group comprising teenagers that did not participate in any of the identified athletic activities. Adolescents were subsequently followed over three successive waves of data collection with the organised sport participation profiles replicated at each time point. In addition, students were grouped longitudinally into one of five trajectories reflecting continued participation, dropout, adoption of sport, continued non-participation or a ‘changer’ profile that reflected substitution of one type of sport for another. However, no information was available regarding the specific types of sport that underpinned physical activity transitions over time. Thus, while the study contributes to our understanding of the different types of sport in which young people engage and further outline possible physical activity change patterns across adolescence, failing to take account of participation in organised non-competitive physical activities (e.g. fitness classes) and non-organised physical activity (e.g. jogging, cycling), in addition to the types of activities underpinning transitions in physical activity, results in an incomplete picture of young people’s overall physical activity behaviours. In order to develop a more nuanced understanding of adolescents’ patterns of physical activity involvement a multidimensional approach is therefore needed that addresses physical activity type and context in addition to characteristics of duration, frequency and intensity, which provide an indication of overall MVPA levels.

### **2.2.8 Conclusion**

The majority of adolescents in Ireland are insufficiently active with physical activity levels demonstrating an age-related decline across adolescence, which is concerning given the many health benefits associated with regular MVPA participation (Kelly et al., 2010; Lunn et al., 2013; Woods et al., 2010). Moreover, girls are at increased risk as they consistently demonstrate lower levels of activity relative to boys and dropout of physical activity at an earlier age (e.g. Borraccino et al., 2009; Nader et al., 2008). The empirical literature has typically focused on overall levels of physical activity without consideration of the underlying physical activity behaviours that contribute to total involvement, which has resulted in a limited understanding of the types of physical activity in which young people engage (e.g. Kelly et al., 2010). A lack of evidence also exists regarding participation in non-organised physical activity and the relative implications for overall MVPA levels among adolescents.

Prior research undertaken on context and type of physical activity however, indicates gender and age-related differences in participation. Boys report higher rates of involvement in organised sport and non-organised physical activity whereas girls demonstrate higher levels of participation in organised dance classes (Bengoechea et al., 2010; Bruner et al., 2009; O’Neill et al., 2011; Woods et al., 2010). In addition, younger adolescents are more likely to participate in organised sport than their older peers (Bailey et al., 2005; Woods et al., 2010), whilst more mixed findings have been evidenced for non-organised physical activity with studies indicating that it is a prevalent activity across different age groups (Bengoechea et al., 2010; Bruner et al., 2009; Eime et al., 2013; Mota & Esculas, 2002). In turn,

boys are more likely to engage in team based activities whereas as females demonstrate a preference for individual modes of physical activity whilst individual activities are most likely to be sustained among adolescents over time (Aaron et al., 2002; Bélanger, Gray-Donald, O’Loughlin, Paradis, & Hanley, 2009; Bradley et al., 2009).

More recent efforts to identify patterns of involvement among young people have adopted person-orientated approaches, which identify sub-groups of individuals that demonstrate similar patterns of behaviour (Collins & Lanza, 2010). However limited research has been conducted in this area, thus the present study attempts to address this gap by adopting a person-orientated approach that takes account of the multiple dimensions of physical activity pertaining to duration, intensity, frequency, context and type, and examining whether discrete profiles of participation differ between male and female and younger and older adolescents.

Moreover, limited research has focused on how patterns of involvement in physical activity change across adolescence and whether discrete profiles of participation are likely to be maintained, discontinued or replaced with an alternative pattern of physical activity. The present study will therefore attempt to overcome these limitations by exploring adolescents’ physical activity patterns at two time-points twelve months apart, which will facilitate an examination of how profiles of physical activity participation change over time. In addition, the study will also comprise an investigation into the psychosocial determinants of distinct physical activity behavioural profiles and predictors of adolescents’ physical activity maintenance and behaviour change (i.e. dropout, uptake). Thus, the theoretical framework underpinning the present research and associated psychosocial predictors will be discussed in the following sections.

### **2.3 A Theoretical Framework for Understanding Adolescents’ Physical Activity Behaviours**

Theoretically based research is central to the understanding of health behaviours as it provides a conceptual framework within which to investigate determinants of behaviour, assess relationships among interrelated constructs and predict outcomes (Kerlinger, 1973). A good theory is generalizable across different populations and contexts, it includes specific constructs that enable hypothesis generation and can be tested through empirical observation (Nigg & Paxton, 2008; Ogden, 2003). Within a physical activity context, theory based research is necessary to facilitate identification of psychosocial determinants and processes underpinning behaviour, which can in turn prove useful for informing and evaluating interventions targeting physical activity behaviour change, adoption and maintenance. However, few studies have examined how psychosocial determinants change over time preferring to focus instead on changes in physical activity behaviour. Therefore, a greater understanding of how modifiable psychosocial theoretical constructs relate to physical activity behaviour change is needed to increase the theory’s usefulness in informing interventions (Masse, Nigg, Basen-Engquist, & Atienza, 2011).

Various theories have been applied within the physical activity context to facilitate understanding of physical activity behaviour change including, among others, theory of reasoned action and theory of planned behaviour, social cognitive theory, and achievement goal theory which are briefly reviewed below. In addition, self-determination theory, which will guide the present research providing a conceptual framework from which to explore the motivational processes underpinning adolescent physical activity behaviour, will be addressed in detail. It has been argued however, that while these theories provide a heuristic base on which to develop initial intervention efforts, none of the theories successfully capture all of the issues specific to physical activity behaviour (King, Stokols, Talen, Brassington, & Killingsworth, 2002). Thus, different approaches for increasing understanding of variations in behaviour and mechanisms of behaviour change have been proposed, which include adding constructs to existing theories, combining theories or incorporating aspects from competing theories (Evenson & Mota, 2011; Hagger, 2009). In accordance, aligning self-determination theory with other theoretical models prominent in the physical activity literature or integrating additional psychosocial constructs offers a potential means for increasing our understanding of motivated physical activity behaviour (Edmunds, Ntoumanis, & Duda, 2007). This position will subsequently be revisited followed a review of the various theoretical frameworks, which includes a detailed overview of self-determination theory.

### **2.3.1 Theory of Reasoned Action and Theory of Planned Behaviour**

Social cognition theories explore the precursors to health behaviours by focusing on the role of individual cognitions and environmental factors in the form of normative beliefs (Ogden, 2003). A range of theoretical models has been used to explain and predict physical activity behaviour with varying degrees of success. In the past, researchers applied models of health behaviour such as the theory of reasoned action (TRA; Ajzen & Fishbein, 1980) to explain volitional health behaviours. The TRA postulates that the most immediate and powerful determinant of behaviour is an individual's intention to perform it. Attitudes, which comprise positive and negative beliefs about a behaviour, and subjective norms, or perceptions of social pressure to comply with the behaviour in question, are identified as predictors of behavioural intentions. However, while the TRA outlined the role of personal agency it failed to address personal or environmental barriers to behaviour. Ajzen (1988) subsequently extended this theory to include a measure of perceived behavioural control, which reflects an individual's belief that a specific activity can be carried out following consideration of internal and external factors related to previous behavioural experience. In accordance, the Theory of Planned Behaviour (TPB; Ajzen, 1988) posits that attitude, subjective norms and perceived behavioural control predict intentions, whilst perceptions of behavioural control can also directly impact behaviour.

The TPB has been widely used to explain physical activity behaviour (e.g. Rhodes, Macdonald, & McKay, 2006). However, outcomes from various studies implementing this framework suggest that the model is better at predicting intentions than behaviours. A meta-analytic review of 72 studies exploring

physical activity behaviour revealed that attitudes, subjective norms and perceived behavioural control accounted for approximately 40% of the variance in intention, whilst behaviour control and intention explained roughly 30% of the variance in physical activity behaviour (Hagger, Chatzisarantis, & Biddle, 2002). A significant limitation of the TPB is therefore the lack of correspondence evidenced between intention and subsequent behaviour. Although it is assumed that people will do what they intend to do as opposed to what they do not intend, intentions do not always translate into action (Armitage & Conner, 2000). This may be attributed to unforeseen barriers, external factors beyond the individual's control or failure to overcome temptation. As such, behavioural intentions alone are insufficient to explain physical activity behaviours. Furthermore, the model does not specify the direction of causality or order of influence among the different beliefs (Schwarzer, 2008a, 2008b). An additional criticism of the model concerns assessment of key constructs relating to intention, perceived norms and feelings of pressure to comply with specific behaviours and the subsequent impact this may have on participant responses. Consideration of these factors may in turn, highlight the salience or social desirability of adopting such behaviour and produce a change in behaviour. Therefore, instead of simply describing an individual's cognition, this approach may unintentionally alter behaviour (Ogden, 2003).

### **2.3.2 Social Cognitive Theory**

Social Cognitive Theory (SCT; Bandura, 1986) identifies self-efficacy, outcome expectancies and self-regulation as reciprocal determinants of behaviour. Central to SCT is self-efficacy, which is defined as the situation-specific confidence an individual has in their ability to perform behaviour required to achieve a desired outcome. SCT posits that confidence in one's ability to carry out behaviour influences the direction, intensity and persistence of such behaviour (Bandura, 1997, 2004). Outcome expectancies include perceived environmental consequences, positive or undesirable, that are separate from personal control. In contrast, action expectancies are particular outcomes considered to result as a consequence of personal actions. SCT also outlines the central role of social agents as models of behaviours, and sources of support and reinforcement.

Research undertaken with young people has evidenced support for the application of social cognitive theory for predicting physical activity behaviour. In a cross-sectional study, Taymoori, Rhodes and Berry (2010) found that self-efficacy and positive outcome expectations directly influenced physical activity participation among female adolescents. Longitudinal cohort designs have also been used to explore the role of self-efficacy and social support on physical activity across adolescence. Dishman and colleagues (2009) found that girls who had high levels of self-efficacy for overcoming barriers in addition to high perceptions of social support demonstrated less of a decline in physical activity across high school, than those who perceived a reduction in social support. Interestingly, girls who had low levels of self-efficacy evidenced low levels of physical activity regardless of perceived levels of social support underscoring the significance of self-efficacy for physical activity participation. A limitation of

SCT is that self-efficacy is typically defined as the dominant predictor of behaviour, which has consequently led some to question whether this psychological construct may actually be more important for explaining behaviour than social cognitive theory per se (Armitage & Conner, 2000). In addition, focusing on self-efficacy or confidence in one's ability to perform physical activity behaviour fails to discriminate between actions that are controlled or volitional in nature offering a limited understanding of young people's underlying motives for physical activity participation (Deci & Ryan, 2000).

### **2.3.3 Achievement Goal Theory**

Achievement Goal Theory (ACG; Nicholls, 1989) provides another approach to exploring motivation within the physical domain, outlining the central construct of competence in predicting behavioural outcomes. ACG theory postulates that individuals act in a rational, goal directed way. Achievement goals are purported to influence achievement-related beliefs, which guide decision making and behaviour. Displaying competence is the goal of action, which may be influenced by different goal states. Accordingly, individuals differ in terms of how they approach situations in regards to their degree of task or ego orientation (Duda, 2001). These two goal perspectives comprise different criterion for determining whether low or high ability has been evidenced at the task at hand and subsequently what constitutes success (Nicholls, 1989).

In a state of task-involvement, ability is self-referenced based on personal effort, improvement and task mastery. Task orientation has been linked to a host of adaptive outcomes such as positive affect and increased physical activity (Ntoumanis & Biddle, 1999; Viira & Raudsepp, 2000). A longitudinal investigation of achievement goal theory within a physical education context further revealed that task or mastery goals predicted intrinsic motivation, perceived competence, positive attitude, exertion and attendance in physical education classes over a one year period (Halvari, Skjesol & Bagøien, 2011). In contrast, an ego-involved conception of ability is dependent on demonstrating superior performance relative to others. High ego-oriented individuals demonstrate less adaptive outcomes such as negative social aspects and maladaptive achievement beliefs about sport involvement (Treasure & Roberts, 1994). Moreover, when combined with a low perception of ability, high ego orientation predicted drop out from competitive sport among a sample of adolescent athletes (Cervelló, Escartí, & Guzmán, 2007).

An additional tenet of ACG is that the contextual environment can influence adoption of specific achievement goals. The type of behaviours, tasks and outcomes implemented by individuals within a position of authority in the physical activity context (e.g. coach, teacher) influences perception of the environment as ego (performance) or task (mastery) involving, and subsequent behaviours necessary to achieve success. The existing literature indicates that perceptions of a mastery motivational climate are associated with more positive motivational and affective outcomes than perceptions of a performance climate (Barkoukis, Ntoumanis & Thøgersen-Ntoumani, 2010; Ntoumanis & Biddle, 1999).

One of the primary limitations of this theory however, is that it ignores the role of social connection as a possible driving force underpinning young people's motivation to engage in physical activity and sport, instead choosing to focus only on one's desire to develop and show physical competence (Allen, 2003). However, sport and physical activities inherently comprise interpersonal interaction as a consequence of team activities undertaken alongside peers, or parental influence, which can reflect supportive or controlling actions. Moreover prior research indicates that affiliation, social acceptance, and relatedness are central reasons underpinning young people's motivation to initiate and maintain participation in sport (Allen, 2003; Weiss & Petlichkoff, 1989). Thus, by failing to address social connections which are imperative within the physical activity context, achievement goals theory results in an incomplete picture of adolescent motivation to engage in sport and physical activities

#### **2.3.4 Self-Determination Theory**

Self-determination theory (SDT; Deci & Ryan, 1985a, 2000; Ryan & Deci, 2000) provides an alternative motivational framework for understanding behaviour, which is based on the premise that humans are active organisms that possess an innate tendency towards psychological growth and development (Deci & Ryan, 2002). Gaining prominence in recent times, self-determination theory has been successfully applied across various domains to address behaviour maintenance and change in a range of health settings (Fortier, Duda, Guerin, & Teixeira, 2012; Ng et al., 2012). Positing the role of social conditions and psychological needs on motivation and behaviour, self-determination theory offers a number of advantages for exploring physical activity over competing motivational and social-cognitive theories. Firstly, central to SDT is the premise that motivation underpins behaviours, and as such it follows that changing an individual's motivation rather than attitudes or intentions (as outlined by theory of reasoned action and planned behaviour) will result in behaviour change. A distinct contribution of self-determination theory is the significance placed on *quality* of motivation in predicting behavioural outcomes, which contrasts other motivational frameworks that emphasise overall quantity of motivation for successful functioning (Deci & Ryan, 2008a, 2008b). By adopting such an approach, self-determination theory can discriminate autonomous and controlled behaviour regulations, which reflect the extent to which actions are experienced as volitional or pressurised. This distinction enables a greater understanding of the reasons underpinning physical activity behaviour (Deci & Ryan, 2000).

Self-determination theory also posits that social or interpersonal contexts can influence adaptive motivation and behaviour through satisfaction of basic psychological needs for competence, relatedness and autonomy. In contrast, the central focus of other theories on perceived competence (e.g. achievement goals theory) or efficacy (social cognitive theory) has resulted in a limited discussion of alternative psychological factors that motivate behaviour. The fundamental role of autonomy in fostering self-determined motivation, alongside perceptions of competence and relatedness is therefore unique to self-determination theory (Ryan, Williams, Patrick, & Deci, 2009). Often considered a



macrotheory of human motivation and development, self-determination comprises various subcomponents including organismic integration theory, basic psychological needs theory and cognitive evaluation theory, which will be explained in detail below.

#### ***2.3.4.1 Motivation and behaviour regulations***

Self-determination theory proposes that qualitatively different reasons underpin behaviour and conceptualises motivation along a continuum ranging from controlling to more autonomous reasons for physical activity engagement. At the most self-determined end of the continuum lies intrinsic motivation, which reflects engagement in activity for the feelings of pleasure and satisfaction that result (Deci & Ryan, 2000, 2002). Physical activity behaviour is completely volitional in nature, undertaken for the enjoyment, interest and challenge inherent within the activity itself. Consequently, intrinsic motives such as feelings of fun, personal challenge and sense of achievement are frequently cited by children and adolescents as key reasons for participating in sport and physical activity (Allender, Cowburn, & Foster, 2006; Allison et al., 2005; Cope, Bailey, & Pearce, 2013; Whitehead & Biddle, 2008).

For some individuals however, physical activity behaviour may not be inherently rewarding yet involvement is maintained over time. In addition, sport practices comprise periods of training characterised by repetitive drills and tasks that are not necessarily enjoyable but participants remain committed. Thus, it appears that other reasons in addition to, or in the absence of intrinsic motivation contributes to physical activity behaviour (Ryan, et al., 2009). In accordance, extrinsic motivation represents participation in an activity for outcomes separable from the activity itself. Comprising four distinct regulations, extrinsic motivation varies in terms of relative autonomy depending on the extent to which the external contingencies have been internalised. From least to most self-determined these include external, introjected, identified and integrated regulations. External regulation represents the most controlling form of motivation in which an individual engages in an activity in order to attain rewards or avoid punishment. Behaviour is dependent on external factors and consequently is unlikely to be maintained if such contingencies are withdrawn (Deci & Ryan, 2000).

##### ***2.3.4.1.1 Organismic integration theory***

Organismic integration theory (OIT; Deci & Ryan, 1985a, 2000), a sub theory of self-determination theory, outlines the processes by which individuals come to internalise externally regulated behaviours and social values, and incorporate them into their sense of self such that performance occurs for more self-determined reasons. Introjected regulation involves partial internalisation of external demands, in which an individual takes in an external regulation but does not fully accept it as their own. Consequently, introjection is a relatively controlled regulation characterised by feelings of 'should' and 'have to', and behaviours are undertaken to avoid negative feelings of guilt and shame, or to achieve ego enhancements such as pride (Deci & Ryan, 1985a, 2008b).

Further along the continuum is identified regulation, which represents a more autonomous form of extrinsic motivation, in which an individual is motivated to pursue an activity in order to attain personally valued goals (Ryan et al., 2009). This regulation entails personal endorsement and a feeling of choice as individuals identify with the activity, perceiving it as important for and consistent with their sense of self (Deci & Ryan, 2008a, 2008b). Finally integrated regulation represents complete internalisation or assimilation of identified regulations within the self and subsequent congruence between one's values and beliefs. Extrinsic motivated action can therefore become self-determined as individuals identify with and fully assimilate their regulation. However, while identified and integrated regulations are accompanied by a sense of volition, they remain extrinsic in nature as physical activity behaviour occurs for reasons other than enjoyment of the activity itself (Deci & Ryan 2000). In respect to integrated regulation it should also be acknowledged that although this type of motivation is frequently encountered among adults, it may not be applicable for children and adolescents owing to their limited developmental capacity to achieve a sense of integration within their self (Vallerand, 1997; 2001). Thus, research pertaining to the role of integrated regulation in adolescent physical activity behaviour remains limited.

Finally in contrast to motivation, amotivation can also occur whereby an individual lacks motivation to act, or acts without intent by simply going through the motions (Ryan & Deci, 2000). This state may be attributed to feelings of incompetence, a lack of perceived contingency between one's actions and desired outcomes such that there is no perceived purpose for undertaking the activity, or simply owing to a lack of interest or value in the activity (Deci & Ryan, 1985a; Ryan & Deci, 2000).

Empirical evidence indicates that the type of motivation endorsed can differentially impact physical activity behaviour. Following a systematic review of studies examining the relation between self-determined motivation and young people's physical activity behaviour, Owen, Smith, Lubans, Ng and Lonsdale (2014) found that intrinsic motivation and identified regulation positively predicted physical activity behaviour demonstrating weak to moderate sized effects. In contrast, introjected and external regulation in addition to amotivation evidenced weak negative associations with physical activity. The findings indicate that self-determined motives positively predict physical activity behaviour among young people, whilst controlling motives undermine participation.

### ***Type of Physical Activity Participation***

Empirical research also suggests that motivation for physical activity may vary dependent on the type of activity undertaken. Frederick and Ryan (1993) found that adult sport participants reported higher levels of intrinsic motivation than exercisers, who in turn demonstrated more extrinsic motives for participation such as enhanced appearance. Furthermore, using an adolescent sample, Spink and colleagues (2006) revealed that feelings of enjoyment, which are characteristic of intrinsic motivation, were more frequently cited as reasons for participation in organised as opposed to non-organised

physical activities. Similar results were evidenced among a sample of children aged from 8 to 10 years, whereby enjoyment was positively related to after-school structured physical activity behaviour but unrelated to unstructured participation (Rosenkranz, Welk, Hastman, & Dzewaltowski, 2011). These findings suggest that motivation for physical activity behaviour differs as a function of activity performed.

#### ***2.3.4.2 Outcomes associated with Autonomous versus Controlled Motivation***

SDT further discriminates between autonomous and controlled motivation for physical activity behaviour by focusing on the degree of internalisation and self-regulation. Autonomous motivation comprises intrinsic motivation and identified and integrated extrinsic regulations that individuals identify with, value and have integrated into their sense of self. Such individuals behave with a sense of volition and choice. In contrast, controlled motivation encompasses introjected and external regulations, which individuals experience as internal and external pressures to act and think in certain ways (Deci & Ryan, 2008a, 2008b). Whilst both controlling and self-determined motives can regulate behaviour, discriminating the quality of motivation regulating behaviour is important in terms of the associated consequences for physical activity and well-being.

Self-determined motivation is associated with adaptive outcomes among young people such as increased physical activity and physical fitness, greater persistence in sport and exercise over time, more positive affect and greater quality of life (Gillison, Standage, & Skevington, 2006, 2011; Power, Ullrich-French, Steele, Daratha, & Bindler, 2011; Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002; Taylor, Ntoumanis, Standage, & Spray, 2010). In contrast, more controlling external motives are related to maladaptive outcomes such as ill-being and sport dropout (Calvo, Cervelló, Jiménez, Iglesias, & Murcia, 2010; Deci & Ryan, 2002) whilst amotivation has also been linked to continued low levels of participation in physical activity and sport discontinuation (Pelletier, Fortier, Vallerand, & Brière, 2001; Sarrazin, et al., 2002; Wang & Biddle, 2001).

#### ***2.3.4.3 Motivational Regulation and Physical Activity Behaviour Change***

Intrinsic motivation and identified regulation have been consistently linked to sustained participation in sport and exercise over time whereas mixed findings have been evidenced in relation to introjected regulation (Daley & Duda, 2006; Gillison, Standage, Skevington, 2011; Sarrazin et al., 2002; Teixeira, Carraça, Markland, Silva & Ryan, 2012). Calvo et al. (2010) revealed that higher levels of introjected regulation, in addition to external regulation predicted sport withdrawal among male teenage soccer players over a year, whilst Gillison et al. (2011) found that introjected regulation, in addition to intrinsic and identified regulation predicted exercise maintenance over a ten-month duration among adolescent boys. Moreover, Pelletier and colleagues (2001) found that introjected regulation in the presence of intrinsic and identified regulations predicted continued involvement in competitive sport over a 10 month period among teenagers and young adults however, this association did not remain 22 months

after initial assessment. Taken together these findings suggest that introjected regulation positively influences behavioural persistence in the short term but this adaptive response appears to diminish over time.

In relation to uptake of physical activity, prior research indicates that adults who initiated exercise as part of an intervention program demonstrated increases in intrinsic motivation and identified regulation over time with increases in identified regulation typically occurring more quickly, within the first few weeks of exercise adoption (Rodgers, Hall, Duncan, Pearson & Milne, 2010; Teixeira et al., 2012). The results suggest that while individuals may not have necessarily enjoyed the activity initially, they internalised the value associated with exercise and behaviour was regulated by identification. Intrinsic motivation increased over time possibly as a result of individuals settling into a routine and gradually beginning to enjoy undertaking exercise for its own sake. The findings underscore the significance of fostering self-determined motives for exercise initiation.

While limited research has been undertaken in respect to adolescent physical activity behaviour adoption and self-determination theory, a recent study undertaken with adolescent girls has attempted to address this shortcoming. Gillison, Seibre, and Standage (2012) interviewed ten adolescent girls who demonstrated an increase in self-determined motivation over one year and attempted to identify the factors that underpinned these changes. The participants also reported higher levels of exercise in comparison to their peers despite evidencing similar levels at baseline. Many girls indicated that they felt they should be exercising regularly, and physical fitness was frequently discussed in respect to physical appearance and how one should look. However, while these participants were more autonomously motivated at follow-up, it appeared that motives for exercise were not fully internalised, reflecting beliefs of significant others, and wider media influences. This is indicative of introjected regulation, in which exercise behaviour is controlled by feelings of obligation, and performed to alleviate feelings of guilt and anxiety. In addition, more self-determined reasons for undertaking physical activity were also evidenced with many girls indicating that feelings of achievement and satisfaction in attaining sport and fitness goals underpinned continued participation. Thus, it appears that autonomous motivation in addition to introjected regulation may contribute to physical activity uptake and participation among adolescents.

#### ***2.3.4.4. Basic Psychological Needs Theory***

An additional subcomponent of self-determination theory is basic psychological needs theory (BPNT), which posits that basic psychological needs for autonomy, competence and relatedness must be supported in order for autonomous motivation and well-being to occur. Competence reflects the need to feel effective and master challenging tasks within one's environment (Deci & Ryan, 2000, 2002). Relatedness refers to the need to feel a sense of connection and belonging with significant others in the physical activity domain. Finally, autonomy represents the need for agency and a sense of volition and ownership over one's behaviours (Deci & Ryan, 2000, 2002). These three psychological needs are

considered to be universal and cross-culturally relevant (Deci & Ryan, 2008a).

The extent to which these psychological needs are supported will determine an individual's location on the continuum. Perceptions of competence are necessary for an individual to be motivated to any extent, with a lack of competence resulting in amotivated behaviour. In turn, perceived competence in the absence of feelings of relatedness and autonomy is sufficient to yield extrinsic motivation; however it is not satisfactory to maintain intrinsic motivation, contradicting many social learning theories that state otherwise (e.g. Bandura, 1997). In order for introjected regulation to occur, feelings of competence in addition to relatedness must be supported. A desire to be accepted typically leads individuals to adopt behaviours modelled or valued by significant others, which they may not necessarily endorse personally. For autonomous motivation to occur however, individual must experience a sense of volition or autonomy, in addition to feeling related and competent to enact the behaviour. Thus, satisfaction of psychological needs for competence, relatedness and autonomy is necessary to promote internalised regulations and autonomous motivation (Ryan & Deci, 2000).

Of the various psychological needs, competence has received additional attention given that it represents a key construct in many theories of motivation. Indeed, it is widely accepted that perceived competence is positively related to adolescent physical activity behaviour (Carroll & Loumidis, 2001; Crane & Temple, 2015; Sallis, Prochaska, & Taylor, 2000; Woods et al., 2001). Qualitative research further suggests that adolescents that feel physically competent enjoy partaking in physical activity and sport as it provides an opportunity to prove oneself and demonstrate ability to others (Coleman, Cox, & Roker, 2008; Dwyer et al., 2006). In contrast, low levels of physical competence can serve as a barrier to physical activity with many teenagers indicating that they lack the necessary skills for performance (Allison et al., 2005; Dwyer et al., 2006; Slater & Tiggemann, 2010).

#### ***Type of Physical Activity Participation***

The relative importance of feeling competent in an activity may also differ as a function of the physical activity context. Research undertaken with adolescents indicates that competence perceptions are more strongly related to participation in organised as compared to non-organised physical activity (Spink et al., 2006). The findings may be attributed to the fact that structured physical activity participation, particularly sports, typically require a certain level of skill to gain entry, which is not necessary for games of a more informal nature.

#### ***Change over time***

Competence perceptions have also been implicated in physical activity behaviour change, with higher perceptions of competence related to continued adolescent participation in sport over one year (Ullrich-French & Smith, 2009). Conversely, research examining sport attrition revealed that young people who drop out of organised sport demonstrate lower levels of physical competence than those who maintain involvement (Crane & Temple, 2015; Salguero, Gonzalez-Boto, Tuero, & Maquez, 2003; Weiss & Ferrer-Caja, 2002). Thus, in accordance with self-determination theory, adolescents need to feel

competent in an activity in order to sustain involvement (Wigfield, 1994). Although less research has been undertaken on the psychological needs for relatedness and autonomy, findings from qualitative studies indicate that feelings of choice over one's participation in sport promotes autonomous motivation and sport participation, whilst poor quality relationships with group or team members diminish motivation and participation in sport and physical activity over time (Bengoechea & Streat, 2007; Slater & Tiggemann, 2010).

In a longitudinal investigation examining the relation between adolescent physical education students' psychological needs and changes in effort in physical education, exercise intentions and leisure-time physical activity over a school trimester, Taylor and colleagues (2010) found that competence need satisfaction was the strongest predictor of the three physical activity outcomes. Moreover, students with higher perceptions of competence reported increased physical activity over the school term. In contrast, relatedness and autonomy needs in physical education classes were not linked to intentions to be active outside of school or leisure time physical activity. However, the authors argued that intention to be active and actual leisure time physical activity represent outcomes that may be too distal to be influenced by satisfaction of autonomy and relatedness needs. In addition, psychological need satisfaction in compulsory physical education classes may not generalise to physical activity behaviour undertaken under one's own volition. In other words, a student may not feel connected to others within their physical education class although these needs may be supported within a club sport in which they participate. Moreover, opportunities or lack thereof to make decisions in PE class may not translate to sports undertaken through one's own choice. Perceptions of competence within physical education however may translate into feelings of competence and ability in sports and physical activities outside of this setting. Therefore, assessing basic psychological needs for autonomy, competence and relatedness in physical activity domains that are undertaken volitionally may provide a greater understanding of the salience of basic psychological needs across various physical activity contexts.

In respect to organised sport, empirical research undertaken on team and individual sport participants revealed that adolescents who maintained involvement over 12 to 21 months reported higher levels of autonomy, relatedness and competence than those who dropped out (Jõesaar & Hein, 2011; Sarrazin, et al., 2002). In turn, focusing on leisure-time physical activity, Gillison and colleagues (2011) explored motivational predictors of behaviour change among teenagers over a ten month period. The results indicated that higher levels of self-determined motivation and psychological needs for competence and relatedness distinguished physical activity maintainers from dropouts. However gender differences were evidenced in respect to autonomy which was significantly related to sustained physical activity participation among girls but not boys. This unexpected finding was subsequently attributed to the high scores evidenced among the latter group of adolescents, which suggests that a ceiling effect was present (Gillison et al., 2011). In summary, the empirical literature offers support for satisfaction of basic psychological needs for competence, relatedness and autonomy in promoting physical activity and

sustained participation among adolescents over time. However, there is also a suggestion that the salience of psychological needs may differ dependent on physical activity context, thus additional research performed across a range of physical activity settings is necessary to explore this issue further.

#### ***2.3.4.5 Cognitive Evaluation Theory***

The third subcomponent of self-determination theory, cognitive evaluation theory (CET; Deci & Ryan, 1985a) posits that social conditions or interpersonal contexts that impact positively upon an individual's experience of autonomy, competence and relatedness will facilitate autonomous motivation. An autonomy supportive environment is typically characterised by choices and opportunities for decision making without pressure to act or think in a certain way. The authoritative agent, typically a coach, instructor or teacher, dependent on the physical activity context, additionally supports perceptions of autonomy by providing a rationale for tasks and rules, encouraging initiation and acknowledging adolescents' feelings and perspectives (Deci & Ryan, 2008b; Mageau & Vallerand, 2003). Prior qualitative research undertaken with young athletes indicated that the qualities they desired in a coach were consistent with an autonomy supportive approach such as wanting the coach to listen to what they were saying, show an interest in them, and allow them participate in decision making (Keegan, Spray, Harwood, & Lavallee, 2010). Physical activity contexts that support autonomy therefore facilitate individuals to experience behaviours as self-endorsed and actively transform social values into their own (Deci & Ryan, 2008b; Hagger & Chatzisarantis, 2008).

In addition, autonomy supportive contexts should allow individuals to feel competent and related. Competence needs can be influenced by the quality and type of feedback provided by coach or instructor in respect to performance and skill execution. Emphasising effort and improvement, providing guidance, offering clear guidelines on tasks and structuring the environment to include optimal challenges reflect actions that underpin feelings of competence and self-determined motivation (Ames, 1992; Amorose, 2007). Moreover, developing positive relationships between participants and leader, as well as promoting cooperation among teammates or other peers within the physical activity setting helps individual to feel connected to and related to others (Álvarez, Balaguer, Castillo, & Duda, 2009; Mageau & Vallerand, 2003).

Studies that have tested the proposed pathways between motivational processes outlined in self-determination theory offer support for its usefulness and application in explaining youth physical activity (Vierling, Standage & Treasure, 2007). For example, Amorose and Anderson-Butcher (2007) demonstrated that perceptions of autonomy-supportive coaching behaviours were positively related to feelings of competence, relatedness and autonomy, which in turn predicted self-determined motives for participation in team and individual sport among secondary school and university students. They also found that autonomy support was more strongly related to feelings of autonomy, which emerged as a stronger predictor of motivational regulations. This enhanced relationship may be attributed to the characteristics of autonomy supportive environments such as choice, decision-making and control,

which are particularly supportive of autonomy needs. Nonetheless, relatedness and competence needs can also be satisfied by an autonomy supportive context that utilises non-controlling feedback and adopts the athlete's perspective (Adie, Duda, & Ntoumanis, 2012).

Quested et al. (2013) additionally revealed that perceived autonomy support predicted satisfaction of basic psychological needs among young athletes, and in turn enjoyment, which was negatively related to intentions to dropout of sport. Perceptions of autonomy support can therefore indirectly impact the quality of young people's sport experience, which has implications for sustained participation in sport over time (Álvarez et al., 2009). Additional evidence from experimental research underscores the significance of adopting an interpersonal autonomy supportive teaching style for promoting physical activity behaviour. Comprising a sample of female adults attending exercise classes, Edmunds, Ntoumanis and Duda (2008) found that individuals assigned to an autonomy supportive intervention condition, in which the instructor offered choices and took account of their perspective, demonstrated greater need satisfaction and more frequent class attendance than their control counterparts over a ten-week period.

Standage, Duda and Ntoumanis (2005) further explored the hypothesised relations outlined in self-determination theory using a sample of secondary school physical education students; however they incorporated measures of competence and relatedness support in addition to autonomy support. The results indicated that social environments provided by physical education teachers that were supportive of autonomy, competence and relatedness needs predicted overall need satisfaction, which in turn was positively related to intrinsic motivation, and negatively associated with extrinsic motivation and amotivation. Measurement invariance was also evidenced across gender offering further support for the universal application of self-determination theory in examining physical activity participation among male and female adolescents. Additional research undertaken with secondary school physical education students revealed that autonomy support indirectly predicted adolescents' intentions to be physically active in their leisure time through satisfaction of psychological needs and autonomous motivation, highlighting the importance of implementing an autonomy supportive environment for promoting youth motivation and physical activity behaviour (Standage, Duda, & Ntoumanis, 2003).

Controlling environments in contrast, undermine basic psychological needs and autonomous motivation (Ryan, et al., 2009). Amorose and Anderson-Butcher (2007) found that coaches who exerted pressure to act and think in a certain manner undermined autonomous motivation to persist in sport among secondary school and college athletes. Negative coaching behaviours such as criticising performance, applying pressure and making threats about punishments have also been associated with feelings of anger, frustration, poor quality coach-athlete relationships and diminished sport motivation among adolescents (Keegan et al., 2010). The extent to which psychological needs are supported by the social environment will therefore determine whether motivation is experienced as autonomous or controlled.



### *Change over time*

In accordance, prior research indicates that autonomy-supportive coaching behaviours were positively related to autonomous motivation among individual sport participants over a 12 to 21-month period whilst a controlling coaching environment predicted external regulation and amotivation (Jõesaar, Hein, & Hagger, 2012; Pelletier et al., 2001). Moreover, perceptions of autonomy support and psychological need satisfaction can also impact sport participation over time. In line with this contention, Jõesaar and Hein (2011) found that adolescent team and individual sport participants who dropped out of sport over two years reported lower levels of autonomy support as well as decreased perceptions of relatedness, competence and autonomy than those who sustained involvement.

### *Type of Physical Activity Participation*

Finally, the contextual environment can also impact participation in various types of physical activity. In a study examining correlates of organised and non-organised physical activity participation among adolescents, perceptions of support from coach were uniquely related to participation in organised activities (Spink et al., 2006). However, these results may be quite intuitive as non-organised physical activity behaviours are typically undertaken in informal settings without a leader, contrasting that of organised sports and physical activities which are performed under the supervision of an authoritative individual. A lack of research has explored the role of self-determination theory in respect to non-organised physical activity behaviour such as walking and running, with most studies focusing on structured participation in school physical education classes or organised sports such as football (e.g. Álvarez et al., 2009; Calvo et al., 2010). Thus, it remains unclear how motivational processes impact on adolescent participation in informal games and non-organised exercise behaviours. In accordance, Biddle, Treasure and Wang (2008) previously recommended that motivational processes underpinning participation in specific types of physical activity including unstructured physical activity are identified and evaluated.

Prior to bringing this discussion to a close, it should be noted that self-determination theory comprises three additional sub-theories alongside organismic integration theory, basic psychological needs theory and cognitive evaluation theory, which have already been addressed. Although not central to the present thesis, a brief summary of the remaining theories will be outlined in order to facilitate a more thorough overview of self-determination theory. In accordance, Causality Orientations Theory (COT; Deci & Ryan, 1985b) refers to an individuals' tendency to orient to autonomous, controlled or impersonal motivation at a more general level rather than in relation to a specific domain or activity (Ryan & Deci, 2007). Autonomously orientated individuals act out of interest and experience their behaviour as self-initiated whereas those orientated towards controlling environments are regulated by rewards, gains and approval. In contrast, the impersonal orientation is characterised by the belief that regulation of one's behaviour and achieving desired outcomes is outside of one's control, with such behaviour often described as amotivated or helpless (Deci & Ryan, 1985b).

A fifth sub-theory, Goal Contents Theory (GCT) posits that the type of goal an individual values for an activity will differentially impact basic need satisfaction and well-being dependent on whether it is intrinsic or extrinsic in nature. Intrinsic goals such as personal growth and social affiliation are inherently rewarding in their own right and consequently foster well-being and self-determined behaviour (Vansteenkiste, Lens, & Deci, 2006). Conversely, extrinsic goal pursuits like wealth, physical appearance and status, which are typically defined in response to external pressures, are linked to poorer wellness than intrinsic pursuits (Kasser & Ryan, 1996). Thus, in addition to underlying motives, this theory states that the content of behavioural goals determines whether basic psychological needs are satisfied (Deci & Ryan, 2000). The final mini-theory contained within Self Determination Theory is Relationships Motivation Theory (RMT), which states that social interactions with close friends, romantic partners and groups must support relatedness needs in addition to feelings of autonomy and competence in order for optimal relational well-being and high quality relationships to ensue (Deci & Ryan, 2014). In sum, self-determination theory represents a macrotheory of human development and motivation.

### **2.3.5 Conclusion**

In conclusion, empirical evidence offers support for self-determination theory as a framework from which to explore motivational and social contextual predictors of youth physical activity participation. It is widely evidenced that intrinsic motivation and identified regulation is related to young people's physical activity and continued involvement over time (Gillison et al., 2011; Owen et al., 2014). However, mixed findings have been evidenced for introjected regulation in respect to physical activity maintenance and dropout with some studies indicating that this controlling form of motivation supports behavioural persistence over shorter periods of time (e.g. Pelletier et al., 2001). In contrast, external regulation and amotivation are consistently related to maladaptive outcomes such as physical activity dropout and low activity (Calvo et al., 2010; Pelletier et al., 2001; Sarrazin, et al., 2002; Wang & Biddle, 2001). Higher levels of competence, relatedness and autonomy predict physical activity and sustained participation across a range of organised settings (Jõesaar & Hein, 2011; Sarrazin et al., 2002). It is also evident that an autonomy supportive environment that fosters feelings of choice can impact psychological needs and intrinsic motivation and subsequently impact physical activity and sport persistence over time (Amorose and Anderson-Butcher, 2007; Pelletier et al., 2001). Less attention however, has addressed the application of self-determination theory to non-organised physical activity contexts with emphasis typically placed on organised participation in sport and physical activity. Investigating the differential impact of contextual conditions, psychological needs and motivation on different types of physical activity would enhance our understanding of the motivational processes underpinning distinct physical activity patterns among adolescents. The present research therefore attempts to address this gap in the literature by comparing motivational characteristics across different profiles of male and female, and younger and older adolescents' physical activity participation and in turn, exploring whether these psychosocial constructs are related to physical activity maintenance and

behaviour change over twelve months.

However, while self-determination theory provides a conceptual framework for understanding the motivational processes underpinning physical activity behaviour, research exploring the influence of socio-contextual variables is limited in comparison to other aspects of the framework. In line with this contention, autonomy support is typically considered in respect to the relationship with the coach, whilst assessment of peer and parental influences is lacking, despite such individuals playing a central role in adolescents' lives. Consequently, it has been argued that autonomy supports reflects only a subset of potentially supportive behaviour that contribute to adolescent physical activity behaviour (George et al., 2013).

#### **2.4 Interpersonal Influences on Physical Activity**

In more recent times, efforts have been made to incorporate measures of parental and peer influences into self-determination theory, which have proved successful in enhancing understanding of how social factors relate to young people's participation in physical activity. Role modelling, support, and peer acceptance have been identified as factors that support psychological needs for relatedness and competence, whilst parental pressure and peer teasing diminish perceived autonomy, relatedness and competence, and in turn autonomous motivation for physical activity (George et al., 2013; Lawman, Wilson, Horn, Resnicow, & Kitzman-Ulrich, 2011; Li et al., 2014). In addition, interpersonal interactions with significant others can also directly impact adolescent physical activity behaviour. These findings are consistent with relationships motivation theory, a sub-theory of self-determination theory, which hypothesizes that social interactions that support basic needs for relatedness, competence and autonomy promote enhanced well-being and high quality relationships (Deci & Ryan, 2014). Thus, in line with prior recommendations, it may be argued that addressing interpersonal influences directly within the self-determination framework will enhance understanding of the mechanisms underpinning physical activity participation and behaviour change among adolescents. An overview of these social factors will thus be presented, and considered in respect to the role that they play in adolescents' physical activity behaviour patterns.

Young people's principal interactions take place with parents and peers, therefore significant others serve as primary socialising agents for physical activity behaviours (Duncan, Duncan, & Strycker, 2005; Fitzgerald, Fitzgerald, & Aherne, 2012; Kirby, Levin, & Inchley, 2011; Mendonça, Cheng, Mélo, & de Farias, 2014; Sallis & Patrick, 1994). Central to these interpersonal interactions is social support, which refers to any behaviour that facilitates an individual to be active. Comprising numerous forms, social support includes direct (e.g. partaking in physical activity with adolescent), instrumental (e.g. providing transport to physical activity venue), and emotionally supportive behaviours (e.g. praise and encouragement).

### **2.4.1 Parental Support**

Empirical reviews of correlates of physical activity behaviour consistently indicate that parental support is positively related to adolescent physical activity (e.g. Edwardson & Gorely, 2010; Mendonça, et al., 2014; Park & Kim, 2008; Sallis, et al., 2000; Sallis, Prochaska, Taylor, Hill, & Geraci, 1999). Moreover, small-to-moderate size effects have been reported for the association between family support and physical activity participation among adolescent girls (Biddle, Whitehead, O'Donovan, & Nevill, 2005). Additional research highlights the importance of distinct forms of parental support for adolescent physical activity behaviours. Qualitative studies indicate that active girls are more likely to undertake physical activity with parents and report higher level of parental encouragement to be active than their sedentary counterparts (Casey, Eime, Payne, & Harvey, 2009; Whitehead & Biddle, 2008). Moreover, being active with parents was identified as a central motive underpinning continued participation in physical activity during adolescence (Whitehead & Biddle, 2008). In addition, Mulhall, Reis and Belgium (2011) found that younger adolescents who exercised with their family demonstrated increased physical activity levels. Consistent with these findings, a systematic review of social support and adolescent physical activity revealed that encouragement and directly undertaking physical activity with adolescent were the most frequent types of parental support associated with youth physical activity (Mendonça et al., 2014).

In a qualitative investigation comprising adolescent physical activity maintainers and decliners, those who remained active across secondary school indicated that parents helped them to do so by providing lifts to practise, viewing competitions, encouraging participation and covering fees. In contrast, teenagers who reporting declining levels of physical activity reported lower perceptions of parental support indicating that parents did not attend their games nor did they drive them to practices (Bélanger et al., 2011). Duncan and colleagues (2005) previously indicated that more frequent parental spectatorship of young people's physical activity behaviour predicted higher adolescent physical activity levels offering further evidence for the significance of this form of support. In addition, focus group discussions revealed that adolescent girls felt that opportunities to participate in sport and physical activity were reduced as a consequence of their parent's unwillingness to drive them to the appropriate setting (Casey et al., 2009). Furthermore, longitudinal research undertaken by Sallis and colleagues (1999) revealed that parent transportation was the only social support variable that was significantly related to changes in children's physical activity levels over a twenty month period. Taken together these findings indicate that different types of parental support play a role in young people's physical activity behaviours. It is important to note however that the relation between social support and physical activity may go either way. In other words, parental social support may be a consequence rather than a source of youth physical activity with inactive adolescents declining or not requiring lifts to places of activity as opposed to parental transportation simply not being provided.

### **2.4.2 Parental Role Models**

In respect to parental modelling of physical activity, mixed findings have been evidenced in relation to the purported association between parental role models and physical activity behaviours among teenagers. The results of two systematic reviews indicated that there was no association between parent activity and adolescent physical activity (Sallis et al., 2000; Van der Horst et al., 2007) whereas another systematic review of the literature indicated that parental role modelling was a significant positive predictor of young people's physical activity (Park & Kim, 2008). Other reviews have proved inconclusive (e.g. Biddle et al., 2005; Gustafson & Rhodes, 2006). Discrepant findings have been attributed to methodological differences pertaining to way in which physical activity is assessed with stronger associations evidenced for validated instruments (Gustafson & Rhodes, 2006). In addition, the type or context of physical activity assessed in addition to whether actual or perceived parental physical activity is recorded may influence the relation between parental role modelling and youth physical activity. Moreover, there is some evidence to suggest that perceptions of parental physical activity is more strongly related to adolescent physical activity behaviours than parent reported physical activity level (Madsen, McCulloch, & Crawford, 2009; Marques, Martins, Sarmiento, Diniz, & Costa, 2014).

It has also been argued that the influence of parental role modelling on adolescent physical activity behaviour may be diminished when parental support is simultaneously considered. Comprising a sample of students aged between 12 and 18 years, Trost et al. (2003) found that parental reported physical activity was a positive predictor of parent support which in turn directly predicted child physical activity. Parental physical activity however, was unrelated to adolescent physical activity, which suggests that the possible influence of parental modelling is attenuated when other mechanisms of parental influences are concurrently observed. The authors suggest that the lack of association evidenced between parental physical activity and adolescent activity may be attributed to the fact that parent participation in physical activity is itself insufficient to promote participation among adolescents and consequently more direct and instrumental parental behaviours are necessary to facilitate this aim.

Irrespective of these findings a large body of research underscores the significance of parental physical activity role models for youth physical activity engagement. The results from the Framingham Children's Study in which parent and child physical activity was measured objectively, revealed that families comprising two parents that were both physically active had children that were six times more likely to be active than those of inactive parents (Moore et al., 1991). Perceptions of parental activity have also been significantly related to self-report physical activity behaviour among adolescents (Anderssen & Wold, 1992; Vilhjalmsson & Thorlindsson, 1998). In addition, qualitative research supports the proposed influence of parental physical activity on adolescent physical activity levels. Interviews undertaken with active and inactive teenage girls revealed that those who frequently engaged in sport reported living in a home in which parents engaged in exercise and physical activity during their free time (Coleman et al., 2008). Conversely, the majority of the girls who refrained from participating in physical activity indicated that their parents were inactive. In addition, some

participants revealed that they would be more inclined to participate in sport and physical activity if their parents were more physically active (Coleman et al., 2008). Thus, these findings suggest that parental physical activity behaviour may exert a powerful influence on adolescent physical activity participation.

### **2.4.3 Mothers, Fathers and Types of Physical Activity**

The empirical literature also suggests that gender of both child and parent can moderate the relation between social support and young people's physical activity behaviour. In a study investigating girls physical activity levels, Davison, Cutting and Birch (2003) found that both parents offered similar levels of encouragement however, different strategies were adopted by each parent to promote physical activity. Mothers provided higher levels of logistic support (e.g. transportation) whereas fathers were more likely to model physical activity behaviours and directly participate in physical activities with daughters. The results further indicated that children who perceived high levels of support from both parents were more likely to be physically active than girls who identified only one parent as socially supportive, who in turn were more active than those who did not receive any parental support. Qualitative findings also indicate that family participation in physical activity does not consist of performing activities together as a family unit, rather two parent families typically report pairing off with one child and providing transportation or doing activities together (Thompson et al., 2010). Thus, parents may support young people's physically active participation in different ways and parental gender may moderate the relationship between adolescent physical activity and parental physical activity and support.

In accordance, prior research indicates that fathers typically engage in greater amounts and more vigorous activities with their sons (Carson, Burks, & Parke, 1993). In addition, boys report greater perceptions of parental support for physical activity, particularly from fathers (Anderssen & Wold, 1992; Edwardson, Gorely, Musson, Duncombe & Sandford, 2014; Kirby et al., 2011; Robbins, Stommel, & Hamel, 2008). Moreover, Yao and Rhodes (2015) revealed that perceptions of father physical activity were more strongly related to boys physical activity than perceived mother physical activity behaviour. It is unclear why boys perceive higher level of support although it is possible that parents place a greater emphasis on son's involvement in physical activity owing to culturally prescribed stereotypes pertaining to sport as a masculine domain (Edwardson et al., 2014). However, it should be acknowledged that young people are also active participants in the process, thus it is possible that physically active children and adolescents initiate activities with parents because of their interest in and enjoyment of sport, which positively impacts parental supportive behaviours. An alternative explanation is that boys are typically more physically active than girls and consequently they elicit more parental support (Beets, Vogel, Forlaw, Pitetti, & Cardinal, 2006). For instance, increased sport participation may require more frequent transport to and from games, higher parental observation, and consequently greater levels of praise offered in respect to performance.

Kirby and colleagues (2011) further indicated that perceptions of support from same gender parent were more strongly related to adolescent physical activity. Thus, mothers exert a greater influence over daughter's physical activity levels while boys are more strongly influenced by paternal behaviours as has been argued previously. Furthermore, it has been suggested that parental involvement in physical activity may actually be more beneficial for girls. In accordance, parental activity and encouragement has been found to influence girls' physical activity levels to a greater extent than boys (Rangul et al., 2011; Trost et al., 1997). These findings suggest that mothers and fathers promote physical activity through different behaviours. Mothers typically act as facilitators of physical activity while fathers are more inclined to model and directly participate in activities with children. In addition, fathers appear to play a greater role in son's behaviour while there is also some evidence to suggest that girls may be influenced more strongly by perceived mother support. Therefore, it is important to explore mother and father as separate sources of influences in order to understand more fully the ways in which parents can differentially influence motivational processes and physical activity behaviour among adolescents.

#### ***Social processes & Type of Physical Activity Participation***

The significance of parental support and parental role models may also differ as a function of the type of physical activity undertaken. In a study comprising sufficiently active adolescents, Spink et al. (2006) found that parental support was more frequently identified by participants as an important factor underpinning involvement in organised as opposed to non-organised physical activity. In respect to parental role models, Cleland, Venn, Fryer, Dwyer, and Blizzard (2005) found that perceptions of parental exercise behaviour was positively associated with children and adolescents' extracurricular sport participation. Marques and colleagues (2014) further explored the relation between perceived parental activity and adolescent participation in organised and non-organised physical activity using a person-centred approach. Four distinct clusters emerged which reflected different combinations of parent and child physical activity levels. Adolescents who had higher perceptions of mother and father physical activity demonstrated the most positive physical activity profile evidencing regular participation in organised and non-organised physical activity. In contrast, adolescents for whom both parents were inactive were characterised by a low active profile reflecting non-participation. Different patterns of adolescent involvement in physical activity were subsequently evidenced dependent on whether mother or father was perceived to be physically active. Individuals with an active father were defined by a pattern of non-organised physical activity participation whereas perceiving one's mother as active was related to involvement in organised physical activity. Prior research indicates that fathers typically play a more direct role in youth physical activity behaviour whilst mother are more likely to provide logistic support, which may help explain the distinctive influence that each parent had on adolescent behaviour in respect to the type of physical activity undertaken (Davison et al., 2003).

#### ***Changes over time***

In respect to parental support, perceived levels appear to diminish over time, with older adolescents reporting lower levels of parental support in comparison to their younger counterparts (Beets et al.,

2006; Davison & Jago, 2009; Edwardson, Gorely, Pearson, & Atkin, 2013; Garcia, Broda, Frenn, Coviak, Pender et al., 1995). In line with these findings, a longitudinal study which tracked girls' participation in physical activity from the age of 9 up until 15 years revealed that parental reported logistic support and role modelling of physical activity behaviours decreased from childhood to adolescence (Davison & Jago, 2009). However, girls who maintained participation in physical activity demonstrated higher levels of parental modelling and logistic support over time than those evidencing declining physical activity levels. It may be argued that parental support underpins continued physical activity as girls will likely persist in an activity if transportation to the required location is maintained, whereas withdrawal of this form of support may result in non-attendance and subsequent inactivity.

The role of perceived parental support in predicting changes in physical activity over four years was additionally examined among a cohort of teenage girls. Dowda and colleagues (2007) found that females who demonstrated higher perceptions of family support at baseline were more physically active four years later than those who initially reported lower levels of support. In addition, changes in perceived family support predicted physical activity changes over time, with decreased levels of family support associated with declining levels of physical activity. The findings, in accordance with those of Davison and Jago (2009), suggest that promoting perceptions of family support among adolescent girls may serve to prevent age-related declines in physical activity. Nonetheless, it is also possible that girls that dropout of physical activity or report declining physical activity levels may no longer want or require parental support. Additional research implementing a prospective longitudinal design with multiple time points is necessary to examine this issue further.

Parental role model physical activity behaviour has also been explored longitudinally independent of parental support. Comprising a sample of girls who were followed over an eight year period from age 9 to 10 up until 18 to 19 years, Madsen et al. (2009) found that perceptions of parental physical activity significantly predicted girls' participation in physical activity each year despite age-related physical activity declines. Rangul and colleagues (2011) further examined the effect of mother and father physical activity levels on male and female adolescent physical activity behaviour over a four year period. The results indicated that inactive girls with a physically active father were more likely to adopt physical activity at follow-up while boys with a physically active father reported a decreased likelihood of initiating physical activity behaviour. In addition, maternal physical activity was positively related to sustained physical activity among girls, with such individuals evidencing a decreased risk of dropout or becoming inactive over time. For boys however, mother physical activity role modelling did not emerge as a significant predictor of physical activity. These findings suggest that parental physical activity exerts a greater influence on female adolescent physical activity behaviour over time. The negative relation evidenced between male physical activity and father physical activity is inconsistent with prior research (e.g. Edwardson & Gorely, 2010; Edwardson et al., 2014; Yao and Rhodes, 2015), which indicates that fathers positively influence son's physical activity participation. It is possible



however that the level of influence parents have over their children's behaviour changes over time. As there is a lack of longitudinal research undertaken in this area it is difficult to draw substantive conclusions regarding parental physical activity and changes in physical activity across adolescence although it appears that parental physical activity may be more strongly related to female physical activity maintenance and behaviour change.

#### **2.4.4 Parental Pressure**

The majority of research has focused on the positive role of parental supportive behaviours on young people's physical activity levels, however this has resulted in a limited understanding of how negative parental behaviours such as pressure impact adolescent physical activity and continued involvement over time. Parental pressure in respect to physical activity behaviour is characterised by criticism, negative responses to losing and overemphasis placed on winning. Prior research indicates that higher perceptions of parental pressure have been linked to maladaptive outcomes including increased stress and anxiety in addition to lower levels of sport enjoyment and participation among children and adolescents (Anderson, Funk, Elliot & Smith, 2003; Fredricks & Eccles, 2004; Hellstedt, 1990; Scanlan & Lewthwaite, 1986; Smith, 1986).

In line with self-determination theory, perceived pressure to think and act in certain ways undermines feelings of autonomy or the extent to which adolescents feel that they have undertaken physical activity out of their own sense of choice, which in turn diminishes self-determined motivation. Controlling environments, in contrast to autonomy supportive contexts, are characterised by coach or parental pressure regarding performance, with the former receiving more attention within the empirical literature. However, Amado and colleagues (2015) recently confirmed the hypothesised relations between parental pressure, psychological need satisfaction and self-determined motivation among a sample of adolescent team and individual sport participants using structural equation modelling. Parental pressure to improve skills and perform optimally was associated with decreased feelings of competence, relatedness and autonomy, which in turn diminished intrinsic motivation for sport participation. In accordance, qualitative findings indicate that parental pressure to sustain participation in physical activity can often become the central motive for adolescent sport participation (Bengoechea & Streat, 2007). Thus, a number of young people may persist in sport simply to satisfy parental wishes, reflecting external behavioural regulation or controlling forms of motivation.

#### ***Parental pressure & Types of Physical Activity Participation***

It has previously been argued that individual sport participation elicits higher perceptions of parental pressure as successful performance is contingent on individual performance. In contrast, team sport requires input from multiple members and pressure may therefore be more likely to originate from peers (Leff & Hoyle, 1995). Qualitative findings offer support for this contention, as previous interviews undertaken with team and individual sport participants revealed that adolescents who engaged in individual sports like badminton and tennis, spoke more frequently about feeling pressure to live up to

others expectations and beat competitors than did team sport players (Bengoechea & Streat, 2007). Such perceptions of pressure are consistent with introjected forms of behavioural regulation in which adolescent internalise a set of values or demands that are endorsed by others and are consequently experienced as controlling. Moreover, it appears that gender differences exist regarding perceived parental pressure in relation to physical activity behaviour. Leff and Hoyle (1995) revealed that males who engaged in individual sport perceived higher levels of pressure from fathers in comparison to female adolescents. Parental pressure has also been identified as a factor that contributes to children's and adolescents' dropout from organised sport, owing to parental interference, performance critique, emphasis on success and expecting too much from ones child (Crane & Temple, 2015). A lack of research however, has explored whether parental pressure may differ dependent on type of physical activity undertaken, and how parental pressure may differentially influence adolescent boys and girls physical activity participation over time.

#### **2.4.5 Conclusion**

In conclusion, parents can influence adolescent physical activity behaviours in the form of social support or modelling. However, the gender of child and parent may moderate this relationship; therefore it is necessary to explore the role of each parent separately (Davison et al., 2003; Kirby et al., 2011; Yao & Rhodes, 2015). It appears that one parent who is supportive or physically active is sufficient to promote physical activity among adolescents however; two parents confer the strongest impact (Cleland et al., 2005; Marques et al., 2014; Vilhjalmsson & Thorlindsson, 1998). Social support is more strongly related to organised physical activity participation than non-organised physical activity (Heitzler et al., 2006; Spink et al., 2006) with mixed findings evidenced regarding parental role models (Cleland et al., 2005). Some positive findings are also evidenced in respect to changing levels of physical activity over time, with higher levels of parental support underpinning sustained physical activity participation (Davison & Jago, 2009; Dowda et al., 2007; Edwardson & Gorely, 2010). However, inconsistent findings have been reported in relation to parental role models and physical activity behaviour change and this relation may be moderated by gender of parent and child (Rangul et al., 2011). Further research is therefore needed to explore how parental influence contributes to adolescents' physical activity patterns over time. In addition, to develop a greater understanding of adolescent physical activity behaviours it is necessary to examine the role of peers as they play a significant role in teenagers' lives.

#### **2.4.6 Peer Influences**

While family may be most important in early childhood, peers take on a more influential role during adolescence (Smith, Cowie & Blades, 2003; Beets et al., 2006). Accordingly, peer relationships occupy a substantial proportion of teenagers' life with approximately one-third of waking hours spent with friends (Hartup & Stevens, 1997). Peer influences therefore reflect central factors to explore given the significance of the peer group in children's development and the fact that many team sports,

structured physical activities, and unstructured play and exercise behaviours are typically performed alongside friends and peers. Similar to parents, peers have the potential to influence adolescent physical activity by providing support and role modelling active behaviours.

#### ***2.4.6.1 Friend Support***

It is widely accepted that peer support is positively related to adolescent physical activity (Park & Kim, 2008; Van der Horst et al., 2007). Prior research indicates that higher perceptions of friend encouragement and watching practices in addition to undertaking physical activity with friends is associated with increased levels of moderate and vigorous physical activity among young people (Duncan, et al., 2005; Springer, Kelder, & Hoelscher, 2006). In a study investigating peer social networks in which adolescent girls were asked to identify three close friends and rate their physical activity behaviour, Voorhees and colleagues (2005) found that frequency of participation in physical activity with friend was the strongest predictor of physical activity involvement. It is possible however, given the cross-sectional design of the study that this finding reflects a selection effect, in that physically active girls are more likely to seek out friends who are predisposed to participating in sports and physical activities. Thus, friends may engage in reciprocal relationships exerting influence over each other with respect to physical activity involvement. Gender may also moderate the influence of peers on adolescent involvement in sport. Coakley and White (1992) found that adolescent girls were more likely than boys to identify support from peers as important to their initiation and continued participation in sport activities, which suggests that peers may play a more salient role in female physical activity behaviours.

#### ***2.4.6.2 Friend Role Models***

Peer role modelling of physical activity has also been identified as a significant correlate of adolescent physical activity behaviour (Anderssen & Wold, 1992; Maturo & Cunningham, 2013; Raudsepp & Viira, 2000a; Sallis et al., 2000). However, perceived peer activity appears to be associated with adolescent physical activity only if the relationship is experienced as emotionally significant; thus perceptions of close friend physical activity levels are more influential than the wider peer group (Vilhjalmsson & Thorlindsson, 1998). Qualitative findings further suggest that peer relationships hold relevance for understanding youth engagement in physical activity. Discussions have frequently centred on friend participation in physical activity and how this can influence personal activity levels. It is apparent that adolescents want to fit in with friends and therefore tend to copy and endorse the behaviours modelled before them. As such girls with inactive friends tend to refrain from taking part in physical activity, however many indicate that if friends initiated physical activity they would likely follow (Coleman et al., 2008; Dwyer et al., 2006; Whitehead & Biddle, 2008).

Similar findings are reported from male focus groups, with adolescent boys indicating a decreased likelihood of undertaking physical activity if friends demonstrate low levels of involvement (Allison et

al., 2005). From the opposite perspective, Coleman et al. (2008) also found that active girls typically have more friends that are physically active and consequently sport and physical activity is considered as an opportunity to socialise together. However, friend dropout from sport or physical activity can also impact adolescent physical activity behaviour as some girls revealed that they did not want to be the only one left playing (Slater & Tiggemann, 2010). Thus, it is evident that peer physical activity behaviour has the potential to influence adolescent physical activity levels in both positive and negative ways.

### ***Modelling & Types of Physical Activity Participation***

In respect to type of physical activity undertaken, a comparison of sufficiently active adolescents who engaged in both organised and non-organised physical activity revealed that friend physical activity was more frequently cited as a central reason underpinning male and female non-organised physical activity participation whereas peer support was associated with involvement in both types of physical activity (Spink et al., 2006). Support from friends is central to youth physical activity involvement whereas active friends appear to serve as role models for more informal type of activities. Alternatively an active friend represents someone with whom one can undertake non-organised physical activity such as walking, cycling or informal games of soccer. Nonetheless, there has been a dearth of research on type of physical activity participation and role of friend support and modelling, therefore further research is necessary to advance understanding on this area.

### **2.4.7 Parental versus Peer Influence**

Empirical evidence indicates that peer and parental influences both play a central role in young people's physical activity behaviours. In accordance, Edwardson and colleagues (2014) found that adolescents who attained recommended levels of moderate-to-vigorous physical activity demonstrated higher levels of social support from parents and peers. However, other studies suggest that peer support may take on greater importance during adolescence. Edwardson et al. (2013) indicated that teenagers reported higher perceptions of support for physical activity from peers in comparison to parents. In addition, Prochaska, Rodgers and Sallis (2002) found that parent and peer support was associated with self-reported physical activity among children aged between 11 and 13 years, however peer support was a stronger predictor of activity levels. Moreover, in a study of physical activity social contexts, adolescents were more likely to report undertaking sport and exercise on the previous day with friends as opposed to family or by oneself, underscoring the significance of direct peer participation for youth physical activity (Dunton, Whalen, Jamner, & Floro, 2007). Furthermore, prior investigations of peer and parental support on adolescent physical activity behaviours indicate that perceived support from peers but not parents was positively related to youth physical activity (Beets, Pitetti, & Forlaw, 2007; Beets et al., 2006). The findings suggest that support from peers represents an important mechanism for promoting physical activity across adolescence.

#### ***2.4.7.1 Self-Determination Theory and Social Support***

Recent studies also indicate that peer and parental support and role modelling behaviours can exert an indirect influence on physical activity. Using structural equation modelling, George et al. (2013) found that social support indirectly impacted undergraduate students' autonomous motivation and in turn, intentions to be physically active through satisfaction of psychological needs for autonomy, relatedness and competence. Competence need satisfaction emerged as a stronger mediator of social support and self-determined motivation suggesting that this is the mechanism through which perceptions of support influence motivation to be active. However, perceptions of social support also satisfied needs for relatedness which suggests that social support may be interpreted as confirmation that others care about them, which in turn may facilitate feelings of interpersonal relatedness (Sarason, Pierce, & Sarason, 1990). In a study of adolescents, peer physical activity was also found to be strongly related to self-determined motivation which in turn predicted levels of moderate-to-vigorous physical activity (Li et al., 2014). In contrast, parental encouragement was related to both autonomous and controlled motives for physical activity, indicating that this form of support was perceived positively by some whilst for others it was experienced as a source of pressure to partake in physical activity. Collectively, these findings indicate that peer and parental behaviours can influence physical activity through both direct and indirect mechanisms.

#### ***2.4.7.2 Relative influence of Parent and Peers on Physical Activity over Time***

Longitudinal studies further highlight the positive role that peer and parental support play in youth physical activity behaviours over time. A study of adolescent girls classified as active maintainers, adopters, inactive, or dropouts on the basis of their level of physical activity participation at age 14 to 15 years and at follow-up three years later revealed that higher perceptions of friend and parental support at baseline, in addition to increased frequency of physical activity with friends predicted continued physical activity behaviour over time (Zook, Saksvig, Wu, & Young, 2014). Changes in physical activity however, were not related to parental or peer support, which suggests that these behaviours may play a more important role in sustaining physical activity involvement over time.

In contrast to the findings however, Neumark-Sztainer and colleagues (2003) found higher levels of parental and peer support were positively associated with changes in vigorous and, moderate-to-vigorous physical activity among adolescent girls that participated in a school-based obesity prevention physical education programme over eight-months. In addition, in a study exploring peer influences on physical activity, Raudsepp and Viira (2008b) found that perceptions of social support from friends increased among adolescent girls from the age of 11 to 13 years, which positively predicted changes in physical activity over time. It is possible that these discrepant findings may be attributed to duration of follow-up with perceptions of support more likely to be related to changes in physical activity over the short term.

Other studies exploring both peer and parental influences on adolescent physical activity over time indicate that peers play a greater determining role. In accordance, Kirby et al. (2011) found that peer support was more strongly related to male and female adolescent physical activity from 11 until 15 years of age. In line with these findings, Duncan, Duncan, Strycker, & Chaumeton, (2007) found that adolescents who had higher perceptions of peer support demonstrated less of a decline in physical activity levels between 12 and 17 years of age. Parental support in contrast, did not emerge as a significant predictor of physical activity. The findings indicate that social support is important for maintaining adolescent involvement in physical activity over time, with perceptions of peer support exerting a greater influence over continued participation. The evidence regarding physical activity change is less consistent; therefore more research is needed particularly with males to elucidate the role of social support and role modelling in physical activity uptake and dropout.

#### **2.4.8 Peer Acceptance**

In addition to friend support and role modelling, the wider peer group can also impact adolescent physical activity behaviours through feelings of acceptance or victimisation. By addressing both positive and negative interpersonal interactions, it is possible to develop a more detailed understanding of the mechanisms through which peer behaviours can influence adolescent physical activity behaviours and pattern of change over time. Peer acceptance encompasses popularity, social status or degree of social acceptance within the peer group (Stuntz & Weiss, 2009). Demonstrating competence within the physical domain has previously been linked to higher levels of peer acceptance (Evans & Roberts, 1987). In turn, greater perceptions of acceptance from peers within the sport context are positively related to enjoyment and more self-determined motivation for sport participation among younger adolescents (Ullrich-French & Smith, 2006). However, there is some evidence to suggest that this relationship may be moderated by gender as value placed on athletic competence may differ between males and females. In accordance, Chase and Drummer (1992) found that athletic competence was the most important determinant of popularity among adolescent boys, whereas physical appearance was the strongest predictor of social status among girls. Consistent with common constructions of masculinity, these findings indicate that sport represents an important context for boys to gain peer acceptance, with higher regard evidenced for more competent peers (Hauge & Haavind, 2011; Phoenix & Frosh, 2001).

In contrast, females are more strongly valued for how they look thus athletic girls may elicit negative peer evaluation for failing to conform to prescribed gender norms (Casey et al., 2009; Dwyer et al., 2006; Slater & Tiggemann, 2010). Contrary to these findings however, Craft, Pfeiffer and Pivarnik (2003) found that peer acceptance was a significant predictor of perceived physical competence among young females adolescents, which suggests that irrespective of the importance placed on aesthetics, the relation between peer acceptance and competence may still hold for teenage girls. This finding is important given that perceived competence has been consistently identified as a positive correlate of

physical activity; therefore it is plausible to suggest that perceived acceptance from peers indirectly exerts its influence on physical activity behaviour through satisfaction of competence needs.

Prior research also indicates that perceived acceptance from peers is positively related to feelings of connection among adolescents. In line with self-determination theory, Cox, Duncheon, and McDavid (2009) found that higher perceptions of peer acceptance was associated with increased feelings of relatedness, which in turn predicted autonomous motivation for physical education among secondary school students. Moreover, perceptions of peer acceptance emerged as a stronger determinant of relatedness than friendship quality, which indicates that the peer group represent important contributors to motivational processes within the physical domain in addition to playing a central role in satisfying psychological needs for relatedness.

In addition, previous research suggests that higher perceptions of peer acceptance may buffer the potentially negative motivational outcomes associated with poor teacher relationships in physical education such as decreased competence (Cox et al., 2009). In accordance, Cox and Ullrich-French (2010) found that adolescents who reported increased levels of peer acceptance in the absence of support from the physical education teacher demonstrated similar levels of perceived competence and physical activity as students evidencing high perceptions of teacher support and acceptance. Thus, feeling accepted by peers indirectly supported self-determined motivation among adolescents by fostering feelings of social connection or relatedness within the physical education context. Peer relationships therefore play a fundamental role in the quality of young people's physical activity experiences and sustained behaviour over time. In accordance, Ullrich-French & Smith (2009) found that higher levels of peer acceptance and friendship quality predicted sustained involvement in sport over one year among children and adolescents, with lower levels underpinning dropout. A lack of research is available however regarding the relation between peer relationships and initiation of physical activity, dropout and sustained participation across adolescence, therefore further research is warranted in this area. Moreover, it is important to determine whether perceived acceptance from peers play a more salient role in adolescent males' physical activity behaviours than females', and whether this proposed association diminishes as adolescents get older.

#### **2.4.9 Peer Teasing**

In addition to exerting a positive influence on young people's motivation and physical activity, peers can undermine activity levels through negative interactions such as teasing, which reflects interpersonal exchanges that provide a means through which, norms and expectations of the peer culture are identified, shared and acknowledged among adolescents. In accordance, negative peer appearance commentary is proposed to highlight appearance attributes that are deemed attractive, with criticism

targeted towards boys and girls who lack such attributes and thus, violate appearance norms (Jones, Vigfusdottir, & Lee, 2004).

Body mass and adiposity have frequently been implicated in the experience of peer criticism and teasing. In a randomised sample of adolescents, Eisenberg, Neumark-Stzainer, and Story (2003) found that 24.7% of boys and 30% of girls were teased by peers in relation to their weight, with higher appearance criticism targeted towards those evidencing excess levels of adiposity. Appearance teasing is consequently associated with maladaptive outcomes such as increased levels of body dissatisfaction and body image concerns among adolescent boys and girls (Barker & Galambos, 2003; Jones et al., 2004; Lawler & Nixon, 2011; Slater & Tiggemann, 2011). Prior research further indicates that negative peer commentary pertaining to body size or weight can diminish enjoyment, and physical activity participation among children (Faith, Leone, Ayers, Heo, & Pietrobelli, 2002). In addition, adolescent girls reported that experiences of peer teasing diminished perceptions of competence and physical activity enjoyment (Casey et al., 2009). It could be argued on the basis of these findings, and in line with self-determination theory, that teasing experiences diminish autonomous motivation for physical activity by decreasing psychological needs for competence, and relatedness or feelings of connection with others in the physical activity setting. Moreover, teasing experiences may serve as a deterrent to physical activity participation, particularly among overweight children; as such individuals may refrain from engaging in physical education classes and sports in an effort to avoid situations that incite peer victimisation (Faith et al, 2002; Storch et al., 2007).

Appearance concerns however, only represent one mode of teasing within the physical activity domain. Criticism may also be directed towards individuals that lack physical competence and skills. Moreover, prior research indicates that girls experience greater levels of teasing from peers during sport and physical activity than boys. Slater and Tiggemann (2011) found that adolescent females reported higher perceptions of being stared at by others, more frequent insults regarding body weight and increased incidents of being laughed at in relation to appearance or lack of coordination across sport and physical activity contexts in comparison to their male counterparts. Interestingly, while adolescent boys and girls both reported teasing from same-gender peers, females additionally identified males as a prominent source of such negative commentary. Qualitative studies support this contention with adolescent girls indicating that boys are primary instigators of peer teasing, attempting to intimidate and embarrass girls, particularly those who are overweight or demonstrate poor motor skills. Furthermore, negative commentary from boys has been identified by girls as a primary barrier to participation in physical activity (Casey et al., 2009; Vu, Murrie, Gonzalez, & Jobe, 2006). Male focus group discussion findings further confirm female perceptions with adolescent boys openly admitting to teasing girls when they fail to perform an activity correctly or demonstrate low physical competency (Vu et al., 2006).



While the existing literature indicates that adolescent girls experience higher levels of teasing relative to male peers, a lack of research has examined whether teasing experiences may differ as a consequence of the physical activity setting or indeed how these negative interactions impact participation in physical activity among male and female adolescents over time. Thus, to facilitate a greater understanding of the mechanisms through which peers impact adolescent physical activity behaviours, and continued involvement and change over time, it is necessary to take account of both positive and negative interpersonal interactions.

## **2.5 Intrapersonal Body-Related Characteristics**

The present research is contextualised within the developmental period of adolescence; a time characterised by heightened preoccupation with one's appearance owing to rapid physical changes accompanying puberty, and social changes contributing to enhanced salience of peer relationships (Ata et al., 2007; Hartup & Stevens, 1997; Voelker, Reel, & Greenleaf, 2015). Body image therefore represents a prevalent concern among adolescents that is likely to have motivational consequences for physical activity behaviour.

### **2.5.1 Body Image Concerns**

Body image is a highly gendered phenomenon, with associated perceptions and outcomes differing among adolescent boys and girls. From a young age, children are exposed to culturally-defined images of physical ideals. While an ultra-thin body ideal is emphasized for females, the male appearance ideal endorses a muscular physique characterised by broad shoulders and a well-developed chest (McCabe & Ricciardelli, 2001; Nichter & Nichter, 1991). As such, girls typically demonstrate a drive for thinness, while boys endorse a drive for muscularity. However, while both males and females may be aware of socio-cultural ideals, it has been argued that girls respond with greater intensity to these body ideals, and consequently experience greater body image dissatisfaction than boys (Knauss, Paxton, & Alsaker, 2007).

Research undertaken with adolescents in Ireland suggests that body image dissatisfaction or subjective unhappiness with some aspect of one's appearance is a prevalent adolescent concern. Accordingly, 54% of boys and 80% of girls reported a desire to alter their body size (Lawler & Nixon, 2011). The increased body dissatisfaction evidenced among adolescent girls may in part be attributed to pubertal development, which results in increased weight and levels of adiposity, moving them further away from the thinness ideal (Thompson and Chad, 2000). In contrast, puberty results in boys' bodies becoming more muscular; thus moving them closer to the masculine ideal which may contribute to a more positive body image. Body mass also plays a central role in perceptions of one's body and body satisfaction. Empirical survey findings support this position, demonstrating that girls are most satisfied with their bodies at below average levels of adiposity, with dissatisfaction increasing with increased body

mass, even among those who are classified as attaining a healthy weight. For boys, higher levels of body satisfaction are evidenced at average levels of body mass with dissatisfaction evidenced among those who are underweight and overweight presumably reflecting a desire to either bulk up or slim down to match body ideals (Jones et al., 2004; Lawler & Nixon, 2011; Presnell, Bearman, & Stice, 2004).

#### ***2.5.1.1 Body Image and Physical Activity Participation***

The heightened awareness of body and weight concerns during adolescence parallels the declining levels of physical activity evidenced among boys and girls (Cash & Pruzinsky, 1990; Ingledew & Sullivan, 2002). It is presently unclear however, as to whether low activity predicts poor body image or low body satisfaction serves as an obstacle to physical activity. In a study comprising 4746 adolescents, Neumark-Sztainer, Goeden, & Story (2004) found that overweight girls and boys reported higher levels of body dissatisfaction than normal weight peers, however low levels of body satisfaction were associated with decreased levels of physical activity involvement among adolescents regardless of weight status. Qualitative studies undertaken with female adolescents suggest that lower perceptions of physical appearance might serve as a barrier to physical activity. Focus group members admitted to feeling insecure and self-conscious in their PE uniform when comparing themselves to other girls whom they considered more attractive (Whitehead & Biddle, 2008). In addition, concerns about weight-related teasing and looking attractive while undertaking exercise in the presence of male peers negatively influenced girls' decisions to partake in physical activity (Dwyer et al., 2006; Whitehead & Biddle, 2008; Coleman et al., 2008). Accordingly, it has been suggested that the higher levels of physical activity evidenced among boys may partly be attributable to the increased body satisfaction demonstrated among this population (Neumark-Stzainer et al., 2004).

The empirical literature further indicates that regular participation in exercise is related to a more positive body image. A meta-analytic review of 121 studies exploring the relationship between body image and exercise behaviour revealed that higher levels of physical activity were linked to increased levels of body satisfaction, whilst exercise intervention participants reported a more positive body image than inactive control counterparts (Hausenblas & Fallon, 2006). Consistent with these findings, prior qualitative research highlights the importance of body image as a central motive for physical activity behaviour among adolescents. Bélanger et al. (2011) found that male physical activity maintainers identified a desire to maintain an attractive muscular physique, of which they were proud, to be a driving factor behind their continued participation in physical activity. Thus, it appears that physical activity contributes to a positive body image among adolescent boys.

Body image concerns may also differ as a function of the physical activity context. Ferron and colleagues (1999) revealed that sport participation was positively related to weight and appearance satisfaction among male adolescents. In addition, Jaffe and Lutter (1995) indicated that female team

sport players demonstrated a more positive body image than those who took part in non-sport physical activities. Moreover, Morano, Colella, & Capranica (2011) found that male team sport participants reported lower levels of body dissatisfaction than individual sport participants. The discrepancy between perceived and actual body size reflected a desire for individual sport athletes to be bigger possibly to enhance sport performance or to attain a more muscular physique representative of cultural ideals. In addition, it has been proposed that individual sports comprise more opportunities for comparison as the focus is on a single individual whereas team sport may exert a protective influence from social evaluation as the focus is on the group rather than the individual.

### ***2.5.1.2 Body Image and Motivation***

Internalisation of cultural ideals may be promoted through the media or as a consequence of peer norms, role modelling behaviours or conversations about appearance (Dittmar, 2009; Jones, 2004; Lawler & Nixon, 2011; Levine and Murnen, 2009). Perceived pressure to conform to cultural ideals can diminish feelings of autonomy and result in more controlling introjected regulations for physical activity behaviour as individuals impose aesthetic standards valued by others on oneself and attempt to attain these body ideals. In accordance, Markland & Ingledew (2007) found that differences in perceived body size discrepancies influenced autonomous motivation, which was positively related to physical activity levels among adolescents. Self-determined motivation for exercise was highest among males when there was no perceived discrepancy between their current and ideal body size, however autonomous motivation decreased as weight loss or weight gains desires increased. These results are consistent with prior research indicating that males want to achieve a muscular ideal and consequently are dissatisfied when they are under or overweight (Jones et al., 2004; Lawler & Nixon, 2011; McCabe & Ricciardelli, 2001; Presnell et al., 2004). For females however, higher perceived discrepancy between one's current and ideal shape indicative of a desire to lose weight was negatively related to autonomous motivation for exercise. The results indicate that body dissatisfaction owing to discrepancy between one's current and ideal shape, can undermine autonomous motivation for physical activity possibly owing to failure to adhere to socially prescribed body ideals.

### **2.5.2 Body Image as a Multi-Dimensional Construct**

Conceptualised as a multidimensional construct, body image encompasses both perceptual and attitudinal dimensions which can be evaluated in relation to aesthetic and functional qualities. Aesthetic body image relates to how the body looks, while functionality refers to what the body can do. Gender differences are evidenced in the centrality of these dimensions as female bodies are typically objectified and valued for aesthetic appearance whereas male bodies are appreciated for their functional qualities (Fredrickson & Roberts, 1997). The perceptual dimension comprises subjective judgements about one's

body size. The attitudinal dimension includes an evaluative component regarding satisfaction with one's body, investment pertaining to the value or importance placed on various body dimensions, as well as behaviours undertaken to maintain these aspects (Abbott & Barber, 2010; Cash & Pruzinsky, 2002; Cash & Szymanski, 1995).

The majority of research has typically focused on body dissatisfaction or overall body image and physical activity behaviour without consideration of the underlying dimensions of body image and how they may differentially impact physical activity behaviour. There are some exceptions to date, however. Abbott and Barber (2011) attempted to uncover the distinct role that aesthetic and functional body image dimensions play in various types of physical activity behaviour among adolescent girls. In relation to aesthetic body image, sport participants reported higher levels of aesthetic values and aesthetic behavioural-investment than girls who did not engage in physical activity. Levels of aesthetic satisfaction levels did not differ however, across the different physical activity behaviour profiles. In addition, sport participants reported higher levels of functional values, functional behavioural-investment and functional satisfaction than non-sport physical activity participants (e.g. going to the gym, running) and those who did not partake in any physical activity. In addition, non-sport physical activity participants reported higher functional values and functional behaviour investment than those who were not physically active. Participation in any type of physical activity appears to promote functionality of the body more as compared to those who remain inactive. However, sport participants valued and invested in the functional body more, and reported higher levels of satisfaction with their functional bodies than those who engaged in non-sport physical activity indicating that sport participation fosters more positive evaluations in respect to the body's functionality. Differences may be attributed to the type of activity undertaken with non-sport physical activity (e.g. jogging) being performed for more appearance enhancing motives which would result in an individual focusing on appearance as opposed to functional related aspects of the body. However motives for physical activity behaviour were not assessed therefore these claims remain speculative. Additional research is needed across a variety of physical activity contexts in order to explore this relationship further.

Gender differences have also been evidenced in respect to aesthetic and functional body image dimensions with males reporting lower levels of aesthetic values and aesthetic behavioural-investment, and significantly higher aesthetic satisfaction, functional values, functional behavioural investment and functional satisfaction than female adolescents (Abbott & Barber, 2010; Abbott, Barber, & Dziurawiec, 2012). In respect to adolescent boys, Ricciardelli, McCabe and Ridge (2006) investigated the way in which the male body is constructed through sport. They found that the aspects of their body that males were satisfied with and would like to improve were consistent with attributes defined as being necessary for successful sport performance or functionality. However, it may be that discussing body concerns in

relation to fitness and performance is more acceptable as it fits in with conceptions of masculinity. In support of these findings, Hargreaves & Tiggemann (2006) reported that adolescent males considered aesthetic body image a feminine or heterosexual issue.

### **2.5.3 Body Mass**

Body mass and level of adiposity can also play an influential role in physical activity behaviours. However, the relation between body mass and physical activity among adolescents is a complex bidirectional one which has previously evidenced inconsistent findings in the empirical literature. In accordance, various reviews of studies comprising objective or self-report measures of physical activity and BMI indicate no relation (Van der Horst et al., 2007), indeterminate associations (Sallis et al., 2000), or inverse relations with adolescents that engage in low levels of physical activity more likely to be overweight than their high active counterparts (Strong et al., 2005). Discrepant findings may be attributed to the way in which physical activity and BMI is measured across studies. Martinez-Gomez and colleagues (2010) previously indicated that adolescents who achieved objectively measured MVPA guidelines on every day over the past week demonstrated a lower risk of excess weight relative to their less active peers. In addition, accelerometry assessed vigorous physical activity was associated with more positive objective adiposity outcomes. Thus, different physical activity thresholds adopted across studies to distinguish active and low active adolescents may be insufficient to capture the daily level of MVPA necessary to impact body mass outcomes. It has also been argued that the type of physical activity undertaken may also play a role. Using self-report measures of height, weight and physical activity, Bengoechea et al. (2010) revealed that overweight younger adolescents were less likely to participate in organised and non-organised physical activity than their peers. Obese older adolescents however did not differ from normal weight peers in relation to organised physical activity, whereas they demonstrated lower levels of involvement in relation to non-organised physical activity. Further research is therefore needed to examine how various types of participation in physical activity influence body mass levels among male and female and younger and older adolescents.

### **2.5.4 Conclusion**

Body image, body mass and motivation are central aspects in adolescent physical activity behaviour that require further consideration. Poor body image may impede physical activity participation, whilst higher levels of functional and aesthetic body image are associated with participation in physical activity (e.g. Abbott & Barber, 2011; Ferron et al., 1999; Neumark-Sztainer et al. 2004). Body mass is also inextricably implicated in body satisfaction and therefore requires consideration alongside body image when investigating physical activity participation and change over time (Jones et al., 2004; Lawler & Nixon, 2011; Presnell et al., 2004). Moreover, body image and body mass may also differ as a function of the context or type of physical activity performed which necessitates further

investigation among adolescents (Abbott & Barber, 2011; Bengoechea et al., 2010; Jaffe & Lutter, 1995; Morano et al., 2011).

## **2.6 Rationale and Outline of Current Research**

Despite the many health benefits associated with meeting recommended moderate-to-vigorous physical activity guidelines the majority of adolescents in Ireland are currently failing to achieve required daily amounts (Kelly et al., 2012; Woods et al., 2010). In addition, physical activity demonstrates an age-related decline across adolescence with dropout occurring earlier for girls than boys (Nader et al., 2008). The goal of the present research is therefore to examine young people's patterns of involvement in physical activity and the psychosocial factors associated with physical activity maintenance and change over one year. A prospective longitudinal design is implemented which comprised two phases of data collection undertaken twelve months apart. The aim of phase one is to explore profiles of adolescent's physical activity participation and to compare these different patterns across a range of psychosocial factors. The aim of phase two is to examine stability and transitions in adolescents' physical activity patterns over twelve months and to investigate the psychosocial characteristics associated with sustained physical activity participation, dropout and adoption of physical activity. To facilitate gender and age-related variations in physical activity to be uncovered, the present research will address each of these aims separately for male and female and younger and older adolescents.

Prior research has typically focused on overall physical activity levels among adolescents without taking account of the different types of physical activity that comprise total involvement, which has resulted in a limited understanding of the patterns of physical activity in which young people engage (e.g. Kelly et al., 2012). Nonetheless some attempts have been made in the literature to classify adolescents on the basis of the context (organised v non-organised) or type (team v individual) of physical activity undertaken (e.g. Bélanger, Gray-Donald, O'Loughlin, Paradis, Hutcheon et al., 2009; Bruner et al., 2009; Eime et al., 2013; Walls et al., 2009). Clear gender differences are evidenced with boys reporting higher levels of participation in organised sport, team based activities and non-organised physical activity than girls, who in turn demonstrate a preferences for more individual type activities (e.g. dance, walking) (Bengoechea et al., 2010; Bradley et al., 2002; Bruner et al., 2009; Woods et al., 2010). In addition, although it has been consistently evidenced that participation in organised sport and physical activity is associated with higher levels of objective and self-reported youth physical activity (e.g. Woods et al., 2010), a lack of research has examined the relative contribution of non-organised physical activity to overall MVPA among adolescents, which reflects an important gap in the empirical literature.

Recent efforts to facilitate a more detailed understanding of young people's physical activity behaviours have resulted in person-orientated approaches being adopted within the literature to identify subgroups of adolescents that engage in similar patterns of physical activity. Only two studies to date

however have focused exclusively on adolescents' physical activity. Agans and Geldhof (2012) identified five distinct profiles reflecting young people's involvement in sport. However, in failing to address non-sport physical activities (e.g. gym, aerobics) and non-organised physical activities (e.g. walking, running) we are left with an incomplete picture of the varied patterns of physical activity that constitute adolescents' overall patterns of engagement. Liu et al. (2013) further indicated that classes of physical activity participation vary among males and females when prevalent types of moderate-to-vigorous physical activity are considered underscoring the importance of examining gender differences in young people's physical activity participation. However, while this study provided information on the type of physical activity undertaken the context of participation was not addressed. The present study therefore attempts to address these shortcomings in the literature by assessing multiple aspects of physical activity behaviour including context, type, frequency, duration and intensity and adopting a person-orientated approach to obtain a more nuanced understanding of adolescents' patterns of physical activity participation. In addition, a lack of research has explored how psychosocial correlates of physical activity differ across various physical activity contexts and settings therefore a secondary aim of this research is to compare young people's profiles of physical activity participation on a range of motivational, social and individual characteristics, which in turn would facilitate a greater understanding of youth patterns of physical activity involvement.

The present research is underpinned by self-determination theory (SDT; Deci & Ryan, 1985a; Ryan & Deci, 2000), which provides a conceptual framework from which to explore motivational and contextual processes underpinning physical activity behaviour. Previous research offer support for the application of self-determination theory in explaining young people's physical activity and changes in participation over time (e.g. Gillison et al., 2011; Jõesaar & Hein, 2011; Sarrazin et al., 2002; Standage et al., 2005). However, the context of non-organised physical activity participation has received little attention; therefore it is unclear how contextual conditions, psychological needs and motivational processes relate to this pattern of engagement, representing a key gap in the existing literature.

In addition, a limitation of self-determination theory is that it does not explicitly account for the role of parental and peer behaviours on young people's physical activity despite a wide body of empirical evidence indicating that significant others are highly influential in adolescents' participation. In accordance, parental support and role modelling is positively associated with adolescents' physical activity (Edwardson et al., 2014; Mendonça et al., 2014; Park & Kin, 2008; Yao & Rhodes, 2015). However, the evidence also indicates that gender of parent and child may moderate this relationship and further differ over time, thus the role of each parent necessitates separate consideration (Davison et al., 2003; Kirby et al., 2011; Yao & Rhodes, 2015). Friend support and physical activity role modelling has also been consistently related to adolescents' physical activity participation (Park & Kim, 2008; Sallis et al., 2000; Van der Horst, 2007), though it has been suggested that friend support may be particularly salient for girls' physical activity as girls are more likely than boys to identify friends as

important to their initiation and sustained participation in physical activity (Coakley & White, 1992). A dearth of research however, has explored whether friend support and role modelling are related to different contexts of physical activity participation, thus the present research will attempt to address this limitation. In addition, perceived acceptance from the wider peer group can impact physical activity participation. This relationship may be further moderated by gender as sport is typically considered a masculine pursuit and consequently this domain may be of greater salience for male popularity (Chase & Drumer, 1992; Phoenix & Frosh, 2002). Finally, more negative interpersonal interactions such as teasing and parental pressure can also undermine physical activity among youth resulting in non-participation and dropout over time (Casey et al., 2009; Crane & Temple, 2015; Vu et al., 2006).

In addition, adolescence plays a decisive role in the development of body image owing to the multiple changes that occur during this period, which results in heightened preoccupation with one's appearance. Body image and body mass therefore reflect intrapersonal factors that have not been addressed in self-determination theory but nonetheless likely have motivational consequences for behaviour (Markland & Ingledew, 2007). Inconsistent findings have previously been evidenced in respect to BMI however, it is possible that failing to take account of the context of participation may have resulted in discrepant results and this consequently reflects an area that requires further consideration (Bengoechea et al., 2010; Strong et al., 2005; Van der Horst et al., 2007). Body image comprises multiple dimensions encompassing aesthetic and functional components that pertain to what the body looks like and what the body can do (Abbott & Barber, 2010; Cash & Pruzinsky, 2002). Prior research indicates that team sport participation is related to greater aesthetic satisfaction while adolescents that engage in organised sport also demonstrate more positive functional body image (Abbott and Barber, 2011; Jaffe & Lutter, 1995; Morano et al., 2011). A lack of research however, has explored how distinct dimensions of body image, and functional aspects in particular, are related to changes in physical activity across adolescence.

A third key aim of the present research is to explore changes and stability in profiles of adolescents' physical activity participation over twelve months. Although it is widely evidenced that physical activity levels demonstrate an age-related decline across adolescence only one study to date has explored transitions in adolescents' profiles of physical activity participation. However within this study, no information was available on the type of physical activities underpinning sustained participation and dropout (Agans & Geldhof, 2012). Thus, the present research attempts to address this limitation by exploring changes in adolescents' physical activity over twelve months and examining the patterns of physical activity that constitute continued participation in physical activity and dropout over time. In addition, most studies that have addressed correlates of physical activity have been cross-sectional in nature which has precluded an investigation in to the factors associated with maintained participation in physical activity and changes over time. Thus, the final aim of the present research is



to explore psychosocial factors associated with physical activity dropout, uptake and sustained participation over one year among adolescents.

In summary, this research aims to provide a more nuanced insight into young people's physical activity by adopting a person-orientated approach to identify subgroups of adolescents that engage in similar patterns of behaviours and to further explore these profiles of physical activity participation across a range of motivational, social and body related characteristics. In addition, participants are followed up after twelve months and physical activity transition trajectories are investigated to identify patterns of physical activity that constitute sustained participation in physical activity or dropout over time. Finally, psychosocial factors associated with physical activity maintenance, dropout, continued non-participation and uptake of physical activity are explored.

## **Chapter 3: Methods**

### **3.1 Chapter Overview**

The purpose of this chapter is to provide an outline of the design of the study, participants, ethical considerations, procedures and materials used for data collection. The chapter also aims to describe the development and pilot of the Physical Activity Recall Seven Day Diary (PAR-7DD), in addition to the multi-sectional questionnaire used to measure various psychosocial characteristics hypothesised to be associated with adolescents' physical activity participation.

### **3.2 Research Design**

A prospective longitudinal design was implemented, which comprised two phases of data collection undertaken twelve months apart. At Time 1, a comprehensive survey package was disseminated to Irish adolescents and objective measures of height and weight were obtained. Latent class analysis was used to assess patterns of involvement in physical activity among adolescents (Chapter 4) and these participation profiles were subsequently compared on a range of motivational, social and body-related characteristics (Chapter 5). Participants were followed-up approximately twelve months after Time 1 and survey measures and objective BMI assessments were repeated. Latent class analysis was performed at Time 2 to identify discrete sub-groups of adolescents' physical activity involvement and subsequent investigation into whether similar physical activity patterns emerged one year later, and whether baseline profiles of physical activity participation were likely to be maintained, discontinued or replaced with alternate physical activity behaviours was undertaken. Adolescents were grouped longitudinally, on the basis of latent class membership at Time 1 and Time 2, into one of four physical activity trajectories reflecting maintained physical activity participation, dropout, continued non-participation or adoption of physical activity (Chapter 6). Mixed between-within models of analysis of variance (ANOVA) were then performed to investigate the psychosocial and individual factors associated with sustained physical activity participation, dropout, continued non-participation and uptake of physical activity over twelve months among male and female, and younger and older adolescents (Chapter 7).

### **3.3 Participants**

#### **3.3.1 Inclusion and Exclusion Criteria**

Criteria for inclusion in the present study were that adolescents were in 1<sup>st</sup> to 5<sup>th</sup> year in secondary school and parental and student consent was obtained. Criteria for exclusion from the study were students who were in 6<sup>th</sup> year (final year post-primary school) as they would not be available at follow-up 12-months later for Time 2 data collection, having already completed secondary school.

### 3.3.2 Ethics

Prior to recruitment, ethical approval for the research was sought from the Trinity College School of Psychology Research Ethics Committee. Ethical considerations included: (i) appreciating and upholding the principles of written, informed consent and participant confidentiality, and right to withdraw participation without penalty, (ii) ensuring the assessment and reduction of potential physical or social risk and/or psychological distress to participants and (iii) full compliance with regulations concerning the storage of personal data. The study received full ethical approval from the School of Psychology Research Ethics Committee in March 2011 (see Appendix A for a copy of the Ethical Approval Letter).

### 3.3.3 Recruitment

From the list of post-primary schools published by the Department of Education and Skills, sixteen schools were initially contacted by post regarding the research project (see Appendix B). All of the participants were recruited from first, second, third, fourth and fifth year classes in secondary schools from county Dublin. Based on the inclusion and exclusion criteria, a total sample of 1004 male and female adolescents participated at Time 1. Of the initial sample, participants who did not complete the Physical Activity Recall Seven Day Diary (PAR-7DD) ( $n = 4$ ) or those who were missing more than 15% of the remaining survey items ( $n = 5$ ) were removed from further analyses. Therefore, the final sample consisted of 995 participants (38.8% males, 61.2% females) who ranged in age from 12 to 17 years ( $M = 13.72$ ,  $SD = 1.25$ ). Table 3.1 illustrates the breakdown of participant characteristics by gender, age group and class at Time 1. Demographic information obtained through the parental consent form (Appendix C) is also included in Table 3.2. The majority of the parental consent forms returned was completed by the child's mother (82.4%).

Table 3.1 *Characteristics of sample at Time 1 by gender, age group and class (N = 995)*

<b>Variable</b>	<b>N</b>	<b>Males</b>	<b>Females</b>	<b>Age-Range</b>	<b>Mean Age</b>	<b>SD</b>
Age	995	386	609	12 – 17	13.73	1.25
<b>Class Group</b>						
1 <sup>st</sup> year	365	125	240	12 – 15	12.53	0.55
2 <sup>nd</sup> year	219	119	100	12 – 15	13.54	0.59
3 <sup>rd</sup> year	279	83	196	14 – 16	14.55	0.52
4 <sup>th</sup> year	10	-	10	15 – 16	15.20	0.42
5 <sup>th</sup> year	122	59	63	15 – 17	15.72	0.71
<b>Age Group</b>						
Younger Adolescents	467	175	292	12 – 13	12.61	0.49
Older Adolescents	528	211	317	14 – 17	14.73	0.79

Table 3.2 *Demographic characteristics of sample at Time 1 (N = 995)*

<b>Variable</b>	<b>N</b>	<b>%</b>
<b>Parent Country of Origin</b>		
Born in Ireland	703	70.7%
Born outside of Ireland	266	26.7%
<b>Ethnicity</b>		
White	720	71.7%
Mixed	21	2.1%
Asian	51	5.1%
Black	71	7.1%
Chinese	6	0.6%
Other	11	1.1%
Missing	124	12.4%
<b>Parent Education</b>		
Primary or less	24	2.4%
Intermediate/Group/Junior Certificate or equivalent	161	16.2%
Leaving Certificate or equivalent	271	27.2%
Diploma/Certificate	255	25.6%
Primary Degree	97	9.7%
Postgraduate/Higher Degree	94	9.4%
Other	2	2.0%
Missing	91	9.1%

At Time 2, approximately twelve months after initial assessment, participants took part in a follow-up study. The sample comprised students from second, third, fourth, fifth and sixth year classes in secondary school. A total of 803 adolescents (37.5% males, 62.5% females) aged between 13 and 18 years ( $M = 14.71$ ,  $SD = 1.29$ ) participated in both waves of data collection. A breakdown of participant characteristics at Time 2 is presented in Table 3.3. Attrition rates ranged from 6.6 % to 28.6% between different schools with an average attrition rate of 17.24% ( $SD = 6.98$ ). The wide ranging dropout rate was due to various factors. For example, some adolescents did not have parental permission to participate in the second wave of data collection ( $n = 14$ ), others had moved schools ( $n = 13$ ), or were absent on the day of assessment ( $n = 165$ ).

Adolescents who participated at both time points ( $n = 803$ ) were compared to those who only took part at Time 1 ( $n = 192$ ) on a number of social, motivational and body-related outcomes assessed at baseline.

A significant difference was found for mother physical activity role model ( $t(994) = -2.69, p = .007$ ) and mother social support scores ( $t(994) = -2.07, p = .039$ ), with the longitudinal sample (Time 1 and Time 2) significantly higher at Time 1 ( $M = 2.81, SD = 1.28; M = 13.17, SD = 4.55$ ) compared to the attrition sample ( $M = 2.53, SD = 1.24; M = 12.41, SD = 4.64$ ). In addition, differences were found on introjected regulation  $t(994) = -2.12, p = .034$ , and external regulation  $t(994) = -2.05, p = .040$ , with the longitudinal sample scoring significantly higher at Time 1 ( $M = 7.24, SD = 3.40; M = 6.90, SD = 3.03$ ) than the attrition sample ( $M = 6.67, SD = 3.20; M = 6.41, SD = 2.76$ ). No other differences were found between groups ( $p > .05$ ).

Table 3.3 *Characteristics of sample at Time 2 by gender, age group and class (N = 803)*

<b>Variable</b>	<b>N</b>	<b>Males</b>	<b>Females</b>	<b>Age-Range</b>	<b>Mean Age</b>	<b>SD</b>
Age	803	301	502	13 – 18	14.71	1.29
<b>Class Group</b>						
2 <sup>nd</sup> year	314	99	215	13 – 15	13.52	0.51
3 <sup>rd</sup> year	180	95	85	13 – 16	14.53	0.57
4 <sup>th</sup> year	103	25	78	15 – 17	15.58	0.53
5 <sup>th</sup> year	107	31	76	15 – 17	15.59	0.57
6 <sup>th</sup> year	99	51	48	16 – 18	16.91	0.69
<b>Age Group</b>						
Younger Adolescents	401	139	262	13 – 14	13.62	0.49
Older Adolescents	402	162	240	15 – 18	15.79	0.86

### 3.4 Procedure

#### 3.4.1 School Recruitment Time 1

A cluster-sampling approach was implemented to select schools. In the first stage, schools were selected within the Co. Dublin area and in the second stage, schools were randomly chosen and invited to take part in the study. A total of nine schools agreed to participate (56% school consent rate) representing a range of compositions. However, following dissemination of information sheets and consent forms, one school (fee-paying single-sex boys) subsequently withdrew from the study resulting in a total of eight participating schools at Time 1. A breakdown of the school characteristics at Time 1 can be seen in Table 3.4. Levels of non-response within schools ranged from 10% to 67%. In total, 11.6 % of respondents were from designated disadvantaged (DEIS) schools.

Table 3.4 *Characteristics of the schools from which participants were recruited for the main study*

	School Type		
	DEIS	Community	Fee-Paying
<b>Mixed gender</b>	1 ( <i>n</i> = 115)	6 ( <i>n</i> = 379, <i>n</i> = 199, <i>n</i> = 42, <i>n</i> = 103, <i>n</i> = 22)	-
<b>Single-sex boys</b>	-		-
<b>Single-sex girls</b>	-	1 ( <i>n</i> = 74)	1 ( <i>n</i> = 61)

The principals of sixteen post-primary schools were initially contacted by post, receiving a letter outlining the purpose of the research and what participation in the study involved for the school and participants (Appendix B). Approximately one-week later principals were contacted by phone as a follow-up to answer any questions about the study. Nine of the principals granted permission for the study to take place and a physical education teacher was subsequently selected to facilitate the research procedure in each school. Following this a date and time was arranged for the researcher to talk to students about the study and invite participation. During this talk, students received a copy of the information sheet (Appendix D) and a parental information sheet and parental consent form (Appendix C) to take home. A suitable date was set in the following weeks to conduct the study in each school. The parental consent form requested permission for their child to participate in the study at Time 1 and twelve-months later at Time 2. Parental permission was also required to collect physical BMI measurements from children at each time point. One school subsequently withdrew from the study at this point. Within the remaining schools, the parents of 1891 adolescents were invited to consent to their child's participation in the research. A total of 60.81% (*n* = 1150) of parents provided permission for their child to take part, while 3.85% (*n* = 46) did not. The remainder did not respond. A number of students were absent on the day of data collection, which resulted in 1004 participants completing the survey at Time 1.

### 3.4.2 School Recruitment Time 2

Approximately two months before the follow-up Time 2 data collection was scheduled to begin, the principals of the eight schools that participated at Time 1 were contacted and invited to participate in the second wave of data collection. Permission was granted from all of the school principals and the physical education teacher who coordinated the research at Time 1 subsequently arranged a suitable day for the Time 2 data collection.

### 3.4.3 Distribution of Questionnaires and Data Collection

The procedure for data collection was identical at Time 1 and Time 2. The survey was completed during a scheduled physical education class in each school. Prior to distribution of the multi-sectional questionnaire (See Appendix E), students were informed that they would fill out a survey aimed at understanding young people's participation in sport and physical activity and different factors that can influence whether or not one engages in physical activity. Participants were assured that responses were anonymous and confidential and that they were free to withdraw from the study at any time without incurring any penalties. The adolescents were then afforded the opportunity to ask any questions they had regarding the study. Participants who were willing to take part in the study were required to complete a consent form (Appendix D). Each consent form contained an ID number which corresponded to the attached survey. This numerical code was used to protect confidentiality and to ensure data could be matched at Time 1 and 2 without using the participant's name.

The researcher subsequently introduced the Physical Activity Recall Seven Day Diary (PAR-7DD) and provided instructions on how it should be completed. Participants' attention was drawn to the accompanying physical activity index card (Appendix F) and completed diary examples, which served to illustrate the information required. The researcher remained with students throughout completion of the survey and addressed any questions students had about the survey items. Completion of the survey took approximately 35- 45 minutes. When participants were finished the researcher briefly checked them for completeness which minimised the amount of missing data. All participants who completed the questionnaire were subsequently entered into a draw to win a range of confectionary items and cinema tickets.

#### **3.4.4 Measurement of Height and Weight**

Following completion of the survey, participant's height and weight were objectively measured in order to calculate BMI. On some occasions, the researcher was asked to return on a separate day in order to collect BMI measurements during a scheduled physical education class. If parental consent had been received and participants also agreed to height and weight measurements, physical recordings took place in a separate room adjacent to the classroom in which the survey was completed or within the physical education hall out of view of other students. Participants came in groups of four to quicken the process, and as each individual came into the room for the measurements, the other three waited outside. Participants were asked to remove their shoes. Height was recorded to the nearest 0.1cm using a portable stadiometer (Leicester Height Measure, Seca Ltd) and weight was then assessed to the nearest 0.1kg using the medically approved portable digital Seca scales with remote display screen (Seca Model 889). Height and weight measurements were taken twice by the same researcher to ensure accuracy. Measurements were subsequently repeated if height measurements differed by  $\geq 1$ cm, or weight measurement varied by  $\geq 0.5$ kg. The averages of each of the two measurements were recorded. Once

physical measurements were completed, participants received a debriefing sheet (Appendix G) and were thanked for their participation.

### **3.5 Measures**

The survey package used in the main study was entitled *Participation in Sport and Physical Activity among Teenagers in Ireland* and can be seen in Appendix E. This multi-sectional survey comprised the PAR-7DD that was used to assess patterns of adolescent participation in physical activity, in addition to measures of motivational, social and body-related influences on physical activity. Respondents completed the *Participation in Sport and Physical Activity among Teenagers in Ireland* at Time 1 and again approximately twelve months later at Time 2. Objective measures of BMI were also recorded at each time point. Finally, socio-demographic information was obtained for each participant from the parental questionnaire disseminated at Time 1. These measures were selected following careful consideration of (i) underlying theory, (ii) identified gaps in the physical activity literature, (iii) practical resources, (iv) psychometric properties, (v) developmental appropriateness, and (vi) overall length of questionnaire. The content of each measure is described in more detail below.

#### **3.5.1 Demographic variables**

In order to reduce participant burden and obtain demographic information, a parental questionnaire was included on the reverse of the parental consent form at Time 1 (Appendix C). Parents were asked to provide information regarding their child's age, date of birth, school year, height and weight, and to indicate their relationship to the child (i.e. mother, father, or other). The background and ethnicity of the responding parent was also assessed using two questions. The initial question asked the respondent "Were you born in Ireland?". Responses were assessed using a forced-choice "yes" or "no" format with those answering 'no' asked to specify their country of origin. In addition, parents were asked to indicate their race/ethnicity from five possible response options (i.e. "White", "Mixed", "Asian", "Black", "Chinese" or "Other"). Individuals who answered 'other' were requested to identify their race/ethnicity. Consistent with prior research, maternal education was used as a proxy for socio-economic status (e.g. Dooley & Fitzgerald, 2012). Respondents self-reported the highest level of education completed by the child's mother or female guardian to date. Seven distinct options were provided; Primary or less, Intermediate, Group/Junior Certificate or equivalent, Leaving Certificate or equivalent, Diploma/Certificate, Primary Degree, Postgraduate/Higher degree, and Other not listed, with space provided to record educational achievement. In addition, students reported their school year, age, date of birth and gender on the cover of the survey booklet at Time 1 and Time 2.



### **3.5.2 Physical Activity**

The Physical Activity Recall Seven Day Diary (PAR-7DD) was used to record physical activity undertaken over the previous seven days with information elicited on the type of activity engaged, context, duration and intensity in addition to who, if anyone the activity was performed alongside. Three additional questions were included to obtain information on adolescents' participation in organised sport and physical activity. A colour physical activity index card comprising sample physical activity entries was also developed to accompany the PAR-7DD and aid completion (Appendix F). This measure was developed for the present study and is described in more detail below.

#### ***3.5.2.1 Development of Physical Activity Recall Seven Day Diary (PAR-7DD)***

##### ***Rationale***

Physical activity undertaken by adolescents during or outside of school hours may comprise active travel, organised participation in team or individual sports, organised non-sport physical activity lessons (e.g. dance, aerobics), and non-organised forms of physical activity such as free play, games, and exercise. Thus, the pattern in which adolescents accumulate overall physical activity can be highly varied. Previous studies however, have typically classified adolescents on the basis of physical activity frequency and intensity, without consideration of the type, or context in which physical activity occurs. The purpose of the PAR-7DD, which was developed for the present study, was therefore to explore the multifaceted patterns of involvement in physical activity among adolescents.

While it may be argued that objective measures of physical activity (e.g. accelerometers) obtain more accurate recordings than self-reported surveys, such instruments are not without limitations proving to be time and cost intensive whilst offering a lack of contextual information (Duncan et al., 2005). In contrast, survey methods have frequently been used to assess physical activity among adolescents as they facilitate data collection from large samples, are relatively inexpensive to administer and record information on habitual patterns of physical activity (Dollman et al., 2009; Trost, 2007). Given that objective and subjective measures of physical activity both present their own unique challenges and advantages, the selection of a suitable measure should be guided by the research aims and objectives in addition to more pragmatic concerns such as cost and available resources (Sallis & Owen, 1999). The present research seeks to identify a greater understanding of different physical activity behavioural patterns among a large sample of adolescents, thus a self-report measure may be considered most suitable for this purpose.

***Design of PAR-7DD.*** The PAR-7DD was subsequently developed on the basis of the 3-Day Physical Activity Recall (3DPAR), a self-report measure of physical activity that has previously evidenced sound psychometric properties among children and adolescents (Pate et al., 2003). The 3DPAR requires participants to identify physical activity behaviour undertaken over the previous three days. Each day is split into 30-minute blocks of time grouped under larger headings that correspond to

the period of time before school, during school or after school. For each block, participants record the type of activity undertaken and rate the perceived level of intensity. A metabolic equivalent (MET) value is subsequently assigned on the basis of activity type and self-reported intensity. A similar format was adopted for the PAR-7DD, albeit with some changes.

The primary difference was that the PAR-7DD did not request information on activities of daily living or general physical activities such as indoor and outdoor chores or part-time work. Instead, participants were simply asked to recall any sport or exercise behaviours undertaken over the previous seven days, beginning with the most recent day first. In addition, participants were instructed to exclude any time spent in physical education, a compulsory class that all students within the present study were required to undertake weekly. Rather, physical activities performed out of choice were of interest, as volitional leisure-time exercise participation has previously been identified as a behavioural indicator of self-determined motivation (Gillison et al., 2006; Haggars, Chatzisarantis, Barkoukis, Wang, Baranoski, 2005). Moreover, leisure time physical activity is typically considered the physical activity domain that has the greatest potential for behaviour change (Booth, 2000). The recall time frame was extended as previous research indicates that several days of data is needed to estimate habitual physical activity behaviours (Trost et al., 2000). Level of physical activity participation has also been found to differ among adolescents on weekday and weekend days, therefore information was sought for the past week to obtain a comprehensive account of young people’s physical activity patterns (Kristensen et al., 2008; Nader et al., 2008). Similar to the 3DPAR, the current physical activity measure divided each weekday into broader time periods that reflected before school, during school and after school activity. These context cues were used to enhance memory recall of adolescents. Weekend days were not separated in this manner, rather adolescents were simply asked to recall any sports or exercise undertaken on Saturday and Sunday. The PAR-7DD comprised several columns moving across the page from left to right, which requested information on various dimensions of physical activity behaviour (Figure 3.1).

Think back over the last 7 days and write down any sports or exercise that you did

Day	NO	YES	Name of Activity/Sport	Type of activity	Minutes in Activity	Effort			Who did you do this activity with?
						Light	Mod	Vig	
Monday BEFORE school			.....	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	.....				.....
Monday DURING school			1	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
Monday AFTER school			1	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2

Figure 3.1. Excerpt from PAR-7DD

Participants were initially asked to indicate whether or not they had participated in physical activity during the allotted weekday or weekend period by ticking yes or no. Adolescents who did not engage

in any physical activity during this specified period were instructed to move down to the next time point and answer accordingly. Meanwhile, those responding in the affirmative were asked to provide more information about the physical activity bout undertaken. Participants were firstly instructed to list the name or type of activity in which they engaged (e.g. soccer, dance). Next, they had to identify the context in which the activity was performed selecting from four possible options: training, class or lesson, match or unstructured. Verbal and written examples were provided to clarify the distinction between each type of activity listed. Adolescents were also informed that activities performed in the absence of an instructor or coach, or those that were not undertaken as part of a lesson, class, training session or competitive event should be classified as unstructured physical activities (Benogoechea et al., 2009). Examples of unstructured or non-organised physical activities were also provided to support understanding (e.g. informal games of football at lunchtime, going for a run/brisk walk). This information was used to determine whether physical activity behaviours were undertaken within an organised or non-organised context.

Participants were then asked to report the duration of time in minutes spent doing this activity. Following on from this, adolescents were asked to rate their effort in each activity as light, moderate or vigorous. To help them choose the correct intensity level, verbal and written cues were provided. Light effort was defined as physical activity that felt easy and in which heart rate and breathing were normal. Descriptions of moderate (e.g. “Heart rate and breathing are faster than normal, may sweat a little”) and vigorous (e.g. “Heart rate much faster, have to breath deeper and faster, will probably sweat”) effort in physical activity were adapted from the Children Sport Participation and Physical Activity Study (Woods et al., 2010). Finally, participants were required to record with whom they performed the activity, for example, friends, family, team, club, or by themselves. The PAR-7DD therefore differed from the 3DPAR as additional information was sought in relation to the context, social setting, specific duration of the activity undertaken and time period being recalled. Based on feedback from the Pilot study (3.6) a colour physical activity index card, containing additional information and examples pertaining to each of the required fields on the PAR-7DD, was subsequently designed to accompany the survey and aid completion.

Three additional questions were also included in the PAR-7DD to evaluate adolescent’s participation in organised sport and physical activity across a range of settings. Involvement in extracurricular activities was assessed with one question “Do you play on any sport or physical activity teams in school?”. Participation in community sports and physical activities was measured with two questions: “Are you a member of any sport or physical activity clubs?” and “Do you currently attend any physical activity classes?”. Participants who responded ‘yes’ were asked to provide the name of the sports or physical activities in which they engaged.

### **3.5.2.2 Operationalization of physical activity indices Moderate-to-vigorous physical activity (MVPA).**

Participation in physical activity behaviour was subsequently operationalised in several ways using data derived from the PAR-7DD. Information provided on the type of physical activity undertaken and self-reported intensity was used to estimate the metabolic equivalent (MET) or amount of energy expenditure associated with that activity. The Compendium of Energy Expenditure for Youth (Ridley et al., 2008), which provides estimated energy costs for different activities at various levels of intensity, was used to assign an equivalent MET value to each activity recorded in the PAR-7DD. This permits an overall estimate of time spent in physical activity at different levels of intensity.

National and international guidelines recommend that young people achieve at least 60 minutes of MVPA daily. A MET value equal to or greater than 4, and 7, corresponds to activities of moderate, and vigorous intensity, respectively. Duration of minutes spent in MVPA (i.e.  $\geq 4$  METs) were calculated separately for each day. Participants who achieved a minimum of 60 minutes of MVPA were considered to have met the recommended physical activity guidelines on that day. The number of days on which adolescents engaged in at least 60 minutes of MVPA was summed to determine the total number of days that physical activity guidelines had been achieved over the past week (Figure 3.2). The proportion of adolescents at Time 1 who met the recommended physical activity guidelines for the previous seven days was  $\leq 1\%$ . Boys were more active than girls averaging 3.4 days ( $SD = 1.65$ ) of recommended MVPA in comparison to girls who met guidelines on a mean of 2.3 days ( $SD = 1.54$ ). In contrast, recommended physical activity guidelines were achieved on a mean of 2.7 days for both younger ( $SD = 1.67$ ) and older ( $SD = 1.68$ ) adolescent cohorts.

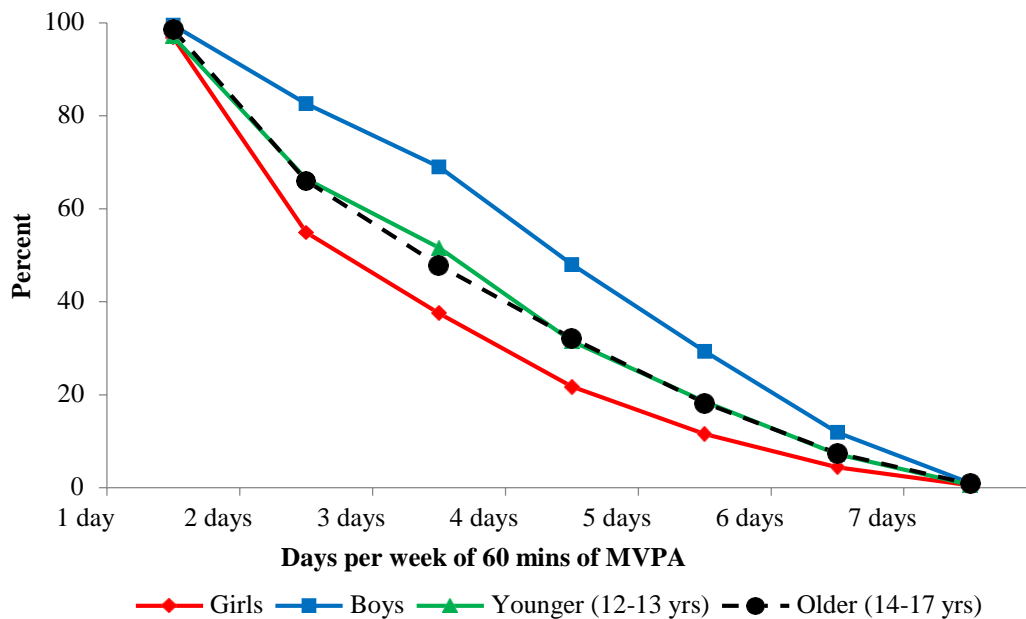


Figure 3.2. Proportion of adolescents by gender and age group who undertook  $\geq 60$  minutes of MVPA per day on 1-7 days per week at Time 1

In view of these findings and considering that the primary focus of this study was not on measuring absolute levels of physical activity but rather to gain a greater insight into adolescents' pattern of involvement in physical activity, a lower physical activity threshold was used to dichotomise adolescents as active or low active. Participants who achieved a minimum of sixty minutes of MVPA on three or more days over the past week were subsequently classified as active whilst those who fell below this cut-off were classified as low active. This threshold reflects a regular pattern of engagement in MVPA, with recommended guidelines achieved on at least three days out of the previous seven.

**Non-organised physical activity.** The PAR-7DD was also used to generate an indicator of participation in non-organised physical activity, which was defined as any sport or activity that does not take place alongside a coach, instructor, trainer or constitutes a class, lesson or training session undertaken within an organised school, club or community setting (Bengoechea et al., 2010). The number of non-organised physical activity sessions reported over the past seven days was summed to determine the total number of non-organised activity sessions undertaken in the past week. Previous research has classified regular participation in a specific type of physical activity as three or more sessions performed during the previous week (Bélanger, Gray-Donald, O'Loughlin, Paradis, Hutcheon et al., 2009). Focusing specifically on participation in non-organised physical activity, Heitzler et al. (2006) categorised youth as high active if they engaged in three or more non-organised physical activity sessions over the past seven days and low active if they did not meet this criterion. In accordance with prior research, the total number of non-organised physical activity sessions was recoded into one variable with '1' reflecting participation in three or more sessions of non-organised physical activity

over the past week and '0' indicating participation in less than three sessions of non-organised physical activity.

Participants also responded to three questions that enquired about organised participation in sport and physical activity classes undertaken within a school, club or alternate setting. To provide a more nuanced understanding of the type of organised sport or physical activity engaged, three new variables were created to reflect participation in team sport, individual sport and organised non-sport physical activity.

**Team sport.** Team sport reflects activities involving multiple athletes working interdependently that are generally practiced competitively between opposing teams (e.g. soccer, basketball, hockey) (Evans, Eys, & Bruner, 2012). Adolescents were considered a participant in team sports if they reported undertaking at least one team sport at school or club level and non-participants if they did not engage in any team sports.

**Individual sport.** Individual sports reflect those in which competitive results are typically based on individual performance (e.g. swimming, martial arts, cross-country running) (Evans, Eys, & Bruner, 2012). Adolescents who reported involvement in at least one individual sport were classified as an individual sport participant, whilst those who did not engage in any individual sports were deemed non-participants.

**Organised non-sport physical activity.** The remaining organised physical activities reported that could not be classified within the team and individual sport categories outlined above were identified as non-sport physical activities. These activities typically reflected less competitive modes of participation (e.g. dance, fitness classes). Adolescents who engaged in at least one organised non-sport physical activity as part of a class or lesson were classified as participants whilst those who did not were classified as non-participants.

**3.5.3 Individual variables.** The motivational variables pertaining to self-determination theory, in addition to the social and body related measures that were included in the multi-sectional questionnaire are detailed below.

**Enjoyment.** Seven negatively worded items from the modified Physical Activity Enjoyment Scale (S-PACES; Dishman et al., 2005; Motl et al., 2001) were used to measure enjoyment of sport and physical activity. Individuals who did not take part in any sport or physical activity during their leisure time were instructed to think about how they felt during physical education (PE) class when responding to each question. The Physical Activity Enjoyment Scale (PACES; Kendzierski & DeCarlo, 1991) was originally developed to assess enjoyment of physical activity among college-aged students and

consisted of 18 bipolar statements rated on a seven-point scale. A modified version of the PACES was subsequently developed for adolescents based on focus groups undertaken with a sample of 8<sup>th</sup> grade girls (Motl et al., 2001). The removal of two items owing to redundant content and a lack of relevance to this age-group resulted in a 16-item scale. The positively worded items were subsequently excluded to reduce participant burden resulting in seven negatively worded items (“When I am physically active I feel bored”) that comprise the shortened version of the modified PACES (S-PACES). Responses were recorded on a 5-point scale ranging from disagree a lot (1) to agree a lot (5). All items were reverse scored and summed to provide an overall measure of physical activity enjoyment. Total scores range from 7 to 35, with higher scores reflecting increased levels of physical activity enjoyment.

The S-PACES has previously demonstrated acceptable factorial validity and gender invariance among a multi-ethnic sample of boys and girls over a 9 month period (Paxton et al., 2008). In addition, adequate factorial validity, internal consistency ( $\alpha = .84$ ), and two-week test-retest reliability ( $r = .73$ ) was reported for adolescent girls aged between 11 and 14 years (Dishman et al., 2005). High internal reliability was also evidenced for the S-PACES at Time 1 ( $\alpha = .90$ ) and Time 2 ( $\alpha = .89$ ) in the present study.

**Motivation.** The Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004) was used to assess motivation towards sport and physical activity. The scale evaluates different reasons for participating in physical activity, which vary along a graded continuum of self-determination. Slight modifications were made to the wording of the scale, with ‘sport and physical activities’ replacing the term ‘exercise’ to facilitate consideration of a wide range of contexts in response to each question. Comprising 19 items, the BREQ-2 consists of 5 subscales that represent distinct regulations outlined within self-determination theory. From most to least self-determined, these include intrinsic motivation (4 items e.g. “I do physical activity/sport because it is fun”), identified regulation (4 items e.g. “I think it is important to make the effort to do physical activity/sport regularly”), introjected regulation (3 items e.g. “I feel guilty when I don’t do physical activities/sport”), external regulation (4 items e.g. “I feel under pressure from my friends and family to take part in physical activities/sport”), and amotivation (4 items e.g. “I don’t see the point in doing physical activities/sport”). Participants responded to each item on a five-point Likert scale ranging from not true for me (1) to very true for me (5). Items were summed for each subscale to provide a total score for the corresponding behavioural regulation.

The BREQ-2 has previously evidenced adequate factorial validity and reliability for each of the five subscales (alpha coefficients ranging from 0.74 to 0.87) among male and female adolescents (Gillison & Standage, 2005; Gillison et al., 2006). In the present study, satisfactory Cronbach alpha coefficients were also reported at Time 1 and Time 2 for intrinsic motivation ( $\alpha = .91$ ,  $\alpha = .89$ ), identified regulation

( $\alpha = .80$ ,  $\alpha = .79$ ), introjected regulation ( $\alpha = .73$ ,  $\alpha = .75$ ), external regulation ( $\alpha = .73$ ,  $\alpha = .76$ ) and amotivation ( $\alpha = .87$ ,  $\alpha = .89$ ), respectively.

Integrated regulation also represents a form of extrinsic motivation outlined by self-determination theory that reflects assimilation of identified regulations within the self and subsequent congruence between one's values and beliefs. Wilson, Rodgers, Loitz and Scime (2006) developed four items to assess integrated regulation that were adapted in the present study to aid comprehension among younger participants (e.g. "I consider physical activity/sport an important part of who I am). The integrated regulation subscale has demonstrated construct validity and acceptable test-retest reliability over a two week period offering support for the stability of this subscale alone or in conjunction with the BREQ-2 (Wilson, Sabiston, Mack, & Blanchard, 2012; Wilson et al., 2006). While this measure was included in the survey at Time 1 and Time 2, many adolescents expressed difficulty and lack of understanding in respect to these items. In accordance with prior research, it appears that this construct may not be suitable for use with children and adolescents owing to their limited developmental capacity to achieve a sense of integration within their self (Vallerand, 2001). Therefore, it was subsequently decided to exclude the integrated regulation subscale from all further analyses.

**Competence.** The Athletic Competence subscale of the Self-Perception Profile for Adolescents (SPPA; Harter, 1988) was used to measure perceptions of ability and athletic competence in sport and physical activity. The subscale comprises five items organised in a structured-alternative format (e.g. 'Some teenagers feel that they are better than others their age at sports BUT other teenagers don't feel they can play as well'). Presented with two possible statements, participants must select one response and indicate whether the statement is 'sort of true' or 'really true' for them. Each item is scored on a scale from 1 to 4 with higher values reflecting greater perceived competence. Harter (1988) demonstrated adequate factorial validity and internal reliability for this subscale among boys and girls aged between 10 and 15 years with alpha coefficients ranging from .86 to .92. In addition, good one-month test-retest reliability ( $r = 0.86$ ) was reported for this measure in a sample of female adolescents (Neumark-Sztainer, Story, Hannan, Tharp & Rex, 2010). In the present study, satisfactory Cronbach alphas were also evidenced at Time 1 (.80) and Time 2 (.83).

**Relatedness.** The Acceptance subscale of the Need for Relatedness Scale (NRS-10; Richer & Vallerand, 1998) was used to assess feelings of connection towards other peers within the physical activity domain. Participants were instructed to think about teammates, physical activity class members, or for those who do not engage in any recreational physical activities responses were sought in relation to classmates in physical education. Comprising five items, participants rated the extent to which they feel supported, understood, listened to, valued and safe on a five-point Likert scale ranging from 'disagree a lot' (1) to 'agree a lot' (5). Higher scores represented increased perceptions of relatedness. The scale was originally developed to assess feelings of relatedness towards colleagues with adequate



psychometric properties evidenced within the work setting (Richer & Vallerand, 1998). The Acceptance subscale has also been widely adapted for use across various physical activity contexts demonstrating satisfactory internal reliability among adolescents (e.g. Standage, Duda, & Ntoumanis, 2003; 2005). In the present study, high Cronbach alphas coefficients were evidenced at Time 1 (.80) and Time 2 (.83).

**Autonomy.** The Autonomy subscales of the Basic Needs Satisfaction in Sport Scale (BNSSS; Ng, Lonsdale & Hodge, 2011) were used to evaluate adolescents' perceptions of autonomy in physical activity contexts. The BNSSS comprises three subscales which correspond to different dimensions of autonomy; choice (4 items), volition (3 items), and internal perceived locus of causality (3 items). Perceived choice reflects the belief that one has flexibility in deciding what to do within an activity (e.g. 'I have a say in how things are done'), volition reflects a sense of unpressured willingness to undertake an activity (e.g. 'I feel I participate in sport and physical activities willingly') and internal perceived locus of causality is characterised by beliefs that one is the originator of their own actions (e.g. 'I feel I am doing what I want to be doing') (Reeve, Nix, & Hamm, 2003). The wording of items was amended to reflect involvement in 'sport and physical activities' to ensure the measure was applicable to both athletes and non-competitive physical activity participants. Responses were rated on a 5 point Likert scale ranging from 'not true at all' to 'very true'.

This measure has demonstrated adequate psychometric properties in previous research. Ng and colleagues (2011) reported good seven-day test-retest reliability among a sample of college athletes, whilst acceptable Cronbach alpha coefficients were reported for the autonomy subscales pertaining to choice ( $\alpha = .82$ ) and internal perceived locus of causality ( $\alpha = .76$ ), with slightly lower values reported for volition ( $\alpha = .61$ ). In other studies comprising adolescent athletes, the subscales of choice, internal perceived locus of causality and volition were combined to reflect a single autonomy scale that evidenced high internal consistency ( $\alpha \geq .83$ ) (Ahmadi, Namazizadeh & Mokhtari, 2012; Curran, Hill, & Niemiec, 2013). The autonomy subscales have also been adapted for use within the physical education context with autonomy supportive teaching interventions related to higher levels of autonomy among adolescents, offering evidence of construct validity (Lonsdale et al., 2013). In the current study, satisfactory reliability was evidenced at Time 1 for choice and internal perceived locus of causality ( $\alpha \geq .83$ ), whereas slightly lower Cronbach alpha coefficients were reported for volition (.65). Thus, in line with prior studies it was decided to combine the ten items to provide a total autonomy score with higher scores representing greater perceptions of autonomy. High internal reliability was subsequently recorded for the combined autonomy subscales at Time 1 ( $\alpha = .89$ ) and Time 2 ( $\alpha = .90$ ).

**Autonomy Support.** The short version of the Sport Climate Questionnaire (SCQ; Deci, 2001) was used to measure perceptions of leadership style and autonomy support in various physical activity contexts. Participants were instructed to think about the organised sport and physical activities in which

they engaged or physical education class for those who were inactive, and answer accordingly. The short version of the SCQ consists of six items that assess the extent to which adolescents perceived their coach, instructor or PE teacher to be autonomy supportive (e.g. “My coach/instructor/PE teacher encourages me to ask questions”). The wording of the SCQ was modified slightly to reflect different sport and physical activity settings to ensure that questions were relevant to all participants. Each item was scored on a five-point Likert scale ranging from ‘disagree a lot’ to ‘agree a lot’. Items were summed to provide a total autonomy support score with higher scores representing increased perceptions of an autonomy-supportive environment. The short form SCQ has demonstrated adequate reliability among children and adolescents in multiple physical activity settings such as PE (Ntoumanis, 2005) and organised sports (Jõesaar, Hein, & Hagger, 2012). High Cronbach alpha reliability coefficients were also recorded at Time 1 (.88) and Time 2 (.90) in the present study.

***Mother and Father Support.*** Five items were originally developed for the Amherst Health and Activity Study to evaluate parental social support for physical activity (Sallis, Taylor, Dowda, Freedson, & Pate, 2002). Participants were asked to reflect over a typical week and indicate the extent, to which each parent provided encouragement to be active, undertook a physical activity with them, provided transport to a physical activity setting, viewed physical activity practices or indicated that physical activity was good for their health. This scale was subsequently modified by Prochaska et al. (2002) who replaced the item regarding parental comments on the importance of physical activity for health with one question assessing praise for physical activity participation. Frequency of behaviours was recorded on a five-point scale ranging from not at all to everyday. In addition, a ‘not applicable’ option was included for those who may be raised primarily by one parent and consequently for whom the question was not relevant. Such responses were scored equivalently to those answering ‘not at all’ to reflect a subsequent lack of parental support. The items were summed together to calculate a total social support score for each parent. Scores could potentially range from 5 to 25 with higher scores reflecting increased perceptions of social support among adolescents. The original scale demonstrated strong two-week test-retest reliability ( $ICC = 0.88$ ) and child and parent reports were found to be significantly correlated ( $r = .61, p < .001$ ; Sallis et al., 2000). In addition, the modified version demonstrated high internal consistency ( $\alpha = .77$ ) among secondary school students (Prochaska et al., 2002). Cronbach alpha coefficients were also satisfactory in the present study for mother support (.77) and father support (.85) at Time 1 and Time 2.

***Mother and Father Physical Activity Role Models.*** One item was developed for the present study to measure perceptions of parental participation in sport and physical activity during a typical week (e.g. During a typical week how often has your Mum/Dad done physical activities themselves or with friends, like going for long walks or playing sports?). Responses ranged on a five-point scale from not at all to every day. Participants were also presented with a ‘not applicable’ option in case either

parent was absent from their life. The question was completed separately for each parent with higher scores representing increased frequency of mother and father physical activity role modelling behaviours.

**Parental Pressure.** The Pressure subscale of the Parental Involvement in Activities Scale (PIAS; Anderson et al., 2003) consists of ten items that measure perceived parental control over participation in organised sport and physical activity (e.g. “My mum or dad sign me up for sport or physical activity lessons without asking me if it’s okay”) and pressure to perform to a high standard (e.g. “My mum or dad get upset when I don’t do as well as they would like me to in sports and physical activities”). Original items were modified to increase relevance to the physical domain i.e. the term ‘sport and physical activity’ was included in place of ‘activity’. Each item included the wording ‘My mum or dad’ to allow consideration of both parents together or alternatively mother or father only if raised in a single parent family. Responses were rated on a four point scale that ranged from ‘disagree a lot’ to ‘agree a lot’ with one item being reverse scored (i.e. “When it comes to sport or physical activities, my mam or dad think that the most important thing is that I have fun”). Scores were summed together with higher scores representing increased perceptions of parental pressure in relation to sport and physical activity. Total scores can potentially range from 10 to 40. The Pressure subscale of the PIAS has previously evidenced good internal reliability among a sample of 9-to-11 year old children ( $\alpha = .71$ ; Anderson et al., 2003) and adolescent athletes ( $\alpha = .84$ ; Braddock, 2007). In addition, parental pressure emerged as a significant negative predictor of children’s sport enjoyment offering support for construct validity (Anderson et al., 2003). The Cronbach alpha coefficients for parental pressure were also satisfactory at Time 1 ( $\alpha = .80$ ) and Time 2 ( $\alpha = .82$ ) in the present study.

**Peer Social Support.** Five items initially developed for use within the Amherst Health and Activity Study assessed peer support for physical activity including encouragement, praise, participation in physical activity with peer, adolescent encouragement of peer physical activity and teasing (Sallis et al., 2002). Prochaska et al. (2002) subsequently removed the peer teasing item resulting in a four-item peer support measure, which was implemented in the present study. Participants rated the frequency of support behaviours during a typical week on a five-point Likert-type scale ranging from not at all to every day. Total scores could range from 1 – 20 with higher scores demonstrating increased perceptions of peer support for physical activity. The four-item peer support scale has evidenced good internal reliability ( $\alpha = .81$ ) among adolescents and has been widely used in other studies examining social support among young people (e.g. Beets et al., 2006; 2007). Cronbach’s alphas for this measure at Time 1 ( $\alpha = .74$ ) and Time 2 ( $\alpha = .71$ ) was also satisfactory in the present study.

**Friend Physical Activity Role Model.** One item was developed for the present study to measure perceptions of friend participation in sport and physical activity during a typical week (i.e. “During a

typical week how often do your friends do physical activities or play sports?"). Participants responded on a five-point scale that ranged from 'not at all' to 'every day' with higher scores representing increased levels of friend physical activity role modelling.

**Peer Acceptance.** The Social Acceptance subscale of the Self-Perception Profile for Adolescents (Harter, 1988) was used to assess the extent to which adolescents feel accepted by peers. Comprising five items, the subscale is presented within a structured alternative format that consists of two opposing statements, for example, 'some teenagers have a lot of friends BUT other teenagers don't have very many friends'. Participants are asked to select the teenager that is most like him or her and to then decide whether the answer is 'sort of true' or 'really true' for them. Item scores ranged from 1 to 4 with higher values reflecting more desirable perceptions of peer acceptance. This subscale was extensively tested and demonstrated good factorial validity and reliability among male and female adolescents with Cronbach alpha coefficients ranging from .77 to .90 (Harter, 1988). In addition, Neumark-Sztainer and colleagues (2003) reported high one-month test-retest reliability ( $r = 0.82$ ) among a sample of teenage girls. The internal consistency of the subscale was also found to be satisfactory in the present study at Time 1 ( $\alpha = .73$ ) and Time 2 ( $\alpha = .75$ ).

**Teasing.** Slater and Tiggemann (2011) developed four items to measure teasing experiences specific to the physical activity domain (e.g. "Have people made fun of you because of how you look?"). Three additional items were designed for the current study to evaluate negative comments targeting one's level of competency in sport and physical activity. The questions included "Have people laughed at you or made fun of you for not being fit enough?", "Have people laughed at you because you are not fast enough?" and "Have people made fun of you for not being good at physical activity or sport?". Responses were scored on a five-point scale that varied from 'never' to very 'often'. Participants who indicated that they had received negative commentary were also asked to identify the source(s) of victimisation from a range of possible agents (i.e. other girls, other boys, family members, coach/instructor, teammates). The seven items were summed to provide a total teasing score that ranged from 7 to 35 with higher scores indicative of increased levels of teasing experienced within a physical activity context.

The original scale has previously demonstrated adequate internal consistency among a sample of male and female adolescents (Slater & Tiggeman, 2011). In the present study, the seven items were combined to form a single measure of teasing that demonstrated satisfactory Cronbach alphas at Time 1 ( $\alpha = .73$ ) and Time 2 ( $\alpha = .76$ ). The revised teasing measure was also subjected to factor analysis with parallel analysis indicating that only one factor should be retained. All of the items were also found to load more strongly on the first component of the component matrix suggesting that a single scale adequately reflected teasing experiences within the physical activity domain. Moreover, teasing was positively correlated with body dissatisfaction ( $r = .21$ ;  $r = .25$ ), and negatively associated with enjoyment ( $r = -$

.26;  $r = -.27$ ) at each time point in the current study, offering evidence of construct validity for the seven-item measure.

**Body Image Dissatisfaction.** The Contour Drawing Rating Scale (CDRS; Thompson & Gray, 1995) was used to measure body dissatisfaction. Participants were presented with a series of male or female contour drawings, which increased incrementally in size from severely underweight (1) to obese (9). Comprising nine options, participants were asked to select the figure that most closely approximated their current body (current figure) and the figure that they would most like to resemble (ideal figure). The discrepancy between these two responses (Current – Ideal) was conceptualised as an index of body size dissatisfaction. For example, a participant who identified her current body as a 6 and ideal figure as a 4 is awarded a body dissatisfaction score of 2 reflecting a desire to lose weight. Alternatively, an individual reporting a current figure of 2 and an ideal figure of 5 would receive a body dissatisfaction score of minus 3, reflecting a desire to gain weight. Lawler and Nixon (2011) previously evidenced satisfactory concurrent validity for self-selected current figures and BMI (girls,  $r = 0.59$ ; boys,  $r = 0.65$ ) and between self-ratings and self-reported weight (girls,  $r = 0.66$ ; boys,  $r = 0.57$ ) among a sample of Irish adolescents. In addition, good one-week test-retest reliability ( $r = 0.78$ ) has been reported for female university students (Thompson & Gray, 1995). In the present study, BMI was positively correlated with body dissatisfaction scores at Time 1 ( $r = .52$ ) and Time 2 ( $r = .59$ ) offering evidence of construct validity.

**Body Image.** The Embodied Image Scale (EIS; Abbott & Barber, 2010) was used to assess the multidimensional nature of body image and includes cognitive, behavioural and affective aspects of aesthetic and functional dimensions of the body. Aesthetic body image reflects appearance orientated body components whilst functional characteristics represent the physical capacities of the body or what it can 'do'. In turn, cognitive aspects refer to the personal value or degree of importance placed on different body dimensions, behavioural aspects represent investment within a particular body dimension and actions undertaken to maintain this dimension, and affective evaluations reflect satisfaction with associated aesthetic or functional dimensions. The EIS comprises 17 items and six subscales that evaluate aesthetic values (3 items e.g. 'How good I feel about my body depends a lot on whether people consider me good looking'), aesthetic behaviour investment (2 items e.g. 'I always try to look the best I can'), aesthetic satisfaction (3 items e.g. 'I am very happy with the appearance of my body'), functional values (3 items e.g. 'How good I feel about my body depends a lot on what my body can do physically'), functional behaviour investment (3 items e.g. 'I always try to physically challenge myself during physical activities'), and functional satisfaction (3 items e.g. 'I am very happy with my performance in physical activities'). Participants responded to each item on a five point scale ranging from 'not true for me' to 'very true for me'. Items were summed for each subscale with higher values reflecting increased value, investment or satisfaction with aesthetic or functional body dimensions.

The EIS has previously demonstrated adequate internal consistency for all subscales with alpha levels ranging from .72 to .90 among a sample of male and female adolescents (Abbott & Barber, 2010, 2011). Factor analysis also revealed that the theorised factor structure of the EIS conformed to three distinct factors for each body dimension. In addition, predictive validity of the EIS was found, with aesthetic and functional body satisfaction demonstrating positive correlations with self-esteem and negative associations with depressed mood (Abbott & Barber, 2010). In the present study, satisfactory Cronbach alpha coefficients were reported at Time 1 and Time 2 for aesthetic values (.71; .72), aesthetic behaviour investment (.67; .70), aesthetic satisfaction (.90; .92), functional values (.72; .76), functional behaviour investment (.78; .83), and functional satisfaction (.88; .89).

**Body Mass Index.** Objective measures of height and weight were also recorded using standardised equipment and procedures. Participants were asked to remove their shoes and height was measured to the nearest 0.1cm using the portable Leicester height rod. A medically approved portable digital scale with a detached remote display screen (Seca Model 889) was subsequently used to assess participants' weight to the nearest 0.1kg. The protocol for measuring height and weight is detailed in Appendix H.

Body mass index (BMI) was calculated by dividing weight in kilograms by height in meters squared ( $\text{kg}/\text{m}^2$ ). Complete height and weight objective measurements were available for 948 participants at Time 1. Excluded participants did not have parental consent ( $n = 23$ ), declined to take part ( $n = 10$ ) or were absent on the day of assessment ( $n = 15$ ). Pearson correlations were used to compare the strength of association between parental reported height ( $n = 554$ ) and weight ( $n = 453$ ) and objective measures. Parental reports were strongly correlated with objective measurements of height ( $r = 0.86, p < .01$ ) and weight ( $r = 0.95, p < .01$ ). Thus, available parental reports ( $n = 31$ ) were subsequently imputed for students missing objective BMI measurements at Time 1. At Time 2 follow-up, objective BMI measurements were obtained from 764 male and female adolescents. The remaining participants ( $n = 39$ ) did not have parental permission, did not provide consent, or were absent on day of assessment.

Age- and gender-specific criterion were subsequently used to define overweight and obesity in line with the International Obesity Taskforce (IOTF) guidelines (Cole, Bellizzi, Flegal, & Dietz, 2000). Age- and gender-corrected BMI values (BMIC) were obtained for each participant by subtracting the age- and-gender specific cut points for overweight from the absolute BMI value (Aires, Mendonça, Silva, Gaya, Santos, et al., 2010). Thus, negative values reflect normal weight whereas positive values indicate overweight or obesity. The distributions of normal weight or non-overweight, overweight and obesity are presented in Table 3.5 for each adolescent cohort at Time 1 and Time 2. These findings are in line with national data which indicate that approximately one in four Irish children and adolescents are currently overweight or obese (GUI, 2012; Woods et al., 2010).

Table 3.5 *Distribution of BMI Classes at Time 1 and Time 2 across gender, and younger and older adolescent cohorts*

	<b>Overall</b> <i>n (%)</i>	<b>Males</b> <i>n (%)</i>	<b>Females</b> <i>n (%)</i>	<b>Younger</b> <i>n (%)</i>	<b>Older</b> <i>n (%)</i>
<b>Time 1</b>					
Normal Weight	739 (74.3%)	294 (76%)	445 (73.2%)	330 (70.5%)	409 (77.6%)
Overweight	202 (20.3%)	69 (17.8%)	133 (21.9%)	100 (21.4%)	102 (19.4%)
Obese	54 (5.4%)	24 (6.2%)	30 (4.9%)	38 (8.1%)	16 (3.0%)
<b>Time 2</b>					
Normal Weight	608 (75.7%)	235 (78.1%)	373 (74.3%)	300 (74.8%)	308 (76.6%)
Overweight	159 (19.8%)	51 (16.9%)	108 (21.5%)	80 (20.0%)	79 (19.7%)
Obese	36 (4.5%)	15 (5.0%)	21 (4.2%)	21 (5.2%)	15 (3.7%)

### 3.6 Pilot Study

#### 3.6.1 Aims

The survey was piloted to serve two main purposes. First, the suitability of two different physical activity measures were evaluated to determine the most effective method for obtaining detailed information on adolescents' involvement in physical activity over the past seven days. Second, younger adolescents' ability to read, comprehend and respond to various motivational, social and body-related survey questions was assessed.

#### 3.6.2 Participants

For the purpose of the pilot study, it was decided to recruit adolescents from first and second year of post-primary school. The participants were 69 students (32 male, 37 female) aged from 12 to 15 years ( $M = 13.33$ ,  $SD = 0.79$ ) attending one post-primary school in Co. Dublin, Ireland.

#### 3.6.3 Materials

A multi-sectional questionnaire was disseminated which comprised two different self-report physical activity recall surveys, in addition to measures of peer and parental support, physical activity role models, parental pressure, peer acceptance, teasing, motivation, enjoyment, competence, relatedness, autonomy, autonomy support, body dissatisfaction and body image. One of the primary aims of the main study was to gain a greater understanding of young people's patterns of involvement in physical activity, therefore a measure was required that could incorporate and address the multidimensional nature of physical activity participation. Existing self-report measures of physical activity were

subsequently reviewed, however none were considered suitable, proving cumbersome to complete (e.g. 3-Day Physical Activity Recall) or offering only a crude measure of activity (e.g. Physical Activity Questionnaire; Kowalski, Crocker & Donen, 2004). As such, using existing measures as a guide, two physical activity recall surveys were developed for the pilot study in an attempt to capture the multidimensional nature of adolescent physical activity behavior.

The first physical activity recall survey comprised a checklist of different sport and physical activities and asked participants to check the corresponding days on which they participated in each activity, similar in format to the Physical Activity checklist (Sallis, Condon, Goggin, Roby, Kolody et al., 1993). Students were also required to write down the duration of each activity. The second physical activity recall survey, which was devised on the basis of the 3D-PAR, required participants to report any sport or exercise that they have undertaken over the past seven days. Each weekday was separated into three sections representing the period of time before school, during school and after school, to aid memory recall. Additional information was required on the context in which the activity was performed (e.g. organised versus non-organised), duration and perceived intensity of activity and with whom, if anyone, the activity was undertaken. Organised participation in sport and physical activity classes within sport, club and community settings was also assessed through three additional questions.

#### **3.6.4 Procedure**

Ethical approval to conduct the study was granted by the School of Psychology Research Ethics Committee, TCD (see Appendix B). The principal of one mixed secondary school was initially contacted by post and informed about the aims of the study. Approximately one week later the principal was contacted by phone to answer any questions about the study. Upon agreement to take part in the pilot study, the researcher arranged a date and time to access the allotted first and second year classes and invite student participation. A written overview of the research was provided to students along with a parental information sheet and parental consent form. In total, 73 of the 90 consent forms disseminated were returned and signed by parents (83.9% response rate). Four students were absent on the day of data collection which resulted in 69 students taking part in the pilot study. All participants provided written consent.

Adolescents were assessed as a group during a regularly scheduled class. Prior to dissemination of the multi-sectional questionnaire, students were informed that the purpose of the research was to find out more about young people's participation in sport and physical activity and the different factors that influence whether or not adolescents are physically active. Participants were assured that there were no right or wrong answers, every teenager was different, and consequently responses were welcomed from students who did not take part in any physical activity at all, as well as those who engaged in minimal, moderate or high levels of physical activity. The researcher subsequently introduced the physical



activity measure, which comprised the first section of the multi-sectional questionnaire, and read aloud the accompanying instructions. Participants were encouraged to ask the researcher any questions they had throughout the testing period. Upon completion of the survey booklet, a discussion was held to obtain students' views of the content and structure of the survey. In particular information was sought on the comprehension of items, identification of survey aspects that were confusing and possible suggestions for improvement. When new ideas appeared exhausted, students were thanked for their participation and provided with a debriefing sheet to take with them.

### **3.6.5 Results**

The pilot study was undertaken for two primary reasons. Firstly, to identify whether the physical activity recall measures provided an effective means of collecting relevant information on the various dimensions of adolescent physical activity behaviour and secondly, to gather feedback on the layout, structure and content of the multi-sectional questionnaire. In relation to the self-report physical activity checklist, a number of issues were raised. For example, some adolescents who took part in sports such as soccer and basketball, indicated involvement in running in addition to the primary sport undertaken, resulting in over-reporting and inaccurate accounts of physical activity participation. It was also noted that some activities could fall under different headings (e.g. cross-country, running/jogging, athletics) and participants were ticking all options that applied reflecting a lack of understanding in relation to the central purpose of the measure. In addition, the presentation of various physical activity options in list format resulted in some students skimming the material without taking sufficient time to read or consider each activity in turn.

The PAR-7DD also presented some challenges. Several students expressed confusion about how to complete the physical activity recall diary despite receiving oral and written instructions. However, when the researcher sat with the participant and completed a single diary entry working from right to left across the page, students grasped the process and were able to proceed through the diary unaided. As such, it became apparent that including a worked example of a completed diary entry would illustrate the process more clearly. In addition, a concrete example would provide a useful reference point when explaining to participants how to fill in each column in the PAR-7DD. Some students also reported that they were unsure as to whether their physical activity participation should be classified within the diary as organised or non-organised in nature. Instead of using a dichotomous response, one participant suggested that different activity options (e.g. class/lesson, training, match, unstructured) be included to facilitate comprehension. In addition, a few adolescents indicated that it would be easier to report duration of activity in minutes as opposed to hours.

Based on these findings, it was decided to remove the physical activity checklist from the survey and continue with the PAR-7DD as it provided additional contextual information facilitating a more

comprehensive overview of adolescents' pattern of involvement in physical activity. Some minor adjustments were made to the PAR-7DD such as the inclusion of options pertaining to physical activity context (e.g. class/lesson, training, match, unstructured), while duration was modified to reflect time in minutes as opposed to hours. In addition, a colour physical activity index card, containing additional information and examples pertaining to each of the required fields on the PAR-7DD, was designed to accompany the survey and aid completion.

Feedback was also obtained in relation to the social, motivational and body related survey items. Overall participant commentary indicated that the questionnaire was clear, appropriately structured and easy to understand. Nevertheless, a number of minor issues were noted by the researcher. Some students indicated that they did not know or see their father regularly and as such were unsure how to respond to questions that sought information on father support and father role model behaviours. To address this problem an additional 'not applicable' response was included for questions pertaining to the distinctive role of mother and father, and written instructions informed participants that this alternative option could be ticked if either parent, for whatever reason, was not around. It was also reported that the response options pertaining to perceptions of support and physical activity role models could be reworded to more accurately reflect frequency of behaviour over a typical week. The response options of "none", "once" and "sometimes" were subsequently replaced by "not at all", "once a week" and "some days".

In addition, difficulty was also evidenced in relation to the peer acceptance and competence measures, which adopted a forced choice format (e.g., "Some teenagers have a lot of friends" BUT "Other teenagers don't have very many friends") accompanied by two options (i.e. "sort of true for me" or "really true for me") presented at each side of the statement. Many students indicated that the layout of the scale was confusing and expressed uncertainty about the correct way to respond. To simplify this process, one response set was removed leaving participants with the option to select from one of only two options (i.e. "sort of true for me" or "really true for me"), which was included after each statement.

To further explore teasing in relation to sport and physical activity, five items were developed for this study (e.g. "Have people laughed at you because you are not fast enough?") and included alongside a previously validated four-item measure of teasing (Slater & Tiggemann, 2011). Participants indicated that two of the items were very similar (i.e. "Have people made fun of you because of your weight or size?" and "Have people called you names that referred to your weight or size?"), therefore only the validated scale item was retained. Another question was identified as confusing (i.e. "Have people made fun of you because you want to take part in activities or sports that are considered very manly for girls?") and on reflection the researcher noted that this item was subjective, potentially loaded and was not entirely specific to the physical activity domain. Thus, this question was subsequently removed. The remaining questions did not present any difficulty, with the exception of the word "*uncoordinated*" (i.e.

“Have people made fun of you or laughed at you for being uncoordinated”). Students were asked for possible explanations and the word “*clumsy*” emerged as a suitable alternative. Seven items pertaining to teasing were subsequently retained for the main study.

In regards to the motivation items (BREQ-2; Markland & Tobin, 2004; Wilson et al., 2006), clarification was sought for the word “*consistent*” (“I do physical activity/sport because it is consistent with my life goals”) and “*pleasurable*” (I find sport/physical activity a pleasurable activity”). Alternative suggestions provided by participants were “*fits in*” and “*enjoyable*”, which were subsequently included in brackets beside the respective words. Some confusion was also evidenced in relation to the statement “I value the benefits of physical activity/sport” and an example (i.e. “being fit and healthy”) was included to aid understanding. The words “*depressed*” and “*frustrates*” described within the enjoyment scale (S-PACES; Dishman et al., 2005; Motl et al., 2001) also presented difficulty for some, and “*sad*” and “*annoys*”, were offered as possible alternatives to facilitate interpretation. In respect to items pertaining to relatedness (NRS-10; Richer & Vallerand, 1998), the word “*valued*” (i.e. “I feel valued”) continued to cause confusion and “*appreciated*” was included in the explanation.

Finally, in relation to the Embodied Image Scale (EIS; Abbott & Barber, 2010), a few participants requested clarification on the word “*challenge*” (i.e. “I always try to physically challenge myself during physical activities”) with “*push*” being offered as a suitable alternative. Further explanation was also requested on questions that enquired about one’s “*physical abilities*” (e.g. “Overall I am very satisfied with my physical abilities”). Participants were asked to identify some examples of physical abilities and many were provided including “*skills*”, “*fitness*”, “*speed*”, and “*strength*”. Following this feedback session, alternative suggestions were subsequently placed in brackets after the potentially difficult items to enhance understanding. No other issues were identified with the layout, format or wording of the questionnaire.

### **3.7 Data management**

Quantitative data from the questionnaire and objective measurements of BMI were analysed using SPSS, Version 21.0 (IBM, 2012) and MPlus 7.1 (Muthén & Muthén, 2011). Various statistical techniques were performed to analyse the data and address associated research aims, which are described in detail within the corresponding results chapters. The procedure for handling missing data is described below.

#### **3.7.1. Missing data**

Missing data can be characterised in three ways. First, data may be missing completely at random (MCAR) or second, data may be missing at random (MAR), whereby patterns of missing data are unrelated to the variable of interest (but may be related to other variables within the data set). Third, data may be not missing at random (NMAR) which is problematic given that the missing data is related

to the dependent variable (Tabachnick & Fidell, 2007). Within the present study, there was a nominal amount of item non-response for survey items and objective BMI measurements (<5% overall) evidenced at Time 1 and Time 2. Using Little's (1988)  $\chi^2$  test, the non-significant results indicated that data were considered missing completely at random (MCAR) at each time point. Missing values were subsequently imputed using expectation maximisation (EM) algorithm, which is a statistical technique that is considered far superior than single imputation methods such as case deletion and means score substitution (Graham, 2009; Pigott, 2001).

### **3.8 Summary**

This chapter provided an overview of the development of the PAR-7DD, and the psychosocial measures chosen for inclusion within the multi-sectional survey. The research design, sample participants, ethical considerations, BMI assessment and data collection procedures undertaken at Time 1 and Time 2 are also addressed in detail.

## **Chapter 4: An Analysis of Physical Activity Behavioural Patterns**

### **4.1 Chapter Overview**

The purpose of this chapter is to identify subgroups of secondary school students that are characterised by distinct patterns of involvement in physical activity using latent class analysis. The chapter begins with an overview of latent class methodology, including data analytic procedures, statistical assumptions and model-fit criterion, which is described in detail. Next, physical activity behavioural profiles are explored among the overall sample using five indicators of observed physical activity behaviour (recommended levels of moderate-to-vigorous physical activity achieved on at least three days over the past week, a minimum of three sessions of non-organised physical activity, organised team sport, organised individual sport, and organised non-sport physical activity). Multiple group analyses are performed in turn, to investigate whether the structure and prevalence of physical activity classes differ by age and gender. The results are subsequently presented for male and female, and younger and older adolescent cohorts.

### **4.2 Introduction**

Physical activity is a complex behaviour characterised by multiple dimensions however, previous research has usually conceptualised physical activity in terms of quantity or amount, emphasising outcomes such as frequency (e.g. number of bouts per week), duration (e.g. minutes per day) and intensity (e.g. moderate, vigorous), with little attention directed towards the context or type of activities performed. In accordance, research undertaken on adolescent physical activity has typically focused on the percentage of youth who are currently meeting, or failing to achieve recommended physical activity guidelines of at least 60 minutes of moderate-to-vigorous intensity physical activity daily. The results from the Health Behaviours in School Aged-Children self-report study (2010) demonstrated that the majority of adolescents are insufficiently active with less than 1 in 3 boys and 1 in 5 girls in Ireland meeting physical activity recommendations (Kelly et al., 2012). Moreover, the proportion of young people that is sufficiently active further declines when age is considered, with older adolescent engaging in lower levels of physical activity than their younger counterparts (Kelly et al., 2012). Focusing on overall physical activity levels highlights specific subgroups of adolescents at increased risk of sedentary or inactive behaviour that necessitate further intervention. However, adopting such an approach has also resulted in a limited understanding of the distinct patterns, or types of physical activity behaviour, in which young people engage.

Recent efforts to obtain a greater insight into the contextual pattern of adolescent physical activity have resulted in physical activity dichotomies being adopted in the empirical literature pertaining to the nature of physical activity performed, reflecting organised or non-organised behaviour, or type of

activity undertaken, broadly classified as individual or team-based participation. Organised physical activity behaviour reflects participation in sports (e.g. team sports, individual sports) and non-sport physical activity classes (e.g. dance, fitness) that are guided by a coach or instructor. In contrast, non-organised physical activities take place in the absence of authoritative figures outside of a structured setting and includes informal games and sports (e.g. skipping, football), and unstructured exercise such as walking and cycling (Bengoechea et al., 2010). Prior research indicates that organised physical activity reflects more team-based moderate-to-vigorous intensity behaviour than non-organised physical activity, which is characterised by engagement in individual type activities of lower intensity (Mota & Esculas, 2002; Santos et al., 2000).

Organised and non-organised physical activity participation also appears to differ as a consequence of gender. For example, Bengoechea et al. (2010) found that adolescent boys reported higher levels of non-organised physical activity than girls, although no differences were evidenced in respect to organised participation, which suggests that lower levels of non-organised physical activity may underpin decreased levels of total physical activity typically evidenced among girls. In contrast, previous research indicates that males in secondary school demonstrate increased rates of extra-school and extra-curricular sport involvement relative to female peers (Woods et al, 2010), who in turn, demonstrate significantly higher rates of participation in organised non-sport physical activities like dance (Fahey et al., 2005; O'Neill et al., 2011). Moreover, participation in organised sport and physical activity is associated with higher levels of moderate-to-vigorous physical activity (MVPA) among adolescent boys and girls (Machado-Rodrigues et al., 2012; Mota & Esculas, 2002; O'Neill et al., 2011; Pfeiffer et al., 2006; Trilk et al., 2012; Woods et al., 2010;). Failing to discriminate underlying types of physical activity participation and associated level of activity may therefore result in gender discrepancies in specific physical activity behaviours being overlooked.

Non-organised physical activity has received much less attention, with inconsistent findings regarding prevalence of behaviour in the literature. Bruner et al. (2009) found that non-organised physical activity (e.g. walking, running) levels did not differ between younger and older adolescents whereas Mota and Esculas (2002) indicated that older adolescents were less likely to participate in this form of activity than their younger counterparts. In contrast, in relation to organised sport participation, older and younger adolescents can be easily discriminated with older secondary school students demonstrating lower rates of involvement (Lunn et al., 2013; Woods et al, 2010). Conflicting reports have also emerged regarding self-reported female participation in non-organised physical activity with one longitudinal study indicating that involvement decreased between the ages of 10 and 11 years (Wall et al., 2011), while another retrospective longitudinal study revealed that non-organised physical activity participation increased among girls as they got older (Eime et al., 2013). In the former study, non-organised physical activity was evaluated in terms of daily participation, whereas the latter comprised a more comprehensive investigation into physical activity behaviour in which multiple

dimensions including, type, domain and mode were explored simultaneously. A lack of research has explored fundamental differences pertaining to the nature and type of physical activity behaviours that constitute overall involvement, which may account for some of the inconsistent findings in the literature. Further research is therefore needed to determine whether patterns of engagement in different types of physical activity differ between male and female, and younger and older adolescents.

More contemporary studies have attempted to address this issue by adopting person-orientated approaches, which seek to identify subgroups of individuals that engage in similar patterns of behaviours. In accordance, Liu et al. (2010) examined physical activity and sedentary behaviour among young people using data from the US National Longitudinal Study of Adolescent Health (1995-2002). Five distinct patterns emerged with the majority of males and females classified into one of three classes, with prevalence rates differing by gender. The low activity and low sedentary class, reflecting individuals who had low probabilities of engaging in all activities surveyed, comprised over half of the female sample and just less than a third of males. Adolescents within this class were also more likely to be older. In contrast, a greater proportion of boys than girls were represented in the moderate physical activity and low sedentary group, in addition to the high active low sedentary group, which was characterised by moderate and high rates of participation in sports and exercise, respectively. These findings, consistent with prior research, indicate that adolescent boys demonstrate more active pattern of involvement in physical activity than girls (Brooks et al., 2015; Kalman et al., 2015; Kelly et al., 2012; Woods et al., 2010). However, by incorporating measures of both sedentary and physical activity behaviours, the study failed to uncover more nuanced patterns of physical activity involvement with adolescents broadly classified as low, moderate or high physical activity participants. Despite a lack of knowledge on this topic, only two studies to date, to the best of the author's knowledge, have focused exclusively on adolescent physical activity behaviour patterns using person-centred approaches.

Liu and colleagues (2013) examined the most common moderate-to-vigorous physical activities performed by adolescent girls and boys that had the highest contribution to total energy expenditure, as part of a national US survey. They found five distinct groupings for males and females, which reflected the most popular forms of physical activity undertaken. The largest female class comprised approximately three quarters of the total sample and was labelled 'dancers/walkers/running', consistent with the type of activities undertaken. The remaining physical activity classes reflected participation in aerobic exercise, swimming, volleyball, and soccer. Among boys, just less than three quarters of the overall population comprised the 'basketball and runner' class which reflected participation in team and individual activities. The other four latent physical activity classes were characterised by participation in football, cycling, soccer and walking. Thus, based on the most prevalent physical activity grouping it is evident that girls demonstrated a greater preference for non-sport physical activities and more

individualised forms of exercise whereas adolescent boys were more likely to engage in team activities. While these findings prove useful in identifying preferred types of physical activity among adolescents, context of participation was not considered therefore it is unclear whether involvement in organised and non-organised physical activity differed between boys and girls.

Agans and Geldhof (2012) in contrast, focused exclusively on type of physical activity undertaken, grouping adolescents on the basis of their involvement in various competitive sports. Five clusters emerged including a team sport grouping, characterised by participation in team sport only, an individual sport cluster reflecting involvement in individual sports only, and a mixed sport group that represented individuals who participated in both team and individual sports. The fourth group comprised secondary school students that engaged in dance activities alongside or in the absence of other sports while the final cluster reflected adolescents who did not engage in any of the athletic activities identified. The results contribute to our knowledge of the different patterns of organised sport that underpin total participation. However, failing to take account of adolescent participation in non-competitive organised physical activity (e.g. fitness classes) and non-organised physical activity (e.g. walking, jogging) represents a somewhat limited approach to understanding young people's overall physical activity behavioural patterns.

A multidimensional approach to evaluating physical activity is therefore needed to achieve a greater insight into the various components underpinning overall patterns of physical activity behaviour. The analysis presented in this chapter therefore attempts to address these shortcomings by taking account of physical activity context (i.e. organised, non-organised), type (organised team sport, organised individual sport, and organised non-sport physical activity such as fitness and dance classes), in addition to duration, intensity and frequency (a minimum of 60 minutes of moderate-to-vigorous physical activity achieved on a least three days over past week), and adopting a person-orientated approach to obtain a more nuanced understanding of young people's pattern of involvement in physical activity.

#### **4.2.1. Research aims and hypotheses**

The present analysis sought to address the following research questions and hypotheses:

1. Are there subgroups of adolescents that are characterised by distinct patterns of involvement in physical activity?
  - It is hypothesised that six subgroups of adolescents characterised by distinct patterns of physical activity will emerge. Based on prior research by Agans and Geldhof (2012), five classes are expected, which correspond to participation in team sport, individual sport, mixed sports reflecting involvement in team and individual sports, an organised non-sport physical activity class and a non-participation class reflecting low levels of activity. In



addition, non-organised physical activity is assessed in the present study; therefore a sixth class is expected to emerge characterised by non-organised physical activity participation.

2. Do patterns of involvement in physical activity differ in respect to levels of moderate-to-vigorous physical activity (MVPA)?
  - It is expected that classes characterised by organised sport and physical activity participation will demonstrate active levels of MVPA while classes characterised by non-participation will evidence low levels of MVPA (Liu et al., 2010; Santos et al., 2004; Mota & Esculas, 2002; Pfeiffer et al., 2006). There is a lack of research available however to guide specific hypotheses regarding the relative contribution of non-organised physical activity to MVPA levels among adolescents.
3. Do patterns of involvement in physical activity differ between adolescent girls and boys?
  - Boys are expected to display profiles of physical activity participation that are characterised by higher levels of MVPA than girls. In turn, a larger proportion of adolescent females as compared to males are expected to be classified as non-participants in physical activity (Patnode et al., 2010; Liu et al., 2010).
  - It is also hypothesised that a higher percentage of males will be represented by profiles of organised sport participation whereas a greater proportion of girls will be characterised by a pattern of involvement in organised non-sport physical activity (e.g. dance) (Woods et al., 2010; O'Neill et al., 2011).
4. Do patterns of involvement in physical activity differ between younger and older adolescents?
  - Consistent with prior research indicating that physical activity levels decline as adolescents get older, it is hypothesised that younger adolescents will demonstrate profiles of physical activity behaviour that are characterised by higher levels of MVPA than older adolescents (Kahn et al., 2008; Nader et al., 2008; Findlay, Garner, & Kohen, 2009; Liu et al., 2010).
  - In addition, it is expected that a greater proportion of younger adolescents in comparison to older adolescents will be represented by patterns of participation in organised sports (Woods et al., 2010; Lunn et al., 2013).

## **4.3 Method**

### **4.3.1 Participants.**

A total sample of 995 adolescents ( $n = 609$  females, 386 males) aged from 12 to 17 years ( $M = 13.72$ ,  $SD = 1.25$ ) participated in the research at Time 1. Participants were students attending eight secondary schools from first to fifth year classes in Co. Dublin. Respondents were also grouped into two cohorts representing younger (12-13 years,  $n = 468$ ) and older adolescents (14-17 years,  $n = 527$ ). Further information regarding sample characteristics is available in Section 3.3.

### 4.3.2 Procedure.

The procedure for data collection is outlined previously in Section 3.8. Data were analysed using SPSS, Version 21.0 (IBM, 2012) and MPlus 7.1 (Muthén & Muthén, 2011).

### 4.3.3 Measures.

Participants completed a survey package entitled *Participation in Sport and Physical Activity among Teenagers in Ireland* at Time 1 which comprised the PAR-7DD and measures of motivational, social and body image factors. Only the PAR-7DD was analysed in the present chapter. As detailed in Section 3.5.2, respondents were asked to report any physical activity that they had undertaken over the past seven days and answer three additional questions about their participation in organised sports and physical activities.

On the basis of this information, five binary indicators of physical activity were subsequently derived, which are described in more detail in Section 3.5.2.2. Participants were classified as active (1) if they accumulated at least 60 minutes of MVPA on three or more days over the past week. If they did not meet these guidelines they were classified as low active (0). In addition, respondents were classified as non-organised physical activity participants (1) if they undertook a minimum of three sessions of non-organised physical activity over the past week or non-participants (0) if they did not meet this criterion. Three binary items were also derived to reflect participation in organised team sport, individual sport and organised non-sport physical activity. Adolescents who engaged in at least one organised team sport (1), individual sport (1), or organised non-sport physical activity (1) were classified as participants in this form of activity whereas those who did not were classified as non-participants (0). Prevalence rates for each of the observed physical activity behaviours for the overall sample, for male and female, and younger and older adolescent cohorts are presented in Table 4.1.

Table 4.1 *Frequency of physical activity behaviours across adolescent cohorts*

Physical Activity Behaviour	Total <i>n</i> = 995 <i>n</i> (%)	Females <i>n</i> = 609 <i>n</i> (%)	Males <i>n</i> = 386 <i>n</i> (%)	Younger <i>n</i> = 468 <i>n</i> (%)	Older <i>n</i> = 527 <i>n</i> (%)
≥ 60mins MVPA on 3 or more days	494 (49.6%)	228 (37.4%)	266 (68.9%)	242 (51.7%)	252 (47.8%)
Non-organised physical activity ≥ 3 sessions	313 (31.5%)	158 (25.9%)	155 (40.2%)	150 (32.1%)	163 (30.9%)
Team sport	429 (43.1%)	201 (33.0%)	228 (59.1%)	235 (50.2%)	194 (36.8%)
Individual sport	300 (30.2%)	169 (27.8%)	131 (33.9%)	173 (37.0%)	127 (24.1%)
Organised non-sport physical activity	217 (21.8%)	171 (28.1%)	46 (11.9%)	94 (20.1%)	123 (23.3%)

*Note.* MVPA = Moderate-to-vigorous physical activity

#### 4.4. Latent Class Analysis

Latent class analysis (LCA) represents a person-orientated approach that focuses on similarities and differences among people rather than relations among variables, as is the case with variable-orientated methods such as factor analysis (Berlin et al., 2014). The purpose of latent class analysis is to identify distinct homogeneous subgroups of individuals within a dataset that engage in similar patterns of behaviours or respond similarly on a set of observed variables, which in turn differentiates them from other subgroups (Collins & Lanza, 2010; Berlin, Williams, & Parra, 2014). Latent class analysis consists of a latent variable model that classifies groups of individuals according to some construct that cannot be measured directly. Comprising a set of latent classes, the latent variable is measured indirectly by multiple observed categorical variables that are used as indicators of the unobservable variable. For example, depression is a latent construct that cannot be observed directly but may be measured indirectly using self-report indicators of sad thoughts, perceptions of being disliked and feelings of failure (Lanza, Bray & Collins, 2013).

A conceptual representation of the latent class model that will be tested in this chapter is presented in Figure 4.1. The latent class variable is represented by a circle and reflects patterns of involvement in physical activity, of which there are a given  $k$  number of classes. The latent variable will be estimated from five observed physical activity categorical variables, which are represented by rectangles. These include participation in a minimum of sixty minutes of moderate-to-vigorous physical activity on three or more days over the previous week, three or more sessions of non-organised physical activity, participation in team sport, individual sport, and organised non-sport physical activity. The relationship between the latent class variable and observed variables are represented by arrows. Within this statistical modelling technique, classes of physical activity behaviour have been estimated to account for relationships between categorical observed variables (Hagenaars & McCutcheon, 2002). In addition, attempts are made to maximise between group variation and minimise within group variation (Muthen & Muthen, 2011).

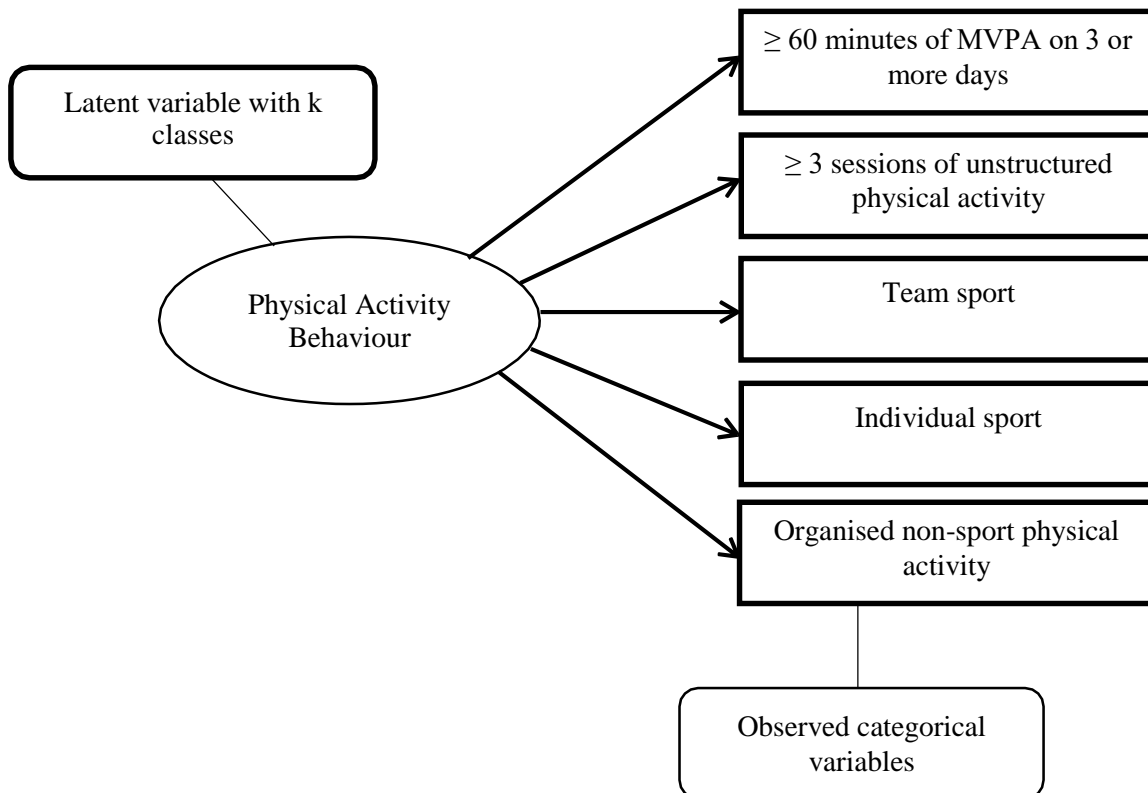


Figure 4.1. Conceptual model of five observed indicators of physical activity behaviour

#### 4.4.1 Model Parameters

The latent class model produces two sets of measurement parameters, latent class prevalences and item-response probabilities. Latent class prevalences represent the probability of membership in each latent class per person or class percentage estimates. Classification is based on a probabilistic method with each individual assigned a probability of belonging to each class conditional on their responses (Goodman, 1974). The latent classes are deemed mutually exclusive and exhaustive and it is posited that each individual belongs to only one class.

Interpretation of the latent classes is based on the class-specific item-response probabilities of endorsing each of the observed physical activity variables. Item-response probabilities range from 0 to 1, with a probability of 1 reflecting a high degree of certainty that individuals within the given latent class report a positive response (e.g. Yes, participates in team sport), whilst an item-response probability of 0 denotes a complete absence of the corresponding behaviour (e.g. No, does not participate in team sport).

#### 4.4.2. Expectation Maximisation

When fitting a latent class model to a dataset, the parameters are estimated using an iterative procedure called the Expectation Maximisation (EM) algorithm which attempts to search for maximum likelihood (ML) parameter estimates. This is the default algorithm in Mplus for latent variable mixture modelling

and the process takes place in two steps. The first step involves calculation of the expected value of log likelihood function for a given number of classes. As such, Mplus estimates likelihood of the observed empirical data conditional on the endorsement probabilities for the given number of latent classes, calculating how well these estimates fit the data. On the basis of this information, the second step attempts to increase the accuracy of the function by obtaining a revised set of parameter estimates. If the estimates are improved, they are retained and improved upon whilst estimates indicating a reduced fit are discarded. Steps one and two are repeated in a cyclical manner until the final criteria consistently converge to the same solution or when the iterative process ceases to improve, indicating that the maximum likelihood solution has been reached. It is recommended that multiple sets of starting values are used when fitting the latent class model and resultant loglikelihood values are compared to ascertain whether equivalent estimates are produced. If the same maximum likelihood solution is obtained regardless of starting values, support for model identification is provided (Collins & Lanza, 2010).

#### ***4.4.2.3 Assumptions of conditional independence***

In latent class analysis, it is assumed that observed categorical variables are statistically independent of each other. In other words, the response to one observed indicator does not inform us about responses to other observed variables. For example, an individual who engages in organised sport may be likely to engage in 60 minutes of MVPA on three or more days a week however, they are not guaranteed to do so and therefore the assumption of conditional independence is satisfied. If this assumption is violated, problems with model identification will likely occur in addition to generation of theoretically meaningless classes (Vermunt & Magidson, 2002).

#### ***4.4.2.4 Model Fit***

An exploratory approach may be adopted when attempting to identify the optimal number of latent classes within a model. In doing so, the number of latent classes estimated increases until there is no further improvement in fit indices and a statistically proper solution is no longer attained (Berlin et al., 2014). In following this approach, two through seven classes were estimated for each latent model in the present study. Fit indices were then used to compare competing models and decide upon the optimal number of latent classes. The most often used fit criteria are the Akaike Information Criteria (AIC; Akaike, 1987), the Bayesian Information Criteria (BIC; Schwarz, 1978), and Sample Size Adjusted Bayesian Information Criterion (SSABIC; Sclove, 1987). Lower values of the entire information criteria indicate superior model fit. However, the information criteria may not always be in agreement regarding the optimal model. Regardless, these indices are considered useful for reducing the number of plausible options regarding number of classes and ruling out certain models (Collins & Lanza, 2010).

Different arguments have been offered in support of which information criterion is superior when conflicting results are evidenced. Yang (2006) found that the Adjusted BIC was preferable following a

simulation study comprising latent class models with continuous outcomes. However, in a simulation study comparing various fit indices across different latent class models and sample sizes, BIC performed the best of all the information criteria in terms of identifying the correct number of classes and as such is generally favoured in model comparisons (Nylund, Asparouhov, & Muthén, 2007). In contrast, the AIC was found to consistently overestimate the correct number of latent classes in mixture models and is therefore given less weight when deciding among competing models (Celeux & Soromenho, 1996).

Additional considerations in selecting the best fitting model include parsimony and model interpretability. Parsimony refers to selection of the simplest model with the fewest parameters that can still adequately represent the data set. Thus, when two models approximate the data adequately, the less complex model is preferable. The interpretability of the latent classes will also play a role in model selection. The model must make conceptual sense and provide useful information that can guide understanding. As such, theory, previous research and practical considerations will also be used when deciding upon the number of classes which best fit the data.

In addition, the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) evaluates the improvement in model fit between successive class models by comparing a model that has  $k$  latent classes to a model with  $k-1$  latent classes (Lo, Mendell & Rubin, 2001). This statistical technique evaluates the null hypothesis that the  $k-1$  class solution is adequate. For example, if you take a hypothetical latent class structure where the latent variable is comprised of 3 classes, the  $k$  (3 class) model would be compared to the  $k-1$  (2 class) solution. If the p-value is non-significant ( $\geq .05$ ), the  $k$  model is superior and successive classes are added until the p-value reaches non-significance ( $\geq .05$ ). At this point, the  $k$  class solution is rejected in favour of the previous model as inclusion of an additional latent class does not result in a statistically significant improvement in model fit. The resultant number of classes best explains the heterogeneity of the data. It should be noted that in order to attain a reliable Lo-Mendell-Rubin likelihood ratio test value, the last class must be the largest class as the first class within the estimated model is deleted when comparing the two models ( $k$  and  $k-1$ ) (Smith & Shevlin, 2008).

Bivariate residuals provide another means of evaluating how well a model fits the data. A significant bivariate residual indicates that there is a significant difference between the number of times a response pattern was observed in the raw data compared to the expected frequency of that pattern by the model structure. It also provides an indication of the most frequently occurring patterns in a dataset and can assist in deciding among competing models. In assessing model suitability, the ten most frequently occurring response patterns will be examined for significant bivariate residuals with more significant residuals indicating poorer model fit. If the model approximates the data well, the observed and expected response patterns proportion will be similarly matched. In practise however, if the model

cannot replicate the most common patterns of use in the database, then it is unlikely that the patterns generated by the model will fit the original data adequately.

Finally, entropy is a summary statistic based on posterior class membership probabilities, which assesses the accuracy with which models classify individuals into their most likely latent class. The measure ranges from 0 to 1, with higher values indicating greater precision or certainty that individuals belong in their assigned class (Ramaswamy, Desarbo, Reibstein, & Robinson, 1993). There is currently a lack of consensus regarding the relative performance of fit indices in latent class modelling. Therefore, model interpretability in addition to agreement of a combination of the Bayesian Information Criteria (BIC), number of significant bivariate residuals and the Lo-Mendell-Rubin likelihood ratio test will be used in this research to determine the best fitting model.

## **4.5 Results**

### **4.5.1. Patterns of response among the total adolescent sample**

As outlined above (Section 4.3.2.1), each of the observed physical activity indicators were binary coded to reflect presence (1 = Yes) or absence (0 = No) of at least 60 minutes of moderate-to-vigorous physical activity on three or more days, a minimum of three sessions of non-organised physical activity, participation in team sport, individual sport, and organised non-sport physical activity, respectively. Each pattern of involvement in physical activity therefore corresponds to the combination of responses obtained for each of these five indicators. For example, a response pattern of 10100 represents an individual who participates in moderate-to-vigorous physical activity on at least three days in addition to team sport but does not engage in non-organised physical activity, individual sport, or organised non-sport physical activity. Similarly, an adolescent who does not engage in any physical activity behaviours could be identified by a response pattern of 00000.

In total, 32 different possible combinations of observed physical activity indicator responses were identified reflecting considerable heterogeneity in adolescents' physical activity behaviours. Of these patterns, the most frequently occurring was that of low physical activity participation representing 192 adolescents who did not engage in any of the physical activity behaviours examined. The next most common pattern reflects high active participation in team sport, followed by a low active pattern of involvement in non-organised physical activity. The ten most common patterns of physical activity behaviour observed among the total sample of adolescents are presented in Table 4.2. The latent model is derived on the basis of these underlying response patterns and should replicate the most common patterns of use in the dataset.

Table 4.2 *Frequency of most prevalent item-response patterns of physical activity among total adolescent sample*

<b>Physical Activity (PA) Behavioural Pattern</b>	<b>≥ 60 min MVPA on ≥ 3 days</b>	<b>Non-organised PA ≥ 3 sessions</b>	<b>Team sport</b>	<b>Individual sport</b>	<b>Organised non-sport PA</b>	<b>Frequency <i>n</i> (%)</b>
No participation in any physical activity behaviours	x	x	x	x	x	192 (19.29%)
≥ 60mins MVPA on ≥ 3 days & Team sport	✓	x	✓	x	x	101 (10.15%)
≥ 3 sessions Non-organised PA only	x	✓	x	x	x	75 (7.54%)
≥ 60min MVPA on ≥ 3 days, ≥ 3 sessions Non-organised PA & Team sport	✓	✓	✓	x	x	57 (5.73%)
≥ 60min MVPA on ≥ 3 days, Team sport & Individual sport	✓	x	✓	✓	x	56 (5.63%)
Team sport only	x	x	✓	x	x	55 (5.53%)
Organised non-sport PA only	x	x	x	x	✓	45 (4.52%)
≥ 60min MVPA on ≥ 3 days & Individual sport	✓	x	x	✓	x	44 (4.42%)
≥ 60min MVPA on ≥ 3 days & ≥ 3 sessions Non-organised PA	✓	✓	x	x	x	43 (4.32%)
Individual sport only	x	x	x	✓	x	39 (3.92%)
Total number of individuals in the 10 most frequent response patterns						707 (71.05%)

*Note.* MVPA = Moderate-to-vigorous physical activity, PA = Physical activity



#### 4.5.2. Latent class analysis on total adolescent sample

Latent class analysis was initially conducted on the overall sample of male and female adolescents ( $n = 995$ ) using five observed binary indicators of physical activity. Full details of the procedure and outcomes of latent class analysis are outlined above (Section 4.4). The fit statistics of two through seven classes are presented in Table 4.3. To determine the optimal number of classes, the information criteria were reviewed. The fit indices were in conflict, with the AIC and SSABIC suggesting a seven class model, whilst the BIC identified a five class solution. It was noted however, that the difference between the two SSABIC values was minimal representing a value of less than one unit in the difference. Statistical model comparisons (Lo-Mendell-Rubin likelihood ratio test) indicated that the five class model provided a statistically significant improvement over the four class solution, and the addition of a sixth class did not result in a significant improvement in model fit. Upon further inspection of the seven class model it was found that one of the additional classes contained a relatively small number of participants representing approximately 1% of the population. This finding, coupled with a preference for the BIC, and a more parsimonious model, resulted in the decision to select a five-class latent model to represent physical activity patterns among the overall sample.

Table 4.3 *Model fit statistics for the latent class models for total adolescent cohort*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	$p$
2	-2991.51 (1)	5985.08	5989.99	5986.81	0.81	1	1403.42	.00
3	-2972.68 (2)	5949.35	5959.16	5952.81	0.81	2	314.62	.00
4	-2958.43 (3)	5922.85	5937.56	5928.04	0.93	2	2837.62	.00
<b>5</b>	<b>-2942.06 (4)</b>	<b>5892.12</b>	<b>5911.74</b>	<b>5899.04</b>	<b>0.88</b>	<b>0</b>	<b>1360.46</b>	<b>.00</b>
6	-2939.96 (35)	5949.92	6121.55	6010.39	0.87	0	4.11	.54
7	-2938.23 (6)	5888.47	5917.89	5898.83	0.76	0	11.38	.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

To assist in interpreting the classes, the endorsement probabilities of each of the observed physical activity indicators were reviewed across the five classes (Table 4.4). As the indicators are binary, these values can be interpreted as the percentage of members in that class who positively endorsed that particular item. Probabilities greater than .50 are marked in bold to facilitate interpretations, indicating that individuals within that class are more likely to report participation than not (Lanza, Bray, & Collins, 2013). Descriptive statistics are also presented for each latent class pertaining to mean daily minutes spent in moderate-to-vigorous physical activity to facilitate a greater insight into overall pattern of

activity. A graphical representation of these physical activity profiles are also presented in Figure 4.2. The observed indicators are depicted along the X axis and the probability of members of each class positively endorsing that physical activity behaviour is represented on the Y axis. Each class is represented by a separate line on the graph.

Table 4.4 *Response probabilities for each of the physical activity indicators by each of the latent classes for total adolescent cohort*

Latent Class	<i>n</i>	$\geq 60$ mins MVPA on $\geq 3$ days	Non-organised PA $\geq 3$ sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M (SD)</i>
1. Organised Dance & Fitness	92	0.40	0.17	0.00	0.00	<b>1.00</b>	32.12 (28.17)
2. Active Individual Sport	125	<b>0.52</b>	0.26	0.00	<b>1.00</b>	0.22	35.87 (32.84)
3. Active Non-Organised PA	166	<b>1.00</b>	<b>0.82</b>	0.46	0.26	0.03	68.41 (37.34)
4. Active Team Sport	270	<b>0.78</b>	0.19	<b>1.00</b>	0.40	0.29	67.45 (44.96)
5. Non-Participation	342	0.00	0.29	0.15	0.00	0.00	11.03 (14.41)

*Note.* Conditional probabilities  $>.5$  in bold to facilitate interpretation. MVPA = Moderate-to-vigorous physical activity. PA = Physical activity

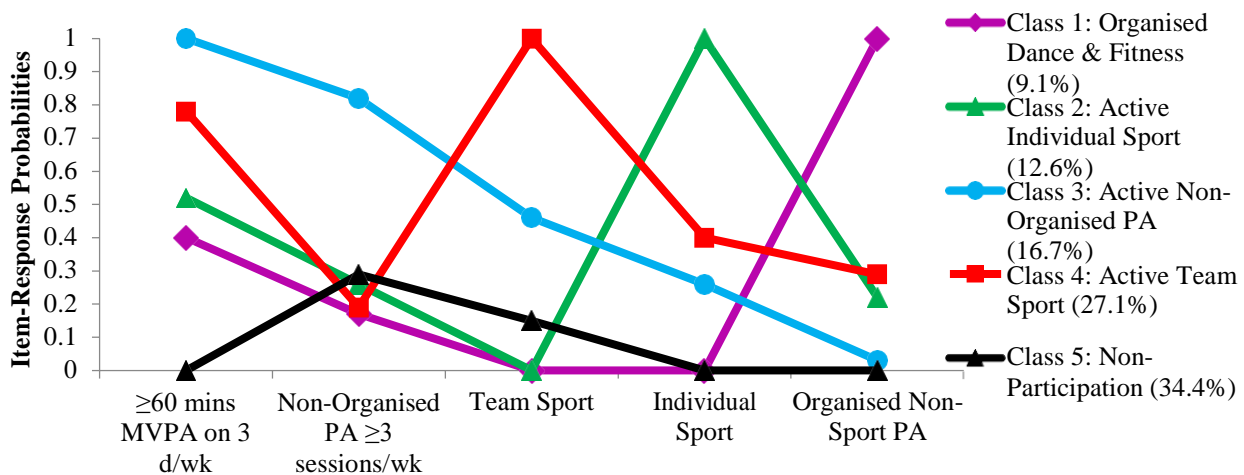


Figure 4.2. Profile plot of the five latent physical activity classes for total adolescent sample

Comprising the smallest proportion of adolescents (9.1%), Class 1 (purple line) reflected a high likelihood of participating in organised non-sport physical activities such as dance (e.g. ballet, tap, Irish dance, hip hop) and fitness (e.g. spinning, aerobics) but demonstrated lower probabilities of engaging in other types of physical activity. As such Class 1 was named ‘Organised Dance and Fitness’. Members of this class spent on average, just over half an hour per day in moderate-to-vigorous physical activity (MVPA). Class 2 (green line) represented 12.6% of the total sample and was characterised by the highest probability of engaging in organised individual sport (e.g. martial arts, swimming, badminton, tennis, cross-country running), moderate probabilities of undertaking recommended levels of MVPA

on at least three days, and low rates of participation in other physical activity behaviours. Adolescents within this class reported a mean of 35 minutes per day in MVPA. This class was subsequently labelled ‘Active Individual Sport’.

In Class 3 (blue line), the majority of participants reported engaging in at least three sessions of non-organised physical activity and meeting recommended levels of MVPA on three or more days over the past week, with lower rates of participation evidenced for organised sport and physical activity. This class contained 16.7% of the total adolescent sample and averaged more than 60 minutes of MVPA daily. Closer inspection of the data revealed that non-organised physical activity behaviour was characterised by participation in unstructured exercise like walking, cycling, jogging, running or body conditioning (e.g. sit-ups, push-ups), in addition to non-organised games and sports such as skipping, tip the can, soccer and basketball. Given this pattern of engagement, Class 3 was named ‘Active Non-Organised Physical Activity’.

Class 4 (red line), the second largest class (27.1%), was characterised by high rates of participation in team sport (e.g. Gaelic football, soccer, hockey, rugby, basketball, hurling) and MVPA with lower probabilities of engaging in other physical activity behaviours. Members of this group were quite active participating on average in more than 60 minutes of MVPA daily. In accordance, this class was labelled ‘Active Team Sport’. Finally, Class 5 (black line) comprised the largest proportion (34.4%) of adolescents and was characterised by low levels of participation across all physical activity behaviours subsequently representing a ‘Non-Participation’ group. This class also demonstrated the lowest levels of physical activity overall, accumulating a mean of only 11 minutes of MVPA per day.

#### **4.5.3 Measurement invariance**

Given the widely evidenced differences between male and female, and younger and older adolescent physical activity behaviours, a test of measurement invariance was performed to determine whether measurement characteristics of the latent classes identified in the full sample were equivalent across gender and age cohorts. Comparisons were made between an unconstrained model, in which parameters were allowed to vary across groups (e.g. males and females), and a constrained model where item-response probabilities were fixed across groups. Invariance is supported when the constrained model approximates the data equally as well as the unconstrained model, denoted by a non-significant likelihood ratio chi-square difference test.

The result of the likelihood ratio chi-square difference test which compared a restricted and unrestricted model for male and female adolescent groups was significant ( $\chi^2 = 206.11$  (29),  $p < .05$ ). In addition, the likelihood ratio chi-square difference test comparing the fully unrestricted 5 class model for the younger and older age-groups, to the restricted 5 class model that forced the thresholds for the physical

activity items to be equal was significant ( $\chi^2 = 64.06$  (29),  $p < .05$ ). The results indicate that the underlying structure of the latent physical activity classes were conceptually different between male and female, and younger and older adolescent groups. Separate latent class models were subsequently estimated for each gender and age cohort.

#### **4.5.4 Patterns of response among female adolescents**

In order to gain a greater understanding of the different patterns of physical activity in which female adolescents engage, the ten most prevalent item-response combinations were identified (Table 4.5). A pattern of low activity was observed most frequently, reflecting non-participation in all physical activity behaviours surveyed. The second and third most common patterns of physical activity were characterised by low active levels of involvement in non-organised physical activity (e.g. jogging) and organised non-sport physical activity (e.g. dance, fitness classes), respectively.

Table 4.5 *Frequency of most prevalent item-response patterns of physical activity among female adolescents*

<b>Physical Activity Behavioural Pattern</b>	<b>≥ 60 mins MVPA on ≥ 3 days</b>	<b>Non-organised PA ≥ 3 sessions</b>	<b>Team sport</b>	<b>Individual sport</b>	<b>Organised non-sport PA</b>	<b>Frequency <i>n</i> (%)</b>
No participation in any physical activity behaviours	x	x	x	x	x	155 (25.45%)
≥ 3 sessions Non-organised PA only	x	✓	x	x	x	56 (9.20%)
Organised non-sport PA only	x	x	x	x	✓	42 (6.89%)
≥ 60mins MVPA on ≥ 3 days & Team sport	✓	x	✓	x	x	39 (6.40%)
Team sport only	x	x	✓	x	x	31 (5.09%)
Individual sport only	x	x	x	✓	x	27 (4.43%)
≥ 60mins MVPA on ≥ 3 days Team sport, & Individual sport	✓	x	✓	✓	x	25 (4.11%)
≥ 60min MVPA on ≥ 3 days & Individual sport	✓	x	x	✓	x	22 (3.61%)
≥ 60min MVPA on ≥ 3 days & ≥ 3 sessions Non-organised PA only	✓	✓	x	x	x	22 (3.61%)
60min MVPA on ≥ 3 days & Organised non-sport PA	✓	x	x	x	✓	22 (3.61%)
Total number of individuals in the 10 most frequent response patterns						441 (72.4%)

#### 4.5.5 Latent class analysis on female adolescents

A latent class analysis was conducted on the female sample with two through seven classes subsequently fit to the data. The information criteria, entropy and likelihood ratio tests are presented in Table 4.6. The BIC and SSABIC information criteria were in agreement suggesting a six class solution. The AIC pointed to a seven class model; however this fit criterion has previously been found to overestimate the correct number of latent classes and consequently is not given much weight when deciding on competing models. The LRT indicated that a four class solution provided a significantly better fit than a five class solution. However, the four class model had one significant associated bivariate residual while the six class model had none, indicating that the four class model provided a poorer fit to the data. Based on these findings, in addition to the BIC and SSABIC criterion, a six class model was selected to represent female physical activity behaviour patterns. The pattern of item-response probabilities for the observed physical activity behaviours were examined across classes, in addition to mean daily minutes spent in moderate-to-vigorous physical activity, to facilitate interpretation of the six latent classes (Table 4.7). A graphical depiction of these physical activity profiles are also presented in Figure 4.3.

Table 4.6 *Model fit statistics for the latent class models for female adolescents*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	<i>p</i>
2	-1775.94 (11)	3573.88	3622.43	3587.50	0.70	1	165.07	.00
3	-1764.61 (17)	3563.21	3638.24	3584.27	0.80	1	22.09	.00
4	-1759.01 (3)	3524.02	3537.26	3527.74	0.82	1	46.61	.00
5	-1751.58 (29)	3561.15	3689.14	3597.08	0.79	0	14.49	.30
<b>6</b>	<b>-1749.54 (5)</b>	<b>3509.09</b>	<b>3531.15</b>	<b>3515.28</b>	<b>0.82</b>	<b>0</b>	<b>123.07</b>	<b>.00</b>
7	-1748.20 (6)	3508.41	3534.89	3515.84	0.81	0	8.45	.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

Table 4.7 Response probabilities for each of the physical activity indicators by each of the latent classes for female adolescents

Latent Class	<i>n</i>	≥ 60mins MVPA on ≥ 3days	Non-organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M (SD)</i>
1. Organised Individual Sport and PA	16	0.00	0.45	0.34	<b>1.00</b>	<b>1.00</b>	25.89 (8.03)
2. Active Individual Sport	58	<b>1.00</b>	0.26	0.39	<b>1.00</b>	0.36	70.01 (69.35)
3. Organised Dance and Fitness	78	0.42	0.21	0.00	0.00	<b>1.00</b>	28.31 (24.19)
4. Non-Organised Physical Activity	104	0.28	<b>0.78</b>	0.16	0.09	0.00	23.64 (22.48)
5. Active Team Sport	140	<b>0.73</b>	0.14	<b>1.00</b>	0.31	0.37	57.96 (31.93)
6. Non-Participation	213	0.00	0.00	0.09	0.15	0.08	9.85 (16.76)

Note. Conditional probabilities >.5 in bold to facilitate interpretation; MVPA = Moderate-to-vigorous physical activity; PA = Physical Activity

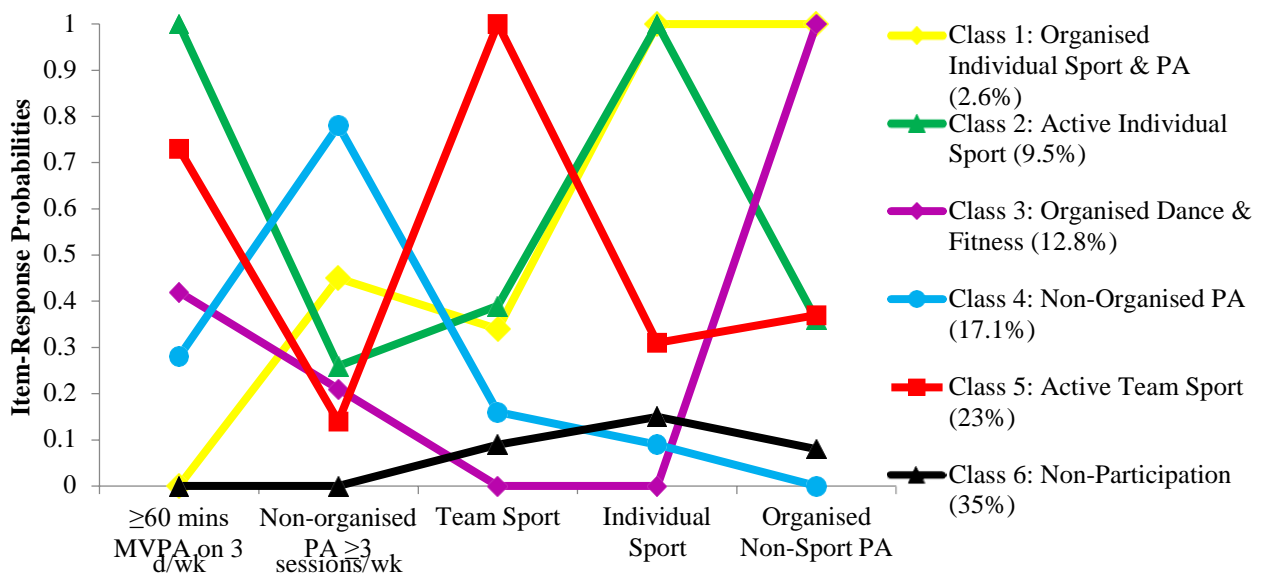


Figure 4.3. Profile plot of the five latent physical activity classes for female adolescents

Class 1 (yellow line) comprised just 2.6% of the female sample and reflected high probabilities of engaging in individual sport and organised non-sport physical activity but lower rates of engagement in other physical activity behaviours (Figure 4.3). Most of the class members were undertaking individual sports such as swimming and cross-country running, in combination with organised dance or fitness classes. Surprisingly, none of the participants in this group engaged in recommended levels of MVPA on three or more days over the past week. This finding is unexpected given the high prevalence of involvement in organised activities. The raw data were subsequently consulted to assess this pattern of

involvement for accuracy. It emerged that the majority of girls were engaging in recommended levels of MVPA on a maximum of two days, or accumulating less than sixty minutes of MVPA on three or more days. More specifically, members of this class were participating on average in 26 minutes of MVPA every day. Therefore, this represents a valid class of adolescent girls who participate in organised activities but at lower levels of MVPA. As such this class was labelled, 'Organised Individual Sport and Physical Activity'.

Class 2 (green line) represented 9.5% of the female sample and had the highest likelihood of engaging in individual sport and MVPA on three or more days, with lower rates of involvement demonstrated for other types of physical activity. Members of this class were very active accumulating a mean of 70 minutes daily in MVPA. This class was subsequently assigned the title 'Active Individual Sport' reflecting participation in a range of sports including martial arts (e.g. Taekwondo, judo, kickboxing), swimming, cross-country running, tennis, badminton, gymnastics, and horse-riding.

Comprising approximately 12.8% of adolescent girls, Class 3 (purple line) was characterised by high rates of participation in organised non-sport physical activity and a low likelihood of engaging in any other physical activity behaviours. Inspection of the raw data revealed that nearly all of the members in this class engaged in dance lessons including ballet, hip-hop and Irish dance, while the remainder participated in structured fitness activities and classes (e.g. circuits). In accordance this class was named 'Organised Dance and Fitness'. Members of this group were moderately active spending on average, just less than half an hour per day in moderate-to-vigorous physical activity.

Class 4 (blue line) contained 17.1% of the female sample and was characterised by low levels of participation in all physical activity behaviours apart from non-organised physical activity, which reflected participation predominantly in activities such as walking, cycling, roller-skating, running and jogging, in addition to non-organised games and sports like tip-the-can, skipping, basketball and soccer. The class was subsequently named 'Non-Organised Physical Activity' and comprised a less active group of girls that accumulated a mean of 24 minutes of MVPA per day.

Approximating roughly one-quarter (23%) of adolescent girls, Class 5 (red line) was discriminated by high rates of MVPA and participation in team sports such as Gaelic football, soccer, camogie, basketball, and hockey. Receiving the label 'Active Team Sport', this class represented an active group of girls that averaged just less than one hour of MVPA per day. Finally, Class 6 (black line) the largest of the classes (35%), comprised girls who had very low probabilities of engaging in any of the physical activity behaviours examined. In addition, this class demonstrated less than 10 minutes on average in MVPA daily and was subsequently named 'Non-Participation'.



#### **4.5.6 Patterns of response among the male sample**

Considerable variation in physical activity behaviour was also evidenced among the male sample with 29 different item-response combinations identified. The top ten most frequently occurring patterns are presented in Table 4.8. In contrast to the female sample, the two most common item-response patterns reflect active physical activity behaviour including a pattern of active team sport engagement, and a mixed pattern of active participation in non-organised physical activity alongside team sport. The third most prevalent pattern is that of non-participation which reflects low levels of involvement in all physical activity behaviours examined.

#### **4.5.7 Latent Class Analysis on male adolescents**

Two through seven latent classes were estimated among the male sample. The fit statistics are presented in Table 4.9. Firstly it was noted that the LRT did not reach statistical significance suggesting that it was inconclusive in determining the optimal number of classes. It was therefore necessary to defer to the other fit criteria. The BIC indicated that a five class solution most closely approximated the data whilst the SSABIC and AIC pointed towards a six class model. However, the AIC and SSABIC values were very similar for the five and six class solution with a value of less than one unit differentiating the scores. In addition, the five class solution evidenced a higher entropy value in comparison to the six class model. This coupled with a preference for BIC and parsimony resulted in selection of a five-class model to represent male physical activity behaviour patterns. Item-response probabilities for each of the observed variables are presented in Table 4.10 and visually depicted in Figure 4.4 to aid understanding. Classes were assigned the label 'active' if the majority of members achieved recommended MVPA on three or more days over the past week. In addition, mean minutes spent in daily moderate-to-vigorous physical activity are also outlined to provide insight into the total activity level associated with each latent class (Table 4.10).

Table 4.8 *Frequency of most prevalent item-response patterns of physical activity among male adolescents*

<b>Physical Activity Behavioural Pattern</b>	<b>≥ 60 mins MVPA on ≥ 3 days</b>	<b>Non- organised PA ≥ 3 sessions</b>	<b>Team sport</b>	<b>Individual sport</b>	<b>Organised non-sport PA</b>	<b>Frequency  n (%)</b>
≥ 60mins MVPA on ≥ 3 days & Team sport	✓	x	✓	x	x	63 (16.32%)
≥ 60mins MVPA on ≥ 3 days, ≥ 3 sessions Non-organised PA & Team sport	✓	✓	✓	x	x	49 (12.69%)
No participation in any physical activity behaviours	x	x	x	x	x	36 (9.33%)
≥ 60mins MVPA on ≥ 3 days, Team sport & Individual sport	✓	x	✓	✓	x	31 (8.03%)
Team sport only	x	x	✓	x	x	24 (6.22%)
≥ 60mins MVPA on ≥ 3 days & Individual sport	✓	x	x	✓	x	22 (5.70%)
≥ 60mins MVPA on ≥ 3 days & ≥ 3 sessions Non-organised PA	✓	✓	x	x	x	21 (5.44%)
≥ 60mins MVPA on ≥ 3 days, ≥ 3 sessions Non-organised PA & Individual sport	✓	✓	x	✓	x	21 (5.44%)
≥ 3 sessions Non-organised PA only	x	✓	x	x	x	19 (4.92%)
≥ 60mins MVPA on ≥ 3days, ≥ 3 sessions Non-organised PA, Team sport, & Individual sport	✓	✓	✓	✓	x	18 (4.66%)
Total number of individuals in the 10 most frequent response patterns						304 (78.75%)

*Note.* MVPA = Moderate-to-vigorous physical activity, PA = Physical activity

Table 4.9 *Model fit statistics for the latent class models for male adolescents*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	<i>p</i>
2	-1114.78 (11)	2251.55	2295.07	2260.17	1.00	2	66.03	.00
3	-1102.69 (2)	2209.38	2217.29	2210.95	0.92	0	1760.52	.00
4	-1094.99 (3)	2195.97	2207.84	2198.32	0.94	0	26.58	.00
<b>5</b>	<b>-1087.43 (4)</b>	<b>2182.86</b>	<b>2198.69</b>	<b>2185.99</b>	<b>0.90</b>	<b>0</b>	<b>37.33</b>	<b>.00</b>
6	-1085.99 (5)	2181.99	2201.77	2185.91	0.84	0	455.34	.00
7	-1085.29 (6)	2182.59	2206.32	2187.28	0.90	0	23.92	.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

Class 1 (purple line), the smallest class (2.8%), was characterised by participation in organised non-sport physical activity and demonstrated high rates of achieving recommended levels of MVPA on three or more days, alongside very low probabilities of engaging in organised sport or non-organised physical activity. Further inspection of this class indicated that all participants were members of a gym and lifted weights, used stationary cardiovascular machinery (e.g. treadmill) or participated in fitness classes (e.g. spinning) between three and five times a week. In addition, members of this class averaged just less than 60 minutes in MVPA daily. As a result this class was labelled ‘Active Organised Fitness’.

Table 4.10 *Response probabilities for each of the physical activity indicators by each of the latent classes for male adolescents*

Latent Class	n	≥ 60mins MVPA on ≥ 3days	Non-organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M (SD)</i>
1. Active Organised Fitness	11	<b>0.83</b>	0.02	0.00	0.00	<b>1.00</b>	56.69 (39.91)
2. Active Individual Sport	68	<b>0.73</b>	0.38	0.00	<b>0.88</b>	0.06	47.81 (33.79)
3. Non-Participation	89	0.00	0.33	0.32	0.11	0.04	18.42 (17.75)
4. Active Non-Organised PA & Team Sport	97	<b>1.00</b>	<b>1.00</b>	<b>0.72</b>	0.27	0.09	79.43 (37.53)
5. Active Team Sport	121	<b>0.91</b>	0.00	<b>1.00</b>	0.34	0.16	71.64 (40.52)

*Note.* Conditional probabilities >.5 in bold to facilitate interpretation. MVPA = Moderate-to-vigorous physical activity. PA = Physical activity

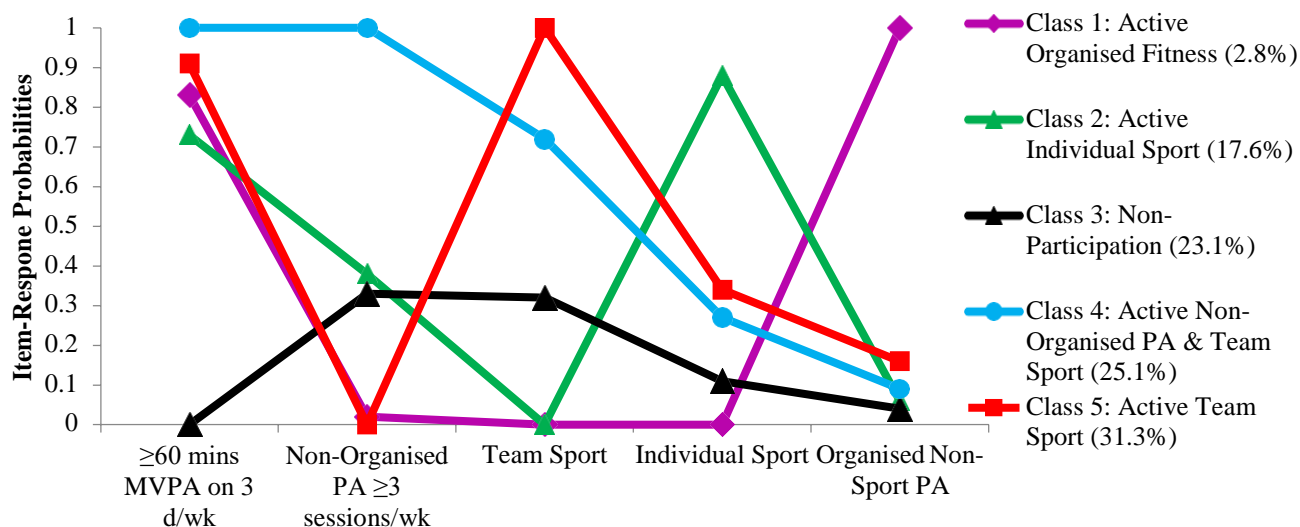


Figure 4.4. Profile plot of the five physical activity behaviour classes for male adolescents

In Class 2 (green line), which contained 17.6% of the male sample, the majority of participants reported that they engaged in individual sports (e.g. martial arts, boxing, athletics, swimming and golf) and were also highly likely to achieve a minimum of 60 minutes of MVPA on at least three days over the previous week, accumulating a daily mean of 47 minutes of MVPA. Owing to low probabilities of engaging in other types of physical activity, this class was subsequently named ‘Active Individual Sport’. Comprising just under a quarter (23.1%) of the male sample, Class 3 (black line) reflected a ‘Non-Participation’ group characterised by low rates of participation in all physical activity behaviours. Accordingly, this group of individuals demonstrated the lowest levels of physical activity overall relative to the other latent classes, accumulating a mean of 18 minutes of MVPA daily.

Class 4 (blue line) was characterised by high rates of participation in non-organised physical activity (e.g. unstructured exercise like jogging and non-organised sports such as soccer), team sport (e.g. Gaelic football, basketball) and meeting MVPA guidelines on at least three days over the past week. Representing one quarter of adolescent boys, this class reflected a high active pattern of participation in both organised and non-organised physical activity, with members accumulating over one hour on average in MVPA daily. As such this class was named ‘Active Non-Organised Physical Activity and Team Sport’. Class 5 (red line), the largest class (31.3%) was characterised by high rates of participation in team sport (e.g. soccer, Gaelic football, rugby, basketball) and recommended levels of MVPA on three or more days in addition to low probabilities of engaging in the other physical activity behaviours. This class also demonstrated an active profile with class members engaging in a mean of more than 60 minutes of MVPA daily. In accordance, this class was labelled ‘Active Team Sport’

#### **4.5.8 Patterns of response among the younger adolescent cohort**

The ten most prevalent item-response combinations for the observed physical activity indicators among the younger adolescent cohort are presented in Table 4.11. The most frequent response pattern evidenced was that of non-participation corresponding to an absence of participation in all physical activity behaviours. The second and third most popular item-response patterns reflect active participation in team sport, and active participation in a combination of organised sports.

#### **4.5.9 Latent Class Analysis on younger adolescent cohort**

The younger adolescent cohort was subjected to latent class analysis with one through seven classes fit to the data. The BIC criterion supported a five class model whereas AIC and SSABIC indicated that a seven class solution would provide the best fit (Table 4.12). Consistent with the BIC, the LMRT suggested that the five-class model was the optimal solution. In addition, the highest entropy value was also evidenced for the five-class solution. Thus, in the interest of parsimony, and in accordance with entropy and BIC, the five class latent model was selected to represent younger adolescents' physical activity patterns. Interpretation of the classes was aided by evaluation of the probabilities of endorsing each of the observed physical activity indicators across each class (Table 4.13). It should be noted that classes were assigned the label 'active' if the majority of member reported at least 60 minutes of MVPA on three or more days over the past week. Descriptive statistics are also presented for each latent class in relation to mean minutes spent in MVPA to aid interpretation (Table 4.13). In addition, a visual representation of the five latent physical activity classes is presented in Figure 4.5.

Table 4.11 *Frequency of most prevalent response patterns of physical activity among younger adolescent cohort*

<b>Physical Activity Behavioural Pattern</b>	<b>≥ 60 mins MVPA on ≥ 3 days</b>	<b>Non- organised PA ≥ 3 sessions</b>	<b>Team sport</b>	<b>Individual sport</b>	<b>Organised non-sport PA</b>	<b>Frequency n (%)</b>
No participation in any physical activity behaviours	x	x	x	x	x	74 (15.81%)
≥ 60mins MVPA on 3 or more days & Team sport	✓	x	✓	x	x	48 (10.26%)
≥ 60mins MVPA on ≥ 3days, Team sport & Individual sport	✓	x	✓	✓	x	36 (7.69%)
Team sport only	x	x	✓	x	x	35 (7.48%)
≥ 60mins MVPA on ≥ 3days, ≥3 sessions Non-organised PA & Team sport	✓	✓	✓	x	x	28 (5.98%)
≥ 3 sessions Non-organised PA only	x	✓	x	x	x	27 (5.77%)
≥ 60mins MVPA on ≥ 3days & ≥ 3 sessions Non-organised PA	✓	✓	x	x	x	23 (4.92%)
≥ 60mins MVPA on ≥ 3days & Individual sport	✓	x	x	✓	x	23 (4.92%)
≥ 60mins MVPA on ≥ 3days Team sport, Individual sport, Organised non-sport PA	✓	x	✓	✓	✓	19 (4.06%)
Individual sport only	x	x	x	✓	x	17 (3.63%)
<b>Total number of individuals in the 10 most frequent response patterns</b>						<b>330 (70.52%)</b>

Table 4.12 *Model fit statistics for the latent class models for younger adolescent cohort*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of significant residuals	LRT	<i>p</i>
2	-1430.45 (1)	2862.89	2867.05	2863.84	0.86	2	786.01	.00
3	-1415.08 (2)	2834.15	2842.45	2836.10	0.81	2	116.90	.00
4	-1403.89 (3)	2813.79	2826.23	2816.71	0.79	0	98.32	.00
<b>5</b>	<b>-1398.54 (4)</b>	<b>2805.08</b>	<b>2821.67</b>	<b>2808.98</b>	<b>0.87</b>	<b>0</b>	<b>295.18</b>	<b>.00</b>
6	-1395.37 (35)	2860.74	3005.93	2894.85	0.84	0	6.18	.23
7	-1393.86 (6)	2799.72	2824.61	2805.57	0.81	0	76.51	.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

Table 4.13 *Response probabilities for each of the physical activity indicators by each of the latent classes for younger adolescent cohort*

Latent Class	<i>n</i>	≥ 60mins MVPA on ≥ 3days	Non-organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M (SD)</i>
1. Active Organised PA & Sports	58	<b>0.77</b>	0.28	<b>0.68</b>	<b>0.68</b>	<b>1.00</b>	79.97 (65.88)
2. Active Non-Organised PA & Team Sport	64	<b>0.72</b>	<b>1.00</b>	<b>0.57</b>	0.08	0.00	54.83 (35.00)
3. Active Individual Sport	90	<b>1.00</b>	0.38	0.50	<b>1.00</b>	0.00	65.84 (35.68)
4. Active Team Sport	99	<b>0.58</b>	0.00	<b>1.00</b>	0.24	0.07	37.74 (30.45)
5. Non-Participation	157	0.03	0.23	0.00	0.20	0.19	11.15 (15.99)

Conditional probabilities >.5 in bold to facilitate interpretation

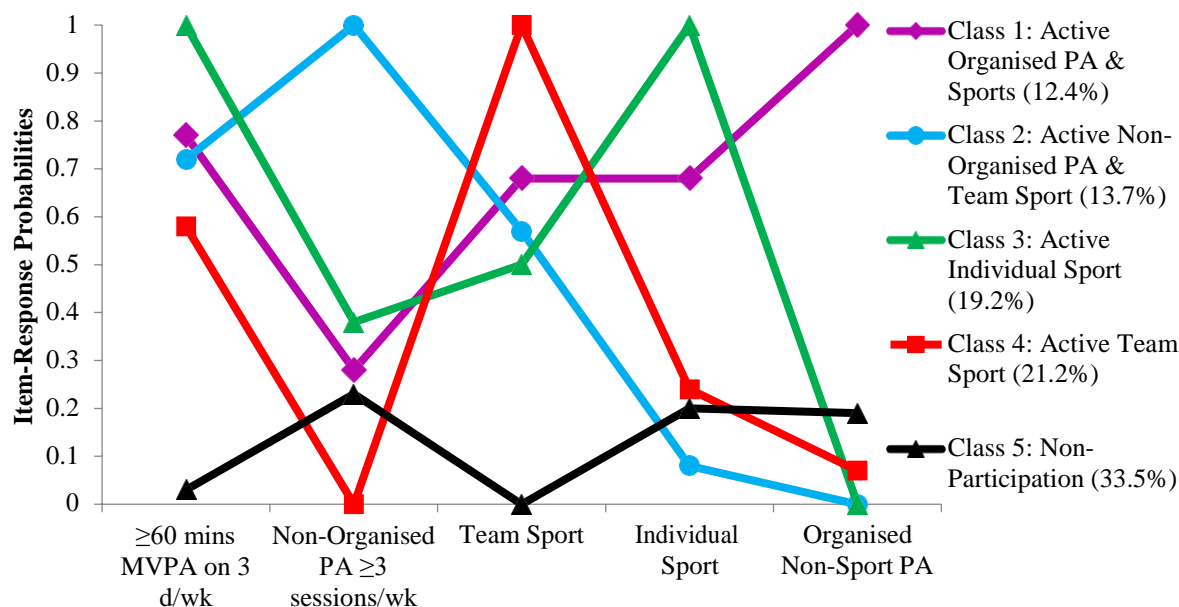


Figure 4.5. Profile plot of the five physical activity behaviour classes for younger adolescent cohort

Comprising the smallest proportion of younger adolescents (12.4%), Class 1 (purple line) was characterised by the highest probability of engaging in organised non-sport physical activity (e.g. dance) and a high likelihood of participating in team sport (e.g. soccer, hockey, basketball), and individual sport (cross-country running, martial arts, badminton, swimming). In addition to a low probability of engaging in non-organised physical activity, members of this class were also very likely to achieve 60 minutes of MVPA on three or more days over the past week, averaging a daily mean of over one hour in MVPA. In accordance, this class was labelled ‘Active Organised Physical Activity and Sports’.

Class 2 (blue line) contained 13.7% of the younger adolescent cohort and represented the highest likelihood of engaging in non-organised physical activity (e.g. cycling, running, tip-the-can, football), high probability of meeting MVPA guidelines on a minimum of three days and a more moderate likelihood of undertaking team sport (e.g. Gaelic football, hockey, basketball). Low rates of participation were evidenced for individual sport and organised physical activities. This mixed pattern of participation in organised and non-organised physical activity contributed to a daily average of over 60 minutes spent in MVPA representing a highly active group of younger adolescents. As such this class was labelled ‘Active Non-Organised PA and Team Sport’.

Representing approximately one fifth (19.2%) of younger adolescents, Class 3 (green line) was characterised by the highest probability of engaging in individual sport (e.g. cross-country running, martial arts, swimming) and recommended MVPA on three or more days. In addition, this group of adolescents evidenced a moderate probability of team sport and low levels of organised and non-organised physical activity behaviour. Demonstrating a daily mean of just less than one hour of MVPA, this class was subsequently labelled ‘Active Individual Sport’.



Class 4 (red line), the second largest class (21.2%) was characterised by the highest probability of engaging in team sport (e.g. Gaelic football, soccer, hockey, rugby, basketball, hurling) , moderate probability of achieving recommended moderate-to-vigorous physical activity on three or more days, and low likelihood of engaging in other types of physical activity. Members of this class were also relatively active reporting on average 37.73 minutes in moderate-to-vigorous physical activity every day. As such, this class was labelled ‘Active Team Sport’. Comprising one third of the younger adolescent sample, Class 5 (black line) was characterised by low probabilities of engaging in all types of physical activity behaviours and as such was labelled a ‘Non-Participation’ group. Members of this class also reported low levels of daily MVPA roughly accumulating 11 mins of recommended activity.

#### **4.5.10 Patterns of Response among the older adolescent cohort**

A total of 32 different item-response combinations were recorded for the older adolescent cohort with the most prevalent patterns presented in Table 4.14. The most common response was that of non-participation, which was characterised by low levels of engagement in all of the physical activity behaviours examined. The second most frequent response reflected active participation in team sport. This was followed, in turn, by a less active pattern of engagement in non-organised physical activity.

#### **4.5.11 Latent Class Analysis on older adolescent cohort**

The fit statistics of two through seven classes for the older adolescent cohort are presented in Table 4.15. The AIC and SSABIC are in conflict with the BIC, as the former fit criteria support a 6 class solution while the latter criterion indicates that a four class model is superior. The differences between the BIC value for the four and six class solution however, was minimal. In addition, statistical model comparisons (LMR-LRT) suggested that either a four or six class solution would provide an appropriate fit to the data. In other words, the addition of a fifth class does not provide a statistically significant improvement over the four class model and similarly a seven-class model does not provide a significantly better fit than a six class model. In addition, neither the four nor six class models had any significant residuals suggesting that both models provided a good fit to the data. High levels of entropy were also evidenced for both solutions however, the four class solution was slightly higher (i.e. 0.92 vs 0.87). The top ten most frequent item-response patterns in the dataset were subsequently considered in addition to an examination of the interpretability of the various solutions and empirical literature to assist in deciding upon the optimal latent class model.

An inspection of the models revealed that the six-class solution replicated six of the ten most frequently occurring item-response patterns among the older adolescent cohort (Table 4.14) whereas the four class solution replicated only three of these prevalent responses. Further examination of the two competing models revealed that the six class model contributed two additional classes reflecting active

participation in non-organised physical activity and a less active profile of individual sport involvement, which were subsequently combined within the four class model. Prior research undertaken on older adolescents sport participation previously revealed five distinct clusters that represented team sport, individual sport, mixed sports, dance and non-participation, which are conceptually similar to the latent classes identified within the six-class model in the present study (Aghans & Geldhof, 2012).

Thus, taking all of this information into consideration, a latent model comprising six classes was selected to represent older adolescents' patterns of involvement in physical activity. The probability of endorsing each of the five observed physical activity variables across each class are presented in Table 4.16. Descriptive statistics pertaining to mean levels of MVPA are also provided to facilitate interpretation. In addition, a graphic depiction of the six latent physical activity classes is presented in Figure 4.6.

Table 4.14 *Frequency of most prevalent response patterns of physical activity among older adolescent cohort*

<b>Physical Activity Behavioural Pattern</b>	<b>≥ 60 mins MVPA on ≥ 3 days</b>	<b>Non- Organised PA ≥ 3 sessions</b>	<b>Team Sport</b>	<b>Individu al Sport</b>	<b>Organised Non-sport PA</b>	<b>Frequency N (%)</b>
No participation in any physical activity behaviours	x	x	x	x	x	118 (22.39%)
≥ 60mins MVPA on ≥ 3days & Team sport	✓	x	✓	x	x	54 (10.25%)
≥ 3 sessions non-organised PA only	x	✓	x	x	x	48 (9.11%)
Organised non-sport PA only	x	x	x	x	✓	29 (5.50%)
≥ 60mins MVPA on ≥ 3day, ≥ 3 sessions non-organised PA & Team sport	✓	✓	✓	x	x	29 (5.50%)
≥ 60mins MVPA on ≥ 3days & Organised non-sport PA	✓	x	x	x	✓	24 (4.55%)
Individual sport only	x	x	x	✓	x	22 (4.18%)
60mins MVPA on ≥ 3days & Individual sport	✓	x	x	✓	x	21 (3.99%)
Team sport only	x	x	✓	x	x	20 (3.80%)
≥ 60mins MVPA on ≥ 3days Team sport & Individual sport	✓	x	✓	✓	x	20 (3.80%)
≥ 60mins MVPA on ≥ 3days & ≥ 3 sessions non-organised PA	✓	✓	x	x	x	20 (3.80%)
<b>Total number of individuals in the 11 most frequent response patterns</b>						<b>405 (76.85%)</b>

Table 4.15 *Model fit statistics for the latent class models for older adolescent cohort*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of significant residuals	LRT	<i>p</i>
2	-1539.07 (1)	3080.14	3084.41	3081.23	0.83	1	834.06	.00
3	-1528.88 (2)	3061.75	3070.29	3063.95	0.80	0	61.70	.00
4	-1515.63 (3)	3037.26	3050.06	3040.54	0.92	0	1415.76	.00
5	-1511.08 (29)	3080.17	3203.97	3111.92	0.83	0	8.85	.12
<b>6</b>	<b>-1510.06 (5)</b>	<b>3030.11</b>	<b>3051.59</b>	<b>3035.59</b>	<b>0.87</b>	<b>0</b>	<b>57.36</b>	<b>.00</b>
7	-1509.51 (6)	3031.02	3056.64	3037.59	0.86	0	3.96	.05

Note: LL(df) loglikelihood value and associated degrees of freedom; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value; AIC Akaike Information Criterion; SSABIC Sample Size Adjusted Bayesian Information Criterion.

Table 4.16 *Response probabilities for each of the physical activity indicators by each of the latent classes for older adolescent cohort*

Latent Class	<i>n</i>	≥ 60mins MVPA on ≥ 3days	Non-organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M (SD)</i>
1. Individual Sport	43	0.35	0.05	0.05	<b>1.00</b>	0.00	33.67 (31.95)
2. Active Mixed Sports	42	<b>0.87</b>	0.00	<b>0.66</b>	<b>1.00</b>	0.30	76.70 (41.20)
3. Active Non-Organised PA	58	<b>0.80</b>	1.00	0.38	0.48	0.12	61.64 (37.64)
4. Organised Dance & Fitness	74	0.43	0.11	0.17	0.10	<b>1.00</b>	35.91 (29.66)
5. Active Team Sport	116	<b>1.00</b>	0.27	<b>0.88</b>	0.00	0.21	71.48 (35.99)
6. Non-Participation	193	0.00	0.27	0.14	0.00	0.00	11.03 (14.64)

Conditional probabilities >.5 in bold to facilitate interpretation

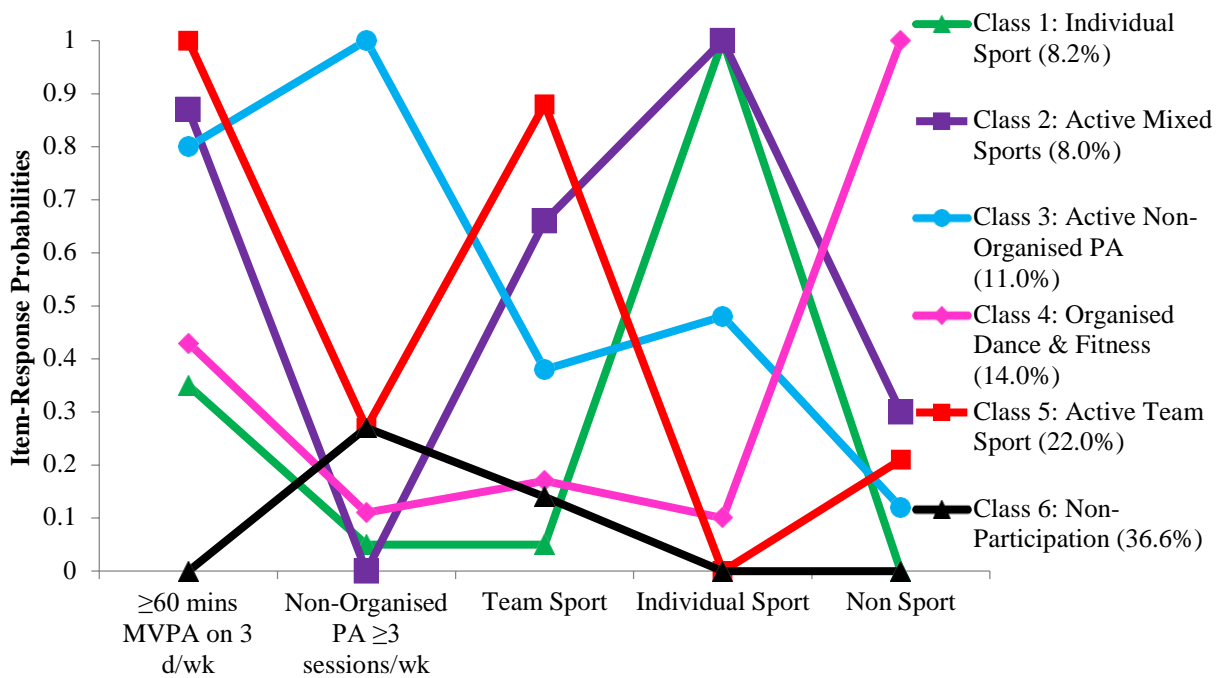


Figure 4.6. Profile plot of the five physical activity behaviour classes for the older adolescent cohort

Class 1 (green line), representing 8.2% of the older adolescent sample, was characterised by high rates of participation in individual sport, and low probabilities of engaging in other types of physical activity. Members within this class were moderately active reporting a daily mean of approximately half an hour spent in moderate-to-vigorous physical activity. This class was subsequently labelled ‘Individual Sport’ reflecting participation in a range of activities including swimming, tennis, badminton, martial arts, horse-riding, gymnastics and cross-country running. Class 2 (purple line), also representing 8% of the older adolescent sample, consisted of individuals who participated in both individual and team sports and had a high likelihood of meeting MVPA guidelines on three or more days over the past week as well as low probabilities of engaging in other physical activity behaviours. Adolescents within this class reported a mean of 76.7 minutes in MVPA reflecting a high active profile. As such this class was named ‘Active Mixed Sports’.

Class 3 (blue line), containing 11% of older adolescents, represented an ‘Active Non-Organised Physical Activity’ group that was defined by high rates of participation in non-organised physical activities, high levels of MVPA and low likelihood of engaging in organised activities. Closer inspection of the raw data revealed that this group was predominantly characterised by individual activities like walking, running and jogging. Moreover, members of this class were highly active accumulating a mean of just over 60 minutes in MVPA every day. Comprising 14% of older adolescents, Class 4 (pink line) was characterised by high levels of participation in organised non-sport physical activity (e.g. dance, fitness classes), moderate probabilities of engaging in moderate-to-vigorous physical activity and lower probabilities of participating in other physical behaviours. Class 4

was therefore labelled ‘Organised Dance and Fitness’. This class engaged in a mean of 35 minutes of MVPA daily representing a more moderately active class.

Reflecting approximately one-fifth of older adolescents, Class 5 (red line) named ‘Active Team Sport’ was characterised by high levels of participation in team sport (e.g. soccer, basketball) and a minimum of 60 minutes of MVPA on three or more days alongside lower probabilities of engaging in other types of physical activity. This class represented high levels of activity evidencing a mean of just over 70 minutes spent in MVPA daily. Finally, comprising the largest proportion of older adolescents (36.6%), Class 6 (black line), demonstrated low probabilities of participating in all physical activities and was defined as a ‘Non-Participation’ group. In accordance, this class reported the lowest mean levels of physical activity accumulating an average of 11 minutes of MVPA every day.

#### **4.6 Discussion**

Previous research has typically focused on adolescents’ total physical activity levels without consideration of the type of participation that constitutes involvement, resulting in a limited understanding of the different patterns of physical activity in which young people engage. The primary goal of this chapter was therefore to examine profiles of physical activity participation among adolescents by incorporating multiple dimensions, or observed indicators, of physical activity including duration, intensity, frequency, activity type and context. The research also sought to investigate whether patterns of involvement in physical activity differed between male and female, and younger and older adolescents.

In partial support of our first hypothesis, five of the six proposed subgroups of physical activity participation were identified among the overall adolescent sample that reflected high *active* patterns of involvement in *team sport*, *individual sport* and *non-organised physical activity*, a less active pattern of engagement in *organised dance and fitness activities*, and a low active class defined by *non-participation* in physical activity. These findings are in line with prior research undertaken by Agans and Geldhof (2012), which outlined five distinct profiles of adolescent sport participation that corresponded to team sport, individual sport, a combination of team and individual sports, dance, and a non-participation group that did not engage in any type of sports. All of these clusters were replicated within the present analysis apart from the mixed sport group. It should be acknowledged however, that the research undertaken by Agans and Geldhof (2012) comprised an older sample of male and female adolescents aged between 15 and 18 years, and consequently, the aforementioned physical activity profiles were supported within the present study when the older adolescent cohort was examined separately. In addition, in the present study organised non-sport physical activities (e.g. gym, spin class) were also considered alongside organised dance activities, which reflected a pattern of *organised dance and fitness* among the overall sample of adolescents. The hypothesised mixed sports profile was

subsequently replaced by an *active* pattern of engagement in *non-organised physical activity* that included unstructured exercise like walking and running as well as participation in informal games and sports. Agans and Geldhof (2012) previously only focused on organised sport participation, which resulted in non-organised patterns of physical activity being overlooked. However, the emergence of an *active non-organised physical activity* class, which comprised 13% of the overall sample, underscores the significance of this behavioural pattern as a distinct and valid form of physical activity involvement among Irish adolescents.

It was also hypothesised that young people characterised by patterns of organised sport and physical activity participation would demonstrate active levels of moderate-to-vigorous physical activity. Active, within the present study, was defined as accumulating a minimum of 60 minutes of MVPA on three or more days over the past week, which is equivalent to meeting recommended physical activity guidelines on at least three days during the previous seven. Consistent with our second hypothesis, classes characterised by organised sport evidenced *active* levels of MVPA behaviour. However, in contrast to our expectations adolescents represented by a pattern of involvement in *organised dance and fitness activities*, evidenced less active MVPA levels. Nonetheless, class members averaged approximately half an hour in MVPA per day suggesting that this physical activity pattern does contribute to overall MVPA levels although to a somewhat lower extent. Partaking in organised physical activity classes or lessons once per week therefore does not constitute an active lifestyle in and of itself but rather it appears that this pattern of engagement may need to be supplemented with additional physical activities in order to meet overall MVPA guidelines. In turn, as predicted the non-participation class was characterised by low levels of MVPA involvement.

Limited research has explored non-organised physical activity behaviour such as running, cycling, and walking among adolescents thus it was unclear whether this pattern of activity would be associated with high or low levels of moderate-to-vigorous physical activity. The results indicated that *non-organised physical activity* was characterised by *active* levels of MVPA participation among the overall adolescent sample. Therefore the present findings make a valuable contribution to the literature indicating that this form of activity can play an important role in helping adolescents to achieve recommended MVPA guidelines. Moreover, the informal nature of non-organised physical activity which can be undertaken alone or with friends, in multiple contexts and across many different times without much cost or organisation represents a mode of physical activity participation that is accessible to all young people, and one which can be easily incorporated into young people's everyday lives.

In response to the third hypothesis about gender differences in patterns of physical activity involvement among males and females, results from the multiple group analysis revealed that the underlying structure and prevalence of physical activity classes identified among the overall adolescent cohort significantly differed when gender was taken into consideration. It was therefore necessary to explore

profiles of physical activity participation separately for male and female adolescents. In line with our third hypothesis, boys were represented by more active profiles of physical activity participation than girls. Indeed, all of the male physical activity behavioural profiles were characterised by active levels of MVPA except for the *non-participation* class, which evidenced low rates of involvement in all of the physical activity behaviours assessed. Thus, it appears that males can accumulate high levels of MVPA through various patterns of participation in distinct physical activity behaviours including *team sport*, *individual sport*, *organised fitness*, and a combination of *non-organised physical activity and organised team sport*. In contrast, only two of the female physical activity classes were classified as *active*, which corresponded to discrete patterns of involvement in organised *team* and *individual sport*. The remaining physical activity profiles for girls were characterised by lower levels of MVPA participation. Consistent with prior research, the findings highlight the significance of organised sport participation in assisting adolescent girls to meet recommended MVPA guidelines (Pfeiffer et al., 2006; Woods et al., 2010).

A *non-participation* class was also common to both genders, although this subgroup comprised a larger proportion of adolescent girls (35.0%) than boys (23.1%), which was in accordance with prior expectations. Furthermore, the *non-participation* profile emerged as the most prevalent pattern of physical activity behaviour among girls representing approximately one third of the overall sample. These findings are in line with Liu et al. (2010) who found that adolescent girls were more likely to be represented by a low active profile of behaviour while males were more predominantly characterised by moderate and high active patterns of physical activity.

It was also hypothesised that the underlying patterns of involvement in physical activity would differ between males and females. In accordance with expectations, a greater proportion of the male sample (74.0%) was characterised by participation in organised sport than females (35.1%). The *active team sport* class, which comprised the largest grouping of adolescent males, in addition to the *active individual sport* and *active non-organised physical activity and team sport* physical activity groups, consisted of just less than three quarters of the male sample. For girls however, the *active team sport* and *active individual sport* class reflected approximately one-third of female participants. Thus organised sport participation represents a more prevalent pattern of physical activity behaviour among males than females. These findings are in agreement with prior research undertaken on secondary school students in Ireland which indicated that boys demonstrate higher rates of participation in organised sport than girls (Woods et al., 2010; Lunn et al., 2013).

In respect to organised non-sport physical activity participation, gender specific patterns emerged reflecting differences in the type of organised physical activities undertaken and levels of MVPA accumulated. Comprising approximately 13% of the female sample, the *organised dance and fitness* class, which was predominantly characterised by participation in dance, represented a prevalent pattern of female physical activity participation that was low active in nature. In contrast, the *active organised*



*fitness* group, representing the smallest of the male physical activity classes (2.8%) comprised a sample of boys who were all gym members, reflecting a more active fitness-orientated sub-group of adolescents. Thus, our hypothesis that a greater proportion of girls than boys would be characterised by a pattern of involvement in organised non-sport was supported. Moreover, not only did a higher proportion of girls engage in organised non-sport physical activity than boys but the specific activity undertaken was also distinct. In line with these findings, previous studies indicate that girls report higher rates of participation in dance activities than boys (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009; O'Neill et al., 2011; Woods et al., 2010).

Differences were also evidenced between boys and girls in terms of the composition of the remaining classes. A distinct pattern of participation in *non-organised physical activity* that was unique to girls emerged, which was characterised by engagement in individual type activities like walking, running and cycling. In contrast, for boys *non-organised physical activity* was typically performed alongside organised *team sport* representing a highly active mixed pattern of physical activity involvement. The results therefore indicate that non-organised physical activity differentially underpins male and female adolescent physical activity patterns. Finally, for girls an additional class emerged that was characterised by participation in *organised individual sport and physical activity* (e.g. cross-country running and dance) and low MVPA levels. This subset of girls comprised a less active pattern of physical activity behaviour, which was not replicated among the male sample. Thus, examining physical activity in a multidimensional manner, allows us to capture the variation evidenced in relation to activity type and level of MVPA participation. The present findings therefore expand upon prior research by Liu et al. (2013) and Agans and Geldhof (2012) by taking into consideration different contexts of adolescents' physical activity participation (i.e. organised and non-organised) that have not been addressed previously, which ultimately facilitates a more detailed understanding of young people's overall patterns of physical activity involvement.

It was also hypothesised that profiles of physical activity participation would differ between younger and older adolescents. The results of the multiple group models revealed that measurement characteristics of the latent classes identified among the overall adolescent sample significantly differed as a function of age indicating that patterns of involvement in physical activity varied between younger and older adolescents. In addition, it was hypothesised that younger adolescents would demonstrate more active profiles of MVPA participation than older adolescents. This prediction was supported by the empirical data as four of the five physical activity participation profiles among younger adolescents' were classified as active, compared to the older cohort, in which only three out of a possible six classes were moderate-to-vigorously active for a minimum of 60 minutes on three or more days. The younger cohort also displayed more mixed patterns of participation in physical activity in contrast to the older adolescent cohort, which was characterised for the most part, by more differentiated patterns of

engagement in specific physical activity behaviours. These patterns of physical activity involvement may be indicative of a developmental trend, in which previous participation in multiple types of physical activity is subsequently replaced with a single preferred activity, possibly as a consequence of diminished leisure time owing to increased academic demands.

Surprisingly, the *non-participation* class emerged as the most prevalent pattern of physical activity among both age-groups with approximately one third of younger and older adolescents characterised by this pattern of inactivity. However, it should be noted that while similar levels of non-participation were evidenced across both age groups, of the remaining classes that were characterised by some form of physical activity participation, all of the younger adolescent physical activity behaviour profiles demonstrated high levels of MVPA, which was not the case among older adolescents. Thus, it appears that when younger adolescents choose to participate in physical activity they display higher levels of MVPA participation.

Additional differences were noted between the younger and older adolescent age-groups in relation to the underlying composition of identified physical activity behaviour patterns. The results were in agreement with our fourth hypothesis that a greater proportion of younger as compared to older adolescents would be represented by profiles of organised sport participation. Indeed, with the exception of the *non-participation* group, all of the younger adolescent latent physical activity classes were characterised by participation in organised sport, to some extent. However, these patterns of involvement in organised sport were highly varied. The *active team sport* and *active individual sport* classes represented discrete patterns of physical activity behaviour. In contrast, the *active organised physical activity and sport* group reflected high rates of participation in organised non-sport physical activity alongside team and individual sport, demonstrating a highly mixed pattern of engagement in organised activities. In turn, the *active non-organised physical activity and team sport* class evidenced high rates of participation in non-organised physical activity in addition to team sport, representing a varied pattern of engagement in organised and non-organised types of physical activity. The findings indicate that organised sport, and team sport in particular, was a prevalent form of activity among younger adolescents.

The physical activity behavioural patterns that were identified among the older adolescent cohort were less varied, with five of the six profiles representing participation in *active team sport*, *individual sport*, a combination of *active team and individual sports*, *organised dance and fitness*, and *non-participation*, which are in line with prior research that outlined five clusters of sport participation among older teenagers (Agans & Geldhof, 2012). An additional physical activity class emerged in the present study reflecting a discrete pattern of *active* participation in *non-organised physical activity*, which was unique to the older adolescent cohort. This class was further characterised by participation in exercises like walking, jogging and running, which indicates that older adolescents demonstrate a

preference for more informal individual type physical activities than their younger counterparts. In support of these findings Eime et al. (2013) revealed that older female adolescents reported higher rates of participation in non-organised physical activity relative to their younger peers.

Prior research has typically excluded assessment of non-organised physical activity participation with limited information available regarding the implication of this activity type for overall adolescent physical activity levels. Therefore, the present findings make an important contribution to our understanding of non-organised physical activity behaviour underscoring the significance of this form of activity for increasing older adolescents' MVPA levels, which is especially pertinent given the age-related decline in physical activity that emerges across adolescence. Another latent physical activity class that was unique to the older adolescent cohort was *organised dance and fitness*, which reflected a lower active pattern of MVPA participation in organised non-sport physical activity classes such as dance and fitness (e.g. spin class, aerobics). These findings further indicate that older adolescents demonstrate a preference for individual type activities, comprising both organised and non-organised participation. In agreement with these findings, Lunn et al. (2013) found that levels of personal exercise reflecting involvement in jogging, swimming and going to the gym increased among male and female adolescents as they got older.

Nonetheless, similarities were also evidenced between the younger and older cohorts with both containing *active team sport* classes, which represented the second most popular pattern of involvement in physical activity for each age-group. In addition, the *active individual sport* class identified among the younger cohort ( $M$  daily MVPA mins = 65.84) was replicated among the older adolescent cohort ( $M$  daily MVPA mins = 33.67); however the latter group demonstrated a less active pattern of MVPA participation. Finally, consistent with research undertaken by Agans and Geldhof (2012), an active mixed sport group emerged that was characterised by participation in a combination of *team and individual sports*, which was unique to the older adolescent cohort.

#### **4.7 Conclusion**

In conclusion, by conceptualising physical activity behaviour in a multidimensional manner, this chapter has described the variation in patterns of involvement in physical activity among Irish adolescents. The findings indicate that patterns of physical activity behaviour differ between male and female, and younger and older adolescents. Boys evidenced more active patterns of participation in physical activity than girls whilst older adolescents demonstrated lower active physical activity behavioural profiles than their younger counterparts. Some similarities were also evidenced however, in respect to male and female physical activity classes, with both groups comprising discrete patterns of *active* engagement in *team sport* and *individual sport* in addition to a *non-participation* physical activity grouping. An *organised non-sport physical activity* pattern also emerged for both groups, however this was characterised by low active MVPA participation in dance classes among girls,

whereas for males participation reflected higher levels of MVPA in organised gym and fitness activities. In addition, unique to girls a pattern of involvement in *non-organised physical activity* (e.g. walking, running) emerged, which contrasted the active pattern of non-organised physical activity undertaken alongside team sport for males. Finally, a subset of lower active females comprised a pattern of engagement in *organised individual sport and physical activity*.

In respect to age-related patterns of physical activity behaviour, younger adolescents represented more mixed profiles of participation compared to older adolescents who showed more discrete patterns of physical activity engagement. Both groups comprised an *active team sport*, in addition to a *non-participant* physical activity class. A pattern of engagement in *individual sport* was also evident among each cohort; however with respect to this profile of participation, younger adolescents reported active levels of moderate-to-vigorous physical activity whereas older adolescents demonstrated a lower active pattern of involvement. In addition, unique to the older adolescent cohort, a high active pattern of participation in a combination of *team and individual sports* was evidenced. The remaining physical activity classes evidenced among the younger adolescent cohort included an active pattern of engagement in *organised physical activity and sport*, in addition to a mixed profile of *non-organised physical activity and team sport* participation that was characterised by high active levels of moderate-to-vigorous physical activity. Contrasting these varied patterns of physical activity engagement, the older adolescent cohort comprised more differentiated patterns of physical activity, which corresponded to an *active* pattern of engagement in *non-organised physical activity* behaviour, and a lower active pattern of *organised* participation in *dance and fitness* activities. Moreover, older adolescents were more likely to be characterised by patterns of participation in individual physical activities than their younger counterparts, who demonstrated a preferences for team based activities.

This chapter has provided insight into the patterns of organised and non-organised physical activity behaviour that characterise gender and age-related participation in moderate-to-vigorous physical activity. In order to develop a better understanding of these physical activity behavioural profiles it would be useful to examine how these physical activity classes differ from one another in relation to motivational, psychological and social factors. As such, the next chapter will address this research question in more detail.

## **Chapter 5: An Analysis of Psychosocial and Individual Correlates of Physical Activity Behaviour Patterns**

### **5.1 Chapter Overview**

In Chapter 4, latent class analyses were performed to identify distinct profiles of physical activity behaviour among adolescents, facilitating a greater insight into the different patterns of physical activity in which young people engage. The purpose of this chapter is to explore differences among profiles of adolescents' physical activity participation on a range of motivational, social and body-related characteristics. In addition, a secondary aim is to determine whether the association between latent physical activity classes and psychosocial factors vary across gender and age-groups. One-way Kruskal-Wallis tests were conducted to compare differences across adolescents' physical activity profile groups. The results are subsequently presented for male and female, and younger and older adolescent cohorts.

### **5.2 Introduction**

Previous studies have typically identified correlates of overall physical activity levels without consideration of the underlying context or type of activity performed, which may have resulted in potential variations in psychosocial factors on adolescents' physical activity behaviour being overlooked (Biddle et al., 2011; Sallis et al., 2000; Van der Horst et al., 2007). Limited research undertaken on the context of young people's physical activity indicates that discrete forms of participation in organised and non-organised physical activity have a unique set of associated predictors (Heitzler et al., 2006; Rosenkranz et al., 2011; Spink et al., 2006). Further disparities may also become apparent when type of activity underpinning organised physical activity is delineated, as participation in sport (team and individual format) and non-sport physical activity (e.g. dance) have often been considered simultaneously despite reflecting different physical activity behavioural forms. In accordance, Baranowski, Andersen, & Carmack (1998) proposed that a greater understanding of the factors underpinning physical activity could be attained by focusing on subgroups of individuals characterised by participation in different types of activity.

In addition to the underlying composition of physical activity, differences may also arise as a consequence of the associated level of moderate-to-vigorous physical activity (MVPA) performed. While it is imperative that factors underpinning recommended amounts of MVPA are uncovered, patterns of physical activity involvement characterised by lower intensity activity (e.g. walking) are more likely to be maintained across adolescence (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009), underscoring the significance of exploring potential differences across varied profiles of adolescents' physical activity participation. However, prior investigations of latent classes of physical activity and sedentary behaviour among youth have tended to focus solely on demographic

characteristics resulting in a limited understanding of modifiable factors underpinning involvement, which therefore require further consideration (Liu et al., 2010; Patnode et al., 2011).

Self-determination theory (Deci & Ryan, 1985a; 2000) has been widely adopted as a framework for understanding the psychological influences and motivational processes that impact adolescents' physical activity behaviour. Central to self-determination theory is the premise that qualitatively distinct reasons underpin physical activity, with motivations appearing to differ as a function of the type of activity performed. Intrinsic motives such as feelings of fun, interest and challenge inherent within the activity have frequently been cited as reasons underpinning participation in sport whilst more extrinsic motives representing enhanced appearance are associated with involvement in fitness activities (e.g. aerobics, weight-lifting) (Allender et al., 2006; Frederick & Ryan, 1997; Ryan et al., 1997). Introjected regulation however, reflecting controlling motives for behaviour in which individuals act to attain contingent self-worth or to reduce negative feelings (e.g. guilt, shame), has been inconsistently related to young people's sport and physical activity participation (Calvo et al., 2010; Gillison et al., 2009; Ryan et al., 2009). In contrast, amotivation, or a lack of motivation, has been identified as a barrier to physical activity among adolescents (Whitehead & Biddle, 2008).

Self-determination theory also posits that satisfaction of psychological needs for competence, relatedness and autonomy influence motivation and physical activity behaviour. Perceptions of competence have been widely researched with qualitative studies indicating that low levels of competence undermine adolescents' participation in physical activity. In contrast, athletically competent teenagers enjoy taking part in sport and physical activity as it provides a platform to demonstrate their abilities to others (Allison et al., 2005; Coleman et al., 2008; Dwyer et al., 2006). Spink et al. (2006) further revealed that perceived competence is of greater significance for organised than non-organised physical activity participation, which may be attributed to the fact that a certain level of skill is required to participate in sport whilst such abilities are not needed for more unstructured forms of activity (e.g. walking, jogging). In addition, greater levels of relatedness or feelings of social connection supported by high quality relationships with coach and teammates has been linked to adolescents' continued sport participation over time (Jõesaar & Hein, 2011; Reinbooth, Duda, & Ntoumanis, 2004; Sarrazin et al., 2002). Perceived autonomy or sense of volition over one's participation is also associated with persistence in individual and team sports, whereas lower levels underpin dropout and low activity (Bengochea & Streat, 2007; Jõesaar and Hein, 2011; Sarrazin et al., 2002).

In turn, self-determination theory proposes that autonomy supportive environments foster basic psychological needs and intrinsic motivation for physical activity. Accordingly, prior studies demonstrate that higher perceptions of autonomy support among adolescents underpins self-determined motivation and organised sport participation (Alvarez et al., 2009; Amorose & Anderson-Butcher,

2007; Jõesaar and Hein, 2011; Pelletier et al., 2011). Moreover, the hypothesised pathways outlined within self-determination theory between psychological and motivational constructs have previously been supported for adolescent cohorts that vary in gender and age (Standage et al., 2005). However, given that the majority of studies that have applied self-determination theory have typically focused on organised sport or overall levels of physical activity, it remains unclear whether psychological processes differentially underlie young people's involvement in organised non-sport physical activities (e.g. dance, fitness classes) or non-organised types of activity, such as walking or jogging. The present study will therefore compare adolescents' physical activity profile groups on a range of motivational characteristics.

Social-contextual variables are briefly addressed in self-determination theory with reference to autonomy support, which is usually provided by a coach or instructor. However, parents and peers have also been found to play a significant role in young people's physical activity (Gerfeson, Cheng, Mélo, & de Farias, 2014; Mendonça et al., 2014; Sallis & Patrick, 1994). Accordingly, parental support is consistently identified as a positive correlate of adolescent physical activity, with less active individuals reporting lower levels of support (Sallis et al., 1999, 2000). In addition, perceived support from mother and father for physical activity is also more strongly related to young people's participation in organised as compared to non-organised physical activity (Heitzler et al., 2006; Spink et al., 2006). Parental behaviours in the form of transportation to practices and moral support from the side line are key forms of support underpinning adolescent involvement in organised physical activity and sport (Davison & Jago, 2009; Duncan et al., 2005). In addition, gender may moderate the role of perceived parental support among adolescents as prior research indicates that fathers exert a greater influence over their son's physical activity behaviour whereas mothers impact daughter's participation more strongly (Edwardson et al., 2014; Kirby et al., 2011). Moreover, perceptions of parental support diminish across adolescence, with older adolescents reporting lower levels of parental support relative to their younger counterparts (Beets et al., 2006; Davison & Jago, 2009).

Parents can also serve as physical activity role models with increased perceptions of mother and father physical activity related to higher levels of sport and physical activity participation among adolescents (Cleland et al., 2005; Marques et al., 2014). In addition, parents can negatively influence young people's experience of physical activity by exerting pressure over participation and criticising performance (Amado et al., 2015; Anderson et al., 2003; Brustad, 1996; Fredericks & Eccles, 2004). Perceived levels of parental pressure may differ however as a consequence of the type of activity performed. Prior research indicates that participation in individual sports elicits greater pressure than team sport as successful performance is contingent on individual as opposed to collective performance (Bengoechea & Streat, 2007; Leff & Hoyle, 1995).

Peers also play a central role in young people's physical activity influencing youth participation through supportive and role modelling behaviours (Mendonça et al., 2014; Park & Kim, 2008; Raudsepp & Viira, 2000a; Van der horst, 2007). In particular, undertaking physical activity with friends has consistently been associated with higher levels of moderate and vigorous physical activity among adolescents (Duncan et al., 2005; Springer et al., 2006; Voorhees et al., 2005). Qualitative reports further indicate that teenagers want to conform to friends and subsequently approximate physical activity levels modelled by close peers (Coleman et al., 2008; Dwyer et al., 2006). In addition, empirical research suggests that peers take on a greater determining role during adolescence with perceived support and role modelling from friends exerting a greater influence over young people's physical activity participation than equivalent parent behaviours (Beets et al., 2006, 2007; Dunton et al., 2007; Edwardson et al., 2013).

The wider peer group can also impact participation in physical activity through feelings of acceptance or victimisation. Sport and physical activity contexts provide an opportunity for demonstrating competency, which has subsequently been linked to higher levels of peer acceptance among boys and girls (Chase & Drummer, 1992; Craft et al., 2003; Evans & Roberts, 1987). However, as sport is traditionally considered a masculine pursuit characterised by traits of aggression, competition and toughness, demonstrating athletic competence within this domain is of greater salience for male popularity (Chase & Drummer, 1992; Phoenix & Frosh, 2001). Negative interpersonal interactions in contrast, such as teasing directed at one's appearance or athletic ability, can deter participation in physical activity as young people are likely to avoid physical activity contexts that may incite such victimisation (Faith et al., 2002; Storch et al., 2007; Vu et al., 2006).

Adolescence also represents a decisive period in the development of body image owing to the many cognitive, social and physical changes accompanying this period of development (Ata et al., 2007; Hartup & Stevens, 1997). Individual characteristics of body mass and body image are therefore likely to have motivational implications for physical activity (Markland & Ingledew, 2007). Prior studies exploring differences across profiles of young people's physical activity and sedentary behaviour have found that girls and boys represented by active physical activity classes are less likely to be overweight than sedentary class members (Huh, Riggs, Spruijt-Metz, Chou, Huang et al., 2011; Patnode et al., 2011). In contrast, systematic reviews have evidenced mixed findings demonstrating inconsistent relationships or a lack of association between both objective and self-report measures of BMI and physical activity among adolescents (Sallis et al., 2000; Van der Horst et al., 2007). Thus, the relationship between BMI and physical activity appears to be a complex one which may be further influenced by the type of activity undertaken (Bengeoechea et al., 2010).

Body image is a multidimensional construct comprising perceptual components in addition to aesthetic dimensions pertaining to how the body looks and functional dimensions regarding what the body can



do. Qualitative findings indicate that decreased satisfaction with one's physical appearance undermines adolescent girls' physical activity participation (Chen, Fox, & Haase, 2010; Whitehead & Biddle, 2008). In contrast, sport participation is positively related to appearance and weight satisfaction among adolescent boys (Ferron et al., 1999). However, Morano et al. (2011) indicated that males that participated in individual sport were less satisfied with their body than team sport players possibly as this form of sport participation elicited more one-on-one comparisons than group activities, in which the group rather than the individual was the focus of social evaluation. In addition, Jaffe and Lutter (1995) found that female team sport participants had a more positive body image than those who engaged in non-sport physical activities. Abbott and Barber (2010) also revealed that teenage girls who participated in sport placed a greater value on the body's attractiveness and demonstrated higher behavioural investment to maintain appearance aspects than girls who did not engage in physical activity.

In relation to functional body image, previous research indicates that adolescent sport participants demonstrate higher levels of functional values, functional behavioural-investment and functional satisfaction than their non-sport physical activity, and sedentary counterparts. In turn, non-sport physical activity participants, such as those who attend the gym or engage in activities like jogging and walking reported a more favourable functional body image in comparison to those who did not participate in physical activity (Abbott & Barber, 2011). While any form of physical activity participation may foster emphasis on the functional qualities of the body, sport participation is associated with more positive evaluations regarding body function. Gender differences have also been evidenced in relation to functional and aesthetic body satisfaction with adolescent girls reporting lower levels of both aesthetic satisfaction and functional aspects of body image than boys (Abbott & Barber, 2010; Abbott et al., 2012). In addition, younger adolescents in comparison to older peers report increased satisfaction with the functionality of their bodies (Abbott et al., 2012).

In summary, psychosocial factors may differentially influence adolescents' physical activity patterns as a function of the type of activity undertaken and associated level of moderate-to-vigorous physical activity. Further differences may arise as a consequence of gender and age, although limited research has addressed this possibility among adolescents. This study will therefore attempt to address these gaps in the research by exploring differences across discrete profiles of young people's physical activity participation on a range of psychosocial factors and examining whether similar associations are evidenced among males and females, and younger and older adolescents.

### **5.2.1 Research aims and hypotheses**

The analysis sought to address the following research questions and hypotheses:

1. Do adolescents' physical activity profile groups differ on motivational indices?
  - It is hypothesised that adolescents characterised by active sport participation will report higher levels of self-determined motivation. In turn, adolescents represented by patterns of non-participation are expected to demonstrate higher levels of amotivation (Owen et al., 2014; Wang & Biddle, 2001; Whitehead & Biddle, 2008).
  - Based on prior research, active organised sport and physical activity participants are expected to demonstrate higher levels of enjoyment relative to adolescents classified as non-organised physical activity participants (Rosenkranz et al., 2011; Spink et al., 2006).
  - In addition, adolescents characterised by profiles of active participation in sport and organised physical activity are hypothesised to report higher perceptions of competence relative to those classified as non-organised physical activity participants and non-participants (Dwyer et al., 2006; Slater & Tiggemann, 2010; Spink et al., 2006; Reinbooth et al., 2004; Woods et al., 2010).
  - In line with self-determination theory, active organised sport participants are expected to demonstrate higher levels of competence, relatedness and autonomy than adolescents characterised by profiles of non-participation in physical activity (Jöesaar & Hein, 2011; Pelletier et al., 2011).
  - It is also hypothesised that active sport participants will demonstrate higher levels of autonomy support compared to less active adolescents (Alvarez et al., 2009; Amorose & Anderson-Butcher, 2007; Pelletier et al., 2001).
  - It is expected that the association between physical activity behavioural patterns and motivational indices will be consistent among male and female adolescents.
  - In addition, the association between physical activity behavioural patterns and motivational factors is hypothesised to be the same for younger and older adolescents.
  
2. Do classes of physical activity behaviour differ on parental influences?
  - Based on previous research, it was hypothesised that adolescents characterised by profiles of active organised sport and physical activity will demonstrate higher levels of parental support than non-organised physical activity participants and non-participants (Heitzler et al., 2006; Sallis et al., 1999; 2000; Spink et al., 2006).
  - Perceptions of support from father are expected to have a greater influence on adolescent boys' physical activity behaviour whereas perceived mother support is hypothesised to influence girls' physical activity more strongly (Edwardson et al., 2014; Kirby et al., 2011).
  - It is also hypothesised that parental support would have a greater effect on younger adolescents' physical activity patterns than older adolescents' patterns (Beets et al., 2006; Edwardson et al., 2013).

- In accordance with prior studies, it is expected that active sport and physical activity participants will perceive higher levels of mother and father role modelling (Cleland et al., 2005; Marques et al., 2014).
  - Adolescents characterised by active participation in individual sport are also hypothesised to report higher levels of parental pressure than active team sport participants (Bengoechea & Streat, 2007; Leff & Hoyle, 1995).
3. Do classes of physical activity behaviour differ on peer influences?
- It is hypothesised that adolescents characterised by profiles of active sport and physical activity participation will demonstrate higher levels of friend support and friend role modelling than less active peers (Duncan et al., 2005; Mendonça et al., 2014; Springer et al., 2006).
  - Active sport participants are expected to demonstrate higher levels of peer acceptance than non-participants (Craft et al., 2003; Evans & Roberts, 1987).
  - In addition, it is hypothesised that peer acceptance will be more strongly related to boys' physical activity behaviours than girls', as sport participation is consistent with common constructions of masculinity (Chase & Drummer, 1992; Phoenix & Frosh, 2011).
  - It is hypothesised that adolescents that do not engage in physical activity will report higher levels of teasing than all other physical activity participants (Faith et al., 2002; Vu et al., 2006).
4. Do classes of physical activity behaviour differ on body-related characteristics?
- It is hypothesised that non-physical activity participants will demonstrate higher levels of BMI compared to adolescents characterised by active participation in sport and physical activity (Huh et al., 2011; Patnode et al., 2011).
  - It is expected that adolescents that do not partake in physical activity will report higher levels of body dissatisfaction than active sport and physical activity participants (Biddle et al., 2011; Chen et al., 2010).
  - In addition, adolescents that engage in team sport are expected to demonstrate higher levels of body satisfaction compared to those characterised by profiles of other types of physical activity and sport participation (Jaffe & Lutter, 1995; Morano et al., 2011).
  - It is hypothesised that adolescents characterised by active sport participation will report higher levels of aesthetic values and aesthetic behaviour investment than non-participants (Abbott & Barber, 2011).
  - In terms of functional body image, profiles of adolescent participation in active organised sport is expected to be associated with higher levels of functional values, functional behaviour investment and functional satisfaction than those characterised by involvement

in organised non-sport physical activity, non-organised physical activity and non-participation (Abbott & Barber, 2011).

- In turn, it is hypothesised that adolescents characterised by organised or non-organised physical activity will evidenced higher levels of functional body image than non-participants (Abbott & Barber, 2011).

## **5.3 Method**

### **5.3.1 Participants**

A total of 995 adolescents ( $n = 609$  females, 386 males) ranging in age from 12 to 17 years took part in the research, as described in Section 4.3.1.

### **5.3.2 Procedure**

The procedure for data collection is outlined previously in Section 3.8. Data were analysed using SPSS version 21.

### **5.3.3. Measures**

Participants completed a survey package entitled *Participation in Sport and Physical Activity among Teenagers in Ireland*. This comprised the PAR-7DD which was analysed in Chapter 4, and measures of psychological constructs from self-determination theory, social factors and body image. All of the measures demonstrated acceptable reliability ( $\alpha \geq .70$ ). Height and weight was also assessed objectively to provide a measure of BMI that was based on gender and age-specific criterion. A full description of each of the measures used including motivation, competence, relatedness, autonomy, autonomy support, social support, role modelling, parental pressure, peer acceptance, teasing, body dissatisfaction, aesthetic and functional body image is provided in Chapter 3.

### **5.3.4. Analysis**

One-way Kruskal-Wallis tests were conducted to assess potential differences among adolescents' physical activity profiles on a range of psychosocial and individual factors. The non-parametric Kruskal-Wallis tests were selected as the data violated many of the assumptions of the parametric alternative method of analysis of variance (ANOVA). For example, the latent physical activity classes comprised unequal sample sizes, in some instances very small class sizes (e.g.  $n = 11$ ) were evidenced, and many of the variable scores were also non-normally distributed within classes (Field, 2013).

Given the earlier pattern of findings in Chapter 4 which revealed gender and age-specific profiles of physical activity participation, adolescents were not examined as an overall group. Instead one-way Kruskal-Wallis tests were performed separately for each adolescent cohort to facilitate examination of gender and age-specific patterns. The overall significance level was set at  $p < .01$  to compensate for any inflation of Type 1 error due to the multiple comparisons across groups. Pairwise

comparisons with adjusted  $p$ -values, to ensure the Type 1 error rate remained at 5%, followed up significant main effects to determine which physical activity profile groups differed from one another (Field, 2013). Significant differences in median scores offer additional support for the predictive validity of the latent physical activity classes, indicating that there are theoretically meaningful differences between classes. In turn, partial eta squared ( $\eta^2_p$ ) effect sizes were calculated to interpret the strength of the overall effect with values equal to or greater than .01, .06, and .14, representing small, medium, and large effect sizes, respectively.

#### **5.4 Results**

Descriptive statistics are presented for the psychosocial and individual variables in Table 5.1 for male, female, younger and older adolescent cohorts. Overall adolescents reported high levels of enjoyment, intrinsic motivation and identified regulation, and low levels of amotivation and external regulation. In addition, girls demonstrated low levels of competence whereas boys reported high perceptions of competence. Adolescents also evidenced relatively high levels of relatedness, autonomy and autonomy support, with males and younger adolescents reporting higher scores relative to their female and older counterparts. For social factors, low-to-medium levels of parent and friend support and role modelling of physical activity were shown across each adolescent group. In turn, pressure and teasing scores were relatively low whereas high levels of peer acceptance were reported. For body image, female and older adolescents demonstrated higher body dissatisfaction and lower aesthetic satisfaction than male and younger adolescents. Similar levels of aesthetic values and aesthetic behavioural investment were reported among each of the adolescent cohorts. Finally, functional values, functional behavioural investment and functional satisfaction scores were relatively high, with males demonstrating higher levels overall.

Table 5.1 *Descriptive statistics for each adolescent cohort on motivational, social and body-related characteristics*

Variable	Min - Max	Girls <i>Med (IQR)</i>	Boys <i>Med (IQR)</i>	Younger <i>Med (IQR)</i>	Older <i>Med (IQR)</i>
<i>Motivational</i>					
Enjoyment	7 – 35	33.00 (8.00)	34.00 (4.00)	33.00 (5.00)	33.00 (6.00)
Intrinsic Motivation	4 – 20	16.00 (7.00)	18.00 (5.00)	17.00 (6.00)	16.00 (7.00)
Identified regulation	4 – 20	15.20 (6.00)	16.00 (4.25)	16.00 (6.00)	16.00 (6.00)
Introjected regulation	3 – 15	7.00 (5.00)	7.00 (5.00)	7.00 (5.00)	7.00 (6.00)
External regulation	4 – 20	6.00 (4.00)	6.00 (5.00)	6.00 (3.65)	6.00 (4.00)
Amotivation	4 – 20	4.00 (2.00)	4.00 (2.00)	4.00 (2.00)	4.00 (2.00)
Competence	5 – 20	11.00 (5.00)	15.00 (6.00)	13.00 (6.00)	12.00 (6.00)
Relatedness	5 – 25	20.00 (7.25)	21.00 (7.00)	21.00 (7.00)	20.00 (8.00)
Autonomy	10 – 50	37.00 (13.00)	40.00 (11.00)	39.00 (11.00)	38 (13.00)
Autonomy Support	6 – 30	21.00 (7.00)	23.00 (8.00)	22.00 (7.00)	21.00 (9.00)
<i>Social</i>					
Mum Support	5 – 25	13.00 (4.42)	13.00 (8.00)	14.00 (6.00)	12.00 (6.00)
Dad Support	5 – 25	12.00 (5.15)	14.00 (8.00)	14.00 (9.00)	12.00 (9.00)
Mum PA Role Model	1 – 5	3.00 (2.00)	3.00 (2.00)	3.00 (2.00)	3.00 (2.00)
Dad PA Role Model	1 – 5	3.00 (2.00)	3.00 (2.00)	3.00 (3.00)	3.00 (2.00)
Parental Pressure	10 – 40	10.00 (5.00)	17.00 (7.00)	16.10 (8.0)	15.00 (6.00)
Friend Support	4 – 20	10.00 (5.00)	12.00 (5.25)	12.00 (5.00)	10.00 (5.00)
Friend PA Role Model	1 – 5	3.00 (0.0)	3.00 (1.00)	3.00 (1.00)	3.00 (1.00)
Peer Acceptance	5 – 20	15.00 (5.00)	16.00 (4.00)	16.00 (5.00)	15.50 (4.20)
Teasing	7 – 35	12.00 (6.00)	11.00 (5.00)	11.00 (5.00)	12.00 (6.00)
<i>Body-related</i>					
BMIc	-8.0 – 18.4	-2.20 (4.41)	-2.42(4.10)	-2.04 (4.66)	-2.48 (3.84)
Body Dissatisfaction	-5 – 6	1.00 (1.00)	0.00 (2.00)	0.00 (1.00)	1.00 (1.00)
Aesthetic Values	3 – 15	9.00 (5.00)	9.00 (4.00)	9.00 (4.00)	9.00 (5.00)
Aes. Behaviour Invest	2 – 10	7.00 (3.00)	6.00 (3.00)	7.00 (3.00)	7.00 (2.10)
Aesthetic Satisfaction	3 – 15	9.00 (6.00)	11.00 (4.00)	10.00 (5.00)	9.00 (5.00)
Functional Values	3 – 15	10.00 (4.00)	11.00 (3.72)	11.00 (4.00)	10.00 (3.00)
Func. Behaviour Invest	3 – 15	10.00 (4.00)	12.00 (4.00)	11.00 (4.00)	11.00 (5.00)
Functional Satisfaction	3 – 15	10.00 (5.00)	12.00 (5.05)	11.00 (5.00)	10.00 (5.00)

*Note.* PA = Physical Activity; BMIc = BMI corrected for age and gender; Aes Behaviour Invest = Aesthetic Behavioural Investment; Func Behaviour Invest = Functional Behavioural Investment.

#### 5.4.1 Comparison of female adolescents' physical activity patterns on psychosocial and individual characteristics

As described in Chapter 4, adolescent girls were represented by six discrete profiles of physical activity participation. These included active participation in team sport, active participation in individual sport, and less active patterns of engagement in organised dance and fitness, non-organised physical activity and a combination of individual sport and organised dance and fitness activities. In addition, a low active class reflecting non-participation in physical activity was evidenced. Descriptive statistics for the motivational, social and body related variables are presented for each of the female latent physical activity classes in Table 5.2.

##### *Motivational characteristics*

The results indicated that the latent physical activity classes significantly differed on enjoyment demonstrating a medium effect ( $H(5) = 66.19, p < .001, \eta_p^2 = .10$ ). Pairwise comparisons with adjusted  $p$ -values revealed that members of the *active team sport* class demonstrated significantly higher levels of enjoyment than those in the *organised dance & fitness* ( $p = .011$ ), *non-organised physical activity* ( $p < .001$ ), and *non-participation* ( $p < .001$ ) classes. In addition, adolescents in the *active individual sport* class reported a significantly higher median score on enjoyment in comparison to girls in the *non-participation class* ( $p < .001$ ).

In relation to self-determined motivation, significant differences were observed among the latent physical activity classes for intrinsic motivation ( $H(5) = 112.27, p < .001, \eta_p^2 = .18$ ) and identified regulation ( $H(5) = 112.50, p < .001, \eta_p^2 = .18$ ), with each of these motives evidencing a large effect size. Follow-up post hoc tests revealed that adolescent girls in the *active team sport* and *active individual sport* classes reported significantly higher levels of intrinsic motivation compared to members of *non-organised physical activity* ( $p < .001; p = .001$ ) and *non-participation* (both  $p < .001$ ) classes. In addition, individuals in the *active team sport* class reported a significantly higher median score on intrinsic motivation than those in the *organised dance & fitness* ( $p = .006$ ) class, who in turn scored significantly higher than girls in the *non-participation* ( $p = .001$ ) class. For identified regulation, pairwise comparisons with adjusted  $p$ -values indicated that members of the *active team sport* and *active individual sport* classes demonstrated significantly higher median scores in comparison to those in *organised dance & fitness* ( $p < .001; p = .002$ ), *non-organised physical activity* (both  $p < .001$ ) and *non-participation* (both  $p < .001$ ) classes.

Table 5.2 Cross-class comparisons of psychosocial variables across the five physical activity behavioural classes among female adolescents

Variable	Min - Max	Class 1 Organised Individual Sport & PA <i>n</i> = 16 Median (IQR)	Class 2 Active Individual Sport <i>n</i> = 58 Median (IQR)	Class 3 Organised Dance & Fitness <i>n</i> = 78 Median (IQR)	Class 4 Non-Organised PA <i>n</i> = 104 Median (IQR)	Class 5 Active Team Sport <i>n</i> = 140 Median (IQR)	Class 6 Non-Participation <i>n</i> = 213 Median (IQR)	<i>H</i>	<i>p</i>	$\eta^2_p$
<i>Motivational</i>										
Enjoyment	7 – 35	33.50 (3.5)	33.5 (4.0) <sup>a</sup>	33.00 (5.5) <sup>b</sup>	31.00 (8.0) <sup>c</sup>	34.00 (3.0) <sup>b, c, d</sup>	30.00 (11.00) <sup>a, d</sup>	66.19	<b>&lt;.001</b>	.10
Intrinsic Motivation	4 – 20	17.50 (6.0)	19.00 (4.3) <sup>a, b</sup>	16.00 (6.0) <sup>c, d</sup>	15.00 (5.8) <sup>a, e</sup>	19.00 (3.8) <sup>c, e, f</sup>	13.00 (7.0) <sup>b, d, f</sup>	112.27	<b>&lt;.001</b>	.18
Identified regulation	4 – 20	16.00 (4.8)	17.00 (3.3) <sup>a, b, c</sup>	15.00 (4.0) <sup>a, d</sup>	14.00 (4.2) <sup>b, e</sup>	17.00 (4.0) <sup>d, e, f</sup>	13.00 (7.0) <sup>c, f</sup>	112.5	<b>&lt;.001</b>	.18
Introjected regulation	3 – 15	6.00 (2.8)	8.00 (6.0) <sup>a</sup>	7.00 (5.0)	6.00 (5.0)	7.00 (4.0) <sup>b</sup>	6.00 (4.0) <sup>a, b</sup>	18.42	<b>.002</b>	.03
External regulation	4 – 20	5.00 (5.0)	6.5 (3.0)	6.00 (4.0)	6.00 (4.5)	6.00 (4.0)	6.00 (4.0)	3.31	.652	.01
Amotivation	4 – 20	4.00 (1.5)	4.00 (0.3) <sup>a</sup>	4.00 (2.0)	4.00 (3.0) <sup>b</sup>	4.00 (0.8) <sup>b, c</sup>	5.00 (5.0) <sup>a, c</sup>	37.68	<b>&lt;.001</b>	.06
Competence	5 – 20	12.00 (6.8)	13.5 (6.0) <sup>a, b, c</sup>	10.50 (5.0) <sup>a, d</sup>	10.00 (5.0) <sup>b, e</sup>	14.00 (5.0) <sup>d, e, f</sup>	10.00 (5.0) <sup>c, f</sup>	83.84	<b>&lt;.001</b>	.14
Relatedness	5 – 25	22.00 (7.0)	20.00 (8.0)	19.00 (6.0) <sup>a</sup>	19.00 (9.0) <sup>b</sup>	22.00 (6.0) <sup>a, b, c</sup>	18.00 (7.0) <sup>c</sup>	38.17	<b>&lt;.001</b>	.05
Autonomy	10 – 50	39.50 (11.3)	39.00 (11.0) <sup>a</sup>	36.00 (11.0)	36.50 (12.0) <sup>b</sup>	42.00 (9.0) <sup>b, c</sup>	32.00 (14.0) <sup>a, c</sup>	42.66	<b>&lt;.001</b>	.15
Autonomy Support	6 – 30	21.00 (7.6)	22.00 (8.0) <sup>a</sup>	22.00 (8.3)	20.5 (8.0) <sup>b</sup>	24.00 (6.8) <sup>b, c</sup>	20.00 (8.0) <sup>a, c</sup>	42.66	<b>&lt;.001</b>	.07
<i>Social variables</i>										
Mum Support	5 – 25	14.00 (5.8)	16.00 (5.0) <sup>a, b, c</sup>	12.00 (6.3) <sup>a, d</sup>	12.00 (6.0) <sup>b, e</sup>	16.00 (5.0) <sup>d, e, f</sup>	11.00 (6.0) <sup>c, f</sup>	112.03	<b>&lt;.001</b>	.18
Dad Support	5 – 25	9.00 (10.3) <sup>a</sup>	14.00 (9.3) <sup>b, c</sup>	10.00 (9.0) <sup>b, d</sup>	11.00 (8.0) <sup>e</sup>	16.00 (5.0) <sup>a, d, e, f</sup>	9.00 (8.0) <sup>c, f</sup>	93.87	<b>&lt;.001</b>	.16
Mum PA Role Model	1 – 5	3.00 (2.0)	3.00 (1.3)	3.00 (3.0)	3.00 (1.8)	3.00 (1.9) <sup>a</sup>	3.00 (2.0) <sup>a</sup>	18.97	<b>.002</b>	.03
Dad PA Role Model	1 – 5	1.00 (2.0) <sup>a</sup>	3.00 (3.0)	1.5 (2.0) <sup>b</sup>	3.00 (3.0)	3.00 (2.0) <sup>a, b, c</sup>	3.00 (2.0) <sup>c</sup>	22.45	<b>&lt;.001</b>	.04
Parental Pressure	10 – 40	14.00 (7.8)	19.00 (8.0) <sup>a, b, c</sup>	16.00 (6.0)	16.00 (6.8) <sup>b</sup>	15.00 (5.0) <sup>a</sup>	15.00 (6.0) <sup>c</sup>	19.66	<b>.001</b>	.03

Note. PA = Physical Activity; Org = Organised. Classes that significantly differed ( $p < .01$ ) on psychosocial variables have *p* values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.



Table 5.2 Cross-class comparisons of psychosocial variables across the five physical activity behavioural classes among female adolescents

Variable	Min - Max	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	<i>H</i>	<i>p</i>	$\eta^2_p$
		Organised Individual Sport & PA <i>n</i> = 16 <i>Median (IQR)</i>	Active Individual Sport <i>n</i> = 58 <i>Median (IQR)</i>	Organised Dance & Fitness <i>n</i> = 78 <i>Median (IQR)</i>	Non-Organised PA <i>n</i> = 104 <i>Median (IQR)</i>	Active Team Sport <i>n</i> = 140 <i>Median (IQR)</i>	Non-Participation <i>n</i> = 213 <i>Median (IQR)</i>			
<i>Social variables</i>										
Friend Support	4 – 20	12.5 (5.8) <sup>a</sup>	12.00 (5.0) <sup>b, c, d</sup>	10.65 (4.0) <sup>b, e, f</sup>	10.00 (4.8) <sup>c, g, h</sup>	12.00 (3.5) <sup>e, g, i</sup>	8.00 (4.8) <sup>a, d, f, h, i</sup>	137.04	<b>&lt;.001</b>	.23
Friend PA Role Model	1 – 5	3.00 (1.8)	3.00 (1.0) <sup>a</sup>	3.00 (0.0)	3.00 (0.0)	3.00 (1.0) <sup>b</sup>	3.00 (1.0) <sup>a, b</sup>	23.02	<b>&lt;.001</b>	.04
Peer Acceptance	5 – 20	12.5 (4.8) <sup>a</sup>	15.5 (5.0)	15.00 (4.0)	15.00 (6.0)	16.00 (4.8) <sup>a</sup>	15.32 (5.0)	16.22	<b>.006</b>	.03
Teasing	7 – 35	16.00 (9.5)	13.00 (5.4)	13.00 (7.0)	12.00 (6.8)	11.00 (6.0)	12.00 (6.0)	15.31	<b>.009</b>	.03
<i>Body Image</i>										
BMIc	-9.1 – 13.3	-0.82 (6.53)	-2.22 (4.27)	-2.14 (5.15)	-1.68 (4.89)	-2.31 (3.93)	-2.44 (3.86)	4.01	.548	.01
Body Dissatisfaction	-2 – 6	1.00 (1.9)	1.00 (1.0)	1.00 (2.0)	1.00 (2.0)	1.00 (1.0)	1.00 (1.0)	2.17	.825	<.01
Aesthetic Values	3 – 15	10.5 (5.6)	9.00 (5.0)	10.00 (6.0)	9.5 (6.0)	9.00 (5.0)	9.00 (4.0)	1.69	.890	<.01
Aes. Behaviour Inv.	2 – 10	7.00 (3.8)	7.00 (2.3)	7.00 (3.0)	7.00 (2.8)	7.00 (3.0)	7.00 (3.3)	3.04	.694	.01
Aesthetic Satisfaction	3 – 15	8.5 (4.8)	10.0 (4.3)	8.0 (5.3) <sup>a</sup>	9.0 (6.0)	10.0 (4.0) <sup>a</sup>	9.0 (6.0)	15.09	<b>.009</b>	.02
Functional Values	3 – 15	10.50 (3.0)	11.00 (4.0) <sup>a, b, c</sup>	9.00 (3.0) <sup>a, d</sup>	9.00 (4.0) <sup>b, e</sup>	11.00 (4.0) <sup>d, e, f</sup>	9.00 (3.0) <sup>c, f</sup>	43.61	<b>&lt;.001</b>	.08
Func. Behaviour	3 – 15	12.00 (5.8) <sup>a</sup>	12.00 (4.0) <sup>b, c, d</sup>	10.00 (3.0) <sup>b, e</sup>	10.00 (3.0) <sup>c, f, g</sup>	12.00 (4.0) <sup>e, f, h</sup>	8.00 (5.0) <sup>a, d, g, h</sup>	145.34	<b>&lt;.001</b>	.24
<i>Invest</i>										
Functional Satisfaction	3 – 15	10.5 (5.0)	12.0 (3.0) <sup>a, b, c</sup>	9.0 (4.3) <sup>a, d</sup>	9.0 (4.8) <sup>b, e</sup>	12.0 (4.0) <sup>d, e, f</sup>	8.0 (5.0) <sup>c, f</sup>	110.60	<b>&lt;.001</b>	.18

*Note.* PA = Physical Activity; BMIc = BMI corrected for age and gender; Aes Behaviour Invest = Aesthetic Behavioural Investment; Func Behaviour Invest = Functional Behavioural Investment. Classes that significantly differed ( $p < .01$ ) on psychosocial variables have *p* values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.

The physical activity profiles also significantly differed on introjected regulation, evidencing a small effect size ( $H(5) = 18.42, p = .002, \eta_p^2 = .03$ ). Post-hoc analyses revealed that adolescents in the *non-participation* class demonstrated significantly lower median introjected regulation scores than *active team sport* ( $p = .014$ ) and *active individual sport* ( $p = .005$ ) class members. However, no significant differences were evidenced among the latent physical activity groups for external regulation. In turn, a significant main effect was evidenced for amotivation among the physical activity profile groups, which was medium in strength ( $H(5) = 37.68, p < .001, \eta_p^2 = .06$ ). Follow-up adjusted pairwise comparisons revealed that *non-participation* group members as expected demonstrated higher levels of amotivation in comparison to the *active team sport* ( $p < .001$ ) and *active individual sport* ( $p = .002$ ) participants. In addition, adolescents within the *active team sport* ( $Mdn = 4.00, IQR = 0.75; M = 4.86, SD = 1.89$ ) class reported significantly lower ( $p = .007$ ) amotivation scores than those in the *non-organised physical activity* class ( $Mdn = 4.00, IQR = 3.00; M = 5.95, IQR = 3.00$ ).

One-way Kruskal-Wallis tests also yielded significant effects for psychological needs for competence ( $H(5) = 83.84, p < .001, \eta_p^2 = .14$ ), relatedness ( $H(5) = 38.17, p < .001, \eta_p^2 = .05$ ), and autonomy ( $H(5) = 42.66, p < .001, \eta_p^2 = .15$ ), with effect sizes ranging from 5% to 15% variance explained. Large effect sizes were evidenced for competence and autonomy, whilst relatedness demonstrated a small-to-moderate association. Post-hoc pairwise comparisons revealed that girls in the *active team sport* and *active individual sport* classes demonstrated significantly higher competence median scores in comparison to those in *organised dance & fitness* ( $p < .001; p = .018$ ), *non-organised physical activity* ( $p < .001; p = .002$ ) and *non-participation* (both  $p < .001$ ) classes suggesting that increased perceptions of competence underpin sport participation. For relatedness, follow-up adjusted pairwise comparisons indicated that *active team sport* members evidenced significantly higher levels than girls classified within the *organised dance & fitness* ( $p = .001$ ), *non-organised physical activity* ( $p = .002$ ) and *non-participation* ( $p < .001$ ) latent physical activity classes. A significant main effect was also evidenced for autonomy support ( $H(5) = 42.66, p < .001, \eta_p^2 = .07$ ), which demonstrated a medium sized effect.

In respect to perceived autonomy and autonomy support, post-hoc analyses revealed similar differences between the latent physical activity classes. Adolescents in the *non-participation* classes demonstrated significantly lower levels of autonomy and autonomy support in comparison to girls in the *active team sport* (both  $p < .001$ ) and *active individual sport* (both  $p = .009$ ) classes. In turn, members of the *active team sport* demonstrated significantly higher median scores on autonomy and autonomy support than individuals in the *non-organised physical activity* class ( $p < .001$ ).

### ***Social characteristics***

In terms of parental influence, significant differences were evidenced across the female physical activity participation profiles on perceived support from mother ( $H(5) = 112.03, p < .001, \eta_p^2 = .18$ ), and father ( $H(5) = 93.87, p < .001, \eta_p^2 = .16$ ), with both effects being large in size. Pairwise adjusted comparisons

showed that members of the *active team sport* and *active individual sport* classes both reported significantly higher levels of mother support compared to those in the *organised dance & fitness* (both  $p < .001$ ), *non-organised physical activity* (both  $p < .001$ ), and *non-participation* (both  $p < .001$ ) latent physical activity classes. For father support, adolescents characterised by a pattern of *active team sport* reported significantly higher median scores relative to girls in the *organised individual sport and physical activity* ( $p = .004$ ), *organised dance & fitness* ( $p < .001$ ), *non-organised physical activity* ( $p < .001$ ) and *non-participation* ( $p < .001$ ) latent physical activity classes. In addition, girls within the *active individual sport* class demonstrated significantly higher perceptions of father support for physical activity than their counterparts in the *organised dance & fitness* ( $p = .017$ ) and *non-participation* ( $p = .001$ ) groups.

Significant group differences also emerged across the physical activity profiles for role modelling of physical activity by mother ( $H(5) = 18.97, p = .002, \eta^2_p = .03$ ), and father ( $H(5) = 22.45, p < .001, \eta^2_p = .04$ ), with each demonstrating a small effect. Follow-up adjusted pairwise comparisons revealed that members of the *active team sport* ( $Mdn = 3.00, IQR = 1.94; M = 3.15, SD = 1.15$ ) demonstrated significantly ( $p = .002$ ) higher levels of maternal role modelling of physical activity than those in the *non-participation* ( $Mdn = 3.00, IQR = 2.00; M = 2.61, SD = 1.31$ ) groups. For father physical activity role modelling, girls classified as *active team sport* ( $Mdn = 3.00, IQR = 2.00; M = 2.91, SD = 1.37$ ) participants significantly differed from individuals in the *organised individual sport and physical activity* ( $p = .029, Mdn = 1.00, IQR = 2.00$ ), *organised dance & fitness* ( $p = .002, Mdn = 1.5, IQR = 1.32$ ), and *non-participation* ( $p = .045, Mdn = 3.00, IQR = 2.00; M = 2.47; SD = 1.34$ ) groups. Perceptions of parental pressure also differed significantly across the physical activity profile groups demonstrating a small sized effect ( $H(5) = 19.66, p = .001, \eta^2_p = .03$ ). Pairwise comparisons revealed that adolescents classified as members of the *active individual sport* class reported significantly higher median levels of parental pressure compared to adolescents in the *active team sport* ( $p = .004$ ), *non-organised physical activity* ( $p = .007$ ) and *non-participation* ( $p = .001$ ) latent classes.

In terms of peer influences, a significant main effect of friend support was found across the latent physical activity classes, which evidenced a large effect ( $H(5) = 137.04, p < .001, \eta^2_p = .23$ ). Follow-up pairwise comparisons revealed that members of the *non-participation* group reported significantly lower levels of support from friends for physical activity in comparison to individuals in all other groups: the *organised individual sport and physical activity* ( $p = .002$ ), *organised dance & fitness* ( $p = .001$ ), *active team sport* ( $p < .001$ ), *active individual sport* ( $p < .001$ ) and *non-organised physical activity* ( $p < .001$ ) groups. In turn, adolescents in both the *active team sport* and *active individual sport* classes reported greater perceptions of friend support relative to their counterparts in *organised dance & fitness* ( $p < .001; p = .023$ ) and *non-organised physical activity* ( $p < .001; p = .014$ ). The physical activity profile groups also significantly differed on frequency of friend physical activity role modelling

( $H(5) = 23.02, p < .001, \eta_p^2 = .04$ ), with follow-up comparisons indicating that girls characterised by patterns of *non-participation* ( $Mdn = 3.00, IQR = 1.00, M = 2.71, SD = 0.86$ ) demonstrated lower levels of friend role modelling of physical activity compared to the *active team sport* ( $p < .001, Mdn = 3.00, IQR = 1.00, M = 3.09, SD = 0.97$ ) and *active individual sport* ( $p = .018$ ) class members.

In addition, peer acceptance also differed significantly across the latent physical activity classes, demonstrating a small effect size ( $H(5) = 16.22, p = .006, \eta_p^2 = .03$ ). Adjusted pairwise comparisons revealed that adolescents in the *organised individual sport and physical activity* class demonstrated significantly lower levels of peer acceptance compared to those in the *active team sport* class ( $p = .021$ ). Finally, teasing in sport also demonstrated a significant main effect across the latent physical activity classes ( $H(5) = 15.31, p = .009, \eta_p^2 = .03$ ). However, follow-up pairwise comparisons revealed that none of the latent physical activity classes significantly differed from each other on median teasing scores.

### ***Body-related characteristics***

There was no significant differences ( $p > .01$ ) on BMIc or body dissatisfaction scores evidenced across the different female physical activity participation profiles. In terms of aesthetic body image, aesthetic satisfaction demonstrated a small significant overall effect ( $H(5) = 15.09, p = .009, \eta_p^2 = .02$ ). Follow-up adjusted pairwise comparisons revealed a marginally significant ( $p = .50$ ) difference between the *active team sport* and *organised dance & fitness* classes, with members of the latter group reporting a lower median score on aesthetic satisfaction. The latent physical activity classes did not differ however on aesthetic values and aesthetic behaviour investment ( $p > .01$ ).

For functional body image, the physical activity profile groups were found to significantly differ on functional values ( $H(5) = 43.61, p < .001, \eta_p^2 = .08$ ), functional behaviour investment ( $H(5) = 145.34, p < .001, \eta_p^2 = .24$ ), and functional satisfaction ( $H(5) = 110.60, p < .001, \eta_p^2 = .18$ ). A medium effect size was evidenced for functional values, whilst large effects were found for functional behaviour investment and functional satisfaction. Follow-up pairwise comparisons with adjusted  $p$ -values indicated that girls in the *active team sport* and *active individual sport* classes demonstrated significantly higher median scores on functional values than those in the *organised dance & fitness* ( $p = .003; p = .001$ ), *non-organised physical activity* ( $p = .006; p = .003$ ) and *non-participation* (both  $p < .001$ ) classes.

In relation to functional behaviour investment, follow-up pairwise comparisons demonstrated that adolescents in the *active team sport* and *active individual sport* classes demonstrated significantly higher median scores than those in the *organised dance & fitness* ( $p < .001; p = .001$ ), *non-organised physical activity* ( $p = .000; p = .038$ ) and *non-participation* ( $p < .001$ ) classes. In addition, members of the *non-participation* class reported significantly lower functional behavioural investment compared to girls within the *organised individual sport and physical activity* ( $p = .001$ ) and *non-organised physical*

*activity* ( $p < .001$ ) classes. In addition, in terms of functional satisfaction, post hoc analysis revealed that adolescents in the *active team sport* and *active individual sport* classes reported higher levels than those in the *organised dance & fitness* (both  $p < .001$ ), *non-organised physical activity* (both  $p < .001$ ) and *non-participation* (both  $p < .001$ ) classes.

#### **5.4.1.1 Summary of findings**

In summary, members of the *active team sport* and *active individual sport* classes significantly differed from those characterised by less active profiles of physical activity participation on a range of psychosocial characteristics including enjoyment, intrinsic motivation, identified regulation, introjected regulation, competence, autonomy, autonomy support, parental support, friend support, and functional aspect of body image, demonstrating higher scores on these variables. In turn, adolescents assigned to the *organised dance and fitness* class demonstrated higher levels of intrinsic motivation than non-participants. In addition, all of the physical activity participation profiles significantly differed from the non-participation group on friend support, with non-participants reporting lower scores. Furthermore, adolescents assigned to the *active team sport* profile reported higher levels of parental and friend role modelling and peer acceptance than girls characterised by less active profiles of participation. Parental pressure was the only characteristics on which active team and individual sport participants differed, with the latter group reporting higher levels of perceived pressure. Finally, there were no significant differences found across the female physical activity classes on external regulation, teasing, BMI, body dissatisfaction or aesthetic body image dimensions.

#### **5.4.2 Comparison of male adolescents' physical activity patterns on psychosocial and individual characteristics**

Descriptive statistics are presented in Table 5.3 for the motivational, social and body-related variables across each of the physical activity participation profiles among adolescent boys. Five latent physical activity classes were evidenced for males which reflected active participation in team sport, individual sport, organised fitness, non-organised physical activity undertaken in combination with team sport, and a pattern of non-participation.

##### ***Motivational characteristics***

The physical activity profile groups significantly differed on enjoyment demonstrating a large effect ( $H(5) = 41.72$ ,  $p < .001$ ,  $\eta^2_p = .14$ ). Follow-up comparisons revealed that members of the *non-participation* class reported significantly lower levels of enjoyment than those in the *active team sport* ( $p < .001$ ), and *active non-organised physical activity & team sport* ( $p < .001$ ) classes. In addition, adolescents in the *active non-organised physical activity & team sport* class demonstrated significantly higher median scores on enjoyment compared to boys in the *active individual sport* class ( $p = .006$ ).

Significant differences were also found among the physical activity profile groups for intrinsic motivation ( $H(5) = 93.87, p < .001, \eta^2_p = .24$ ), and identified regulation ( $H(5) = 71.93, p < .001, \eta^2_p = .18$ ), with large effect sizes evidenced. Pairwise comparisons with adjusted  $p$ -values indicated that the *active team sport* and *active non-organised physical activity & team sport* class members demonstrated significantly higher intrinsic motivation in comparison to individuals in the *active organised fitness* ( $p = .024, p = .007$ ), *active individual sport* ( $p = .001; p < .001$ ) and *non-participation* (both  $p < .001$ ) classes. In addition, adolescents in the *active individual sport* class reported higher median scores on intrinsic motivation than those in the *non-participation* class ( $p = .030$ ).

Table 5.3 Cross-class comparisons of psychosocial variables across the five physical activity profile classes among male adolescents

Variable	Min - Max	Class 1 Active Organised Fitness <i>n</i> = 11 Median (IQR)	Class 2 Active Individual Sport <i>n</i> = 68 Median (IQR)	Class 3 Non-Participation <i>n</i> = 89 Median (IQR)	Class 4 Active Non-Org. PA & Team Sport <i>n</i> = 97 Median (IQR)	Class 5 Active Team Sport <i>n</i> = 121 Median (IQR)	<i>H</i>	<i>p</i>	$\eta^2_p$
<i>Motivational</i>									
Enjoyment	7 – 35	32.00 (8.0)	33.00 (6.0) <sup>a</sup>	32.00 (10.5) <sup>b, c</sup>	35.00 (1.5) <sup>a, b</sup>	35.00 (3.0) <sup>c</sup>	41.72	<b>&lt;.001</b>	.14
Intrinsic Motivation	4 – 20	15.00 (4.0) <sup>a, b</sup>	16.00 (6.8) <sup>c, d, e</sup>	14.00 (5.5) <sup>c, f, g</sup>	19.70 (2.0) <sup>a, d, f</sup>	19.00 (3.0) <sup>b, e, g</sup>	93.87	<b>&lt;.001</b>	.24
Identified regulation	4 – 20	15.00 (4.0) <sup>a, b</sup>	15.50 (5.8) <sup>c, d</sup>	14.00 (5.9) <sup>e, f</sup>	17.00 (5.0) <sup>a, c, e</sup>	18.00 (3.0) <sup>b, d, f</sup>	71.93	<b>&lt;.001</b>	.18
Introjected regulation	3 – 15	6.00 (7.0)	6.00 (5.9)	5.00 (4.5)	7.00 (5.5)	7.00 (5.0)	13.15	.011	.03
External regulation	4 – 20	5.00 (3.0)	6.00 (5.0)	6.00 (5.0)	6.12 (6.0)	6.00 (4.0)	3.04	.551	.01
Amotivation	4 – 20	4.00 (4.0)	4.00 (2.0)	5.00 (4.0) <sup>a, b</sup>	4.00 (2.0) <sup>a</sup>	4.00 (1.0) <sup>b</sup>	19.95	<b>.001</b>	.04
Competence	5 – 20	12.00 (4.0) <sup>a, b</sup>	13.00 (5.8) <sup>c, d</sup>	11.00 (6.0) <sup>e, f</sup>	15.00 (4.0) <sup>a, c, e</sup>	16.18 (4.0) <sup>b, d, f</sup>	79.97	<b>&lt;.001</b>	.21
Relatedness	5 – 25	18.00 (5.0) <sup>a, b</sup>	20.00 (7.0) <sup>c, d</sup>	18.00 (6.0) <sup>e, f</sup>	23.00 (5.0) <sup>a, c, e</sup>	22.00 (6.0) <sup>b, d, f</sup>	51.64	<b>&lt;.001</b>	.11
Autonomy	10 – 50	36.00 (7.0)	39.00 (11.0) <sup>a, b</sup>	34.00 (14.5) <sup>c, d</sup>	42.00 (7.70) <sup>a, c</sup>	42.00 (8.0) <sup>b, d</sup>	45.53	<b>&lt;.001</b>	.13
Autonomy Support	6 – 30	23.00 (3.0)	22.00 (6.8) <sup>a, b</sup>	18.00 (8.5) <sup>c, d</sup>	24.00 (8.0) <sup>a, c</sup>	24.00 (6.0) <sup>b, d</sup>	57.92	<b>&lt;.001</b>	.15
<i>Social variables</i>									
Mum Support	5 – 25	11.00 (4.0)	13.00 (5.3)	10.00 (8.0) <sup>a, b</sup>	13.89 (6.0) <sup>a</sup>	15.00 (6.5) <sup>b</sup>	29.73	<b>&lt;.001</b>	.08
Dad Support	5 – 25	10.00 (7.4)	14.00 (7.8) <sup>a</sup>	9.00 (8.1) <sup>a, b, c</sup>	15.00 (7.5) <sup>b</sup>	15.00 (7.0) <sup>c</sup>	48.02	<b>&lt;.001</b>	.13
Mum PA Role Model	1 – 5	3.00 (1.5)	3.00 (1.0)	3.00 (2.0)	3.00 (2.0)	3.00 (2.0)	11.36	.023	.03
Dad PA Role Model	1 – 5	1.00 (2.0)	3.00 (3.0)	2.00 (2.0)	3.00 (2.0)	3.00 (2.0)	13.31	.010	.04
Parental Pressure	10 – 40	17.00 (6.0)	17.50 (6.8)	16.00 (7.0)	17.00 (7.5)	17.00 (7.0)	2.62	.623	<.01

Note. PA = Physical Activity; Org = Organised. Classes that significantly differed ( $p < .01$ ) on psychosocial variables have  $p$  values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.

Table 5.3 Cross-class comparisons of psychosocial variables across the five physical activity profile classes among male adolescents

Variable	Min - Max	Class 1	Class 2	Class 3	Class 4	Class 5	<i>H</i>	<i>p</i>	$\eta^2_p$
		Active Organised Fitness <i>n</i> = 11 <i>Median (IQR)</i>	Active Individual Sport <i>n</i> = 68 <i>Median (IQR)</i>	Non-Participation <i>n</i> = 89 <i>Median (IQR)</i>	Active Non-Org. PA & Team Sport <i>n</i> = 97 <i>Median (IQR)</i>	Active Team Sport <i>n</i> = 121 <i>Median (IQR)</i>			
<i>Social variables</i>									
Friend Support	4 – 20	12.00 (6.0)	10.00 (5.0) <sup>a, b</sup>	10.00 (6.0) <sup>c, d</sup>	14.00 (4.0) <sup>a, c</sup>	13.00 (4.0) <sup>b, d</sup>	61.44	<b>&lt;.001</b>	.16
Friend PA Role Model	1 – 5	4.00 (1.0)	3.00 (1.0)	3.00 (1.0) <sup>a, b</sup>	4.00 (1.0) <sup>a</sup>	4.00 (1.0) <sup>b</sup>	19.84	<b>.001</b>	.04
Peer Acceptance	5 – 20	16.00 (5.0)	15.00 (5.0)	14.00 (5.0) <sup>a, b</sup>	16.15 (4.7) <sup>a</sup>	16.00 (3.0) <sup>b</sup>	25.27	<b>&lt;.001</b>	.07
Teasing	7 – 35	12.00 (4.0)	11.50 (6.0)	12.00 (5.0) <sup>a, b</sup>	10.00 (5.0) <sup>a</sup>	10.00 (5.0) <sup>b</sup>	16.60	<b>.002</b>	.04
<i>Body Image</i>									
BMIc	-8.0 – 18.4	-3.79 (3.32)	-2.85 (4.67)	-2.39 (5.95)	-2.50 (4.12)	-2.26 (3.53)	3.53	.473	.01
Body Dissatisfaction	-5 – 4	-1.00 (1.0)	0.00 (2.0)	0.00 (2.5)	0.00 (2.0)	0.00 (2.0)	8.48	.076	.02
Aesthetic Values	3 – 15	8.00 (5.0)	8.00 (4.0)	8.00 (4.0)	9.00 (5.0)	9.00 (4.0)	4.11	.392	.01
Aes. Behaviour Invest	2 – 10	7.00 (4.0)	6.00 (4.0)	6.00 (3.0) <sup>a, b</sup>	7.00 (2.0) <sup>a</sup>	6.00 (3.0) <sup>b</sup>	18.94	<b>.001</b>	.05
Aesthetic Satisfaction	3 – 15	10.00 (4.0)	10.50 (3.0) <sup>a</sup>	10.00 (4.0) <sup>b, c</sup>	12.00 (5.0) <sup>b</sup>	12.00 (5.0) <sup>a, c</sup>	25.72	<b>&lt;.001</b>	.06
Functional Values	3 – 15	10.00 (3.0)	11.00 (3.8) <sup>a</sup>	10.00 (4.0) <sup>b, c</sup>	13.00 (3.0) <sup>a, b</sup>	12.00 (4.0) <sup>c</sup>	59.75	<b>&lt;.001</b>	.16
Func. Behaviour Invest	3 – 15	11.00 (1.0) <sup>a, b</sup>	11.00 (3.8) <sup>c, d</sup>	10.00 (5.0) <sup>e, f</sup>	13.00 (4.0) <sup>a, c, e</sup>	13.00 (3.2) <sup>b, d, f</sup>	75.89	<b>&lt;.001</b>	.20
Functional Satisfaction	3 – 15	10.00 (3.0) <sup>a</sup>	11.38 (5.0) <sup>b, c</sup>	9.00 (4.0) <sup>b, d, e</sup>	13.00 (4.0) <sup>d</sup>	13.00 (3.0) <sup>a, c, e</sup>	70.55	<b>&lt;.001</b>	.20

Note. PA = Physical Activity; Org = Organised; Aes Behaviour Invest = Aesthetic Behavioural Investment; Func Behaviour Invest = Functional Behavioural Investment.

Classes that significantly differed ( $p < .01$ ) on psychosocial variables have *p* values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.



In respect to identified regulation, adjusted pairwise comparisons revealed that male adolescents represented by the *active team sport* and *active non-organised physical activity & team sport* groups evidenced significantly higher scores compared to boys in the *active organised fitness* ( $p = .009$ ;  $p = .032$ ), *active individual sport* ( $p < .001$ ;  $p = .002$ ) and *non-participation* (both  $p < .001$ ) classes, as was the case for intrinsic motivation. In contrast to self-determined motivation, the physical activity profile groups did not significantly differ ( $p > .01$ ) on more controlling motives pertaining to introjected regulation and external regulation. Amotivation, in turn yielded a small significant effect among the latent physical activity classes ( $H(5) = 19.95$ ,  $p = .001$ ,  $\eta^2_p = .04$ ). As expected *non-participation* class members demonstrated significantly higher levels of amotivation in comparison to those in the *active team sport* ( $p < .001$ ) and *active non-organised physical activity & team sport* ( $p = .029$ ) classes.

The physical activity profile groups also significantly differed on perceptions of competence ( $H(5) = 79.97$ ,  $p < .001$ ,  $\eta^2_p = .21$ ), relatedness ( $H(5) = 51.64$ ,  $p < .001$ ,  $\eta^2_p = .11$ ), autonomy ( $H(5) = 45.53$ ,  $p < .001$ ,  $\eta^2_p = .13$ ), and autonomy support ( $H(5) = 57.92$ ,  $p < .001$ ,  $\eta^2_p = .15$ ). Competence evidenced a large effect size explaining 21% of the overall variance among physical activity profile groups. Follow-up pairwise comparisons revealed that adolescents in the *active team sport* class evidenced significantly higher competence scores compared to boys in the *active organised*, *active individual sport* and *non-participation* (all  $p < .001$ ) classes. In addition, *active non-organised physical activity & team sport* members also reported increased perceptions of competence relative to those in the *active organised fitness* ( $p = .026$ ), *active individual sport* ( $p = .016$ ) and *non-participation* ( $p < .001$ ) classes.

For relatedness, a medium effect size was evidenced. Post-hoc analysis indicated that males classified as *active team sport* and *active non-organised physical activity & team sport* participants demonstrated significantly higher relatedness scores in comparison to *active organised fitness* ( $p = .043$ ;  $p = .026$ ), *active individual sport* ( $p = .016$ ;  $p = .007$ ) and *non-participation* (both  $p < .001$ ) group members.

A medium-to-large effect was evidenced for autonomy. Follow-up pairwise comparisons revealed that members of the *active team sport* class significantly differed from those in *active individual sport* ( $p = .009$ ) and *non-participation* ( $p < .001$ ) classes, evidencing higher median levels of autonomy. In addition, boys in the *active non-organised physical activity & team sport* class reported higher autonomy scores relative to those characterised by *individual sport* ( $p = .007$ ) and *non-participation* ( $p < .001$ ) profiles of physical activity participation. In turn, autonomy support evidenced a large effect size. Post hoc analysis indicated a similar pattern of differences across physical activity profile groups for autonomy support, as was found for perceived autonomy. In accordance, *active team sport* and *active non-organised physical activity & team sport* class members demonstrated higher median scores on autonomy support than adolescent boys in the *active individual sport* ( $p = .003$ ;  $p = .017$ ) and *non-participation* (both  $p < .001$ ) groups.

### ***Social characteristics***

In relation to parental influences, the one-way Kruskal-Wallis tests also showed a significant main effect of perceived support for physical activity from mother ( $H(5) = 29.73, p < .001, \eta_p^2 = .08$ ), and father ( $H(5) = 48.02, p < .001, \eta_p^2 = .13$ ), across the physical activity profile groups. Perceived mother support had a medium effect whilst perceptions of father support explained more variance overall, demonstrating a moderate-to-large effect. Follow-up adjusted pairwise comparisons revealed that adolescents in the *active team sport* and *active non-organised physical activity & team sport* groups reported significantly higher levels of mother support than members of the *non-participation* group (both  $p < .001$ ). In relation to perceived father support for physical activity, the *non-participation* class members demonstrated significantly lower median score compared to individuals in the *active individual sport* ( $p = .044$ ), *active team sport* ( $p < .001$ ) and *active non-organised physical activity & team sport* ( $p < .001$ ) classes. There were no significant differences ( $p > .01$ ) evidenced among the physical activity profiles groups for maternal and paternal physical activity role modelling or parental pressure, however.

For peer influences, the physical activity profile groups significantly differed on friend support, demonstrating the largest effect size of all the social factors ( $H(5) = 61.44, p < .001, \eta_p^2 = .16$ ). Follow-up adjusted pairwise comparisons showed that *active team sport* and *active non-organised physical activity & team sport* class membership was associated with significantly higher levels of friend support than classification in *active individual sport* ( $p = .001; p < .001$ ) and *non-participation* classes (both  $p < .001$ ). In addition, significant differences were evidenced across the physical activity profile groups on friend physical activity role modelling ( $H(5) = 19.84, p = .001, \eta_p^2 = .04$ ) and peer acceptance ( $H(5) = 25.27, p < .001, \eta_p^2 = .07$ ). Evidencing a small effect, post hoc analysis revealed that adolescents in the *non-participation* class reported lower levels of friend physical activity role modelling of physical activity in comparison to *active team sport* ( $p < .001$ ) and *active non-organised physical activity & team sport* ( $p = .002$ ) class members. A medium sized effect was evidenced for peer acceptance. Follow-up pairwise comparisons revealed that *active team sport* and *active non-organised physical activity & team sport* participants evidenced significantly greater perceptions of peer acceptance as compared to members of the *non-participation* class (both  $p < .001$ ).

In turn, levels of teasing also significantly differed across the latent physical activity classes, evidencing a small effect size ( $H(5) = 16.60, p = .002, \eta_p^2 = .04$ ). Adjusted post-hoc comparisons indicated that *non-participation* class members evidenced higher levels of teasing in comparison to *active team sport* ( $p = .003$ ) and *active non-organised physical activity & team sport* ( $p = .041$ ) participants.

### ***Body-related characteristics***

There were no significant differences found between the latent physical activity classes on BMIc, body dissatisfaction or aesthetic values ( $p > .01$ ). A significant main effect of aesthetic behavioural

investment ( $H(5) = 18.94, p = .001, \eta^2 = .05$ ) and aesthetic satisfaction ( $H(5) = 25.72, p < .001, \eta^2 = .06$ ) was evidenced across the physical activity profile groups. The effect size of the relationship was small-to-medium for aesthetic behavioural investment. Follow-up pairwise comparisons revealed that boys who were assigned to the *non-participation* class ( $M = 5.71, SD = 1.85$ ) significantly differed from the *active team sport* ( $p = .044; M = 6.49, SD = 1.89$ ) and *active non-organised physical activity & team sport* ( $p < .001; M = 6.96, SD = 1.95$ ) class members, with the *non-participation* group demonstrating lower levels of aesthetic behavioural investment. For aesthetic satisfaction a medium sized effect was evidenced. Similarly, *non-participation* class members demonstrated lower median aesthetic satisfaction scores than those classified as *active team sport* ( $p < .001$ ) and *active non-organised physical activity & team sport* ( $p = .002$ ) participants. In addition, post-hoc analysis with adjusted  $p$ -values revealed that adolescents in the *active team sport* class evidenced higher satisfaction with one's body compared to individuals in the *active individual sport* ( $p = .040$ ) class.

In respect to functional body image, one-way Kruskal-Wallis tests yielded significant effects for functional values ( $H(5) = 59.75, p < .001, \eta^2_p = .16$ ), functional behaviour investment ( $H(5) = 75.89, p < .001, \eta^2_p = .20$ ), and functional satisfaction ( $H(5) = 70.55, p < .001, \eta^2_p = .20$ ). All of these effect sizes were large in magnitude explaining between 16% and 20% of the overall variance across physical activity profile groups. Adjusted pairwise comparisons revealed that adolescents in the *active non-organised physical activity & team sport* class demonstrated significantly higher levels of functional values compared to *active individual sport* ( $p < .001$ ) and *non-participation* ( $p < .001$ ) class members. In addition, boys characterised by participation in *active team sport* reported significantly higher functional values median score than those assigned to the *non-participation* ( $p < .001$ ) class.

For functional behavioural investment, members of the *active team sport* class demonstrated significantly higher levels in comparison to those in the *active organised fitness* ( $p = .020$ ), *active individual sport* ( $p < .001$ ) and *non-participation* ( $p < .001$ ) classes. In addition, the *active non-organised physical activity & team sport* class members also significantly differed from individuals in the *active organised fitness* ( $p = .030$ ), *active individual sport* ( $p = .001$ ) and *non-participation* ( $p < .001$ ) classes. In terms of functional satisfaction, members of the *non-participation* class reported significantly lower levels compared to adolescents in the *active individual sport* ( $p = .023$ ), *active team sport* ( $p < .001$ ) and *active non-organised physical activity & team sport* ( $p < .001$ ) classes. In addition, *active team sport* members evidenced higher satisfaction with one's functionality in comparison to the *active organised fitness* ( $p = .019$ ), and *active individual sport* ( $p = .001$ ) classes.

#### 5.4.2.1 Summary

In summary, members of the *active team sport* and *active non-organised physical activity & team sport* classes significantly differed from those characterised by other profiles of physical activity participation

on a range of psychosocial characteristics including enjoyment, intrinsic motivation, identified regulation, competence, relatedness, autonomy, autonomy support, aesthetic satisfaction, functional values, functional behaviour investment and functional satisfaction displaying more favourable outcomes. In addition, adolescents characterised by participation in team sport alone or in combination with non-organised physical activity could be further differentiated from non-participants demonstrating higher scores on parental support, friend support, friend physical activity role modelling, peer acceptance, aesthetic behavioural investment and lower levels of teasing and amotivation. In turn, there were also some differences found between male adolescents characterised by profiles of *active individual sport* and *non-participation*, with the former group reporting significantly higher levels of intrinsic motivation, father support and functional satisfaction. Finally, there were no significant differences found across the male physical activity classes on introjected regulation, external regulation, parental role modelling, parental pressure, BMIC, body dissatisfaction or aesthetic values.

#### **5.4.3 Comparison of younger adolescents' physical activity patterns on psychosocial and individual characteristics**

Descriptive statistics are presented for the motivational, social and body related variables in Table 5.4 for each of the younger latent physical activity classes. Five different physical activity participation profiles were identified among younger adolescents in Chapter 4. These included active patterns of participation in team sport, individual sport, non-organised physical activity undertaken alongside team sport, and involvement in a combination of organised physical activities and sports. An additional class represented younger adolescents that did not engage in physical activity.

##### ***Motivational characteristics***

The younger adolescent physical activity profile groups significantly differed on enjoyment with a medium size effect evidenced ( $H(5) = 39.35, p < .001, \eta_p^2 = .09$ ). Post hoc analyses indicated that adolescents in the *non-participation* class reported significantly lower scores on enjoyment in comparison to the other physical activity classes (for example, the *active organised physical activity & sports* ( $p < .001$ ), *active non-organised physical activity and team sport* ( $p < .001$ ), *active individual sport* ( $p = .001$ ), and *active team sport* ( $p = .004$ ) classes). In terms of self-determined motivation, a significant main effect of intrinsic motivation ( $H(5) = 90.11, p < .001, \eta^2 = .19$ ) and identified regulation ( $H(5) = 103.45, p < .001, \eta^2 = .22$ ) was evidenced across the physical activity profile groups, which reflected large effect sizes. Follow-up adjusted pairwise comparisons revealed that *non-participation* class members reported significantly lower levels of intrinsic motivation ( $p < .001$ ) and identified regulation ( $p < .001$ ) compared to individuals in all of the other latent physical activity classes.

For the less self-determined forms of motivation, a small significant main effect for introjected

regulation was found ( $H(5) = 17.21, p = .002, \eta^2_p = .04$ ), however the physical activity profile groups did not significantly differ on external regulation. Post hoc analyses revealed that younger adolescents in the *active organised physical activity & sports* class demonstrated higher levels of introjected regulation than those in the *active team sport* ( $p = .015$ ) and *non-participation* ( $p = .002$ ) classes. In addition, the physical activity profile groups significantly differed on amotivation, demonstrating a small-to-medium effect. As expected follow-up analyses indicated that individuals in the *non-participation* group evidenced higher scores on amotivation than members of the *active organised physical activity & sports* ( $p = .004$ ), *active individual sport* ( $p = .001$ ), and *active team sport* ( $p = .004$ ) classes.

One-way Kruskal-Wallis tests also revealed significant effects for competence ( $H(5) = 84.81, p < .001, \eta^2_p = .18$ ), relatedness ( $H(5) = 41.89, p < .001, \eta^2_p = .08$ ), autonomy ( $H(5) = 66.36, p < .001, \eta^2_p = .15$ ) and autonomy support ( $H(5) = 32.75, p < .001, \eta^2_p = .08$ ). Large effect sizes were evidenced for perceived competence and autonomy whilst relatedness and autonomy support demonstrated medium effects. Pairwise comparisons with adjusted  $p$  values revealed that adolescent characterised by participation in the *active organised physical activity & sports* ( $p < .001$ ), *active non-organised physical activity and team sport* ( $p = .001$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .004$ ) classes reported significantly higher competence scores than those classified as *non-participants*. For relatedness, similar differences between groups were evidenced with the *non-participation* class members evidencing significantly lower levels compared to *active organised physical activity & sports* ( $p < .001$ ), *active non-organised physical activity and team sport* ( $p < .001$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .015$ ) participants. In relation to autonomy, post-hoc analysis revealed that membership in the *non-participation* group was associated with significantly lower median scores relative to participation in all of the other physical activity profile groups ( $p < .001$ ). Finally in terms of autonomy support, adjusted pairwise comparisons revealed that *non-participation* group members reported significantly lower median scores than those in the *active organised physical activity & sports* ( $p < .001$ ), *active non-organised physical activity and team sport* ( $p = .022$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .014$ ) classes.

Table 5.4 Cross-class comparisons of psychosocial variables across the five physical activity profile classes among younger adolescents

Variable	Min - Max	Class 1 Active Organised PA & Sport <i>n</i> = 58 Median (IQR)	Class 2 Active Non-Org. PA & Team Sport <i>n</i> = 64 Median (IQR)	Class 3 Active Individual Sport <i>n</i> = 90 Median (IQR)	Class 4 Active Team Sport <i>n</i> = 99 Median (IQR)	Class 5 Non-Participation <i>n</i> = 157 Median (IQR)	<i>H</i>	<i>p</i>	$\eta^2_p$
<i>Motivational</i>									
Enjoyment	7 – 35	35.00 (3.0) <sup>a</sup>	34.00 (3.0) <sup>b</sup>	34.00 (3.0) <sup>c</sup>	33.00 (4.0) <sup>d</sup>	32.00 (9.0) <sup>a, b, c, d</sup>	39.35	<b>&lt;.001</b>	.09
Intrinsic Motivation	4 – 20	18.50 (4.0) <sup>a</sup>	18.00 (4.8) <sup>b</sup>	19.00 (4.0) <sup>c</sup>	19.00 (6.0) <sup>d</sup>	14.00 (6.0) <sup>a, b, c, d</sup>	90.11	<b>&lt;.001</b>	.19
Identified regulation	4 – 20	16.50 (4.0) <sup>a</sup>	16.00 (5.0) <sup>b</sup>	18.00 (4.0) <sup>c</sup>	16.00 (5.0) <sup>d</sup>	13.00 (6.0) <sup>a, b, c, d</sup>	103.45	<b>&lt;.001</b>	.22
Introjected regulation	3 – 15	7.50 (6.0) <sup>a, b</sup>	7.00 (5.5)	7.00 (5.0)	6.00 (4.0) <sup>a</sup>	6.00 (4.0) <sup>b</sup>	17.21	<b>.002</b>	.04
External regulation	4 – 20	6.50 (4.3)	7.00 (4.8)	6.00 (4.0)	6.00 (5.0)	6.00 (4.0)	6.54	.162	.02
Amotivation	4 – 20	4.00 (1.0) <sup>a</sup>	4.00 (2.8)	4.00 (1.0) <sup>c</sup>	4.00 (2.0) <sup>c</sup>	5.00 (4.0) <sup>a, b, c</sup>	26.28	<b>&lt;.001</b>	.05
Competence	5 – 20	15.00 (6.0) <sup>a</sup>	13.00 (5.5) <sup>b</sup>	15.00 (5.0) <sup>c</sup>	14.00 (5.0) <sup>d</sup>	10.00 (5.0) <sup>a, b, c, d</sup>	84.81	<b>&lt;.001</b>	.18
Relatedness	5 – 25	23.00 (5.0) <sup>a</sup>	22.00 (5.0) <sup>b</sup>	23.00 (6.0) <sup>c</sup>	21.00 (7.0) <sup>d</sup>	19.00 (6.7) <sup>a, b, c, d</sup>	41.89	<b>&lt;.001</b>	.08
Autonomy	10 – 50	41.00 (8.4) <sup>a</sup>	40.00 (9.25) <sup>b</sup>	40.00 (10.5) <sup>c</sup>	40.00 (10.0) <sup>d</sup>	34.00 (12.0) <sup>a, b, c, d</sup>	66.36	<b>&lt;.001</b>	.15
Autonomy Support	6 – 30	24.00 (6.2) <sup>a</sup>	23.00 (5.8) <sup>b</sup>	23.00 (7.3) <sup>c</sup>	22.00 (8.0) <sup>d</sup>	20.00 (7.0) <sup>a, b, c, d</sup>	32.75	<b>&lt;.001</b>	.08
<i>Social variables</i>									
Mum Support	5 – 25	17.00 (6.0) <sup>a, b, c</sup>	14.05 (4.0) <sup>a</sup>	15.41 (6.0) <sup>d</sup>	15.00 (8.0) <sup>b, e</sup>	13.00 (6.0) <sup>c, d, e</sup>	45.90	<b>&lt;.001</b>	.09
Dad Support	5 – 25	16.00 (8.0) <sup>a</sup>	15.00 (8.3) <sup>b</sup>	15.00 (6.0) <sup>c</sup>	14.00 (8.0) <sup>d</sup>	11.00 (8.5) <sup>a, b, c, d</sup>	45.08	<b>&lt;.001</b>	.10
Mum PA Role Model	1 – 5	3.00 (1.0)	3.00 (2.0)	3.00 (0.5)	3.00 (1.0)	3.00 (2.0)	10.17	.038	.02
Dad PA Role Model	1 – 5	3.00 (3.0)	3.00 (2.8)	3.00 (2.0)	3.00 (2.0)	3.00 (2.0)	10.76	.029	.02
Parental Pressure	10 – 40	17.00 (8.0)	17.00 (6.8)	18.00 (9.5)	16.10 (9.0)	16.00 (6.2)	8.66	.070	.02

Note. PA = Physical Activity; Org = Organised. Classes that significantly differed ( $p < .01$ ) on psychosocial variables have  $p$  values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.

Table 5.4 Cross-class comparisons of psychosocial variables across the five physical activity profile classes among younger adolescents

Variable	Min - Max	Class 1 Active Organised PA & Sport <i>n</i> = 58 <i>Median (IQR)</i>	Class 2 Active Non-Org. PA & Team Sport <i>n</i> = 64 <i>Median (IQR)</i>	Class 3 Active Individual Sport <i>n</i> = 90 <i>Median (IQR)</i>	Class 4 Active Team Sport <i>n</i> = 99 <i>Median (IQR)</i>	Class 5 Non-Participation <i>n</i> = 157 <i>Median (IQR)</i>	<i>H</i>	<i>p</i>	$\eta^2_p$
<i>Social variables</i>									
Friend Support	4 – 20	13.50 (3.3) <sup>a</sup>	13.00 (4.0) <sup>b</sup>	12.00 (4.0) <sup>c</sup>	12.00 (4.0) <sup>d</sup>	9.00 (5.0) <sup>a, b, c, d</sup>	86.82	<b>&lt;.001</b>	.18
Friend PA Role Model	1 – 5	3.00 (1.0) <sup>a</sup>	3.00 (1.0) <sup>b</sup>	4.00 (1.0) <sup>c</sup>	3.00 (1.0) <sup>d</sup>	3.00 (1.0) <sup>a, b, c, d</sup>	50.34	<b>&lt;.001</b>	.10
Peer Acceptance	5 – 20	17.00 (4.0) <sup>a</sup>	15.34 (5.0) <sup>b</sup>	17.00 (4.0) <sup>b, c</sup>	16.00 (4.0) <sup>d</sup>	14.15 (6.0) <sup>a, c, d</sup>	30.76	<b>&lt;.001</b>	.07
Teasing	7 – 35	11.00 (6.0)	12.00 (4.8)	10.00 (4.0)	11.00 (6.0)	12.00 (6.0)	7.43	.115	.02
<i>Body Image</i>									
BMIc	-8.5 – 18.4	-2.24 (4.5)	-1.69 (4.9)	-2.60 (3.7)	-2.15 (4.6)	-1.82 (5.4)	5.62	.229	.01
Body Dissatisfaction	-5 – 5	0.75 (1.0)	0.00 (1.9)	0.00 (1.0)	0.00 (1.0)	1.00 (1.0)	3.03	.552	.01
Aesthetic Values	3 – 15	9.85 (4.3)	9.00 (4.8)	9.00 (4.3)	8.00 (4.8)	9.00 (4.0)	7.89	.096	.02
Aes. Behaviour Invest	2 – 10	8.00 (3.0) <sup>a</sup>	7.00 (3.0)	7.00 (3.0)	7.00 (4.0)	6.00 (3.5) <sup>a</sup>	11.47	.022	.03
Aesthetic Satisfaction	3 – 15	10.50 (4.3)	11.00 (3.0)	11.00 (5.0) <sup>a</sup>	10.00 (5.0)	9.00 (6.0) <sup>a</sup>	18.94	<b>.001</b>	.05
Functional Values	3 – 15	11.00 (3.9) <sup>a</sup>	12.00 (3.0) <sup>b, c</sup>	12.00 (4.0) <sup>d</sup>	11.00 (4.0) <sup>c, e</sup>	9.00 (3.0) <sup>a, b, d, e</sup>	62.15	<b>&lt;.001</b>	.14
Func. Behaviour Invest	3 – 15	12.00 (4.3) <sup>a</sup>	12.00 (3.5) <sup>b</sup>	13.00 (4.0) <sup>c, d</sup>	11.00 (5.0) <sup>c, e</sup>	9.00 (4.0) <sup>a, b, d, e</sup>	115.25	<b>&lt;.001</b>	.25
Functional Satisfaction	3 – 15	12.00 (5.0) <sup>a</sup>	12.00 (5.0) <sup>b</sup>	13.00 (4.0) <sup>c</sup>	12.00 (6.0) <sup>d</sup>	9.00 (4.0) <sup>a, b, c, d</sup>	74.27	<b>&lt;.001</b>	.17

*Note.* PA = Physical Activity; Org = Organised; BMIc = BMI corrected for age and gender; Func Behaviour Invest = Functional Behavioural Investment; Aes Behaviour Invest = Aesthetic Behavioural Investment Classes that significantly differed ( $p < .01$ ) on psychosocial variables have *p* values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.

### ***Social characteristics***

In relation to parental influences, a significant main effect of perceived support from mother ( $H(5) = 45.90, p < .001, \eta^2_p = .09$ ) and father ( $H(5) = 45.08, p < .001, \eta^2_p = .10$ ) was evidenced across the physical activity profile groups, which showed a medium size effect. Follow-up pairwise comparisons indicated that members of the *active organised physical activity & sports* class reported higher levels of maternal support for physical activity than individuals in the *active non-organised physical activity and team sport* ( $p = .019$ ), *active team sport* ( $p = .004$ ) and *non-participation* ( $p < .001$ ) classes. In addition, adolescents in the *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .034$ ) classes demonstrated increased perceptions of mother support relative to *non-participants*. For father support, *non-participation* class members reported significantly lower median scores in comparison to all other groups: *active organised physical activity & sports* ( $p < .001$ ), *active non-organised physical activity and team sport* ( $p = .001$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .008$ ) participants. In contrast, maternal and paternal physical activity role modelling behaviours and parental pressure were not found to significantly differ ( $p > .01$ ) across the younger adolescents' physical activity participation profiles.

For peer influences, perceptions of friend support for physical activity significantly differed among the physical activity profile groups demonstrating a large effect size ( $H(5) = 86.82, p < .001, \eta^2_p = .18$ ). Post-hoc comparisons indicated that members of the *non-participation* group evidenced significantly lower levels ( $p < .001$ ) of support from friends compared to younger adolescents in each of the other physical activity profile groups. The physical activity profile groups also differed significantly on friend physical activity role modelling ( $H(5) = 50.34, p < .001, \eta^2_p = .10$ ) and peer acceptance ( $H(5) = 30.76, p < .001, \eta^2_p = .07$ ). The effect sizes of these relationships were moderate in size. Pairwise comparisons with adjusted p-values indicated that adolescents in the *active organised physical activity & sports* ( $p = .002$ ), *active non-organised physical activity and team sport* ( $p = .003$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p < .001$ ) classes demonstrated significantly higher levels of friend physical activity role modelling behaviour than those classified as *non-participants*. For peer acceptance, members of the *non-participation* class reported significantly lower perceptions of acceptance from peers compared to youth in the *active organised physical activity & sports* ( $p = .001$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .043$ ) classes. In turn, adolescents assigned to the *active individual sport* class reported significantly higher levels of peer acceptance than *active non-organised physical activity and team sport* members ( $p = .042$ ). Finally, in relation to negative interactions, teasing experiences did not significantly differ among the latent physical activity classes ( $p > .01$ ).



### ***Body-related characteristics***

The physical activity profile groups did not significantly differ on BMIc, body dissatisfaction scores, aesthetic values or aesthetic behavioural investment ( $p > .01$ ). A significant main effect was found for aesthetic satisfaction ( $H(5) = 18.94, p < .001, \eta^2 = .05$ ). Demonstrating a small-to-medium size effect, follow-up pairwise comparisons revealed that *active individual sport* class members were more satisfied with the appearance of their body than those characterised as *non-participants* ( $p = .001$ ).

In respect to functional body image, the physical activity profile groups evidenced significant differences on functional values ( $H(5) = 62.15, p < .001, \eta_p^2 = .14$ ), functional behaviour investment ( $H(5) = 115.25, p < .001, \eta_p^2 = .25$ ) and functional satisfaction ( $H(5) = 74.27, p < .001, \eta_p^2 = .17$ ), with these associations demonstrating large effect sizes. Follow-up pairwise comparisons indicated that adolescents in the *non-participation* class reported significantly lower functional value scores compared to those in all other groups: the *active organised physical activity & sports* ( $p = .001$ ), *active non-organised physical activity and team sport* ( $p < .001$ ), *active individual sport* ( $p < .001$ ), and *active team sport* ( $p = .002$ ) classes. In addition, *active non-organised physical activity and team sport* class members demonstrated higher functional values than *active team sport* ( $p = .049$ ) adolescents. A similar pattern of differences was evidenced among the physical activity profile groups for functional behaviour investment and functional satisfaction. In accordance, post hoc analyses revealed that youth characterised by a pattern of *non-participation* reported significantly ( $p < .001$ ) lower levels of both functional behaviour investment and functional satisfaction relative to adolescents in all of the other physical activity profile groups. Members of the *active individual sport* and *active team sport classes* also differed significantly on functional behavioural investment ( $p = .035$ ) with the former group evidencing significantly higher scores.

#### ***5.4.3.1 Summary***

In summary, the results indicate that members of the *non-participation* class demonstrated significantly poorer outcomes in comparison to the other physical activity profiles reporting lower levels of enjoyment, intrinsic motivation, identified regulation, competence, relatedness, autonomy, autonomy support, parental support, friend support, friend physical activity role modelling, peer acceptance, aesthetic behavioural investment, functional values, functional behavioural investment, and functional satisfaction as well as higher amotivation scores. In addition, the *active individual sport* and *non-participation* members differed on aesthetic satisfaction with the latter group displaying poorer scores. Although the other physical activity classes for the most part did not differ from each other there were some exceptions. The *active organised physical activity and sport* class reported higher levels of introjected regulation and mother support than those characterised by participation in *active team sport* and *active non-organised physical activity and team sport*. Furthermore, members of the *active*

*individual sport* class evidenced higher scores on functional behavioural investment than *active team sport* participants. Finally, there were no significant differences found across the younger physical activity classes on external regulation, parental physical activity role modelling, parental pressure, teasing, BMIc, body dissatisfaction, aesthetic values and aesthetic behavioural investment.

#### **5.4.4 Comparison of older adolescents' physical activity patterns on psychosocial and individual characteristics**

Descriptive statistics are presented in Table 5.5 for the motivational, social and body-related variables across each of the older adolescent physical activity participation profiles. As previously identified in Chapter 4, older adolescents were characterised by six distinct patterns of physical activity which included active participation in team sport, a combination of team and individual sports, and non-organised physical activity. In addition to a non-participation class, two additional profiles of physical activity participation were identified which reflected less active patterns of engagement in individual sport, and organised dance and fitness activities.

##### ***Motivational characteristics***

The physical activity profile groups significantly differed on enjoyment, demonstrating a large effect size ( $H(5) = 68.93, p < .001, \eta_p^2 = .14$ ). Follow-up pairwise comparisons revealed that members of the *active team sport* group reported higher levels of enjoyment than those classified within the *individual sport* ( $p < .001$ ), *organised dance & fitness* ( $p = .004$ ), and *non-participation* physical activity ( $p < .001$ ) groups. In addition, adolescents in the *active mixed sports* ( $p = .001$ ), and *active non-organised physical activity* ( $p < .001$ ) classes demonstrated higher enjoyment scores relative to their counterparts in the *non-participation* class.

One-way Kruskal-Wallis tests also yielded significant large effects for intrinsic motivation ( $H(5) = 128.16, p < .001, \eta_p^2 = .23$ ) and identified regulation ( $H(5) = 116.84, p < .001, \eta_p^2 = .21$ ), and smaller effects for introjected regulation ( $H(5) = 15.44, p = .009, \eta_p^2 = .03$ ), and amotivation ( $H(5) = 33.93, p < .001, \eta_p^2 = .05$ ), however external regulation was not found to significantly differ across the older adolescents' physical activity profile groups ( $p > .01$ ). Post hoc analyses indicated that *non-participation* group members reported significantly lower levels of intrinsic motivation in comparison to all other groups: *individual sport* ( $p = .010$ ), *active mixed sports* ( $p < .001$ ), *active non-organised physical activity* ( $p < .001$ ) *organised dance & fitness* ( $p < .001$ ), and *active team sport* ( $p < .010$ ) participants. In addition, members of the *active team sport* class evidenced significantly higher median intrinsic motivation scores than older adolescents characterised by participation in *individual sport* ( $p = .005$ ), and *organised dance & fitness* ( $p = .002$ ).

Table 5.5 Cross-class comparisons of psychosocial variables across the five physical activity behavioural classes among older adolescents

Variable	Min - Max	Class 1 Individual Sport <i>n</i> = 43 Median (IQR)	Class 2 Active Mixed Sports <i>n</i> = 42 Median (IQR)	Class 3 Active Non- Organised PA <i>n</i> = 58 Median (IQR)	Class 4 Organised Dance & Fitness <i>n</i> = 74 Median (IQR)	Class 5 Active Team Sport <i>n</i> = 116 Median (IQR)	Class 6 Non-Participation <i>n</i> = 193 Median (IQR)	<i>H</i>	<i>p</i>	$\eta^2_p$
<i>Motivational</i>										
Enjoyment	7 – 35	32.00 (9.0) <sup>a</sup>	33.5 (3.3) <sup>b</sup>	34.00 (6.0) <sup>c</sup>	33.0 (6.0) <sup>d</sup>	34.5 (3.0) <sup>a, d, e</sup>	30.0 (12.0) <sup>b, c, e</sup>	68.93	<b>&lt;.001</b>	.14
Intrinsic Motivation	4 – 20	15.0 (7.0) <sup>a, b</sup>	19.0 (4.0) <sup>c</sup>	18.0 (5.0) <sup>d</sup>	17.0 (7.0) <sup>e, f</sup>	19.0 (3.0) <sup>a, e, g</sup>	13.0 (6.0) <sup>b, c, d, f, g</sup>	128.16	<b>&lt;.001</b>	.23
Identified regulation	4 – 20	16.0 (7.0) <sup>a, b</sup>	17.5 (3.0) <sup>a, c, d</sup>	16.0 (5.3) <sup>e, f</sup>	15.0 (4.3) <sup>c, g</sup>	18.0 (4.0) <sup>b, e, g, h</sup>	13.0 (6.0) <sup>d, f, h</sup>	116.84	<b>&lt;.001</b>	.21
Introjected regulation	3 – 15	7.0 (5.0)	7.0 (5.3)	7.0 (6.0)	7.0 (4.3)	7.0 (5.0)	6.0 (4.0)	15.44	<b>.009</b>	.03
External regulation	4 – 20	6.0 (4.0)	6.0 (5.0)	6.0 (5.0)	5.0 (4.0)	5.0 (4.0)	6.0 (4.0)	2.55	.769	.01
Amotivation	4 – 20	4.0 (3.0)	4.0 (1.0) <sup>a</sup>	4.0 (2.3)	4.0 (2.0)	4.0 (0.0) <sup>b</sup>	5.0 (4.0) <sup>a, b</sup>	33.93	<b>&lt;.001</b>	.05
Competence	5 – 20	12.0 (6.0) <sup>a, b</sup>	15.00 (4.3) <sup>a, c, d</sup>	13.00 (6.3) <sup>e, f</sup>	11.00 (5.0) <sup>c, e, g</sup>	15.00 (4.0) <sup>b, g, h</sup>	10.00 (4.0) <sup>d, f, h</sup>	131.59	<b>&lt;.001</b>	.25
Relatedness	5 – 25	18.00 (8.0) <sup>a</sup>	21.50 (9.0) <sup>b</sup>	20.00 (6.0) <sup>c</sup>	20.00 (8.0)	21.00 (6.0) <sup>a, d</sup>	17.00 (6.0) <sup>b, c, d</sup>	37.95	<b>&lt;.001</b>	.07
Autonomy	10 – 50	36.00 (13.0) <sup>a</sup>	41.00 (10.2) <sup>b</sup>	39.00 (11.3) <sup>c</sup>	37.00 (8.00) <sup>d</sup>	42.00 (8.0) <sup>a, e</sup>	33.00 (16.0) <sup>b, c, d, e</sup>	73.28	<b>&lt;.001</b>	.15
Autonomy Support	6 – 30	21.00 (8.1)	23.00 (7.0) <sup>a</sup>	22.50 (7.0) <sup>b</sup>	22.00 (8.3) <sup>c</sup>	25.00 (6.0) <sup>d</sup>	19.00 (9.0) <sup>a, b, c, d</sup>	61.30	<b>&lt;.001</b>	.11
<i>Social variables</i>										
Mum Support	5 – 25	12.00 (6.0)	14.71 (6.3) <sup>a, b</sup>	13.5 (7.3) <sup>c</sup>	12.00 (5.0) <sup>a, d</sup>	14.00 (6.0) <sup>d, e</sup>	10.00 (6.0) <sup>b, c, e</sup>	76.13	<b>&lt;.001</b>	.15
Dad Support	5 – 25	11.00 (10.0) <sup>a</sup>	14.00 (8.0) <sup>b</sup>	13.00 (9.3) <sup>c</sup>	9.00 (8.0) <sup>d</sup>	15.00 (7.0) <sup>a, d, e</sup>	9.00 (7.0) <sup>b, c, e</sup>	89.34	<b>&lt;.001</b>	.18
Mum PA Role Model	1 – 5	3.00 (3.0)	3.00 (2.0)	3.00 (2.3)	3.00 (3.0)	3.00 (1.0)	3.00 (2.0)	8.43	.134	.02
Dad PA Role Model	1 – 5	3.00 (3.0)	3.00 (2.3)	3.00 (3.0)	2.00 (3.0)	3.00 (2.0)	3.00 (2.0)	5.15	.397	.01
Parental Pressure	10 – 40	16.00 (8.0)	16.5 (7.0)	15.00 (7.0)	15.00 (7.0)	16.00 (5.0)	14.00 (6.0)	13.16	.022	.02

Note. PA = Physical Activity; Org = Organised. Classes that significantly differed ( $p < .01$ ) on psychosocial variables have *p* values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.

Table 5.5. Cross-class comparisons of psychosocial variables across the five physical activity behavioural classes among older adolescents

Variable	Min - Max	Class 1 Individual Sport <i>n</i> = 43 Median (IQR)	Class 2 Active Mixed Sports <i>n</i> = 42 Median (IQR)	Class 3 Active Non- Organised PA <i>n</i> = 58 Median (IQR)	Class 4 Organised Dance & Fitness <i>n</i> = 74 Median (IQR)	Class 5 Active Team Sport <i>n</i> = 116 Median (IQR)	Class 6 Non-Participation <i>n</i> = 193 Median (IQR)	<i>H</i>	<i>p</i>	$\eta^2_p$
<i>Social variables</i>										
Friend Support	4 – 20	9.00 (5.0) <sup>a, b, c,</sup>	12.00 (5.3) <sup>a, d, e</sup>	12.00 (4.0) <sup>b, f, g</sup>	10.00 (4.3) <sup>d, f, h</sup>	13.00 (4.0) <sup>c, h, i</sup>	8.00 (5.0) <sup>e, g, i</sup>	107.18	<b>&lt;.001</b>	.21
Friend PA Role Model	1 – 5	3.00 (0.0) <sup>a</sup>	3.00 (1.0)	3.00 (1.0)	3.00 (1.3) <sup>b</sup>	3.00 (1.0) <sup>a, b, c</sup>	3.00 (0.0) <sup>c</sup>	33.62	<b>&lt;.001</b>	.06
Peer Acceptance	5 – 20	15.00 (4.0)	16.00 (4.2)	16.00 (4.0)	15.00 (4.0)	16.00 (4.0)	15.00 (4.0)	13.69	.018	.03
Teasing	7 – 35	12.00 (5.0)	13.00 (6.0)	13.00 (8.3) <sup>a</sup>	13.00 (6.3) <sup>b</sup>	10.00 (4.0) <sup>a, b, c</sup>	13.00 (5.0) <sup>c</sup>	28.24	<b>&lt;.001</b>	.05
<i>Body Image</i>										
BMIc	-9.1 – 13.3	-2.33 (3.1)	-2.39 (4.0)	-2.47 (4.2)	-2.51 (4.4)	-2.48 (3.9)	-2.64 (4.0)	0.88	.972	<.01
Body Dissatisfaction	- 5 - 6	0.00 (1.0)	0.00 (1.3)	0.00 (1.6)	1.00 (1.0)	0.00 (1.0)	1.00 (2.0)	15.08	.010	.02
Aesthetic Values	3 – 15	9.00 (5.0)	8.50 (5.0)	8.50 (5.3)	10.50 (4.5)	9.00 (4.0)	9.00 (4.0)	5.08	.406	.01
Aes. Behaviour Inv.	2 – 10	6.00 (3.0)	7.00 (2.3)	7.00 (2.0)	7.00 (3.0)	7.00 (3.0)	7.00 (2.5)	3.88	.567	.01
Aesthetic Satisfaction	3 – 15	10.00 (5.0)	10.00 (6.3)	9.50 (6.0)	9.00 (4.9) <sup>a</sup>	10.92 (4.0) <sup>a, b</sup>	9.00 (5.0) <sup>b</sup>	25.35	<b>&lt;.001</b>	.05
Functional Values	3 – 15	11.00 (4.0)	11.5 (4.6) <sup>a, b</sup>	11.00 (4.0) <sup>c</sup>	10.00 (3.0) <sup>a, d</sup>	12.00 (3.0) <sup>d, e</sup>	9.00 (3.0) <sup>b, c, e</sup>	57.40	<b>&lt;.001</b>	.11
Func. Behaviour Invest	3 – 15	10.00 (5.0) <sup>a, b</sup>	12.00 (4.0) <sup>a, c, d</sup>	11.00 (4.0) <sup>e</sup>	10.00 (3.0) <sup>c, f</sup>	13.00 (3.0) <sup>b, f, g</sup>	9.00 (5.0) <sup>d, e, g</sup>	134.49	<b>&lt;.001</b>	.25
Functional Satisfaction	3 – 15	11.00 (5.0) <sup>a</sup>	12.5 (3.5) <sup>b, c</sup>	11.00 (4.0) <sup>d</sup>	9.00 (4.0) <sup>b, e</sup>	13.00 (3.0) <sup>e, f</sup>	8.00 (4.5) <sup>a, c, d, f</sup>	122.14	<b>&lt;.001</b>	.23

Note. PA = Physical Activity; Org = Organised. BMIc = BMI corrected for age and gender; Aes Behaviour Inv = Aesthetic Behavioural Investment Func Behaviour Invest = Functional Behavioural Investment. Classes that significantly differed ( $p < .01$ ) on psychosocial variables have *p* values shown in bold. Significant pairwise differences between classes are denoted by the same alphabet superscript in each row.

In respect to identified regulation, follow-up pairwise comparisons indicated that adolescents in the *active mixed sports* class demonstrated higher scores compared to those in the *individual sport* ( $p = .024$ ), *organised dance & fitness* ( $p = .003$ ), and *non-participation* ( $p < .001$ ) classes. Membership in the *active team sport* class was also associated with significantly higher levels of identified regulation relative to the *individual sport* ( $p < .001$ ), *active non-organised physical activity* ( $p = .035$ ) *organised dance & fitness* ( $p < .001$ ), and *non-participation* ( $p < .001$ ) classes. In turn, adolescents in the *active non-organised physical activity* and *non-participation* classes differed significantly ( $p < .001$ ), with the former class demonstrating higher identified regulation for physical activity behaviour. For introjected regulation although a significant main effect emerged, follow-up comparison tests revealed that none of the physical activity profile groups significantly differed from each other. In respect to amotivation, a small significant effect was found with post hoc tests indicating that members of the *non-participation* class reported significantly higher amotivation than adolescents classified as *active mixed sports* ( $p = .010$ ), and *active team sport* ( $p < .001$ ) participants.

The physical activity profiles also significantly differed on basic psychological needs for competence ( $H(5) = 131.59$ ,  $p < .001$ ,  $\eta^2_p = .25$ ), relatedness ( $H(5) = 37.95$ ,  $p < .001$ ,  $\eta^2_p = .07$ ), and autonomy ( $H(5) = 73.28$ ,  $p < .001$ ,  $\eta^2_p = .15$ ). Large effect sizes were evidenced for competence and autonomy whilst a medium effect was found for relatedness. Post-hoc analyses revealed that *active mixed sports* and *active team sport* members reported significantly higher perceptions of competence than adolescents in the *individual sport* ( $p = .003$ ;  $p < .001$ ), *organised dance & fitness* (both  $p < .001$ ), and *non-participation* (both  $p < .001$ ) classes. In addition, individuals classified as members of the *active non-organised physical activity* group demonstrated higher competence scores relative to their adolescent counterparts in the *organised dance & fitness* ( $p = .008$ ), and *non-participation* ( $p < .001$ ) classes.

For relatedness, older adolescents in the *active team sport* class evidenced significantly higher scores than those in the *individual sport* ( $p = .003$ ;  $p = .011$ ), and *non-participation* ( $p < .001$ ) classes. In addition members of the *non-participation* class evidenced significantly lower perceptions of relatedness compared to individual classified as *active mixed sports* ( $p = .035$ ) and *active non-organised physical activity* ( $p = .040$ ) participants. In relation to autonomy, follow-up comparisons revealed that adolescents in the *active team sport* and *individual sport* classes differed significantly ( $p = .005$ ), with the latter class demonstrating significantly lower autonomy scores. In addition, members of the *active mixed sports* ( $p < .001$ ), *active non-organised physical activity* ( $p = .001$ ), *organised dance & fitness* ( $p = .027$ ), and *active team sport* ( $p < .001$ ) groups all reported significantly higher autonomy levels than adolescents classified as *non-participants*. Perceived autonomy support was also found to significantly differ across the physical activity profile groups, demonstrating a medium effect ( $H(5) = 61.30$ ,  $p < .001$ ,  $\eta^2_p = .11$ ). Pairwise comparisons with adjusted  $p$  values revealed that *non-participation* class members evidenced significantly lower levels of autonomy support than *active mixed sports* ( $p < .001$ ), *active non-organised*

*physical activity* ( $p = .003$ ), *organised dance & fitness* ( $p = .030$ ), and *active team sport* ( $p < .001$ ) group participants.

### ***Social characteristics***

The physical activity profile groups also significantly differed on a range of interpersonal characteristics. In relation to parental influence, a significant main effect of perceived support from mother ( $H(5) = 76.13$ ,  $p < .001$ ,  $\eta_p^2 = .15$ ) and father ( $H(5) = 89.34$ ,  $p < .001$ ,  $\eta_p^2 = .18$ ) was evidenced among the physical activity profile groups, with large effect sizes reported. Follow-up post hoc tests indicated that adolescents in the *active mixed sports* and *active team sport* classes demonstrated significantly higher levels of mother support for physical activity compared to those in the *organised dance & fitness* ( $p = .047$ ;  $p = .006$ ) and *non-participation* classes (both  $p < .001$ ). In addition, the *active non-organised physical activity* and *non-participation* classes differed significantly, with the latter group demonstrating lower perceptions of maternal support ( $p < .001$ ). For perceived father support, the *active mixed sports* ( $p < .001$ ), *active non-organised physical activity* ( $p < .001$ ) and *active team sport* ( $p < .001$ ) classes members reported significantly higher levels of father support than *non-participation* physical activity classes. The *active team sport* participants also evidenced significantly greater perceptions of paternal support for physical activity relative to their counterparts in the *individual sport* ( $p < .001$ ) and *organised dance & fitness* ( $p < .001$ ) classes. There were no significant differences ( $p > .01$ ) found among the older adolescent physical activity profile groups for mother or father physical activity role modelling or parental pressure, however.

In terms of peer influences, the physical activity profile groups significantly differed on friend social support ( $H(5) = 107.18$ ,  $p < .001$ ,  $\eta_p^2 = .21$ ), and friend physical activity role modelling ( $H(5) = 33.62$ ,  $p < .001$ ,  $\eta_p^2 = .06$ ) however no significant differences were found for peer acceptance ( $p > .01$ ). For perceived support from friends, which evidenced a large effect size, adjusted pairwise comparisons revealed that members of the *active mixed sports* and *active team sport* classes demonstrated significantly higher levels of friend support than adolescents in the *individual sport* ( $p = .027$ ;  $p < .001$ ), *organised dance & fitness* ( $p = .041$ ;  $p < .001$ ), and *non-participation* ( $p < .001$ ) classes. In turn, *active non-organised physical activity* class members evidenced greater perceived support from friends in comparison to *individual sport* ( $p = .029$ ), *organised dance & fitness* ( $p = .040$ ) and *non-participation* ( $p < .001$ ) physical activity profile participants. Demonstrating a small significant effect, post hoc analyses revealed that older adolescents in the *active team sport* group significantly differed from those in the *individual sport* ( $p = .031$ ), *organised dance & fitness* ( $p = .004$ ) and *non-participation* ( $p < .001$ ) classes on friend physical activity role modelling. Similar median scores were evidenced across these groups, however inspection of mean values indicated that *active team sport* ( $M = 3.41$ ,  $SD = 0.88$ ) participants demonstrated significantly higher friend physical activity role model scores relative to *individual sport*

( $M = 2.94$ ,  $SD = 0.82$ ), *organised dance & fitness* ( $M = 2.93$ ,  $SD = 0.91$ ) and *non-participation* ( $M = 2.88$ ,  $SD = 0.89$ ) class members.

Finally, a significant small-to-moderate effect was found for teasing ( $H(5) = 28.24$ ,  $p < .001$ ,  $\eta_p^2 = .05$ ). Follow-up pairwise comparisons revealed that *active team sport* class members reported significantly lower median levels of teasing during sport relative to adolescents characterised by patterns of *active non-organised physical activity* ( $p = .011$ ), *organised dance & fitness* ( $p < .001$ ) and *non-participation* ( $p < .001$ ).

### **Body Characteristics**

There were no significant differences found among the older adolescent physical activity profile groups for BMIc, body dissatisfaction, aesthetic values or aesthetic behaviour investment ( $p > .01$ ). In turn, aesthetic satisfaction was the only dimensions of aesthetic body image to differ significantly across the physical activity profiles groups, demonstrating a small-to-medium effect ( $H(5) = 25.35$ ,  $p < .001$ ,  $\eta_p^2 = .05$ ). Adjusted pairwise comparisons indicated that *active team sport* class members evidenced significantly higher levels of aesthetic satisfaction compared to individuals in *organised dance & fitness* ( $p = .001$ ) and *non-participation* ( $p < .001$ ) classes.

In relation to functional body image, the physical activity profile groups significantly differed on functional values ( $H(5) = 57.40$ ,  $p < .001$ ,  $\eta_p^2 = .11$ ), functional behaviour investment ( $H(5) = 134.49$ ,  $p < .001$ ,  $\eta_p^2 = .25$ ) and functional satisfaction ( $H(5) = 122.14$ ,  $p < .001$ ,  $\eta_p^2 = .23$ ), with effect sizes ranging from 11% to 25% of variance explained. A medium effect was evidenced for functional values, whereas large effects were found for functional behavioural investment and functional satisfaction. Post hoc analyses revealed that adolescents in the *active mixed sports* and *active team sport* classes demonstrated higher functional values scores in comparison to *organised dance & fitness* ( $p = .004$ ;  $p < .001$ ) and *non-participation* (both  $p < .001$ ) class members. In turn, individuals characterised by *active non-organised physical activity* and *non-participation* physical activity profiles significantly differed from each other ( $p = .019$ ), with the latter group reporting lower functional values.

For functional behavioural investment, follow-up pairwise comparisons with adjusted  $p$ -values indicated that adolescents in the *active mixed sports* and *active team sport* classes demonstrated significantly higher functional behaviour investment scores than those in the *individual sport* ( $p = .039$ ;  $p < .001$ ), *organised dance & fitness* ( $p = .002$ ;  $p < .001$ ) and *non-participation* (both  $p < .001$ ) classes. Significant group differences were also evidenced between the *active non-organised physical activity* and *non-participation* profile groups, with the latter group evidencing lower functional behavioural investment scores ( $p < .001$ ). Finally in relation to functional satisfaction, members of the *non-participation* class reported significantly lower scores compared to adolescents in the *individual sport* ( $p < .001$ ), *active mixed sports* ( $p < .001$ ), *active non-organised physical activity* ( $p < .001$ ) and *active*

*team sport* ( $p < .001$ ) classes. In addition, individuals in the *active mixed sports* ( $p = .001$ ) and *active team sport* ( $p < .001$ ) classes revealed higher levels of functional satisfaction than members of the *organised dance & fitness* class.

#### **5.4.4.1 Summary**

In summary, members of the *active mixed sports* and *active team sport* classes scored similarly across a range of psychosocial characteristics differing significantly from non-participants and those characterised by less active profiles of physical activity participation on enjoyment, intrinsic motivation, identified regulation, competence, relatedness, autonomy, autonomy support, parent support, friend support, functional values, functional behavioural investment and functional satisfaction demonstrating higher scores on these variables in addition to lower levels of amotivation. Adolescents assigned to the *active team sport* profile also reported higher levels of friend physical activity role modelling and aesthetic satisfaction, as well as lower teasing scores than those characterised by other physical activity patterns. In addition, the *active non-organised physical activity* group was found to differ mostly from non-participants reporting significantly higher scores on motivational characteristics, support and functional aspects of body image. Finally, there were no significant differences found across the older adolescent physical activity classes on introjected regulation, external regulation, parental role modelling, parental pressure, peer acceptance, BMIC, body dissatisfaction, aesthetic values, or aesthetic behavioural investment.

## **5.5 Discussion**

In addition to the psychological processes outlined within self-determination theory, many social and individual characteristics have been identified as playing a central role in adolescents' physical activity behaviours. However, past studies have typically explored correlates of overall physical activity, which has resulted in a limited understanding of how psychosocial characteristics may vary as a function of the context of participation (e.g. Biddle et al., 2011; Sallis et al., 2000). Moreover, when organised and non-organised physical activity behaviour has been discriminated, the types of activities underpinning organised participation has received limited attention, with sport (e.g. team, individual) and non-sport (e.g. dance, fitness classes) physical activities often considered simultaneously. The primary purpose of this chapter was therefore to examine physical activity profile group differences among adolescents on a range of motivation, social and body-related factors. A secondary aim, addressed in this discussion, was to consider whether the association between adolescents' physical activity patterns and related psychosocial factors varied across gender and age-groups.

In brief, as outlined in further detail in Chapter 4, adolescent girls were characterised by six discrete latent physical activity classes reflecting active participation in team sport, and individual sport, and less active patterns of engagement in organised individual sport and physical activity (e.g. dual



participation in swimming and dance lessons), organised dance and fitness classes, non-organised physical activity (e.g. walking, jogging) and a pattern of non-participation. In contrast, adolescent boys comprised five distinct physical activity profiles representing active participation in organised fitness activities (e.g. going to the gym, spinning classes), team sport, individual sport, a combination of non-organised physical activity (e.g. jogging, cycling) and team sport, in addition to a low active non-participation group. Given that four of the five male latent physical activity groups were classified as active meaning that they accrued at least 60 minutes of moderate-to-vigorous physical activity on three or more days over the past week, this enabled a greater comparison across classes in respect to the specific type of activity undertaken.

Among younger adolescents, in addition to a profile of non-participation, four different patterns of physical activity were identified that reflected active participation in a combination of organised physical activity and sports, individual sport, team sport, and non-organised physical activity undertaken alongside team sport. Thus, with the exception of the non-participation class, the remaining classes were characterised by participation in at least one form of organised sport reflecting a highly active cohort with less distinctive physical activity behavioural patterns. The older adolescents in turn, were represented by six discrete physical activity profiles that could be easily discriminated in terms of type of physical activity performed and associated level of moderate-to-vigorous physical activity. These included active patterns of engagement in team sport, non-organised physical activity, and a combination of team and individual sports, in addition to less active profiles of participation in individual sport, and organised dance and fitness activities. The final class comprised non-participants who did not take part in any type of sport or physical activity.

### ***Motivational Characteristics***

In respect to motivational indices, our primary hypotheses were broadly supported as adolescents characterised by profiles of active participation in organised sport demonstrated higher levels of self-determined motivation, competence, relatedness, autonomy and autonomy support whilst non-participants reported higher scores on amotivation. The strength of these associations and profiles of physical activity group differences further differed however, on the basis on the adolescent cohort examined.

For intrinsic motivation and identified regulation, large effect sizes were consistently evidenced among each of the adolescent cohorts, explaining between 18% and 24% of the overall variance in physical activity. In addition to the expected differences evidenced between active sport participants and non-participants, several specific observations were of note. Adolescents characterised by profiles of active participation in non-organised physical activity (e.g. walking, jogging, press-ups, sit-ups, informal games) and less active patterns of organised dance and fitness, or low active individual sport participation, were also more intrinsically motivated than non-participants. Gender differences were

also evidenced in respect to type of sport undertaken and associated self-determined motivation. For girls, active team and individual sport participants reported similarly high levels of intrinsic motivation and identified regulation. In contrast, boys that engaged in team sport alone or in combination with non-organised physical activity demonstrated the highest levels of self-determined motivation suggesting that team sport may have increased motivational salience for boys.

In respect to controlling motives, external regulation did not significantly differ across groups, however introjected regulation evidenced a small significant effect, with non-participants demonstrating lower levels of introjected regulation relative to those characterised by active profiles of sport and physical activity participation. Introjected regulation is characterised by feelings of obligation with behaviour typically undertaken to avoid negative emotions (e.g. guilt, shame) or to attain contingent self-worth (Deci & Ryan, 2008b). In line with these findings, Gillison and colleagues (2009) revealed that adolescents who were high in introjected regulation reported participating in sport and physical activity to obtain peer approval or alternatively to avoid feelings of guilt over letting others (e.g. team members) down (Gillison, Osborne, Standage, & Skevington, 2009). Contrary to our predictions that similar age and gender-related patterns of association would be evidenced for motivational indices however, the effect of introjected regulation was unique to female (.03) and younger (.04) adolescents, whilst a significant overall effect evidenced among older adolescents did not reveal any physical activity profile group differences at follow-up. Inconsistent findings have previously been found regarding introjected regulation and sport participation, although research suggests that this form of motivation can underpin sport and physical activity persistence over short durations when self-determined motives are simultaneously endorsed (Gillison et al., 2011; Pelletier et al., 2001). Finally for amotivation, as predicted, non-participants evidenced higher levels relative to active sport participants, with a medium association evidenced for girls (.06), and small-to-moderate effects evidenced for the remaining adolescent cohorts.

It was also hypothesised that adolescents characterised by profiles of participation in organised sport and physical activity would demonstrate higher levels of enjoyment than non-organised physical activity participants, however this hypothesis was only partially supported, with discrepancies arising as a consequence of the type of organised activity undertaken and associated level of activity. Moreover, unexpectedly the strength of association differed across gender and age-groups with a large effect evidenced for boys (.14) and a more moderate effect found for girls (.10), whilst medium and large effects were reported for the younger (.09) and older (.14) cohorts, respectively.

In turn, adolescents characterised by profiles of active team sport participation reported higher levels of enjoyment than adolescents who engaged in low active levels of non-organised physical activity (e.g. walking, jogging) but active team sport participants did not differ from those who achieved active levels of moderate-to-vigorous participation in non-organised physical activity. Thus, similar levels of

enjoyment where reflected among those who were active, regardless of whether it was through team sports or non-organised physical activity. In addition, contrary to expectations, enjoyment levels did not significantly differ among non-organised physical activity participants and those engaging in individual sports or organised dance and fitness classes. The findings suggest that organised team sport in particular, is related to increased enjoyment but undertaking active levels of non-organised physical activity participation, may also be associated with similar positive effects.

In relation to basic psychological needs, competence demonstrated a consistently large effect across each of the adolescent cohorts, explaining 14% to 25% of the overall variance in physical activity behaviour. It was expected that active organised sport and physical activity participants would demonstrate greater levels of competence than non-organised physical activity, and non-participants, however this hypothesis was only partially supported. Consistent with prior research, adolescents characterised by active levels of sport participation demonstrated significantly higher perceptions of competence than individuals that engaged in less active physical activity patterns (Woods et al., 2010; Coleman et al., 2008). However, perceived competence levels did not differ between adolescents accumulating active levels of moderate-to-vigorous physical activity in organised sport or non-organised physical activity (e.g. walking, jogging) contexts. Moreover, active non-organised physical activity participants reported higher competence relative to those undertaking less active patterns of organised physical activities and those who did not engage in physical activity. Thus, it appears that the level or amount of physical activity undertaken rather than context of participation is of importance for adolescents' competence perceptions.

For relatedness, a small-to-medium effect was reported for adolescent girls (.05) and medium effects were evidenced for boys (.11) and the younger (.07) and older (.07) adolescent cohorts. As predicted the findings indicated that participation in team sport specifically was associated with higher levels of relatedness compared to other profiles of sport and physical activity involvement. Performing as part of a mutually dependent group facilitates multiple opportunities to form connections and develop positive relationships with teammates, which ultimately contribute to enhanced feelings of relatedness (Reinbooth et al., 2004; Vazou, Ntoumanis, & Duda, 2005).

In turn, as predicted, adolescent sport participants demonstrated higher levels of autonomy and autonomy support compared to their less active counterparts. For girls, autonomy (.15) demonstrated a large effect whereas autonomy support (.07) evidenced a more moderate effect size. These patterns of associations were reversed among males however, with autonomy support (.15) revealing a large, and autonomy (.07), a medium-to-large effect. In contrast, similar strength associations were evidenced among the younger and older adolescent cohorts with large and medium effect sizes evidenced for autonomy and autonomy support, respectively. For males, perceived autonomy and autonomy support also differed as a function of the type of sport undertaken with team sport participants having higher

scores than individual sport participants. Thus, it appears that involvement in team sport may be particularly advantageous for adolescent boys, whereas active sport participation irrespective of type is associated with more adaptive motivational characteristics among girls. In addition, for older adolescents, active patterns of involvement in non-organised physical activity and lower active participation in organised dance and fitness, was also associated with greater feelings of autonomy and autonomy support compared to non-participants indicating that higher perceptions of volition and choice is central for older adolescents' physical activity participation.

Although it was hypothesised that similar patterns of association would be found between motivational indices and physical activity profiles across gender, this was not entirely supported. In accordance, introjected regulation, amotivation and autonomy had more of an effect on adolescent females' physical activity patterns whereas enjoyment, relatedness and autonomy support evidenced effect sizes of higher magnitude among males. Similarly large effects were evidenced however for self-determined motivation and competence. Thus it appears that perceptions of choice over one's physical activity participation are fundamental for girls' active participation in sport. In contrast, feelings of relatedness, enjoyment and autonomy support, played a greater role in boys' physical activity behaviours, and team sport was associated with more positive motivational characteristics than individual sport among this gender.

In respect to age-related differences, the association between physical activity profiles and motivational indices were broadly consistent between younger and older adolescents, with the exception that enjoyment demonstrated a bigger effect among older teenagers, whereas introjected regulation had a small but significant effect on the younger adolescent cohort. Moreover, among the younger cohort, all of the latent physical activity classes typically differed from the non-participant class on the self-determined constructs with few differences evidenced among the active classes. This may be attributed to the underlying composition of these active classes which each reflected participation in at least one organised sport and consequently more similar types of physical activity participation. Among the older adolescent cohort however, it was apparent that active patterns of sport and non-organised physical activity were associated with a range of positive motivational outcomes. This was particularly encouraging given that non-organised unstructured physical activity participation (e.g. walking, running) does not require much organisation, equipment, or cost, and is accessible for all teenagers to perform if desired.

### ***Social characteristics***

In addition to motivational processes, peer and parental influences have been identified as playing a central role in adolescent's physical activity behaviour patterns. Consistent with predictions adolescents characterised by active patterns of participation in organised sport and physical activity demonstrated

higher perceptions of mother and father support for physical activity than their less active peers. Also of note, adolescents that engaged in active levels of non-organised physical activity demonstrated higher levels of parental support than non-participants. Thus, parental support appears to play an important role in helping adolescents to achieve recommended levels of moderate-to-vigorous-physical activity. Prior qualitative studies indicate that moral support, transportation and undertaking activity alongside adolescents, which may be of particular relevance for individuals engaging in more unstructured or non-organised forms of exercise, are key parental behaviours that facilitate active sport and physical activity participation among youth (Mulhall et al., 2011; Duncan et al., 2005; Bélanger et al., 2011).

The strength of the association between mother and father support and adolescent's physical activity was found to vary however, across gender and age-groups. For adolescent girls, perceived mother (.18) and father (.16) support demonstrated a large effect. In contrast, among boys perceived mother support (.08) evidenced a medium effect whilst father (.13) support evidenced a moderate-to-large association. While effects sizes were in expected directions offering support for our hypothesis that perceived support from same-gender parent has a greater impact on adolescent's physical activity behaviour, overall effect size for each parent were of similar magnitude indicating that both parents were of equal importance. Of greater relevance perhaps is the finding that parental support influenced girls' physical activity participation to a greater extent than boys.

In respect to age-related differences, findings were contrary to our expectations as the strength of the association between physical activity participation and mother and father support was large for older adolescents (.15 – .18) whereas these effects were medium in size for their younger counterparts (.09 – .10). Thus it appears that even though perceptions of parental support decrease as adolescents get older, such behaviours continued to impact older adolescent's physical activity participation and indeed take on greater importance for this age-group who is at increased risk of physical activity decline. Parental support may therefore be important in helping to sustain adolescents' physical activity involvement over time.

For mother and father physical activity role modelling, it was expected that adolescents characterised by active profiles of sport and physical activity participation would demonstrate higher perceived parental physical activity. This hypothesis was supported only among the female cohort with effects being small in magnitude. Follow-up comparisons revealed that higher levels of mother and father physical activity role modelling were associated with active team sport participation. In accordance with this finding, Cleland et al. (2005) found that young people that had two active parents demonstrated higher levels of sport participation than those who did not. In addition, consistent with predictions, active individual sport participants demonstrated higher levels of parental pressure than those engaged in team sport, however the effect size of the relationship was small and once again this effect was only significant for adolescent girls. Thus, the present findings indicate that parental support is important for

both male and female adolescents' physical activity behaviours, but other processes such as parental pressure and role modelling also matter for females specifically.

In addition, it was hypothesised that higher levels of friend support would be associated with more active profiles of sport and physical activity participation among adolescents and the results were broadly found to be in line with this expectation. Furthermore, adolescents characterised by both active and less active moderate-to-vigorous patterns of engagement in sport, and organised and non-organised physical activity also evidenced higher perceived friend support relative to those who refrained from participation, underscoring the significance of perceived support from friends for young people's participation in physical activity. In turn, friend support for physical activity demonstrated the largest effect size across all of the social variables accounting for between 16% and 23% of the overall variance in adolescent's physical activity behaviour. Peer support was also found to be more strongly related to adolescent's physical activity participation than parental support, which is in accordance with previous studies indicating that peer behaviours take on a greater determining role during this phase of development (Beets et al., 2006; Duncan et al., 2007; Kirby et al., 2011).

For friend role modelling of physical activity, as predicted, higher perceptions of friend physical activity were related to more active profiles of sport and physical activity participation among adolescents, and in particular, team sport. Effects varied in size with small associations evidenced among girls (.04) and boys (.04), while more moderate sized effects were evidenced among younger (.10) and older (.06) adolescents. In addition, consistent with our hypothesis, active sport participation was associated with higher levels of peer acceptance, with team sport participation proving to be especially salient in gaining social status among adolescent girls and boys. It was also expected that the strength of the association would be greater for males than females, and this hypothesis was confirmed as peer acceptance evidenced a medium effect size among boys (.07) and a small effect among girls (.03). Sport participation is associated with cultural notions of masculinity, thus demonstrating competency within this domain is related to greater peer approval among males than females (Messner & Sabo, 1990; Chase & Drummer, 1992). Age-related differences were also evidenced for the association between peer acceptance and physical activity with a medium effect evidenced among younger adolescents (.07) and a non-significant effect found for older adolescents. This may suggest that although sport participation is highly regarded among peers during early adolescence, the significance attached to athletic competence decreases as adolescents get older.

In respect to negative interpersonal interactions, it was hypothesised that non-participants would report higher levels of teasing in physical activity contexts than more active peers. In accordance, adolescents that did not partake in physical activity reported higher levels of teasing relative to those who

participated in team sport. The effect size of this relationship was small among adolescent boys (.03) and girls (.04); however follow-up comparison revealed that none of the female physical activity profile groups significantly differed from each other. In addition, perceived teasing did not significantly differ among younger adolescents whereas a small-to-medium effect was evidenced for older adolescents (.05), with team sport participants reporting lower levels of teasing relative to non-organised physical activity participants and non-participants. Perceived teasing experiences therefore have a greater association with older adolescents' physical activity participation, however being part of a group, as is the case with team sport may exert a protective influence over victimisation from others.

### ***Body-related characteristics***

Finally, body mass and body image have also been implicated in adolescents' physical activity behaviours. Contrary to our hypothesis however, BMI did not differ among adolescents who participated in active levels of sport and physical activity and those who refrained from taking part in physical activity. Nonetheless, inconsistent findings have previously been reported regarding the relation between physical activity and BMI assessed via self-report or objective means, with systematic reviews indicating indeterminate associations among adolescents (Sallis et al., 2000). Martinez-Gomez et al (2010) previously indicated that recommended daily amounts of objectively measured moderate-to-vigorous physical activity (MVPA) was associated with a decreased risk of overweight and obesity among adolescents. Thus, it is possible that the MVPA threshold adopted within the present analysis to classify adolescents as active, which equated to a minimum of 60 minutes of MVPA on three or more days over the past week, was too low to detect noticeable differences in adiposity among the different physical activity profile groups.

In addition, while it was expected that adolescents who did not participate in physical activity would demonstrate higher levels of body dissatisfaction, this position was not supported. Body image however, is a multidimensional construct and significant differences were evidenced among adolescents' physical activity profile groups when discrete dimensions of aesthetic and functional body image were considered. In relation to aesthetic body image it was expected that adolescents represented by profiles of active team sport participation would demonstrate higher levels of aesthetic satisfaction, however this hypothesis was only partially supported. In accordance with predictions, active organised sport participants demonstrated higher levels of aesthetic satisfaction relative to non-sport participants and non-physical activity participants. The strength of this association also differed across gender with boys (.06) demonstrating a medium effect, while a small effect size was reported for girls (.02). In turn, younger and older adolescents demonstrated equivalent small-to-medium effect sizes for aesthetic satisfaction (.05). For males alone, active team sport participation was associated with higher levels of aesthetic satisfaction relative to individual sport participation. These findings are in agreement with Morano et al. (2011) who found that boys that engaged in team sports demonstrated greater satisfaction with their body than those who participated in individual sports. In contrast, for younger adolescents, a

profile of active individual sport participation was associated with higher levels of aesthetic satisfaction in comparison to non-participants. However individuals within this group also reported a moderate probability of engaging in team sport.

It was also hypothesised that active sport participants would demonstrate higher levels of aesthetic behavioural investment and aesthetic values than non-physical activity participants. However, aesthetic values did not significantly differ across groups, whilst aesthetic behavioural investment evidenced a small-to-medium size effect among male (.05) adolescents' physical activity profile groups only. Differences were found in the hypothesised directions with non-participants demonstrating significantly lower levels of aesthetic behavioural investment than males characterised by active levels of participation in team sport alone or in combination with non-organised physical activity. Overall, it appears that aesthetic body image is more strongly related to male rather than female adolescent physical activity behaviour. In accordance, Gillison and colleagues (2011) found that higher levels of body satisfaction were associated with sustained physical activity involvement over ten months among boys but not girls.

For functional body image, functional behaviour investment and functional satisfaction demonstrated consistently large effects across each of the adolescent cohorts accounting for between 17% and 25% of the overall variance in physical activity behaviour. In contrast, for functional values differential effect sizes were evidenced across gender and age-groups. For males (.16) a large effect emerged, whilst for females (.08) a moderate effect was found. In turn, functional values evidenced a large association with physical activity behaviour among younger adolescents (.14) whilst a medium effect was reported for the older adolescent (.11) cohort. As expected, adolescents characterised by profiles of active, and less active sport participation, demonstrated higher levels of functional values, functional behaviour investment and functional satisfaction than organised physical activity (e.g. dance, gym, fitness classes) participants and non-participants. Thus, it appears that boys and younger adolescents place a greater level of importance on being good at sports and physical activity.

It was also hypothesised that active sport participants would demonstrate increased functionality compared to those engaged in non-organised physical activity. However, differences between these physical activity profile groups were dependent on the associated level of MVPA undertaken, with active sport participants reporting more positive functional body image than less active non-organised participants but failing to differ from those attaining active levels of MVPA. In turn, consistent with our hypothesis, non-organised physical activity participants (e.g. running, walking) reported higher levels of functional values, functional behaviour investment and functional satisfaction than non-participants regardless of the overall level of MVPA undertaken. The findings indicate that participation in non-organised physical activity even at low levels of MVPA promotes appreciation of the functional qualities of the body, which in turn is associated with a more positive functional body image.



In contrast to predictions however, adolescents that engaged in organised non-sport activities (e.g. dance, fitness classes) did not differ from non-participants across any of the dimensions of functional body image. Based on these findings it is plausible to suggest that adolescents may engage in organised dance or fitness type activities to lose weight or enhance appearance, with such motives detracting focus from the functionality of the body, as emphasis is placed solely on outcomes of physical activity participation (Abbott & Barber, 2010). Moreover, adolescents characterised by profiles of organised non-sport participation reported lower levels of aesthetic satisfaction suggesting that they have a poorer body image overall.

## **5.6 Conclusion**

In summary, profiles of adolescents' physical activity participation were found to differ on a range of motivational, social and body-image related variables with self-determined motivation, enjoyment, autonomy, competence, autonomy support, parental support, friend support and functional body image demonstrating the greatest effect sizes. Patterns of physical activity involvement among adolescents were subsequently discriminated on psychosocial factors as a consequence of the underlying type of activity and associated level of MVPA performed. The results indicated that active levels of moderate-to-vigorous intensity participation in organised sport, and team sport in particular, was associated with more positive profiles of motivational, social and body-image characteristics among adolescents than less active profiles of physical activity engagement. In addition, active levels of participation in non-organised physical activity such as jogging, running and cycling was also related to more favourable adolescent psychosocial profiles. However these benefits were not associated with non-organised physical activity participation that was characterised by a lower level of activity, underscoring the significance of attaining active levels of MVPA. Despite this, physical activity profiles characterised by less active patterns of sport, organised, and non-organised physical activity were linked to higher feelings of enjoyment, intrinsic motivation, friend support and enhanced functionality relative to non-participants. This suggests that even low levels of physical activity participation may be associated with more adaptive profiles of psychosocial characteristics.

Further differences were evidenced as a function of gender and age. For girls, active patterns of participation in organised sport irrespective of format undertaken (e.g. team vs individual) was associated with more adaptive psychosocial outcomes relative to less active profiles of participation. In contrast, for boys active profiles characterised by team sport was related to more positive psychosocial outcomes compared to the active individual sport participation profile suggesting that team sport plays a particularly salient role among adolescent males. In addition, introjected regulation, amotivation, autonomy and in particular parental support and role modelling had a greater effect on female

adolescents' physical activity patterns whereas enjoyment, relatedness, autonomy support, peer acceptance and aesthetic body image played a more central role in males' physical activity participation.

Age-related group differences were also evidenced. Among the younger cohort, active patterns of physical activity participation were primarily discriminated from non-participants with few differences evidenced among the different active classes. This may be attributed to the underlying composition of these classes which each represented participation in organised sport to some extent and as such were less distinctive. Thus, these findings suggest that younger adolescents that engage in active patterns of physical activity display similar psychosocial characteristics regardless of the type of activity performed. In contrast, among older adolescents distinct psychosocial characteristics were evident depending upon the type of activity undertaken and associated level of MVPA with active organised sport and active non-organised profiles related to more positive psychosocial profiles.

In addition, peer acceptance and functional values had a greater effect on younger adolescents' physical activity behaviours whereas enjoyment, parental support and teasing were more strongly related to older adolescents' physical activity profiles. In conclusion, a greater understanding of how discrete patterns of adolescent's physical activity involvement differ on psychosocial factors may prove useful for informing intervention aimed at promoting different physical activity behaviours among male and female and younger and older adolescents.

## **Chapter 6. An examination of stability and changes in adolescent's pattern of involvement in physical activity over twelve months**

### **6.1 Chapter Overview**

The purpose of this chapter is to examine stability and changes in profiles of male and female, and younger and older adolescents' physical activity participation over an approximate twelve month period. In Chapter 4, latent class analysis was performed to identify young people's patterns of involvement in physical activity using five observed indicators of physical activity behaviour (recommended levels of moderate-to-vigorous physical activity achieved on at least three days over the past week, a minimum of three sessions of non-organised physical activity, organised team sport, organised individual sport, and organised non-sport physical activity). This was followed in Chapter 5 by an examination of differences among adolescent's profiles of physical activity participation on a range of psychosocial factors. In the present chapter, participants were reassessed twelve months after Time 1 and latent class analysis is repeated to investigate whether similar profiles of physical activity participation are established at follow-up. Crosstabs of latent class assignment at each time point are then used to explore transitions in physical activity from Time 1 to Time 2. Next, adolescents are grouped longitudinally into one of four possible physical activity maintenance and behaviour change trajectories reflecting maintained participation in physical activity one year later, dropout, uptake of physical activity or continued non-participation. In turn, gender and age-related differences in physical activity maintenance and change over time are subsequently explored.

### **6.2 Introduction**

It is widely evidenced that physical activity levels demonstrate an age-related decline across the teenage years, with physical activity dropout occurring earlier for girls than boys (Kalman et al., 2015; Nader et al., 2008; Troiano et al., 2008). In line with these findings, a systematic review of longitudinal changes in objective and survey assessed physical activity participation during adolescence revealed that physical activity levels decreased on average by 7% per year (Dumith, Gigante, Domingues, & Kohl, 2011). While quantitative information is available regarding level of physical activity decline, limited research has examined *how* young people's pattern of involvement in physical activity changes over time. Indeed only one study to date, to the best of the author's knowledge, has examined patterns of stability and changes in profiles of physical activity participation across adolescence.

Agans and Geldhof (2012) identified five discrete patterns of self-report organised sport participation among high school students across three successive waves of data collection that corresponded to team sport, individual sport, a combination of team and individual sport, dance, and non-participation. Based on physical activity involvement at each time point, adolescents were subsequently grouped into broader trajectories reflecting sustained participation, dropout, continued non-participation,

uptake of sport among those initially classified as non-participants, and a 'changer' pattern reflecting individuals that swapped one type of sport for another. The authors revealed that approximately one fifth of teenagers sustained participation in the same type of physical activity throughout the duration of the study whereas roughly one-third of students altered their pattern of involvement in physical activity replacing one sport form for another. In addition, between 15% and 17% of girls and boys dropped out of physical activity during the successive follow-up waves whilst approximately 1 in 10 adolescents initiated participation in sport. Although the findings highlight the multiple and varied pathways that comprise youth participation in organised physical activity across adolescence, no information was available regarding the type of sports underpinning these transitions. Thus, it is unclear whether certain profiles of participation are more likely to be maintained, dropped or replaced over time with alternate activities.

Other studies that have discriminated physical activity in respect to organised and non-organised behaviour indicate that context of participation may change across adolescence. In accordance, Wall and colleagues (2011) found that high levels of participation in non-organised physical activity decreased among girls between the age of 10 and 11 years, coinciding with an increased prevalence of organised sport and physical activity involvement, which suggests that unstructured physical activity may be replaced with structured participation over time. In contrast to these findings, using retrospective reports Eime et al. (2013) demonstrated that younger (12/13 years) and older (16/17 years) female adolescents reported higher levels of participation in non-organised physical activity (e.g. walking, jogging, rollerblading) and lower levels of involvement in competitive team and individual sport relative to the previous year. In addition, cross-sectional comparisons revealed that older girls were more likely to participate in organised non-competitive physical activity (e.g. aerobics, circuits) and non-organised physical activity than younger counterparts. The discrepant findings regarding non-organised physical activity may be attributed to the way in which involvement was assessed across studies. The former study adopted a higher threshold reflecting daily participation that may have resulted in continued non-organised physical activity undertaken at lower activity levels throughout adolescence being overlooked.

Additional studies further indicate that participation in organised non-sport (e.g. gym classes) and non-organised physical activity (walking, running) becomes more prevalent throughout adolescence. For example, Aaron et al. (2002) found that aerobics and weight lifting increased among teenage girls over a four year period despite involvement in other types of physical activity declining. Lunn and colleagues (2013) also revealed that personal exercise reflecting swimming, jogging and going to the gym was the only type of activity in which participation increased among Irish girls and boys over the secondary school years. In contrast, patterns of low activity characterised by a lack of participation in physical activity demonstrates high levels of stability over time. Indeed, longitudinal studies indicate that adolescents classified as inactive at baseline are highly unlikely to take part in physical activity at

successive follow-ups (Aaron et al., 2002; Zook et al., 2014). It should be acknowledged however, that a small proportion of sedentary young people will go on to take up physical activity during adolescence with individual type activities such as physical conditioning, running, jogging, walking and cycling representing preferred options (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009).

Gender differences have also been evidenced in respect to young people's pattern of involvement in physical activity over time. Prior research indicates that boys are more likely to participate in team based activities across adolescence whereas girls demonstrate a preference for more individual type sports and physical activities (e.g. swimming, dance, walking) (Aaron et al., 2002; Bélanger, Sabiston, Barnett, O'Loughlin, Ward et al., 2015; Bradley et al., 2000; Lunn et al., 2013). In addition, in a study exploring maintained participation in team and individual physical activities among girls and boys from 12 to 17 years of age, Bélanger and colleagues (2009) found that boys were more likely to persist in team sport over time than girls whereas dance activities were sustained longer by female students relative to males. Team sport participation was also found to be high in early adolescence although it starkly declined across the secondary school years. Longitudinal research further highlights gender disparities in relation to changes in overall physical activity levels across adolescence with girls more likely than boys to be classified as dropouts and non-participants, and less likely to be categorised as physical activity maintainers or adopters (Rangul et al., 2011; Gillison et al., 2011;). In addition, age-related differences in physical activity have been widely reported. Accordingly, younger teenagers are consistently found to be more physically active than their older counterparts with physical activity levels continuing to decline throughout adolescence (Brooks et al., 2015; Currie et al., 2015; Kelly et al., 2012).

In summary, limited research has explored longitudinal changes in patterns or types of physical activity involvement among young people. Moreover, only one study to date (Agans & Geldhof, 2012) has examined transitions in profiles of physical activity participation across adolescence, although gender and age-related differences were not explored, resulting in an incomplete understanding of how youth physical activity behaviours change over time. In addition, it is unclear whether certain patterns of physical activity involvement are more likely to be maintained or dropped over time than others. The aim of this chapter is therefore to address this gap in the literature by investigating stability and changes in young people's pattern of physical activity involvement over twelve months. In addition, gender and age-related differences in physical activity maintenance and change will be explored. Developing a greater understanding of the patterns of physical activity behaviour that are sustained, replaced, and discontinued across adolescence would prove useful for informing design of policies and programmes aimed at promoting uptake and continued physical activity participation among teenagers.

### **6.2.1 Research aims and hypotheses.**

The present analysis sought to address the following research questions and hypotheses:

1. Do adolescent's profiles of participation in physical activity remain stable or change over twelve months?
  - Agans and Geldhof (2012) previously indicated that profiles of organised sport participation were stable over three waves of data collection among adolescents. However, involvement in organised non-sport physical activity (e.g. gym) or non-organised physical activity (e.g. running, walking) was not assessed, which has been found to increase throughout the secondary school years (Eime et al., 2013; Fahey et al., 2005; Lunn et al., 2013). In addition, the analyses comprised a combined sample of male and female adolescents that did not allow for variations in gender and age-related physical activity to be uncovered. Prior research also indicates that quantity of physical activity undertaken decreases during adolescence and as such it is expected that lower levels of physical activity participation and increased levels of non-participation would be evidenced at follow-up. However, a lack of research exists to guide specific hypotheses regarding change and stability in profiles of physical activity participation among adolescents over a twelve month period, thus this aim is exploratory in nature.
2. Are gender differences found in respect to changes in physical activity participation over twelve months?
  - It is expected that boys will be more likely than girls to sustain participation in team sport at follow-up twelve months later.
  - It is hypothesised that a higher proportion of girls will drop out of physical activity than boys over twelve months. In addition, it is expected that adolescents characterised by certain patterns of physical activity will be more likely to transition into patterns of non-participation.
3. Are age-related differences found in respect to changes in physical activity participation over twelve months?
  - It is hypothesised that a higher proportion of older adolescents will drop out of physical activity than younger adolescents over twelve months. In addition, it is expected that adolescents characterised by certain patterns of physical activity participation will be more likely to transition into patterns of non-participation.

## **6.3 Method**

### **6.3.1 Participants.**

A total of 995 respondents from eight post-primary schools located in Dublin participated in the research at Time 1 (see Chapter 3 for detailed description of Time 1 sample). Participants were followed up approximately 12 months later and reassessed. The longitudinal sample comprised a total of 803 participants ( $n = 502$  females) that ranged in age from 13 to 18 years ( $M$  age = 14.71,  $SD = 1.29$ ). Students from across all stages of the Irish secondary school system took part in the research at Time 2, with 2<sup>nd</sup> year ( $n = 314$ , 39.1%), 3<sup>rd</sup> year ( $n = 180$ , 22.4%), 4<sup>th</sup> year ( $n = 103$ , 12.8%), 5<sup>th</sup> year ( $n = 107$ , 13.3%) and 6<sup>th</sup> year ( $n = 99$ , 12.3%) included. As described in Section 3.3, attrition rates ranged from 6.6% ( $n = 4$ ) to 26.6% ( $n = 12$ ) between different schools with an average attrition rate of 17.24% ( $SD = 6.98$ ).

### **6.3.2. Procedure.**

The procedure for obtaining ethical approval, selecting schools and collecting data at Time 1 and Time 2 is detailed in Chapter 3. All of the schools that had taken part at Time 1 agreed to participate at follow-up approximately twelve-months later. Parental consent for child participation at Time 2 was also obtained at Time 1. Data were analysed using MPlus 7.1 (Muthén & Muthén, 2011).

### **6.3.3 Measures.**

Analyses at Time 2 included measures from Time 1 (described in Chapter 3), and measures from Time 2. At each time point participants completed the Physical Activity Recall Seven Day Diary (PAR-7DD), in which they had to record any physical activity they had undertaken over the past week and answer three additional questions regarding organised sport and physical activity participation. On the basis of this information five binary indicators were derived which are described in more detail in Section 3.5.2.2. Participants were classified as active (1) if they accumulated at least 60 minutes of MVPA on three or more days over the past week. If they did not meet these guidelines they were classified as low active (0). In addition, respondents were classified as non-organised physical activity participants (1) if they undertook a minimum of three sessions of non-organised physical activity over the past week or non-participants (0) if they did not meet this criterion. Three binary items were also derived to reflect participation in organised team sport, individual sport and organised non-sport physical activity. Adolescents who engaged in at least one organised team sport (1), individual sport (1), or organised non-sport physical activity (1) were classified as participants in this form of activity whereas those who did not were classified as non-participants (0). Prevalence rates for each of the observed physical activity behaviours at Time 2 for the overall sample, male and female, and younger and older adolescent cohorts are presented in Table 6.1.

Table 6.1 *Prevalence of physical activity behaviours across adolescent cohorts at Time 2*

Physical Activity Behaviour	Total	Females	Males	Younger	Older
	<i>n</i> = 803	<i>n</i> = 502	<i>n</i> = 301	<i>n</i> = 401	<i>n</i> = 402
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
≥ 60mins MVPA on 3 or more day	369 (45.9%)	174 (34.7%)	195 (64.8%)	215 (53.6%)	154 (38.3%)
Non-organised physical activity ≥ 3 sessions	275 (34.3%)	152 (30.3%)	123 (40.9%)	146 (36.4%)	129 (32.1%)
Team sport	347 (43.2%)	178 (35.5%)	169 (56.1%)	211 (52.6%)	136 (33.8%)
Individual sport	229 (28.5%)	129 (25.7%)	100 (33.2%)	140 (34.9%)	89 (22.1%)
Organised non-sport physical activity	218 (27.2%)	173 (34.5%)	45 (15.0%)	87 (21.7%)	131 (32.6%)

*Note.* MVPA = Moderate-to-vigorous physical activity

### 6.3.4 Data Analysis.

Latent class analysis was repeated at Time 2 to establish classes of physical activity behaviour among male and female, and younger and older adolescents twelve months after initial assessment. This facilitated an investigation into whether similar profiles of physical activity participation emerged at each time point. Five observed binary indicators of physical activity were used to estimate the latent class model at Time 1 and Time 2, which included recommended levels of moderate-to-vigorous physical activity achieved on at least three days over the past week, a minimum of three sessions of non-organised physical activity, and participation in organised team sport, organised individual sport, and organised non-sport physical activity (See Section 3.3 for a more in-depth explanation of the LCA indicators).

The best fitting latent model is determined through a combination of parsimony, statistical indicators and fit criterion. Lower values on the Akaike Information Criterion (AIC; Akaike, 1987), Bayesian Information Criterion (BIC; Schwartz, 1978), and Adjusted BIC (ABIC; Sclove, 1987) indicate superior model fit. The Lo-Mendell Rubin adjusted likelihood ratio test (LMR-LRT; Lo et al., 2001) assesses the improvement in model fit between successive classes by comparing the estimated model (*k*) with a model with one less class (*k*-1). A non-significant result indicates that an additional class does not result in a statistically significant improvement in model fit and the previous model is selected as providing the best fit to the data. Entropy values, in turn, provide an indication of the percentage of the sample accurately classified by any given model. Finally, significant bivariate residuals facilitate an additional means of evaluating model fit, with more significant residuals indicating poorer model fit. In addition, a model must make conceptual sense therefore previous research was used to guide selection of the optimal solution. A more detailed overview of the latent class procedure and fit criteria are provided in Section 4.4.2.4. Within the present analysis, model interpretability in addition to an agreement of a



combination of the BIC, number of significant bivariate residuals, and the LMR-LRT was used to determine the model that best approximated the data.

After a latent class model was identified as best fitting the data, latent class assignments for each participant at Time 1 and Time 2 were saved in a data file. Crosstabs of latent class assignments at baseline and follow-up were used to track membership in latent physical activity classes over twelve months and to describe stability and changes in adolescents' physical activity behaviour over time. In addition, the saved latent class assignments at baseline and follow-up were used to group participants longitudinally into one of four possible physical activity maintenance and behaviour change trajectories, which reflected whether an adolescent was classified as a physical activity participant or non-participant at each time point. These longitudinal trajectories represented maintained physical activity participation (member of class characterised by some form of participation in physical activity at Time 1 and Time 2), dropout (member of class characterised by some form of physical activity participation at Time 1 but non-participant at Time 2), uptake of physical activity (non-participant at Time 1 but member of class characterised by some form of physical activity participation at Time 2) and continued non-participation (members of non-participation class at Time 1 and Time 2.).

## **6.4 Results**

### **6.4.1 Latent class analysis among female adolescents at Time 2**

A series of latent class models comprising two through seven classes were estimated for the female adolescent cohort at Time 2 ( $n = 502$ ). The accompanying fit information is presented in Table 6.2.

The AIC, BIC, and SSABIC fit criteria were in agreement suggesting a six class model. In contrast, the LMR-LRT demonstrated that a two class solution fit the model better than a one class solution, whilst a four class solution offered a statistically better fit than a five class model. However, there was one significant bivariate residual associated with the two class solution indicating that it provided a poor fit to the data. Further inspection of the competing models revealed that the difference between the BIC values for the four and six class solution was minimal with a score of less than two discriminating these classes. In addition, neither the four nor six class models had any significant bivariate residuals indicating that both models approximated the data well. High entropy score were also evidenced for each of these solutions, although the six class solution performed more favourably.

The interpretability of the four and six class models were subsequently considered in line with the empirical literature to assist in identifying the optimal solution. In comparison to the four class solution, the six class model comprised a highly active class characterised by high probabilities of engaging in all physical activity behaviours, which represented less than 2% ( $n = 9$ ) of the female sample. An additional class presented by the six class model was characterised by high probability of active

participation in organised non-sport (e.g. dance) activities, and a moderate likelihood of performing team sport, whereas the corresponding class identified within the four class model reflected a high likelihood of active engagement in organised non-sport physical activities alongside more unstructured physical activity forms (e.g. walking). A prior investigation into natural groupings of young people’s physical activity however, revealed that the majority of adolescent girls were characterised by a mixed pattern of engagement in dance, walking and jogging, whilst the remainder were grouped into four distinct classes representing participation in aerobic exercise, swimming, volleyball and soccer (Liu et al., 2013). The findings offer support for the latent physical activity class outlined within the four class model indicating that engagement in non-sport activities alongside more informal exercise represents a highly prevalent pattern of physical activity among girls. The six class model relative to the four class model therefore presents two additional female physical activity behaviour patterns that do not appear to have been previously supported by the literature. Thus, in line with the LMR-LRT, and a minimally discrepant BIC value, the four class model was considered to provide a more parsimonious and meaningful interpretation of adolescent girls’ physical activity patterns at Time 2.

Class-specific item-response probabilities of endorsing each of the observed physical activity behaviours were used to aid interpretation of the four latent classes (Table 6.3). Figure 6.1 presents the profile plots with the five physical activity behaviour indicators along the *x*-axis and the probability of endorsing each item along the *y*-axis. Descriptive statistics pertaining to mean daily minutes spent in moderate-to-vigorous physical activity s also provided in Table 6.3 to facilitate a more comprehensive examination of female adolescents’ physical activity behavioural patterns at follow-up.

Table 6.2 *Model fit statistics for the latent class models at Time 2 among female adolescents*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	<i>p</i>
2	-1488.84 (11)	2999.67	3046.08	3011.16	1.00	1	153.40	.00
3	-1477.09 (17)	2988.18	3059.90	3005.94	0.80	0	22.88	.06
<b>4</b>	<b>-1470.41 (3)</b>	<b>2946.82</b>	<b>2959.48</b>	<b>2949.95</b>	<b>0.82</b>	<b>0</b>	<b>51.25</b>	<b>.00</b>
5	-1465.72 (29)	2989.44	3111.78	3019.73	0.89	0	9.14	.05
6	-1463.27 (5)	2936.55	2957.64	2941.77	0.92	0	57.91	.00
7	-1462.29 (6)	2936.58	2961.89	2942.85	0.88	0	95.35	.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

Table 6.3 Descriptive statistics and item-response probabilities for physical activity behaviour indicators among female adolescents at Time 2

Latent Class	<i>n</i>	$\geq 60$ mins MVPA on $\geq 3$ days	Non- organised PA $\geq 3$ sessions	Team sport	Individual sport	Organised non-Sport PA	Mean daily mins MVPA <i>M</i> ( <i>SD</i> )
1. Active Exercise	40	<b>0.57</b>	<b>1.00</b>	0.00	0.01	<b>0.70</b>	47.18 (33.57)
2. Organised Dance & Fitness	83	0.37	0.00	0.03	0.23	<b>1.00</b>	29.80 (29.96)
3. Active Sport	126	<b>0.93</b>	0.31	<b>0.82</b>	<b>0.51</b>	0.39	62.96 (24.23)
4. Non Participation	253	0.00	0.27	0.22	0.16	0.14	11.28 (12.62)

Note. PA = Physical Activity; MVPA = Moderate-to-vigorous physical activity; Conditional probabilities  $>.5$  in bold to facilitate interpretation

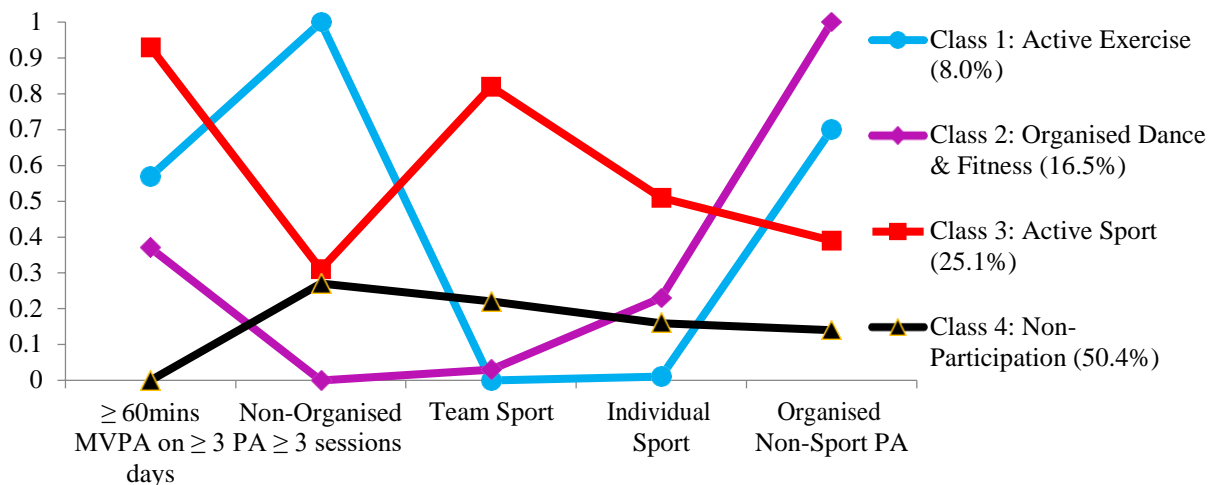


Figure 6.1. Profile plot of the four physical activity behaviour classes for female adolescents at Time 2

Comprising the smallest proportion of girls (8%), Class 1 (i.e. blue line) was characterised by the highest likelihood of engaging in at least three sessions of non-organised physical activity per week, high probability of non-sport organised physical activity, moderate probability of moderate to-vigorous physical activity and low likelihood of sport participation. Further inspection of this class revealed that non-organised physical activity involvement typically reflected individualised pursuits such as walking, jogging, swimming and running. This form of activity was additionally supplemented by participation in organised fitness or dance activities. Members of this class were relatively active accumulating a mean of 47.18 minutes of moderate-to-vigorous physical activity (MVPA) daily. In accordance, this

class was subsequently labelled ‘Active Exercise’ reflecting the regular and active nature of physical activities undertaken.

Class 2 (i.e. purple line) representing 16.5% of female adolescents was characterised by the highest probability of engaging in organised non-sport physical activity but lower probabilities of endorsing the remaining physical activity behaviours. Approximately 75% of girls assigned to this class undertook organised dance classes whilst the remainder went to the gym and engaged in yoga or fitness classes (e.g. aerobics, Zumba, circuits). As such this class was named ‘Organised Dance and Fitness’. Adolescents within this class could be distinguished from those assigned to the *active exercise* class as they engaged solely in a pattern of non-organised physical activity that was undertaken at lower levels of physical activity, averaging approximately 30 minutes per day in MVPA.

Class 3 (i.e. red line) which comprised a quarter of female adolescents surveyed, was distinguished by the highest probability of engaging in team sport (e.g. Gaelic football, basketball, hockey), individual sport (e.g. swimming, martial arts, cross-country running) and recommended MVPA guidelines on a minimum of three days over the past week. Members of this class were highly active participating on average in more than 60 minutes of moderate-to-vigorous physical activity daily. In accordance, this class was labelled ‘Active Sport’. Finally, the majority (50.4%) of adolescent girls were represented by Class 4 (i.e. black line), which was characterised by low probabilities of endorsing any of the observed physical activity behaviours and consequently received the label ‘Non-Participation’. Girls within this class also reported the lowest mean levels of moderate-to-vigorous physical activity accumulating only 11 minutes per day in MVPA.

#### ***6.4.1.1 Patterns of stability and change in physical activity from Time 1 to Time 2 among female adolescents***

Latent class analysis undertaken at Time 1 identified six patterns of physical activity behaviour among female adolescents which corresponded to *active participation in team sport, active individual sport*, and less active patterns of engagement in *organised dance and fitness, non-organised physical activity* and a combination of *individual sport and organised physical activity*. In addition, a low active class reflecting *non-participation* emerged (Refer to Section 4.5.5). At Time 2, latent class analysis was repeated and four distinct patterns of involvement in physical activity were identified, as outlined above. Crosstabs of latent class assignments at each time point were used to examine movement and stability among the physical activity classes from baseline to follow-up (Table 6.4). The percentage of adolescent girls who belonged to each of the latent physical activity classes at Time 1 and Time 2 is shown in Table 6.4 and graphically depicted in Figure 6.2.

Table 6.4 Patterns of stability and change in physical activity patterns from Time 1 to Time 2 among female adolescents

Time 2 Latent PA Class				
	Class 1	Class 2	Class 3	Class 4
	Active Exercise	Organised Dance & Fitness	Active Sport	Non-Participation
	<i>n</i> = 40 (8.0%)	<i>n</i> = 83 (16.5%)	<i>n</i> = 126 (25.1%)	<i>n</i> = 253 (50.4%)
Time 1 Latent PA Class	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
C1. Organised Individual Sport & PA ( <i>n</i> = 15)	3 (20%)	4 (26.7%)	1 (6.7%)	7 (46.7%)
C2. Active Individual Sport ( <i>n</i> = 45)	2 (4.4%)	7 (15.6%)	20 (44.4%)	16 (35.6%)
C3. Organised Dance & Fitness ( <i>n</i> = 65)	10 (15.4%)	29 (44.6%)	4 (6.2%)	22 (33.8%)
C4. Non-Organised PA ( <i>n</i> = 92)	12 (13.0%)	11 (12.0%)	11 (12.0%)	58 (63.0%)
C5. Active Team Sport ( <i>n</i> = 121)	4 (3.3%)	8 (6.6%)	77 (63.6%)	32 (26.4%)
C6. Non-Participation ( <i>n</i> = 164)	9 (5.5%)	24 (14.6%)	13 (7.9%)	118 (72.0%)

Note. PA = Physical Activity

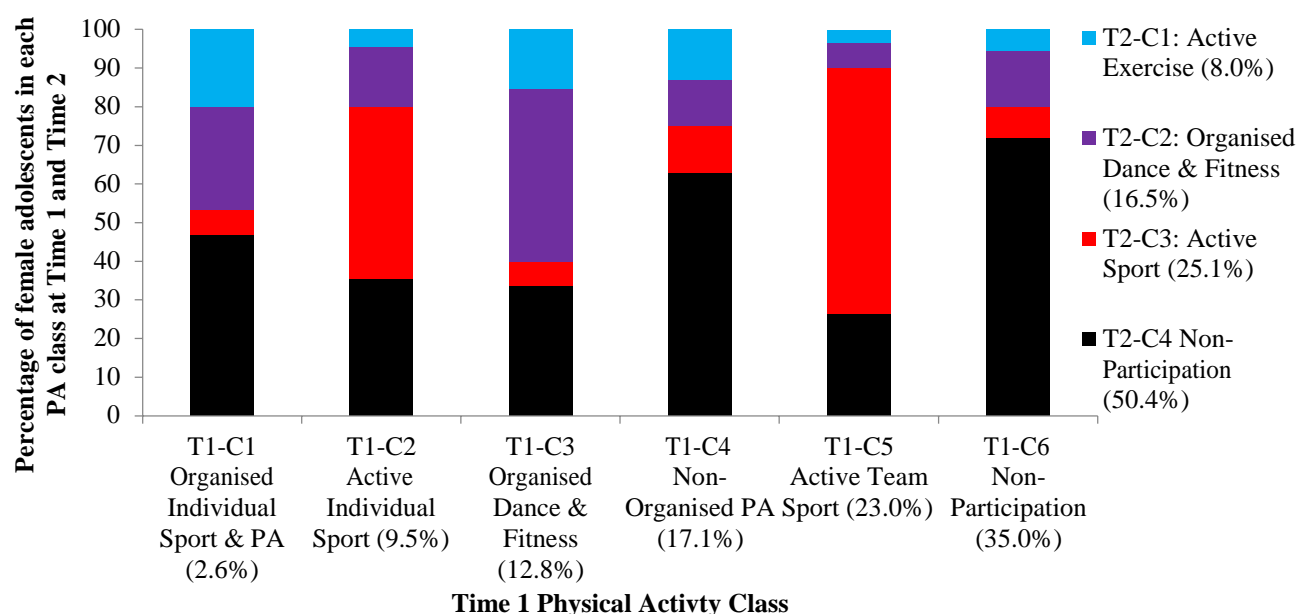


Figure 6.2. Proportion of female adolescents assigned to each latent class at Time 1 and Time 2

Note. PA = Physical Activity, T1 = Time 1, T2 = Time 2, C1 = Class 1, etc.

Firstly, it should be noted that two of the latent groups were conceptually similar at Time 1 and Time 2; the *non-participation*, and *organised dance & fitness* classes, demonstrating a moderate degree of stability in female adolescents' physical activity participation over twelve months. The *non-participation* class, which comprised the largest proportion of girls at each time point, represented just

less than a third of girls at baseline and over half of the female sample at follow-up, indicating that a sizeable proportion became non-active twelve months later. The majority of adolescents ( $n = 118$ , 72%) who were classified as *non-participants* at Time 1 continued to refrain from taking part in physical activity at Time 2. However, girls characterised by different profiles of participation in physical activity at baseline also transitioned into the *non-participation* group at follow-up, with a greater number of low active *non-organised physical activity* participants becoming non-active over time. The remaining baseline non-participants adopted some form of physical activity behaviour at follow-up with most ( $n = 24$ , 14.6%) opting to initiate participation in organised non-sport physical activities such as dance and fitness classes including circuits, aerobics and Zumba.

The *organised dance & fitness* class comprised a greater proportion of female adolescents at follow-up than baseline (16.5% vs 12.8%). Just less than half (44.4%) of all girls assigned to this class at Time 1 were represented by this participation profile at Time 2. A smaller proportion of girls (15.4%) transitioned into a more active pattern of engagement combining organised non-sport activities with more informal exercise (*active exercise*). Taken together, approximately 60% of girls who were classified as *organised dance & fitness* participants at Time 1 were represented by one of two latent classes characterised by high probabilities of organised non-sport physical activity at follow-up indicating moderate-to-high stability in this behavioural pattern over time. In addition, a minority of girls ( $n = 4$ ) replaced this form of activity with sport participation whilst approximately one third of girls dropped out of physical activity altogether.

There was no latent physical activity class identified at follow-up that resembled adolescent girls' baseline pattern of low active participation in *organised individual sport and physical activity*. At Time 2, just over half ( $n = 8$ ) of the original female members were assigned into one of the latent physical activity classes characterised by involvement in organised sport or physical activity whilst the remainder ( $n = 7$ ) discontinued physical activity participation. It should be acknowledged however, that this class represented a very small number of adolescents at Time 1 ( $n = 16$ ), therefore further research is warranted among a larger female sample to determine whether this pattern of involvement is likely to be replicated and sustained over time.

The *active sport* class identified at follow-up combined team and individual sport participants that comprised distinct physical activity profiles at baseline. The majority (63.6%) of girls classified as active team sport members at Time 1 sustained participation in sport at Time 2 whilst a minority (9.9%) swapped this pattern of involvement for an alternate profile of organised non-sport physical activity undertaken alone or in combination with non-organised exercise performed at varied levels of moderate-to-vigorous physical activity. In addition, a smaller percentage of baseline *active team sport* members became non-active at follow-up compared to those characterised by other profiles of physical activity participation. In contrast to team sport participants, a smaller number of girls who were

classified as *active individual sport* participants at Time 1 maintained sport involvement at Time 2 (44.4%) owing to greater levels of drop out (35.6%) and a larger proportion of girls swapping sport for participation in organised and non-organised individualised type physical activities (20%). Nonetheless approximately half of the female sample characterised by active involvement in individual sport at Time 1 maintained active levels of participation in moderate-to-vigorous physical activity twelve months later. The findings indicate that withdrawal from sport does not necessarily result in inactivity but may be replaced instead with a non-competitive mode of physical activity participation characterised by low or high levels of moderate-to-vigorous physical activity.

Finally, girls classified as *non-organised physical activity* participants at Time 1 demonstrated the greatest risk of dropping out of physical activity, with the majority (63%) of members transitioning to the *non-participation* class at Time 2. A minority of *non-organised physical activity* participants ( $n = 12$ ) actually increased moderate-to-vigorous physical activity levels one year later by combining non-organised physical activity with participation in organised dance and fitness type activities. The remaining girls replaced this context of participation with a pattern of engagement in organised sports ( $n = 11$ ) or physical activity ( $n = 11$ ). Thus, it is evident that a pattern of low active involvement in *non-organised physical activity* demonstrates low levels of stability and continuation over time.

In summary, there is some consolidation in female physical activity behaviours over time. Most notably, the *organised dance and fitness* and *non-participation* classes were conceptually similar at each time point. A small proportion of girls ( $n = 10$ ) within the *organised dance and fitness* class also increased their level of moderate-to-vigorous physical activity by transitioning into the *active exercise* group, in which regular non-organised exercise (e.g. walking, jogging, swimming) was performed alongside organised non-sport physical activities. In turn, the majority of girls classified as non-participants at baseline were characterised by a pattern of inactivity at follow-up. Moreover, half of the female sample was classified as non-participants twelve months later underscoring the steep age-related dropout in physical activity across adolescence. A small proportion of girls however, adopted physical activity at follow-up with most opting for low active patterns of involvement in organised physical activities like gym and dance classes. The *active sport* class at Time 2 comprised one quarter of adolescent girls and subsequently replaced the discrete patterns of active involvement in team and individual sport identified at baseline. The majority of active team sport baseline participants sustained participation in sport one year later suggesting that this active profile of participation conferred a positive influence over girls' moderate-to-vigorous physical activity levels and physical activity behaviour over time. Following on from this, the *non-organised physical activity* class at Time 1 was subsequently replaced by a more active pattern of engagement in organised and non-organised individual type physical activities at Time 2, which is consistent with prior research indicating that participation in non-competitive forms of exercise increase across adolescence among girls (Eime et al., 2013).

In contrast, the *organised individual sport & physical activity* pattern identified at Time 1 was not replicated at follow-up which may be a consequence of the small number of girls ( $n = 16$ ) that comprised this group at baseline. Finally, as expected dropout was evidenced across all profiles of physical activity participation, however girls assigned to the *non-organised physical activity* class demonstrated the greatest risk of becoming non-active twelve months later. It is interesting to note however, that the majority of girls characterised by participation in *organised dance and fitness*, continued to take part in physical activity at follow-up, despite demonstrating similar levels of moderate-to-vigorous physical activity at baseline, as those classified as *non-organised physical activity* participants. These findings suggest that the context of participation may impact female persistence in physical activity over twelve months with structured activities identified as most beneficial for sustained participation. Finally, there was some movement across latent classes characterised by physical activity participation, with a small proportion of adolescents substituting baseline physical activity behaviours with a less active pattern of engagement in organised non-sport physical activity.

#### ***6.4.1.2 Longitudinal physical activity trajectories from Time 1 to Time 2 among female adolescents***

On the basis of latent class membership at Time 1 and Time 2, adolescents were subsequently grouped longitudinally into one of four physical activity maintenance and behaviour change trajectories which corresponded to maintained participation in physical activity (physical activity participant at Time 1 and Time 2), dropout (physical activity participant at Time 1 but non-participant at Time 2), adoption of physical activity (non-participant at Time 1 but physical activity participant at Time 2) or continued non-participation (non-participant at Time 1 and Time 2). Descriptive statistics are presented in Table 6.5 for mean daily minutes spent in moderate-to-vigorous physical activity (MVPA) and mean number of days on which recommended MVPA guidelines were met. One-way ANOVAs revealed that physical activity trajectory groups significantly differed on mean daily minutes spent in moderate-to-vigorous physical activity ( $F(3, 498) = 127.70, p < .001, \eta^2_p = .44$ ) and mean number of days on which recommended MVPA guidelines were met ( $F(3, 498) = 175.60, p < .001, \eta^2_p = .51$ ). Post hoc comparisons revealed that physical activity maintainers reported significantly higher mean daily minutes and mean number of days on which recommended levels of MPVA was achieved than all of the other groups ( $p < .001$ ). In turn, physical activity adopters demonstrated significantly higher mean daily MVPA minutes and number of days that recommended MVPA guidelines were met compared to non-participants (both  $p < .001$ ) and dropouts (both  $p < .001$ ). There were no other significant differences found between groups.



Table 6.5 Descriptive statistics for female adolescent's physical activity trajectory groups at Time 2

	Min – Max	Maintainer (n = 203, 40.4%)	Non-Participant (n = 118, 23.5%)	Dropout (n = 135, 26.9%)	Adopter (n = 46, 9.2%)
Mean Daily mins MVPA	0 -174.3	53.55 (31.93)	8.04 (11.28)	14.12 (13.07)	30.90 (21.56)
Mean no. of days ≥ 60mins MVPA	0 -7	3.62 (1.85)	0.42 (0.67)	0.84 (0.80)	2.33 (1.66)

Note. MVPA = Moderate-to-vigorous physical activity

#### 6.4.2 Latent class analysis among male adolescents at Time 2

Latent class analysis was conducted at Time 2 to identify physical activity patterns among male adolescents (n = 301) and to facilitate examination of common patterns and transitions in physical activity behaviour over a twelve-month period. Model fit information for two through seven classes is presented in Table 6.6. The fit indices were in conflict with the BIC criterion supporting a four class solution whilst that AIC and SSABIC indicated that a six class solution was optimal. However, the fit information criteria were very similar for four through six classes with minimal differences evidenced on respective AIC, BIC and SSABIC scores. The Lo-Mendell-Rubin likelihood ratio test offered support for the six class model indicating that the addition of a seventh class did not significantly improve model fit over that of a six class solution. Similarly high entropy values were evidenced for the four and six class models and neither had any significant bivariate residuals indicating that both solutions provided a good fit to the data.

Further examination of the four and six class solution was subsequently undertaken to evaluate the interpretability of these latent classes. The four class model represented four distinct patterns of involvement in physical activity that was replicated by the six class model. The six class solution offered two additional classes, with one class reflecting a low active pattern of participation in non-organised physical activities like cycling, running and swimming. Prior research indicates that participation in individual forms of exercise increase among Irish adolescents across secondary school offering support for this distinct profile of physical activity participation (Lunn et al., 2013). However, the second additional class comprised a mere eight participants and reflected a pattern of active participation in a mixture of sports and physical activities. While five of these classes represented discrete physical activity patterns, the low number of males assigned to the remaining class suggested that the six class solution did not provide an optimal fit to the data.

It was subsequently decided to inspect the latent classes represented by the five class solution given that the fit criteria did not differ much among the four, five and six class models. Five distinct patterns

of physical activity emerged replicating the four patterns identified within the four class model in addition to a less active pattern of participation in non-organised physical activity, which was also identified among the six class model. Given that the five class solution appeared to provide the most meaningful interpretation of the data, in addition to the minimal discrepancies evidenced among the fit criteria for four through six classes, the five class model was selected as the best-fitting model. Item-response probabilities for each of the observed variables are presented in Table 6.7 and visually depicted in Figure 6.3 to aid interpretation of each of these latent classes. In addition, mean minutes spent in daily moderate-to-vigorous physical activity is provided to facilitate interpretation of each of the profiles of male adolescent's physical activity participation (Table 6.7).

Table 6.6 *Model fit statistics for the latent class models at Time 2 among male adolescents*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	<i>p</i>
2	-883.84 (11)	1789.67	1830.45	1795.56	1.00	1	77.19	0.00
3	-873.54	1751.08	1758.50	1752.16	1.00	0	1180.20	0.00
4	-869.74 (3)	1745.47	1756.59	1747.08	0.84	0	750.16	0.00
<b>5</b>	<b>-867.60 (4)</b>	<b>1743.21</b>	<b>1758.03</b>	<b>1745.35</b>	<b>0.79</b>	<b>0</b>	<b>512.61</b>	<b>0.00</b>
6	-865.48 (5)	1740.97	1759.50	1743.65	0.84	0	44.85	0.00
7	-864.73 (41)	1811.47	1963.46	1833.43	0.87	0	1.46	0.52

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

Table 6.7 *Descriptive statistics and item-response probabilities for physical activity behaviour indicators among male adolescents at Time 2*

Latent Class	<i>n</i>	≥ 60mins MVPA on ≥ 3 days	Non-organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M</i> (SD)
1. Active Individual Sport & Non-Organised PA	23	<b>0.83</b>	<b>0.76</b>	0.00	<b>1.00</b>	0.20	74.99 (30.71)
2. Non-Organised PA	44	0.41	<b>1.00</b>	0.17	0.00	0.08	37.80 (25.52)
3. Active Mixed Sports	35	<b>0.91</b>	0.00	<b>0.71</b>	<b>0.53</b>	0.30	67.84 (35.93)
4. Non-Participation	71	0.00	0.00	0.21	0.18	0.18	14.29 (13.46)
5. Active Team	128	<b>0.94</b>	0.50	<b>1.00</b>	0.27	0.08	72.65 (32.17)

*Note.* PA = Physical Activity; Conditional probabilities >.5 in bold to facilitate interpretation

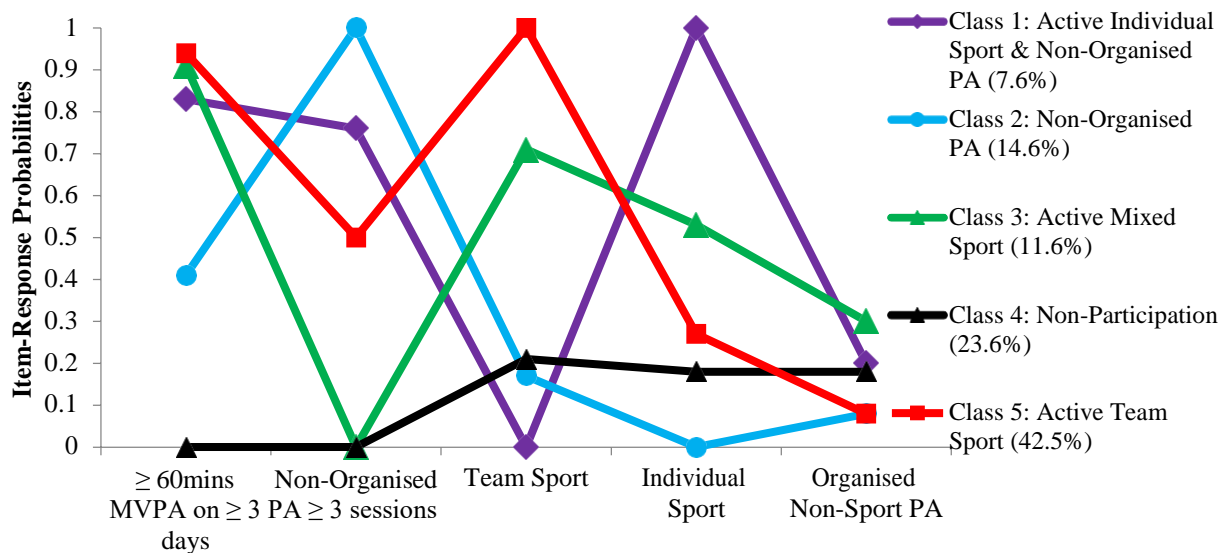


Figure 6.3. Profile plot of the five physical activity behaviour classes for male adolescents at Time 2

Class 1 (i.e. purple line), the smallest of the classes containing 7% of male adolescents, was characterised by high probabilities of engaging in individual sport (e.g. cross-country running, swimming, martial arts), non-organised physical activity and recommended moderate-to-vigorous physical activity guidelines on at least three days over the past week. Further inspection of this group revealed that participation in individual sport was supplemented by participation in unstructured physical activities such as running, cycling and informal games of soccer and basketball. Members of this group also demonstrated high mean levels of moderate-to-vigorous physical activity (MVPA) averaging over one hour spent in MVPA daily, which is consistent with recommended physical activity guidelines. This class was subsequently labelled ‘Active Individual Sport and Non-Organised Physical Activity’.

Comprising 14% of the male sample at follow-up, Class 2 (i.e. blue line) reflected high rates of participation in non-organised physical activity and a low likelihood of engaging in any of the other physical activity behaviours. Inspection of the raw data revealed that the majority of adolescents engaged in informal individual physical activities such as jogging, swimming, walking, cycling and conditioning exercises like sit-ups and press-ups. The class was subsequently named ‘Non-Organised Physical Activity’ and comprised a less active group of boys that accumulated a mean of 37.8 minutes of moderate-to-vigorous physical activity per day. Class 3 (i.e. green line) represented 11% of males and was characterised by moderate-to-high probabilities of engaging in team sport (e.g. soccer, Gaelic football, rugby, basketball) and individual sport (e.g. martial arts, cross-country running, tennis) in addition to a high likelihood of achieving recommended levels of MVPA on a minimum of three days over the past week. Low rates of participation were evidenced however for organised non-sport physical

activity and non-organised physical activity. Members of this group were highly active spending more than 60 minutes on average in moderate-to-vigorous physical activity per day. In accordance this class was labelled ‘Active Mixed Sports’ representing dual participation in team and individual sports.

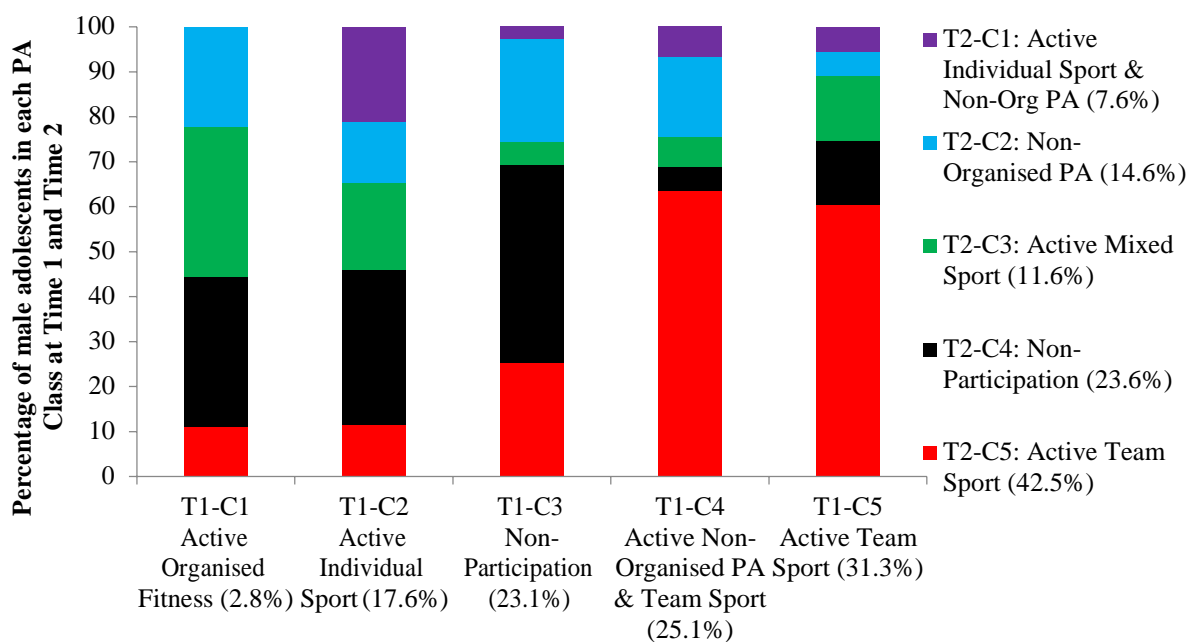
Containing just less than one-quarter (23.6%) of male adolescents at follow-up, Class 4 (i.e. black line) was discriminated by low probabilities of engaging in all of the physical activity behaviours measured and was subsequently named ‘Non-Participation’. Boys represented by this class also reported the lowest levels of daily moderate-to-vigorous physical activity accumulating on average just 14 minutes of recommended MVPA per day. In turn, Class 5 (i.e. red line), the largest of the male classes at follow-up (42.5%) was labelled ‘Active Team Sport’ owing to a distinctive profile that was characterised by the highest probability of engaging in team sport and recommended amounts of moderate-to-vigorous physical activity on three or more days as well as a lower likelihood of participating in the remaining physical activity behaviours. Class members were also found to be highly active spending over 70 minutes daily in MVPA.

#### ***6.4.2.1. Patterns of stability and change in physical activity from Time 1 to Time 2 among male adolescents***

Latent class analysis performed at Time 1 identified five distinct patterns of physical activity among male adolescents, which included active participation in team sport, individual sport, organised fitness, non-organised physical activity undertaken in combination with team sport, and a pattern of non-participation. Approximately twelve months later at Time 2, five discrete latent physical activity classes were established. Crosstabs of latent class assignments at each time point were used to examine movement and stability among the physical activity classes from baseline to follow-up (Table 6.8), which is graphically depicted in Figure 6.4. Given that some of the latent classes were structurally different at each time point however, some caution is required when interpreting the physical activity transitions from Time 1 to Time 2.

Table 6.8 *Patterns of stability and change in physical activity patterns from Time 1 to Time 2 among male adolescents*

<b>Time 2 Latent PA Class</b>					
	Class 1	Class 2	Class 3	Class 4	Class 5
	Active Individual Sport & Non-Organised PA ( <i>n</i> = 23, 7.6%)	Non-Organised PA ( <i>n</i> = 44, 14.6%)	Active Mixed Sport ( <i>n</i> = 35, 11.6%)	Non-Participation ( <i>n</i> = 71, 23.6%)	Active Team Sport ( <i>n</i> = 128, 42.5%)
<b>Time 1 Latent PA Class</b>	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
C1. Active Organised Fitness ( <i>n</i> = 9)	0 (0%)	2 (22.2%)	3 (33.3%)	3 (33.3%)	1 (11.1%)
C2. Active Individual Sport ( <i>n</i> = 52)	11 (21.1%)	7 (13.5%)	10 (19.2%)	18 (34.6%)	6 (11.5%)
C3. Non-Participation ( <i>n</i> = 75)	2 (2.7%)	17 (22.7%)	4 (5.3%)	33(44.0%)	19 (25.3%)
C4. Active Non-Organised PA/Team Sport ( <i>n</i> =74)	5 (6.8%)	13 (17.6%)	5 (6.8%)	4 (5.4%)	47 (63.5%)
C5. Active Team Sport ( <i>n</i> = 91)	5 (5.5%)	5 (5.5%)	13 (14.3%)	13 (14.3%)	55 (60.4%)



#### Time 1 Physical Activity Class

Figure 6.4. Proportion of male adolescents assigned to each latent class at Time 1 and Time 2

Note. PA = Physical Activity, T1 = Time 1, T2 = Time 2, C1 = Class 1, etc.

In partial support of our hypothesis, two of the five baseline classes, *active team sport* and *non-participation*, were replicated at follow-up demonstrating a moderate degree of stability over time for male physical activity patterns. The *active team sport* class comprised the largest proportion of adolescents (31.3%) at Time 1 and again at Time 2 (42.5%), indicating that this pattern of physical activity involvement is most prevalent among males. In line with this finding, national research undertaken on Irish secondary school students' participation in physical activity indicates that extra-school and extra-curricular participation among boys is dominated by participation in team sports such as soccer and Gaelic football (CSPPA, 2010). In addition, the majority of adolescents assigned to the *active team sport class* at baseline continued to persist in team sport at follow-up while some complemented this form of participation with individual sport, with three-quarters of original members represented by a discrete or mixed profile of participation in team sport twelve months later. In turn, a minority of boys characterised by *active team sport* participation at Time 1 dropped out of physical activity altogether or replaced participation with more individualised patterns of high or low active moderate-to-vigorous physical activity. The *non-participation* class was also structurally stable over time containing a similar proportion of adolescents at each time point, which was equivalent to just less than one-quarter of the overall male sample. A greater proportion of boys classified as non-participants at Time 1 comprised the non-participant group at Time 2 than boys from any other group. However, dropout was evidenced among all of the physical activity classes with more males represented at baseline by active patterns of involvement in individual type sports and

physical activity becoming non-active over time than those characterised by team sport participation. In turn, just over half of those classified as non-participants at Time 1 adopted some form of physical activity at Time 2 with *active team sport* participation (e.g. Gaelic football, soccer, basketball, rugby) or a less active pattern of engagement in *non-organised physical activity* like running, jogging, swimming and physical conditioning (e.g. sit-ups, press-ups) reflecting the most popular options.

In turn, the *active organised fitness* class established at Time 1 was not replicated at Time 2. However, this class comprised a very small proportion of males ( $n = 12$ ) at baseline with a quarter of these members subsequently dropping out of the study at follow-up, which may explain the lack of stability in this pattern of activity evidenced over time. Of the remaining boys for whom information was available, three became inactive, two adopted a less active pattern of *non-organised physical activity*, whilst the remainder ( $n = 4$ ) replaced organised physical activity with active sport participation. It is difficult however to draw any conclusions regarding the stability of this pattern owing to the initially low number of members at Time 1 and attrition at Time 2. Further replication of this profile should be sought among a larger sample of males and followed over time to facilitate a more thorough assessment of this pattern of involvement during adolescence.

The *active individual sport* and mixed profile of *active non-organised physical activity and team sport* participation were not replicated at follow-up. Instead these physical activity patterns were replaced by a pattern of *active individual sport* undertaken in combination with *non-organised physical activity*, a mixed profile of *active* participation in *team and individual sport*, and a more discrete profile of less active *non-organised physical activity* (e.g. running, cycling). Among those classified as *active individual sport* participants at Time 1, roughly one fifth were classified as *active individual sport and non-organised physical activity* members at follow-up, whilst another fifth were assigned to the *active mixed sport* class, indicating that individual sport was supplemented with additional types of physical activity over time. In turn, very few individual sport participants swapped individual sport for team sport involvement. A greater proportion of baseline active individual sport members however dropped out of physical activity or transitioned into a less active pattern of informal exercise at follow-up than those characterised by team sport participation, indicating that the individual format of sport participation may be less likely to be maintained over time.

Finally, the majority of boys assigned to the *active non-organised physical activity and team sport* class at Time 1 were characterised by active participation in team sports alone or in combination with individual sports at follow-up whereas a smaller proportion were represented by a less active pattern of involvement in more informal physical activities (e.g. running). Perhaps what is most interesting about this baseline pattern of active team sport and non-organised physical activity involvement is the low rate of dropout evidenced at Time 2, with only four boys becoming non-active over time. Promoting participation in more informal activities alongside organised sport may help adolescents to maintain physical activity involvement over time whilst also providing those who discontinue sport participation with an alternative mode of physical activity participation, albeit one that may be characterised by lower levels of moderate-to-vigorous physical activity.

In summary, the results indicate that there is some consolidation in male adolescent physical activity behaviours over a one-year period. The most prevalent pattern of physical activity evidenced among boys at baseline and follow-up is *active* participation in *team sport* which is structurally stable over time. The majority of adolescents assigned to this baseline group also sustained involvement in team sport twelve months later demonstrating relatively low levels of dropout. In addition, the *non-participation* profile was replicated at follow-up with a similar percentage of adolescents refraining from taking part in physical activity at each time point. Just less than half of the members of the *non-participation* group at Time 1 remained non-participants at follow-up, whilst the remaining members adopted some form of physical activity with most joining team sport or performing non-organised individualised type activities.

The *active organised fitness* class was not replicated at follow-up although this is likely due to the small number of baseline participants and subsequent attrition. In addition, the *active non-organised and team sport* class did not emerge at Time 2 however, the majority of participants assigned to this class at Time 1 were characterised by active team sport participation whilst a smaller proportion dropped team sport and engaged solely in non-organised physical activity twelve months later. In addition, the discrete profile of *active individual sport* was also not established at follow up. These baseline classes were subsequently replaced by a mixed profile of *active* participation in *individual sport and non-organised physical activity*, *active mixed* involvement in *team and individual sports*, and a less active profile of *non-organised physical activity*. Although physical activity dropout rates were relatively low for male adolescents over twelve months, a greater proportion of boys characterised by profiles of individual sport and physical activity became non-active over time. In turn, the identification of a less active profile characterised by participation in informal individualised exercise (e.g. running, swimming, cycling) reflects a patterns of physical activity that has previously been found to gain prominence throughout the adolescent years (Eime et al., 2013; Lunn et al., 2013).

#### ***6.4.2.2 Longitudinal physical activity trajectories from Time 1 to Time 2 among male adolescents***

Based on profiles of physical activity participation at Time 1 and Time 2, adolescents were grouped longitudinally into one of four trajectories reflecting maintained participation in physical activity (physical activity participant at Time 1 and Time 2), dropout (physical activity participant at Time 1 but non-participant at Time 2), adoption of physical activity (non-participant at Time 1 but physical activity participant at Time 2) or continued non-participation (non-participant at Time 1 and Time 2).

Descriptive statistics are presented in Table 6.9 for mean daily minutes spent in moderate-to-vigorous physical activity (MVPA) and mean number of days on which recommended MVPA was achieved for each of the physical activity trajectory groups. One way ANOVA revealed that the physical activity trajectory groups significantly differed at Time 2 on mean daily minutes spent in moderate-to-vigorous physical activity ( $F(3, 297) = 53.26, p < .001, \eta^2_p = .35$ ) and mean number of days on which recommended MVPA guidelines were met ( $F(3, 297) = 68.79, p < .001, \eta^2_p = .41$ ). Post hoc pairwise comparisons indicated that physical activity maintainers reported significantly higher mean daily minutes of MVPA and mean number of days that



recommended physical activity guidelines were met than dropouts (both  $p < .001$ ), non-participants (both  $p < .001$ ), and physical activity adopters ( $p = .024$ ;  $p = .007$ ). In addition, adopters demonstrated significantly higher mean minutes in MVPA and number of days on which recommended MVPA guidelines were met in comparison to non-participants (both  $p < .001$ ) and dropouts (both  $p < .001$ ). The non-participant and dropout physical activity trajectory groups did not significantly differ from each other.

Table 6.9 *Descriptive statistics for male adolescent's physical activity trajectory groups at Time 2*

	Min - Max	Maintainer ( $n = 189, 62.8\%$ )	Non-Participant ( $n = 33, 11.0\%$ )	Dropout ( $n = 37, 12.3\%$ )	Adopter ( $n = 42, 14.0\%$ )
Mean Daily mins MVPA	0 -174.3	67.93 (34.03)	9.48 (11.25)	18.98 (13.80)	52.93 (33.27)
Mean no. of days $\geq 60$ mins MVPA	0 -7	4.26 (1.86)	0.55 (0.79)	1.19 (0.85)	3.31 (1.92)

### 6.4.3 Latent class analysis among younger adolescents at Time 2

A series of latent class models comprising two through seven classes was estimated for the younger adolescent cohort ( $n = 401$ ) at Time 2 approximately twelve months after initial assessment (Table 6.10). The BIC and SSABIC were in agreement suggesting a five class solution, while the AIC indicated that a seven class solution was optimal. Less emphasis however, is placed on the AIC indicator, as previous research has found that it tends to overestimate the correct number of classes (Yang, 2006). The Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) indicated that a two class model provided a significantly better fit than a three class model, and the addition of a sixth class did not provide a statistically significant improvement over the five class model. Thus, in accordance with the BIC, SSABIC and LMR-LRT, a five class latent model was selected to represent younger adolescents' physical activity patterns at Time 2. Interpretation of the latent classes was aided by evaluating the probabilities of endorsing each of the observed physical activity indicators across each class (Table 6.11), which is graphically depicted in Figure 6.5. Descriptive statistics are also presented for each latent class in relation to mean daily minutes spent in MVPA (Table 6.11).

Table 6.10 *Model fit statistics for the latent class models at Time 2 among younger adolescents*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	<i>p</i>
2	-1229.61	2461.23	2465.22	2462.05	0.84	0	588.39	0.00
3	-1222.17 (17)	2478.33	2546.22	2492.28	0.71	0	14.50	0.09
4	-1216.89 (3)	2439.77	2451.75	2442.23	0.76	0	584.39	0.00
<b>5</b>	<b>-1211.60 (4)</b>	<b>2431.21</b>	<b>2447.18</b>	<b>2434.49</b>	<b>0.82</b>	<b>0</b>	<b>57.57</b>	<b>0.00</b>
6	-1210.17 (35)	2490.33	2630.12	2519.06	0.86	0	2.80	0.55
7	-1209.16 (6)	2430.16	2454.13	2435.09	0.85	0	627.04	0.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.

Table 6.11 *Descriptive statistics and item-response probabilities for physical activity behaviour indicators among younger adolescents at Time 2*

Latent Class	<i>n</i>	≥ 60mins MVPA on ≥ 3 days	Non-organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M</i> (SD)
1. Active Organised PA & Team Sport	21	<b>0.84</b>	0.23	<b>0.52</b>	0.00	<b>1.00</b>	71.77 (31.88)
2. Non-Organised PA	54	0.35	<b>1.00</b>	0.00	0.09	0.25	35.93 (33.44)
3. Active Mixed Sport	103	<b>0.93</b>	0.39	<b>0.58</b>	<b>1.00</b>	0.30	71.90 (30.39)
4. Active Team Sport	125	<b>0.74</b>	0.42	<b>0.98</b>	0.23	0.06	47.96 (30.20)
5. Non-Participation	98	0.00	0.00	0.18	0.19	0.18	10.20 (13.11)

*Note.* PA = Physical Activity; Conditional probabilities >.5 in bold to facilitate interpretation

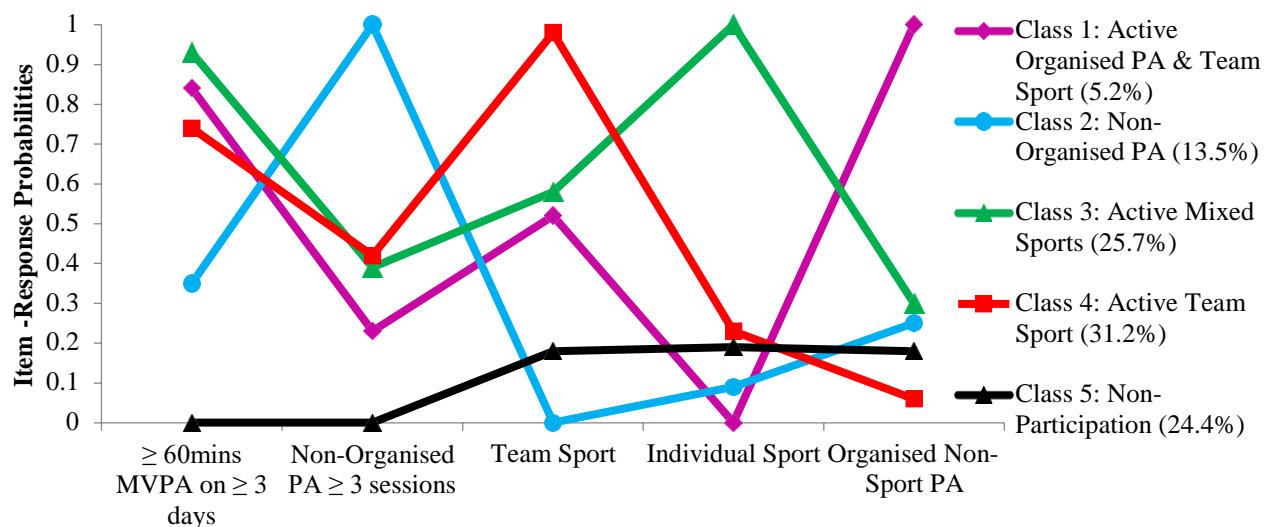


Figure 6.5. Profile plot of the five physical activity behaviour classes for the younger adolescent cohort at Time 2

Comprising approximately 5% of the younger adolescent cohort, Class 1 (i.e. pink line) was characterised by high probability of engaging in organised non-sport physical activity and achieving moderate-to-vigorous physical activity on a minimum of three days over the past week (Figure 6.5). In addition, members of this class had a moderate probability of undertaking team sport alongside lower probabilities of endorsing other physical activity behaviours. Further inspection of this class revealed that members participated in organised dance classes or structured fitness activities such as aerobics and circuits in addition to team sports such as Gaelic football and basketball. Adolescents characterised by this pattern of physical activity were highly active accumulating over 70 minutes on average per day in moderate-to-vigorous physical activity. As such this class was named ‘Active Organised Physical Activity & Team Sport’.

Class 2 (i.e. blue line) represented 13% of younger adolescents and evidenced high probability of performing non-organised physical activity along with a reduced likelihood of engaging in other physical activity behaviours. A small proportion of adolescents ( $n = 12$ ) assigned to this class participated in non-organised team games in addition to undertaking informal exercise like jogging and swimming. However, the remaining adolescents participated solely in a range of individual type physical activities like running, jogging, swimming and walking. In addition, members of this class were moderately active undertaking approximately 35 mean minutes per day in moderate-to-vigorous physical activity. In turn, this class received the label ‘Non-Organised Physical Activity’.

Containing one-quarter of the younger adolescent cohort, Class 3 (i.e. green line) was characterised by the highest probability of engaging in individual sport (e.g. cross-country running, swimming, martial arts, badminton) and moderate-to-vigorous physical activity, a more moderate probability of undertaking team sport (e.g. basketball, football) and low likelihood of engaging in organised and non-organised physical activity. This class was labelled ‘Active Mixed Sports’ and represented a highly active group of youth who spent over 70 minutes per day on average in moderate-to-vigorous physical activity. Class 4

(i.e. red line), the largest class comprising 31.2% of younger adolescents, evidenced a distinct pattern of involvement in organised team sport (e.g. Gaelic football, camogie, hockey, rugby) and high likelihood of attaining recommended levels of moderate-to-vigorous physical activity on at least three days over the previous week. Receiving the label ‘Active Team Sport’, adolescents within this class reported a mean of 47 minutes per day in moderate-to-vigorous physical activity. Representing one quarter of the younger adolescent sample at follow-up, Class 5 (i.e. black line) was discriminated by low probabilities of engaging in all of the physical activity behaviours assessed and as such was named ‘Non-Participation’. Members of this class were low active reporting a mean of 10 minutes of recommended moderate-to-vigorous physical activity daily.

#### **6.4.3.1. Patterns of stability and change in physical activity from Time 1 to Time 2 among younger adolescents**

Latent class analysis revealed five distinct patterns of physical activity involvement among younger adolescents at Time 1 and Time 2. At follow-up, two classes were structurally stable and two classes were closely approximated indicating a moderate-to-high degree of stability over time. Latent class membership was saved for each participant at Time 1 and Time 2, which enabled investigation into continued participation and changes across younger adolescents’ physical activity patterns during the two waves of data collection (Table 6.12). The proportion of youth assigned to each latent class at baseline and follow-up is presented in Figure 6.6.

Table 6.12 *Patterns of stability and change in physical activity patterns from Time 1 to Time 2 among younger adolescents*

	<b>Time 2 Latent PA Class</b>				
	Class 1	Class 2	Class 3	Class 4	Class 5
	Active Organised PA & Team Sport ( <i>n</i> = 21, 5.2%)	Non-Organised PA ( <i>n</i> = 54, 13.5%)	Active Mixed Sports ( <i>n</i> = 103, 25.7%)	Active Team Sport ( <i>n</i> = 125, 31.2%)	Non-Participation ( <i>n</i> = 98, 24.4%)
<b>Time 1 Latent PA Class</b>	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
C1. Active Organised PA & Sport ( <i>n</i> = 53)	11 (20.8%)	5 (9.4%)	22 (41.5%)	10 (18.9%)	5 (9.4%)
C2. Active Non-Organised PA & Team Sport ( <i>n</i> = 53)	2 (3.8%)	14 (26.4%)	5 (9.4%)	27 (50.9%)	5 (9.4%)
C3. Active Individual Sport ( <i>n</i> = 78)	0 (0%)	4 (5.1%)	43 (55.2%)	21 (26.9)	10 (12.8%)
C4. Active Team Sport ( <i>n</i> = 83)	5 (6.0%)	4 (4.8%)	15 (18.1%)	49 (59.0%)	10 (12.1%)
C5. Non-Participation ( <i>n</i> = 134)	3 (2.2%)	27 (20.2)	18 (13.4%)	18 (13.4%)	68 (50.8%)

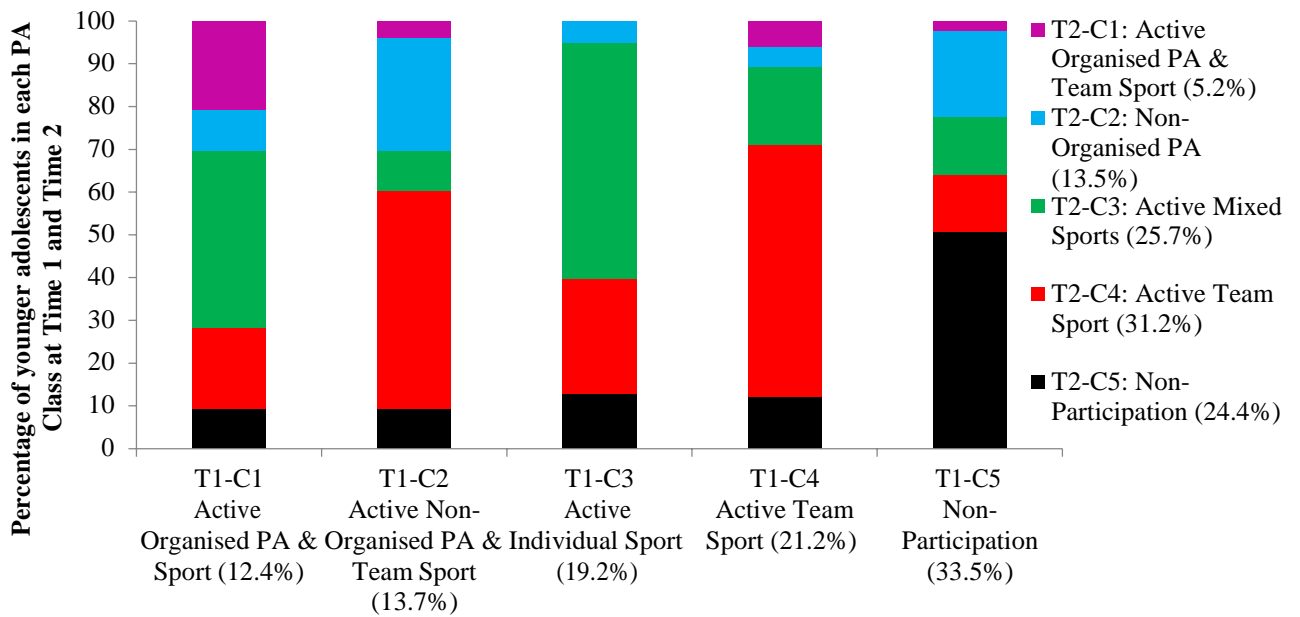


Figure 6.6. Proportion of younger adolescents assigned to each latent class at Time 1 and Time 2

Note. PA = Physical Activity, T1 = Time 1, T2 = Time 2, C1 = Class 1, etc.

The *active team sport* class was clearly established at each time point representing just less than one-third of younger adolescents, and reflecting the most prevalent pattern of physical activity among this cohort at follow-up. The majority of adolescents (59%) also sustained their active team sport status over time. In turn, approximately one quarter of baseline members transitioned into a pattern of physical activity in which team sport was subsequently combined with participation in individual sport or organised non-sport physical activity, representing a dual pattern of more active engagement in organised physical activity behaviours. In addition, a minority of adolescents replaced active team sport participation with a less active pattern of involvement in *non-organised physical activity* at follow-up whereas a small proportion dropped out of physical activity.

The *non-participation* class also evidenced a high degree of stability over time. Roughly half of individuals assigned to this class at baseline maintained their low active status at follow-up while the remaining members initiated some form of physical activity with the majority adopting regular participation in informal exercise activities (e.g. running, cycling) or joining organised sports (e.g. basketball, badminton, cross-country, Gaelic football, swimming). Contrary to expectations however, the proportion of younger adolescents classified as *non-participants* decreased from Time 1 to Time 2. It is possible that some of the first year students assessed within the initial months of commencing secondary school had not yet joined extracurricular sports but subsequently initiated involvement when opportunities became available. In addition, it may have been that some of the students originally classified as non-participants at Time 1 were subsequently characterised by a lower active pattern of involvement in *non-organised physical activity* which emerged at Time 2, but was not established at Time 1. In other words, the younger adolescent cohort may have been overrepresented in the non-participant class at baseline. Alternatively, the emergence of this latent class at follow-up may be indicative of a developmental transition in youth physical activity participation, which is in line with prior

studies indicating that informal exercise participation increases across the adolescent years (Eime et al., 2013; Lunn et al., 2013).

The *active organised physical activity and sports* class at Time 1 reflected participation in multiple types of physical activity including organised non-sport physical activity, team sport and individual sport. This was replaced at Time 2 by a slightly more distinctive and less varied pattern of involvement in *active organised physical activity and team sport*. The majority of baseline members were classified by an active profile of dual participation in team and individual sports, or a mixed pattern of *organised non-sport and team sport* involvement at follow-up, which suggests that adolescents engaged in multiple activities at Time 1 are likely to sustain participation in a combination of structured physical activities approximately one year later. Additional transitions across physical activity classes were noted with 19% of adolescents decreasing the number of activities undertaken and settling on a discrete pattern of active participation in team sport at Time 2. In turn, a minority ( $n = 5$ ) of younger adolescents swapped *organised physical activity and sport* for a less active pattern of engagement in *non-organised physical activity* while the remainder ( $n = 5$ ) discontinued participation in physical activity twelve months later.

In turn, the *active individual sport* class at Time 1 characterised by high probability of individual sport, moderate-to-vigorous physical activity and a moderate likelihood of team sport (0.50) was structurally similar to the *active mixed sports* class that emerged at Time 2, which reflected high likelihood of individual sport, moderate-to-vigorous physical activity and a more moderate probability of team sport participation. Approximately half of the *active individual sport* baseline members were classified as *active mixed sport* participants at follow-up whilst a quarter of younger adolescents replaced individual sport with an active pattern of involvement in team sport. In addition, a small proportion of *active individual sport* participants at Time 1 was classified as non-participants at follow-up or had transitioned into a lower active pattern of unstructured physical activity participation. The results indicate that younger adolescents are highly likely to sustain participation in organised sport twelve months later.

Finally, the *active non-organised physical activity and team sport* class was not replicated at follow-up. Instead, this mixed participation profile was replaced with a more discrete pattern of *non-organised physical activity* characterised by lower levels of moderate-to-vigorous physical activity. The majority of adolescents assigned to the *active non-organised physical activity and team sport* group at Time 1 continued to actively participate in team sport at Time 2; whilst roughly a quarter of members replaced this pattern of behaviour with a less active profile of *non-organised physical activity*. In contrast, a small number of participants transitioned into one of the other profiles characterised by active participation in a combination of organised sports or physical activity or subsequently dropped out of physical activity twelve months later.

Overall, there appears to be some consolidation in physical activity behaviour patterns among the younger adolescent cohort over a twelve month period. The *non-participant* and *active team sport* classes evidenced the highest level of structural stability with both patterns of behaviour clearly identified at each time point. The majority of members assigned to these baseline classes also maintained their status at follow up. The remaining

physical activity classes identified at Time 1 were conceptually similar to the *active mixed sports*, and *active organised physical activity and team sport* class that emerged at follow-up. Of note however, are the relatively low levels of dropout evidenced across each of the different profiles of physical activity participation with the majority of younger adolescents continuing to persist in organised sport and physical activity over time. Nonetheless, a small shift appears to be taking place as younger adolescents' patterns of involvement in physical activity represent more differentiated profiles of dual type activity participation or distinct forms of physical activity engagement twelve months later. The emergence of the lower active non-organised physical activity profile at follow-up also reflects a unique pattern of individualised participation that may be adopted in place of organised sports and physical activities.

#### 6.4.3.2 Longitudinal physical activity trajectories from Time 1 to Time 2 among younger adolescents

The younger adolescent cohort was subsequently categorised into one of four physical activity trajectories representing maintained physical activity behaviour, dropout, uptake of physical activity or sustained low activity based on latent class membership at Time 1 and Time 2. Descriptive statistics for each physical activity trajectory group are presented in Table 6.13. Significant differences were evidenced across the physical activity trajectory groups on mean daily minutes spent in moderate-to-vigorous physical activity ( $F(3,397) = 72.83, p < .001, \eta^2_p = .36$ ) and average number of days on which recommended levels of physical activity were achieved ( $F(3, 397) = 89.77, p < .001, \eta^2_p = .40$ ). Follow-up bonferroni adjusted post hoc tests revealed that maintainers were most active demonstrating significantly higher mean daily minutes and number of days on which recommended levels of moderate-to-vigorous physical activity (MVPA) was met than all of the other physical activity trajectory groups ( $p < .001$ ). In addition, physical activity adopters reported more mean daily MVPA minutes and mean number of days spent in MVPA in comparison to dropouts ( $p = .009; p < .001$ ) and non-participants (both  $p < .001$ )

Table 6.13 Descriptive statistics for younger adolescent's physical activity trajectory groups at Time 2

	Min - Max	Maintainer ( $n = 237, 59.1\%$ )	Non-Participant ( $n = 68, 17.0\%$ )	Dropout ( $n = 30, 7.5\%$ )	Adopter ( $n = 66, 16.5\%$ )
Mean Daily mins MVPA	0 -174.3	60.95 (32.61)	7.58 (10.94)	16.12 (15.68)	36.38 (31.82)
Mean no. of days $\geq 60$ mins MVPA	0 -7	3.90 (1.85)	0.47 (0.74)	0.90 (0.89)	2.44 (2.02)

#### 6.4.4 Latent class analysis among older adolescents at Time 2

Latent class analysis was performed at Time 2 to identify profiles of physical activity participation among the older adolescent cohort ( $n = 402$ ). Fit information for two through seven classes is presented in Table 6.14. The AIC, BIC and SSABIC fit criterion were in agreement suggesting a five-class model. In contrast, the LRT offers support for a three-class solution indicating that the addition of a fourth class does not result in a

statistically significant improvement in model fit. The five and three class solutions both demonstrated high levels of entropy and a lack of significant bivariate residuals suggesting that each of these models provided a good fit to the data. Further inspection of these models revealed that the three class solution comprised distinct patterns of physical activity corresponding to active involvement in team sport, non-participation and organised non-sport physical activity. The five class solution replicated these discrete physical activity profiles and contributed an additional two classes, which reflected active non-organised physical activity, and a mixed pattern of active participation in team and individual sports. In addition, the latter model contained five latent classes that were conceptually similar to five of the six physical activity profiles established among the older adolescent cohort at Time 1. Based on these findings, in addition to the fit criteria, a five class model was selected to represent older adolescents' patterns of involvement in physical activity at Time 2. The item-response probabilities of endorsing each of the physical activity behaviours were used to interpret the five latent classes (Table 6.15). Descriptive statistics pertaining to mean daily levels of moderate-to-vigorous physical activity are also provided to facilitate a greater insight into overall patterns of activity (Table 6.15). In addition, a graphic depiction of the five latent physical activity classes is presented in Figure 6.7.

Table 6.14 *Model fit statistics for the latent class models for the older adolescent cohort at Time 2*

Number of Classes	LL (df)	AIC	BIC	SSABIC	Entropy	Number of Significant Residuals	LRT	<i>p</i>
2	-1179.70 (11)	2381.40	2425.36	2390.46	1.00	0	123.84	0.00
3	-1170.92 (17)	2375.84	2443.78	2389.83	0.99	0	17.09	0.00
4	-1166.99 (23)	2379.97	2471.89	2398.91	0.90	0	7.66	0.12
<b>5</b>	<b>-1164.74 (4)</b>	<b>2337.49</b>	<b>2353.47</b>	<b>2340.78</b>	<b>0.84</b>	<b>0</b>	<b>260.73</b>	<b>0.00</b>
6	-1166.07 (5)	2342.14	2362.12	2346.26	0.86	0	369.73	0.00
7	-1163.26 (6)	2338.52	2362.50	2343.46	0.78	0	316.14	0.00

*Note.* LL(df) loglikelihood value and associated degrees of freedom; AIC Akaike Information Criterion; BIC Bayesian Information Criteria; SSABIC Sample Size Adjusted Bayesian Information Criterion; LRT Lo-Mendell-Rubin Adjusted likelihood ratio test value.



Table 6.15 Descriptive statistics and item-response probabilities for physical activity behaviour indicators among older adolescents at Time 2

Latent Class	<i>n</i>	≥ 60mins MVPA on ≥ 3 days	Non- organised PA ≥ 3 sessions	Team sport	Individual sport	Organised non-sport PA	Mean daily mins MVPA <i>M (SD)</i>
1. Active Mixed Sports	62	<b>0.87</b>	0.00	<b>0.75</b>	<b>0.51</b>	0.44	65.98 (36.59)
2. Active Team Sport	79	<b>0.55</b>	0.40	<b>1.00</b>	0.09	0.16	42.29 (25.80)
3. Active Non-Organised PA	38	<b>1.00</b>	<b>1.00</b>	0.33	0.37	0.37	76.13 (30.63)
4. Organised Dance & Fitness	71	0.21	0.22	0.02	0.15	<b>1.00</b>	21.91 (17.71)
5. Non-Participation	152	0.00	0.34	0.01	0.15	0.00	9.84 (12.42)

Note. PA = Physical Activity; Conditional probabilities >.5 in bold to facilitate interpretation

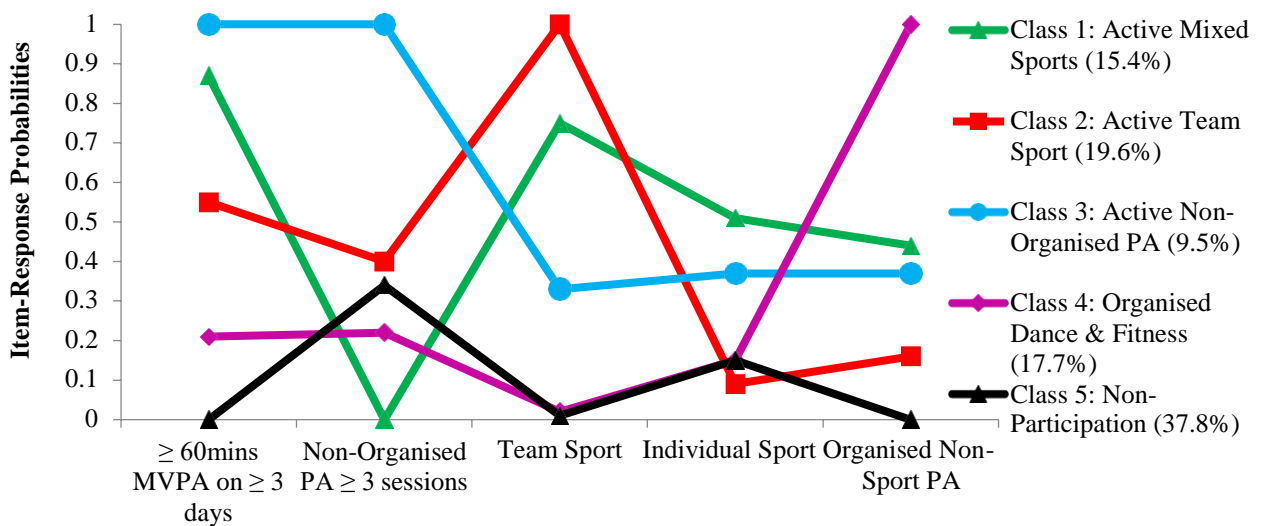


Figure 6.7. Profile plot of the five physical activity behaviour classes for the older adolescent cohort at Time 2

Class 1 (i.e. green line) comprising 15.4% of older adolescents was characterised by a high likelihood of engaging in team sport (e.g. basketball, Gaelic football), moderate-to-vigorous physical activity on three or more days over the past week, and a moderate probability of individual sport (swimming, badminton, martial arts). Lower rates of participation were evidenced for the other types of physical activity. This class demonstrated a highly active profile with class members averaging over one hour in moderate-to-vigorous physical activity daily. In accordance, this class was labelled ‘Active Mixed Sports’. Approximating roughly one fifth of the older adolescent sample, Class 2 (i.e. red line) reflected the highest probability of engaging in team sport (e.g. soccer, hockey, rugby), a moderate probability of achieving recommended moderate-to-vigorous physical activity on three or more days and a low likelihood of engaging in other physical activity behaviours. Members of this class also accumulated a mean of 42 minutes per day in moderate-to-vigorous physical activity. As such, this class was named ‘Active Team Sport’.

Class 3 (i.e. blue line), the smallest latent group (9.5%), demonstrated the highest probability of undertaking non-organised physical activity and moderate-to-vigorous physical activity, whilst lower rates of participation were evidenced for organised physical activity and sports. Adolescents assigned to this group were characterised by a pattern of participation in individual-type exercises like walking, cycling, jogging and swimming. Receiving the label ‘Active Non-Organised Physical Activity’, this class reflected a highly active group of adolescents that engaged in a mean of more than one hour of moderate-to-vigorous physical activity daily. Comprising 17.7% of the older adolescent sample, Class 4 (i.e. purple line) was characterised by low levels of participation in all physical activity behaviours apart from organised non-sport physical activity. Closer inspection of this group revealed that the majority of members exercised in the gym and attended fitness classes (e.g. spinning, circuits, Zumba, body conditioning, yoga) whilst the remainder undertook dance lessons. This class was subsequently named ‘Organised Dance and Fitness’ and represented a low active group of adolescents that accumulated a mean of 21 minutes of moderate-to-vigorous physical activity per day. Class 5 (i.e. black line), which contained over one third of adolescents, was discriminated from the other latent classes by a low probability of endorsing all of the physical activity behaviours. As such, this class was labelled ‘Non-Participation’. Members of this class reported the lowest levels of activity spending less than 10 minutes on average in daily moderate-to-vigorous physical activity.

#### ***6.4.4.1 Patterns of stability and change in physical activity from Time 1 to Time 2 among older adolescents***

Latent class analysis identified six distinct patterns of involvement in physical activity among older adolescents at Time 1. Approximately twelve months later latent class analysis was repeated and five latent classes emerged that were structurally similar to the five of the six classes identified at baseline, demonstrating a high degree of stability in older adolescents’ physical activity patterns over time. Crosstabs of latent class assignments at each time point were subsequently used to examine movement and stability across the physical activity classes from Time 1 to Time 2 (Table 6.16). The proportion of adolescents assigned to each class at baseline and follow-up is presented in Figure 6.8 to facilitate a greater understanding of the patterns of physical activity that were maintained, replaced or dropped over time.

Table 6.16 *Patterns of stability and change in physical activity patterns from Time 1 to Time 2 among older adolescents*

<b>Time 2 Latent PA Class</b>					
	Class 1	Class 2	Class 3	Class 4	Class 5
	Active Mixed Sports ( <i>n</i> = 62, 15.4%)	Active Team Sport ( <i>n</i> = 79, 19.7%)	Active Non-Organised PA ( <i>n</i> = 38, 9.5%)	Organised Dance & Fitness ( <i>n</i> = 71, 17.7%)	Non-Participation ( <i>n</i> = 152, 37.8%)
<b>Time 1 Latent PA Class</b>	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
C1. Individual Sport ( <i>n</i> = 32)	5 (15.6%)	1 (3.1%)	1 (3.1%)	10 (31.2%)	15 (46.9%)
C2. Active Mixed Sports ( <i>n</i> = 32)	15 (46.9%)	6 (18.8%)	5 (15.6%)	4 (12.5%)	2 (6.2%)
C3. Active Non-Organised PA ( <i>n</i> = 41)	5 (12.2%)	9 (22.0%)	9 (22.0%)	6 (14.6%)	12 (29.3%)
C4. Organised Dance & Fitness ( <i>n</i> = 59)	6 (10.2%)	6 (10.2%)	5 (8.5%)	25 (42.4%)	17 (28.8%)
C5. Active Team Sport ( <i>n</i> = 87)	26 (29.9%)	40 (46.0%)	9 (10.3%)	5 (5.7%)	7 (8.0%)
C6. Non-Participation ( <i>n</i> = 148)	5 (3.4%)	16 (10.8%)	9 (6.1%)	21 (14.2%)	97 (65.5%)

Note. PA = Physical Activity

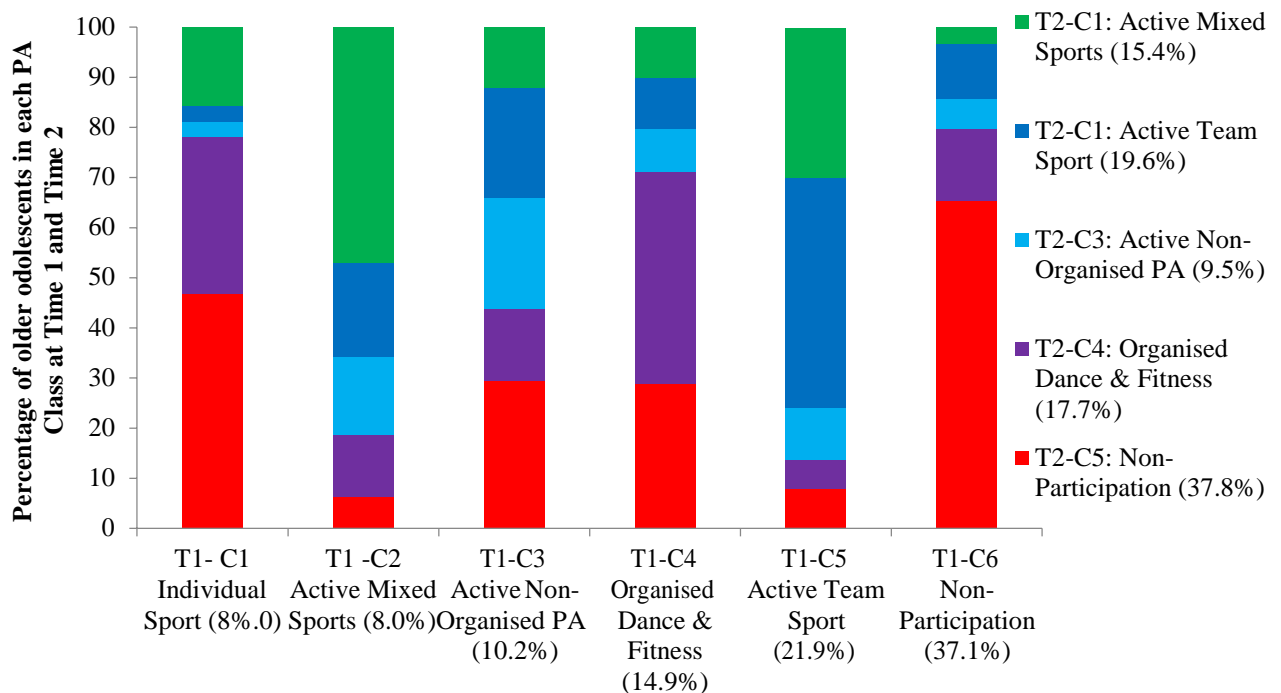


Figure 6.8. Proportion of older adolescents assigned to each latent class at Time 1 and Time 2

Note. PA = Physical Activity, T1 = Time 1, T2 = Time 2, C1 = Class 1, etc.

The *individual sport* class characterised at Time 1 by a low active pattern of participation in organised individual sports was the only class that was not replicated at Time 2. Among those originally assigned to this class at baseline, approximately 15% transitioned into a more active pattern of sport participation undertaking individual sport in combination with team sports. It was very unlikely for baseline members however, to replace individual sport participation with an active pattern of engagement in team sport or non-organised physical activity. In addition, roughly one third of adolescents replaced individual sport with involvement in

a similarly low active pattern of engagement in organised fitness activities (e.g. gym, Zumba). In turn, just fewer than half of the individual sport participants dropped out of physical activity and were classified as non-participants at follow-up suggesting that this pattern of low sport participation is unlikely to be sustained one year later. Further replication is warranted with a larger sample of older adolescents however, to investigate the stability of this pattern of physical activity involvement over time in more detail.

The *active mixed sports* class was identified at each time point, with just under half of adolescents sustaining dual participation in team and individual sports one year later. Adolescents assigned to this class at baseline also demonstrated the lowest risk of dropout with only 2 participants becoming non-active over time. In addition, a number of physical activity transitions were noted with roughly equivalent numbers of baseline *active mixed sport* class members replacing participation with a more differentiated pattern of *active team sport*, *active non-organised physical activity* or a lower active pattern of engagement in organised non-sport fitness activities (e.g. going to the gym). The findings indicate that older adolescents who discontinue sport may subsequently remain somewhat active twelve months later by taking part in more individual type activities adopted within structured or unstructured contexts.

The *active non-organised physical activity* class characterised by participation in informal exercises such as walking, running, and cycling was established at both Time 1 and Time 2. However, only 22% of baseline members maintained this pattern of physical activity involvement at follow-up whilst 29% of participants were classified as non-participants twelve months later. The remaining adolescents substituted active levels of non-organised physical activity for active participation in team sport or a combination of sports, or alternatively switched to a less active pattern of engagement in organised non-sport physical activity. Thus, this pattern of active non-organised physical activity appears to be highly changeable over time with baseline participants represented by a range of different physical activity patterns twelve months later. The *organised dance and fitness* class also emerged at each time point with 42% of baseline members continuing to persist in this pattern of physical activity at follow-up suggesting a moderate degree of stability in terms of sustained participation over time. Approximately equal numbers of participants also changed their pattern and level of physical activity involvement twelve months later opting for a more active profile of participation in sport or non-organised physical activity whilst the remainder (28.8%) discontinued physical activity.

A discrete pattern of *active team sport* participation was also established at each time point. Approximately three quarters of baseline members were characterised by a pattern of active participation in team sport alone (46%) or in combination with individual sports (29.9%) twelve months after initial assessment indicating that team sport participation is highly likely to be continued over one year among older adolescents. In addition, a minority of older adolescents dropped out of physical activity whilst the remainder replaced sport participation with an *active* pattern of engagement in *non-organised physical activity* or a less active profile of participation in *organised dance and fitness* classes. The results indicate that discontinuation from organised sport may result in participation in other types of physical activity as opposed to simply transitioning into a pattern of non-participation.

Finally, the *non-participation* class was the most prevalent pattern of physical activity involvement evidenced among older adolescents at Time 1 and Time 2 representing approximately 37% of youth at each time point. In addition the majority of adolescents classified as non-participants at baseline retained their non-participant status at follow-up suggesting that this low active pattern was highly likely to be continued over time. Nonetheless, approximately one-third of adolescents classified as non-participants at Time 1 subsequently joined an organised sport or physical activity twelve months later with an equivalent number initiating an active pattern of participation in organised sports or a lower active profile of organised dance and fitness activities. In turn, a smaller number opted to take up active levels of participation in non-organised physical activity (e.g. walking, running).

Overall, the results indicate strong consolidation of physical activity behavioural patterns among older adolescents over a one year period. Accordingly, five of the original baseline profiles of physical activity participation were established at follow-up, which corresponded to active patterns of involvement in team sport, mixed sports, non-organised physical activity, a less active pattern of engagement in organised dance and fitness classes, and non-participation. The findings indicate that mid-to-late adolescence represents a period during which discrete patterns of physical activity involvement are established, and for the most part these profiles remain stable over one year. Of note, the majority of adolescents classified as active team sport or mixed sport participants at Time 1 continued to maintain participation in sport twelve months later. A lower proportion of adolescents represented by these aforementioned baseline classes also became non-active at follow-up compared to those characterised by participation in organised-non-sport physical activity or non-organised physical activity. In contrast however, only one-fifth of adolescents classified as *active non-organised physical activity* participants at Time 1 sustained this status at follow-up suggesting that this pattern of engagement is highly variable over time. Indeed for some, a regular pattern of informal exercise engagement appeared to serve as a stepping stone to taking up organised physical activity or sport whilst for others the lack of structure within these activities resulted in dropout and subsequent non-participation.

In turn, roughly two-fifths of adolescents continued to sustain participation in a less active profile of *organised dance and fitness* activities one year later, with just less than one in three becoming non-active over time. A small number of adolescents from each of the Time 1 physical activity classes also changed the type or pattern of physical activity in which they engaged, demonstrating that sport or physical activity discontinuation does not necessarily result in non-activity. Finally, the majority of students classified as non-participants at Time 1 remained non-participants at Time 2 indicating that this pattern of physical activity is more resistant to change among older adolescents.

#### ***6.4.4.2 Longitudinal physical activity trajectories from Time 1 to Time 2 among older adolescents***

Participants were subsequently grouped into one of four longitudinal trajectories reflecting maintained physical activity participation, dropout, uptake of physical activity or continued non-participation over a twelve-month period. Descriptive statistics for daily mean minutes in moderate-to-vigorous physical activity (MVPA) and

mean number of days that recommended levels of MPVA was achieved for each older adolescent physical activity trajectory groups are presented in Table 6.17. One-way ANOVA revealed that physical activity trajectory groups significantly differed on mean minutes spent in daily moderate-to-vigorous physical activity ( $F(3, 398) = 62.30, p < .001, \eta^2 = .33$ ) and mean number of days on which physical activity guidelines were achieved ( $F(3, 398) = 97.46, p < .001, \eta^2 = .42$ ). Follow-up pairwise comparisons indicated that physical activity maintainers reported significantly more minutes on average in daily moderate-to-vigorous physical activity and greater mean number of days on which recommended physical activity levels were achieved in comparison to the dropouts (both  $p < .001$ ), non-participants (both  $p < .001$ ) and physical activity adopters ( $p < .001; p = .001$ ). In addition, physical activity adopters were significantly more active than dropouts ( $p = .001$ ) and non-participants ( $p < .001$ ) demonstrating higher mean minutes of moderate-to-vigorous physical activity and a greater number of days on which recommended MVPA was achieved.

Table 6.17 *Descriptive statistics for older adolescent's physical activity trajectory groups at Time 2*

	Min - Max	PA Maintainer ( $n = 199,$ 49.4%)	Non-Participant ( $n = 98, 24.4%$ )	Dropout ( $n = 54, 13.5%$ )	Adopter ( $n = 51, 12.7%$ )
Mean Daily mins MVPA	0-174.29	51.14 (35.23)	7.90 (10.89)	13.37 (14.24)	33.40 (25.60)
Mean no. of days $\geq$ 60mins MVPA	0-7	3.38 (1.99)	0.33 (0.61)	0.72 (0.83)	2.39 (1.72)

## 6.5 Conclusion

Although quantitative information is available regarding changes in young people's physical activity levels across adolescence, a lack of research has examined how profiles of participation in physical activity change over time. The primary aim of this chapter is therefore to address these shortcomings by investigating stability and transitions in profiles of physical activity participation over twelve months among male and female, and younger and older adolescents. In addition, gender and age-related differences in physical activity maintenance and behaviour change were explored.

Given that only one study to date (Agans & Geldhof, 2012), which focused exclusively on organised sport, has examined profiles of adolescents' participation longitudinally, limited information was available to guide specific hypotheses regarding expected change and stability in adolescents' physical activity patterns over time. Nonetheless, it was expected that some degree of physical activity decline would occur from Time 1 to Time 2 that would subsequently be expressed in terms of increased prevalence of non-participation or less active levels of physical activity involvement at follow-up. The primary hypotheses pertaining to expected changes and stability in young people's physical activity patterns over twelve months were therefore exploratory in nature.

In relation to female adolescents' physical activity patterns, a profile of *organised dance and fitness*, and *non-participation* was clearly established at each time point. The latter profile represented the most prevalent activity pattern at baseline comprising one third of adolescent girls. However, at follow-up twelve months later approximately 1 in 2 girls were represented by a pattern of non-activity underscoring the high levels of female physical activity dropout evidenced across adolescence. The remaining baseline classes of *active team sport* and *active individual sport* were replaced by an *active sport* class at follow-up that comprised one-quarter of the female sample. In addition, a mixed profile of active participation in informal exercise (e.g. walking, running) undertaken in combination with organised non-sport physical activity (e.g. dance, gym) emerged at Time 2 in place of the less active pattern of *non-organised physical activity* identified at Time 1, which suggests that supplementing organised participation with informal exercise can facilitate a means of promoting active levels of moderate-to-vigorous physical activity among girls.

In turn, the *organised individual sport and physical activity* class established at baseline did not emerge at follow-up, however this comprised a very small number of girls ( $n = 16$ ) initially, which may explain the lack of stability over time. Taken together the findings indicate that physical activity dropout and subsequent *non-participation* increased over one year among girls, sport participation decreased and individual type non-sport physical activity continued to reflect popular patterns of active and less active female involvement in physical activity. In line with these findings, Eime et al. (2013) found that older adolescent girls demonstrated higher levels of involvement in non-competitive organised and non-organised physical activity (e.g. dancing, aerobics, jogging) and lower levels of team and individual sport participation compared to their younger peers.

For adolescent boys, five distinct physical activity classes emerged at baseline and follow-up. However, only two of these profiles of physical activity participation were stable over time, which corresponded to *active team sport* and *non-participation*. Approximately two-fifths of the male sample were characterised by a pattern of active engagement in team sport twelve months later underscoring the popularity of this form of physical activity among teenage boys. In accordance, national research conducted in Ireland revealed that team games dominate male adolescents' participation in sport (CSSPA, 2010; Lunn et al., 2013). The *active organised fitness* class established at Time 1 in contrast, was not replicated at follow-up although this is likely due to the low number of baseline participants and subsequent attrition at Time 2.

The remaining baseline classes reflecting *active individual sport* and *active non-organised physical activity and team sport* were replaced at follow-up by three different physical activity patterns reflecting active dual participation in team and individual sports, an active profile of individual sport performed in combination with non-organised physical activity and a less active pattern of engagement in informal exercise (e.g. running, cycling, sit-ups). Thus, the findings indicated that boys remained an active cohort over time with the majority of adolescents characterised by participation in sport, and team sport in particular, twelve months later. However, the emergence of a discrete profile of *non-organised physical activity* involvement characterised by lower levels of moderate-to-vigorous physical activity at Time 2 represents a shift for some towards less structured individual forms of exercise and a subsequent decline in physical activity.

In relation to the younger adolescent cohort, five classes of physical activity behaviour were established at each time point with the *active team sport* and *non-participation* class demonstrating a high level of stability from baseline to follow-up. In addition, the *active individual sport* profile identified at Time 1 was conceptually similar to the *active mixed sports* class at Time 2, as both reflected a high likelihood of individual sport and moderate-to-vigorous physical activity alongside a more moderate probability of team sport participation. Although the most prevalent baseline activity pattern reflected *non-participation* and comprised a third of the younger adolescent cohort, the proportion of non-active participants decreased at follow-up with roughly one quarter of young people characterised by a pattern of inactivity. These findings however, must be considered in light of the other changes evidenced in respect to younger adolescents' profiles of physical activity participation from Time 1 to Time 2.

In accordance, the *active organised physical activity and sports* class, which reflected engagement in multiple activities at baseline was replaced at follow-up by a pattern of active participation in *organised physical activity and team sport* reflecting a decrease in the number of different organised activities performed in combination. In addition, a discrete profile of participation in *non-organised physical activity* (e.g. running, walking, cycling) emerged at Time 2 in place of the *active non-organised physical activity and team sport* class identified at Time 1, denoting a lower active pattern of informal exercise participation. Thus, it appears that younger adolescents' physical activity patterns are becoming more differentiated and less varied over time, with subtle declines in physical activity evidenced through a diminished combination of activities underpinning profiles of participation. The low active profile of non-organised physical activity participation also replaced active patterns of sport participation among some younger adolescents reflecting declining levels of physical activity behaviour. However, it has also been reported previously that personal exercise increases during the secondary school years (Lunn et al., 2013). Thus, this lower active profile of *non-organised physical activity* may reflect this pattern of behaviour gaining prominence across adolescence. Notwithstanding these findings, active levels of team sport participation undertaken alone or in combination with individual sports represented preferred pattern of physical activity among younger adolescents at Time 2, with the majority of participants engaging in active levels of sport twelve months after initial assessment.

Among the older adolescent cohort, physical activity was characterised by six different profiles at Time 1, with five of these patterns replicated at follow-up twelve months later, which corresponded to *active team sport*, *active mixed sports*, *active non-organised physical activity*, *organised dance & fitness*, and *non-participation*. The findings indicate that patterns of involvement in physical activity become more stable during mid-to-late adolescence with each profile underpinned by a different type of participation. The most prevalent pattern of activity among the older adolescent cohort at each time point was *non-participation* with just less than two-fifths of the sample classified as non-active at follow-up. The majority of adolescents however, were represented by a pattern of participation in structured activities at Time 2. In accordance, approximately one third of older adolescents were characterised by active patterns of team or mixed sports participation whilst just less than one fifth of individuals engaged in lower levels of organised non-sport physical activity (e.g. gym, dance). In addition, roughly 1 in 10 older adolescents engaged in active levels of unstructured forms of



exercise (e.g. walking, swimming, running) indicating that non-organised physical activity in addition to organised sport continued to represent a means of attaining recommended levels of moderate-to-vigorous physical activity among this cohort twelve months later.

Gender differences have also been reported in relation to sustained participation in physical activity over time. Accordingly, it was hypothesised that boys would be more likely than girls to maintain involvement in team sport at follow-up twelve months later. The results indicated that team sport participation represented a more prevalent pattern of male physical activity behaviour at Time 2, with double the number of boys compared to girls characterised by a profile of team sport at follow-up. However, in contrast to expectations, it was found that irrespective of gender, the majority (60% - 75%) of adolescents, classified as *active team sport* participants at baseline, continued to participate in team sport alone or in combination with individual sport at follow-up. These findings contradict prior research undertaken by Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley (2009), which found that girls were more likely than boys to discontinue participation in team games over a five-year period. However, the present study focused on change over one year; thus it is possible that a greater gender disparity in sport persistence would have been evidenced had adolescents been followed over a longer period of time.

In addition, it was expected that a greater proportion of boys would maintain participation in physical activity twelve months later whereas a greater proportion of girls would be classified as dropouts. Consistent with predictions, approximately twice as many female adolescents in comparison to males discontinued physical activity at follow-up. The results further revealed that adolescents characterised by certain profiles of physical activity participation at Time 1 were more likely to transition into the *non-participation* group at Time 2. In accordance, the majority of girls that engaged in less active patterns of *non-organised physical activity* at baseline subsequently discontinued physical activity participation twelve months later. In contrast, *active team sport* participants demonstrated the lowest rate of dropout whilst approximately one third of girls represented at Time 1 by participation in *active individual sport* or *organised dance and fitness* became non-active twelve months later. Similar levels of dropout were evidenced for the aforementioned individual sport and organised non-sport physical activity participants despite each of these patterns being characterised by different levels of moderate-to-vigorous physical activity. Thus, it appears that the underlying nature of organised physical activity participation may influence persistence twelve months later, with girls characterised by team based activities more likely to sustain involvement over time than those defined by individual pursuits. Moreover, approximately twice as many *non-organised physical activity* (63%) participants dropped out of physical activity over twelve months in comparison to girls characterised at baseline by a pattern of organised participation in team sport (26.4%), individual sport (35.6%), dance or fitness classes (33.8%) or a combination of individual sport and physical activity lessons (46.7%). Thus, the results indicate that organised physical activity contexts and team sport in particular, are more beneficial for promoting sustained physical activity participation among girls over time.

It is also widely evidenced that physical activity levels demonstrate an age-related decline during adolescence (Nader et al., 2008). As such it was hypothesised that a greater proportion of older in comparison to younger

adolescents would discontinue physical activity participation over twelve months. In line with expectations, approximately two times the number of older adolescents dropped out of physical activity from Time 1 to Time 2 relative to their younger counterparts. In addition the results indicated that dropouts were disproportionately represented by different patterns of involvement in physical activity at baseline. Indeed, adolescents characterised by active profiles of team sport or mixed sports demonstrated the lowest levels of dropout with the majority of baseline participants maintaining sport participation at follow-up. In contrast, nearly half of older teenagers that engaged in lower active levels of participation in *individual sport* at Time 1 became non-active at Time 2.

In turn, similar levels of dropout were evidenced among individuals represented at baseline by patterns of participation in *active non-organised physical activity* and *organised dance and fitness* with approximately 1 in 3 older teenagers dropping out of physical activity twelve months later. Both of the aforementioned participation profiles were characterised by involvement in individual type exercises (e.g. running, swimming) albeit at different levels of moderate-to-vigorous physical activity, indicating that individual pursuits regardless of whether they are structured or unstructured in nature are less likely to be continued by older adolescents over time in comparison to team sport activities. Moreover, it was also noted that active participation in non-organised physical activity was least likely to be sustained over time, with approximately only one fifth of baseline members maintaining participation in this pattern of activity at follow-up while another half transitioned into a pattern of organised sport or physical activity. Thus, this profile of participation is highly variable and demonstrates low stability in terms of continued persistence over time.

In conclusion, this chapter offers a unique insight into young people's patterns of physical activity involvement and the associated stability and changes evidenced in profiles of participation over a twelve month period among male and female, and younger and older adolescents, which has not been addressed previously. In brief, girls demonstrated increased prevalence of *non-participation* over time, whereas the emergence of a lower active profile of *non-organised physical activity* among boys reflected declining levels of participation. In addition, younger adolescent's profiles of physical activity appear to become more differentiated and less varied at follow-up twelve months later, whilst patterns of involvement among older adolescents demonstrated high levels of stability over time reflecting discrete types of physical activity participation.

Gender and age-related differences were also evidenced in respect to physical activity maintenance and behaviour change. Girls demonstrated higher levels of dropout in comparison to boys, whereas older adolescents reported higher rates of dropout than their younger counterparts. In turn, irrespective of age or gender, adolescents characterised by team sport undertaken alone or in combination with individual sport, were least likely to discontinue participation in physical activity twelve months after baseline, indicating that this type of sport may exert a protective function over physical activity decline. While this chapter provides a greater understanding of how young people's physical activity patterns change over time it is also imperative to determine what underlies this change. The next chapter will therefore investigate whether social, motivational and body-related factors underpin physical activity maintenance and change among adolescents

over twelve months.

## **Chapter 7: Predictors of physical activity maintenance and behaviour change trajectories over twelve months among adolescents**

### **7.1 Chapter Overview**

The purpose of this chapter is to examine psychosocial predictors associated with physical activity maintenance and behaviour change over an approximate twelve month period among adolescents using a prospective longitudinal research design. Specifically, the chapter investigates how motivational, social, and body related variables change over a year and whether this pattern differs among teenagers who maintain physical activity participation, dropout, continue to be non-participants over time or subsequently adopt physical activity. In Chapter 4, latent class analysis was performed to explore patterns of involvement in physical activity among adolescents at Time 1, which was followed in Chapter 5 by an examination of group differences on a range of psychosocial factors among the gender and age-specific cohorts. In turn, participants were followed up approximately one year later and in Chapter 6, latent class analysis was repeated to investigate stability and changes in profiles of young people's physical activity participation over time. Adolescents were grouped longitudinally into one of four possible physical activity trajectories based on latent class membership at Time 1 and Time 2 that reflected maintained physical activity participation, dropout, continued non-participation or uptake of physical activity. Following on from this in the present chapter, mixed between-within models of analysis of variance (ANOVA) were conducted to compare mean scores on motivational, social and body related characteristics across physical activity trajectory groups from Time 1 to Time 2. The results are presented separately for male and female, and younger and older adolescents.

### **7.2 Introduction**

Prior research indicates that physical activity levels evidence an age-related decline during adolescence with the drop off occurring earlier for girls than boys (Nader et al., 2008; Troiano et al., 2008). Nonetheless, some teenagers continue to take part in physical activity during this period of development with a minority initiating physical activity involvement (Agans & Geldhof, 2012; Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009). Few studies however, have explored longitudinal patterns of physical activity maintenance and change over time. Moreover, a lack of research has addressed factors associated with sustained physical activity behaviour, dropout, uptake of physical activity or continued non-participation across adolescence. A greater understanding of the modifiable psychosocial predictors underpinning transitions in physical activity is therefore needed to inform effective interventions and policy initiatives aimed at reducing physical activity dropout, fostering continued involvement and changing low levels of participation among young people.

Self-determination theory (Deci & Ryan, 1985a, 2000) presents a motivational framework within which to explore psychological processes influencing physical activity and behaviour change. In accordance, a key premise of self-determination theory is that different types of motivation underpin behaviour. Ranging from volitional to more pressurised reasons for physical activity, these include intrinsic, identified, introjected and external regulations. Amotivation can also occur whereby an individual lacks motivation or acts without intent by simply going through the motions (Ryan & Deci, 2000). Reflecting enjoyment inherent within the activity

itself, and personal value placed on participation, intrinsic motivation and identified regulation have been consistently linked to young people's continued involvement in sport and physical activity over time with lower levels underpinning dropout (Gillison et al., 2010; Pelletier et al., 2001; Sarrazin et al., 2002). Decreased perceptions of enjoyment or feelings of fun have also been related to adolescents' sport discontinuation over time (Crane & Temple, 2015). In addition, prior research indicates that increased levels of self-determined motivation are related to uptake of physical activity among teenagers and adults (Gillison et al., 2011, 2012; Rodgers et al., 2010).

Contradictory results have been reported however in relation to introjected regulation, in which behaviour controlled by internal obligations and rewards is undertaken to avoid feelings of guilt, and shame, or to achieve ego enhancements such as pride (Ryan et al., 2009). In accordance, Gillison et al. (2011) found that introjected regulation in combination with intrinsic and identified regulation predicted exercise maintenance among adolescent boys over ten months whereas Calvo et al. (2010) indicated that introjected regulation alongside external regulation underpinned male withdrawal from sport over one year. In contrast, Pelletier and colleagues (2001) revealed that introjected regulation predicted sustained involvement in sport over ten months among adolescents and young adults although this association was not replicated 22 months after initial assessment, which suggests that introjected regulation underpins behavioural persistence over shorter periods of time. In turn, higher levels of external regulation and amotivation have been associated with low activity and sport dropout over time (Calvo et al., 2010; Gillison et al., 2010; Pelletier et al., 2001; Wang & Biddle, 2001).

Self-determination theory also posits that basic psychological needs for autonomy, relatedness and competence must be supported in order for optimal motivation and well-being to occur. Autonomy reflects a sense of ownership over one's behaviour, relatedness conveys feelings of belonging and competence represents perceptions of athletic ability (Deci & Ryan, 2000). Longitudinal research indicates that boys and girls that drop out of sport and physical activity demonstrate lower levels of autonomy, relatedness and competence than those who maintain involvement during adolescence (Crane & Temple, 2015; Gillison et al., 2011; Jõesaar & Hein, 2011; Sarrazin et al., 2002). In addition, low perceptions of competence have frequently been cited as a barrier to physical activity with many young people reporting that they lack the necessary skills for participation (e.g. Allison et al., 2005; Slater & Tiggemann, 2010; Woods et al., 2010). Finally, a third proponent of self-determination theory is that social conditions impact self-determined motivation through satisfaction of basic psychological needs. Autonomy supportive environments that are characterised by choice and decision making opportunities are associated with higher intrinsic motivation and physical activity participation whereas decreased perceptions of autonomy support underpin dropout (Edmunds et al., 2007; Jõesaar & Hein, 2011; Lonsdale et al., 2013; Pelletier et al., 2001; Standage et al., 2005).

It has previously been argued however, that autonomy support represents only a subset of social behaviours that impact youth physical activity participation (George et al., 2013). In accordance, it is widely reported that parents and peers play an influential role in adolescents' physical activity patterns. Prior longitudinal investigations indicate that parental support in the form of undertaking activity with their child, providing

transportation, watching practices, and praising participation is associated with sustained physical activity participation among adolescents over time whereas decreased perceptions underpin declining physical activity levels and dropout (Bélanger et al., 2011; Davison & Jago, 2009; Dowda et al., 2007; Edwardson & Gorely, 2010; Zook et al., 2014).

Parents can also serve as physical activity role models for young people with limited research indicating that such behaviours may differentially impact male and female adolescents' physical activity participation across adolescence. For girls, higher perceptions of parental physical activity have also been linked to continued participation in physical activity from the age of 9 to 18 years (Madsen et al., 2009). In respect to physical activity change, Rangul and colleagues (2011) found that maternal physical activity was associated with a lower risk of female adolescent dropout over a four-year period, whereas father physical activity positively predicted uptake of physical activity among those classified at baseline as inactive. In contrast, parental physical activity levels were found to be unrelated to physical activity maintenance or dropout among teenage males at follow-up four years after initial assessment (Rangul et al., 2011). Given the lack of longitudinal studies investigating parental role models and physical activity behaviour it is difficult to draw substantive conclusions regarding this relationship although it appears that parental physical activity may play a more central role in sustained physical activity behaviours among girls than among boys.

Parental pressure can also impact young people's physical activity behaviours by diminishing enjoyment. In line with self-determination theory, feelings of pressure can undermine psychological needs for autonomy and volitional motivation, with such individuals acting out of external regulation and sustaining sport and physical activity participation simply to satisfy parental demands (Amado et al., 2015; Bengoechea & Streat, 2007). Moreover, in a systematic review of factors associated with dropout from organised sport, Crane and Temple (2015) found that perceived pressure from parents underpinned sport discontinuation among young people.

In addition to parents, peers can also impact youth physical activity participation by providing support and modelling physical activity behaviours. Indeed, higher levels of friend social support have previously been linked to sustained physical activity participation among girls throughout secondary school (Raudsepp & Viira, 2008b; Zook et al., 2014). In addition, Duncan et al. (2007) indicated that male and female teenagers that reported increased perceptions of friend physical activity and friend support evidenced less of a decline in physical activity levels from 12 to 17 years of age. It has also been argued that peers may play a more salient role in female as compared to male physical activity behaviours. Accordingly, Coakley and White (1992) found that adolescent girls were more likely than boys to identify support from peers as important to their initiation and continued participation in sport.

Perceived acceptance or victimisation from the wider peer group can also influence youth physical activity behaviours over time. Ullrich-French and Smith (2009) found that young people who dropped out of sport reported lower levels of peer acceptance than those who continued to persist at follow-up one year after baseline. In contrast, negative social interactions such as teasing directed at one's appearance or physical abilities can serve as a barrier to physical activity and contribute to low levels of activity over time as youth

are unlikely to participate in physical activity contexts that elicit such victimisation (Casey et al., 2009; Faith et al., 2002; Vu et al., 2006). Thus, it is clear that friends and peer can impact adolescent physical activity participation over time in both positive and negative ways.

Body image concerns also become more prevalent during adolescence owing to the many physical, social and cognitive changes that occur during this period of development (Ata et al., 2007; Hartup & Stevens, 1997). Heightened awareness of one's physical self may subsequently impart motivational consequences for physical activity behaviour. In relation to BMI and changes in young people's physical activity however, inconsistent findings have been evidenced. Comprising a population based sample, Rangul et al. (2011) found that boys who were objectively classified as overweight were more likely to drop out of physical activity and remain inactive throughout the duration of the four-year study than those who were normal weight. However, BMI did not emerge as a significant predictor of physical activity among girls. In contrast to these findings, previous studies indicated that uptake of physical activity among adolescent females was associated with a decreased likelihood of being overweight or obese whereas higher BMI levels predicted dropout and inactivity over a duration of two years or less (Gillison et al., 2011; Zook et al., 2014). While mixed findings have been reported, broadly speaking it appears that excess weight is associated with more negative physical activity outcomes such as dropout and continued non-participation over time whereas uptake and sustained physical activity is related to lower levels of adiposity.

In addition, body image can also play a role in young people's physical activity participation. Body image represents a multidimensional construct that comprises aesthetic and functional dimensions that pertain to how the body looks and what it can do, respectively. Low levels of physical activity are associated with higher body dissatisfaction among adolescents, however a lack of research has explored whether body image relates to changes in physical activity over time (Neumark-Sztainer et al., 2004). Nonetheless, a prior investigation by Gillison et al. (2011) found that boys aged 13 to 15 years that sustained participation in physical activity over ten months reported higher levels of body satisfaction than those who subsequently dropped out. Body satisfaction did not discriminate among female physical activity patterns, however. In addition, Bélanger et al. (2011) revealed that male adolescents were more likely than girls to identify maintenance of an attractive appearance that they were satisfied with as a primary reason for sustaining physical activity participation over time. Moreover, boys demonstrate higher levels of aesthetic body satisfaction than girls (Abbott & Barber, 2010; Abbott et al., 2012). These findings suggest that aesthetic body image may play a greater role in males' continued physical activity behaviours over time. In respect to functional body image, Abbott and Barber (2011) found that adolescents that engaged in sports or physical activities reported higher levels of functional values, functional behaviour investment and functional satisfaction than those who did not partake in physical activity. Although this study was cross-sectional in nature, it is plausible to suggest on the basis of these findings that sustained participation in physical activity will be associated with more positive evaluations regarding functional qualities of the body.

In summary, few longitudinal studies have explored the factors underpinning changes in physical activity across adolescence. Moreover, it is unclear whether gender and age-related differences exist in respect to

psychosocial predictors and maintained physical activity participation, dropout, continued non-participation or adoption of physical activity over time. The present chapter therefore attempts to address this gap in the literature by implementing a prospective longitudinal design to investigate psychosocial factors associated with physical activity maintenance and behaviour change over twelve months among male and female, and younger and older adolescents.

### **7.2.1 Research aims and hypotheses.**

The present analysis sought to address the following research questions and hypotheses, which will be addressed in relation to male and female, and younger and older adolescents:

1. Are changes in motivational variables associated with physical activity maintenance and behaviour change over twelve months among adolescents?
  - Based on past research, it is expected that increases in intrinsic motivation and identified regulation will be associated with uptake of physical activity among adolescents over twelve months whilst decreases in self-determined motivation will underpin dropout (Gillison et al., 2011; Pelletier et al., 2001; Sarrazin et al., 2002).
  - It is also hypothesised that decreases in enjoyment will be associated with dropout (Crane & Temple, 2015).
  - It is predicted that increases in introjected regulation will be associated with continued participation in physical activity over twelve months (Gillison et al., 2010; Pelletier et al., 2001).
  - In addition, it is expected that increases in external regulation and amotivation scores will be related to physical activity dropout among adolescents (Calvo et al., 2010; Gillison et al., 2010; Pelletier et al., 2001).
  - It is hypothesised that decreases in autonomy, relatedness, and competence will underpin dropout over twelve months (Crane & Temple, 2015; Gillison et al., 2011; Jõesaar & Hein, 2011; Sarrazin et al., 2002).
  - It is also predicted that decreases in perceived autonomy support will be associated with dropout (Pelletier et al., 2001; Quested et al., 2013).
2. Are changes in social variables associated with physical activity maintenance and behaviour change over twelve months among adolescents?
  - In respect to parental influences it is hypothesised that decreases in parental support will be related to physical activity dropout among adolescents over twelve months (Bélanger et al., 2011; Davison & Jago, 2009; Dowda et al., 2007; Zook et al., 2014).
  - The relation between parental physical activity role models and physical activity change is expected to differ across gender. For girls, it is hypothesised that decreases in mother role modelling will be associated with dropout whilst increases in father role modelling will be related to uptake of physical activity. In contrast, mother and father physical activity role models are not expected to be related to dropout among boys (Rangul et al., 2011).



- It is also expected that increases in parental pressures will be associated with physical activity dropout among adolescents over time (Crane & Temple, 2015)
  - In relation to peer influences, it is expected that decreases in friend support, friend role modelling of physical activity and peer acceptance will underpin adolescent dropout from physical activity over twelve months (Duncan et al., 2007; Raudsepp & Viira, 2008b; Ullrich- French and Smith, 2009; Zook et al., 2014).
  - In addition, it is expected that higher levels of teasing will be associated with continued non-participation in physical activity.
3. Are changes in body-related variables associated with physical activity maintenance and behaviour change over twelve months among adolescents?
- It is expected that decreases in BMI will be associated with adoption of physical activity whereas increases in BMI will underpin dropout (Gillison et al., 2011; Rangul et al., 2011; Zook et al., 2014).
  - It is expected that higher levels of body dissatisfaction will be related to continued non-participation in physical activity (Chen et al., 2010; Neumark-Sztainer et al., 2004; Whitehead & Biddle, 2008).
  - Gender differences are hypothesised to emerge in relation to aesthetic satisfaction with increases in aesthetic satisfaction associated with continued physical activity participation among boys whilst lower levels will be related to dropout. In contrast, aesthetic satisfaction is not expected to be a significant predictor of physical activity change among girls (Bélanger et al., 2011; Gillison et al., 2011).
  - It is also expected based on previous research that decreases in functional values, functional behavioural investment and functional satisfaction will be associated with dropout from physical activity over time (Abbott & Barber, 2011).

## 7.3 Method

### 7.3.1 Participants.

A total of 803 adolescent respondents ( $n = 502$  females) who participated at Time 1 and Time 2, as described in Section 6.3.1, were used in the current analyses. Further information is available on the attrition and longitudinal sample in Section 3.3.3.

### 7.3.2 Procedure

The procedure for data collection is outlined previously in Section 3.8. Data were analysed using SPSS, Version 21.0.

### 7.3.3 Measures

A full description of all measures used in the study is provided in Chapter 3. Participants completed a survey package entitled *Participation in Sport and Physical Activity among Teenagers in Ireland* at Time 1 and Time

2. The PAR-7DD was excluded from the present analysis as it was previously addressed in Chapter 4 and Chapter 6. The remaining motivational, social and body-image constructs all demonstrated acceptable reliability ( $\alpha \geq .70$ ). Height and weight was also assessed objectively to obtain a measure of BMI. Age - and gender - corrected BMI values were subsequently recorded for each participant by subtracting the age-and-gender specific cut points for overweight from the absolute BMI value (Aires et al., 2010). In turn, negative values represent normal weight while positive values indicate overweight or obesity.

### **7.3.4 Data Analysis**

As described in Chapter 6, participants were grouped into one of four physical activity maintenance and behaviour change trajectories based on their profile of physical activity participation at Time 1 and Time 2. Physical activity maintainers reflected adolescents that were represented by a profile of participation in some form of physical activity at both Time 1 and Time 2 (continued to participate in physical activity over time). Dropouts, in contrast, were classified as physical activity participants at Time 1 but were subsequently categorised as non-participants at Time 2 (no longer took part in physical activity). In turn, continued non-participants reflected those categorised by profiles of non-participation at Time 1 and Time 2 (did not participate in physical activity at baseline or follow-up). Finally, adopters were classified as non-participants at Time 1 but were assigned to a latent physical activity class at Time 2 that was characterised by some level of physical activity participation (commenced participation in physical activity).

Data analyses were performed using SPSS, Version 21.0. All measures were analysed using 2 x 4 mixed between-within groups ANOVAs, which comprised a combination of an independent group ANOVA and repeated-measures ANOVA. The within-groups factors was Time (Time 1, Time 2) and the between-groups factors was physical activity maintenance and behaviour change trajectories (physical activity maintainer, dropout, non-participant, adopter), while the social, motivational and body related variables were the dependent factors. Separate mixed-model ANOVAs were performed for each of the dependent variables to examine the interaction between time and physical activity maintenance and behaviour change trajectory group factors.

Prior to conducting mixed between-within groups ANOVA, preliminary analyses was performed to ensure assumptions were met. The assumption of normality for ANOVA refers to the sampling distributions of means for each level of the independent variable (i.e. physical activity trajectory group). In accordance with the central limit theorem, irrespective of the distribution of raw scores, the sampling distributions of means can be assumed to be normally distributed if a sample size of 30 or more cases is obtained (Tabachnick & Fidell, 2007a). This criterion was satisfied across all gender and age cohorts. Normality was also evaluated for each dependent variable by obtaining standardised skewness and kurtosis scores for each physical activity trajectory group, with z-scores greater than 3.29 significant at  $p < .001$  (Field, 2013). This value was exceeded by some of the larger groups comprising approximately 100 or more cases suggesting that the distribution of the sample was non-normal. However, in large samples these values can be significant even for minor and unimportant deviations from normality (Field, 2013). In addition, in reasonably big samples skewness will not substantively

impact analysis whilst underestimates of variances associated with positive and negative kurtosis can be overcome with samples of 100 or 200 cases, respectively (Tabachnick & Fidell, 2007b). Furthermore, as sample size increases sampling distributions are more likely to approximate normality (Field, 2013).

It should be acknowledged at this point that the parametric statistical approach employed in this chapter contrasts with the non-parametric Kruskal Wallis tests that were used to compare differences among adolescents' physical activity profiles at Time 1 (Chapter 5), despite both sets of analyses using the same set of psychosocial dependent variables. However, it is also important to note that the independent variable examined across each analysis varied and consequently reflect a different sample of young people. For instance, sub-groups of adolescents' characterised by different profiles of physical activity were examined in Chapter 5 whereas adolescents were grouped on the basis of their physical activity trajectory from Time 1 to Time 2 in the current chapter. In addition, the former analyses comprised unequal and small numbers of participants alongside non-normal distribution of variables within latent classes which rendered the data unsuitable for parametric analysis. However, in the present chapter a minimum of 30 cases was available for each level of the independent variable, which as stated above, is sufficient to overcome violations to the assumption of normality in ANOVA. Thus, parametric mixed between-within groups ANOVA were considered appropriate for the present analyses.

The dataset was also assessed for potential outliers using a combination of statistical and graphical methods. Histograms, box plots and normality plots were initially inspected to identify any cases that appeared to be disconnected from the distribution of scores for each dependent variable. Subsequent cases demonstrating standard scores in excess of 3.29 were removed from the respective analyses to avoid distortion of results (Tabachnick & Fidell, 2007b). Among the female adolescent cohort one outlier was removed for BMI. For the male cohort three outliers for teasing and two outliers for enjoyment were deleted. In contrast, the older adolescent cohort did not contain any outliers whereas eight outliers were detected among the younger cohort. These included two outliers for both enjoyment and parental pressure, and four for teasing, which were subsequently removed from the dataset.

In addition, homogeneity of variance was assessed for each dependent variable using Levene's test, with significance values less than .05 indicating that the assumption had been violated. ANOVA has been shown to be robust to the violation of this assumption however, if the ratio of largest to smallest sample variance does not exceed a score of 10, and the largest sample size is no more than 4 times greater than the smallest sample size (Tabachnick & Fidell, 2007a). The older cohort satisfied these criteria for all dependent variables, however as sample sizes were more discrepant among the younger and gender specific cohorts this assumption was not met. Significant Levene's tests were subsequently recorded for a number of social, motivational and body-related dependent variables among the male, female and younger adolescent cohort at Time 1 and at Time 2. To correct for heterogeneity of variance, Tabachnick and Field (2007a) recommend applying a more stringent alpha level when interpreting untransformed scores. In accordance, the overall significance level was set at  $p < 0.01$  to compensate for any inflation of Type I error rate due to heterogeneity of variance or multiple comparisons.

A statistically significant interaction effect indicates that the effect of one independent variable on the dependent variable changes depending on the level of another independent variable (Field, 2013). Simple effects analysis, in combination with the interaction plot, was used to break down interaction effects and locate the source of the mean differences. In simple main effects analysis, one independent variable is held constant at one level, while mean difference are examined across the levels of the other independent variable (Tabachnick & Fidell, 2007b). For example, differences could be explored among physical activity trajectory groups at Time 1 and again, at Time 2. Alternatively, mean differences could be examined from Time 1 to Time 2 for each distinct physical activity trajectory group. In the presence of a significant interaction, post hoc pairwise comparisons were performed with a Bonferroni adjustment ( $p < .05$ ) to control for Type I error (Field, 2013). Statistically significant effect sizes were calculated using partial eta squared ( $\eta^2_p$ ). Cohen's (1988) commonly proposed guidelines were used to interpret the strength of the effect sizes, with values equal to or greater than .01, .06 and .14, representing small, medium and large effect sizes, respectively.

## **7.4 Results**

### **7.4.1 Predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent girls**

#### ***7.4.1.1. Motivational predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent girls***

Descriptive statistics for female physical activity maintainers, dropouts, continued non-participants and physical activity adopters on motivational variables at Time 1 and Time 2 are presented in Table 7.1. High scores are shown for enjoyment, intrinsic motivation and identified regulation across the physical activity trajectory groups with lower scores evidenced for non-participants. In turn low scores are evidenced across all groups for external regulation and amotivation. In addition, medium levels of introjected regulation, competence, relatedness, autonomy and autonomy support were reported.

Table 7.1 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among female adolescents on motivational characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
Enjoyment	7 – 35	Time 1	31.88 (4.59)	30.94 (5.15)	27.70 (6.90)	28.37 (6.79)
		Time 2	31.51 (5.07)	29.12 (6.06)	26.49 (6.78)	30.13 (5.14)
Intrinsic Motivation	4 – 20	Time 1	17.09 (3.37)	15.59 (3.84)	13.22 (4.79)	13.59 (4.21)
		Time 2	16.96 (3.31)	13.87 (4.41)	12.33 (4.56)	15.20 (4.21)
Identified Regulation	4 – 20	Time 1	15.82 (3.33)	14.73 (3.40)	12.39 (4.14)	13.26 (3.71)
		Time 2	16.05 (3.15)	13.99 (3.60)	12.58 (3.59)	14.92 (2.96)
Introjected Regulation	3 – 15	Time 1	7.86 (3.46)	7.25 (3.05)	6.72 (3.31)	7.00 (3.37)
		Time 2	9.88 (3.34)	7.77 (3.36)	7.63 (3.37)	8.26 (3.40)
External Regulation	4 – 20	Time 1	6.76 (2.94)	7.07 (3.01)	6.74 (2.71)	6.21 (2.25)
		Time 2	7.29 (3.29)	6.87 (2.77)	7.43 (3.32)	6.89 (2.78)
Amotivation	4 – 20	Time 1	5.05 (2.20)	5.47 (2.64)	6.77 (4.01)	5.76 (2.89)
		Time 2	5.25 (2.50)	6.83 (3.79)	8.34 (3.93)	5.94 (2.56)
Competence	5 – 20	Time 1	12.75 (3.87)	11.42 (3.22)	10.40 (3.37)	10.87 (3.45)
		Time 2	12.52 (3.86)	10.64 (3.59)	10.06 (3.37)	11.13 (3.49)
Relatedness	5 – 25	Time 1	20.10 (4.93)	19.48 (4.86)	17.81 (5.35)	17.67 (5.65)
		Time 2	20.11 (4.71)	18.44 (4.58)	16.70 (4.91)	17.67 (4.96)
Autonomy	10 – 50	Time 1	39.11 (7.76)	36.84 (7.36)	32.49 (9.58)	31.08 (8.78)
		Time 2	39.75 (6.97)	35.12 (8.18)	31.27 (9.29)	36.56 (7.63)
Autonomy Support	6 – 30	Time 1	22.37 (5.23)	21.08 (5.73)	19.63 (5.41)	19.02 (5.94)
		Time 2	22.32 (5.22)	20.63 (5.60)	18.66 (6.05)	20.15 (4.91)

*Note.* PA = Physical Activity

Ten 2 X 4 mixed-model ANOVAs were performed to examine whether mean scores on enjoyment, motivation, basic psychological needs and autonomy support showed different patterns of change over time among the female physical activity maintainer, dropout, non-participation and physical activity adopter groups. A significant interaction between time and physical activity trajectory group was found for enjoyment, which demonstrated a small effect size ( $\Lambda = 0.97$ ,  $F(3, 498) = 4.62$ ,  $p = .003$ ,  $\eta^2_p = .03$ ). Simple main effects analyses were used to uncover the source of the interaction. As shown in Figure 7.1, the physical activity trajectory groups demonstrated different patterns of change over time in relation to enjoyment. The dropout ( $\Lambda = 0.98$ ,  $F(1, 498) = 12.41$ ,  $p < .001$ ,  $\eta^2_p = .02$ ) and non-participant ( $\Lambda = 0.99$ ,  $F(1, 498) = 4.78$ ,  $p = .029$ ,  $\eta^2_p = .01$ ) groups reported a significant reduction in enjoyment, whereas a significant increase was evidenced among the physical activity adopter group ( $\Lambda = 0.99$ ,  $F(1, 498) = 3.95$ ,  $p = .048$ ,  $\eta^2_p = .01$ ). In contrast, physical activity maintainers demonstrated stable levels of enjoyment from baseline to follow-up ( $\Lambda = 1.00$ ,  $F(1, 498) = 0.76$ ,  $p = .388$ ,  $\eta^2_p = .001$ ).

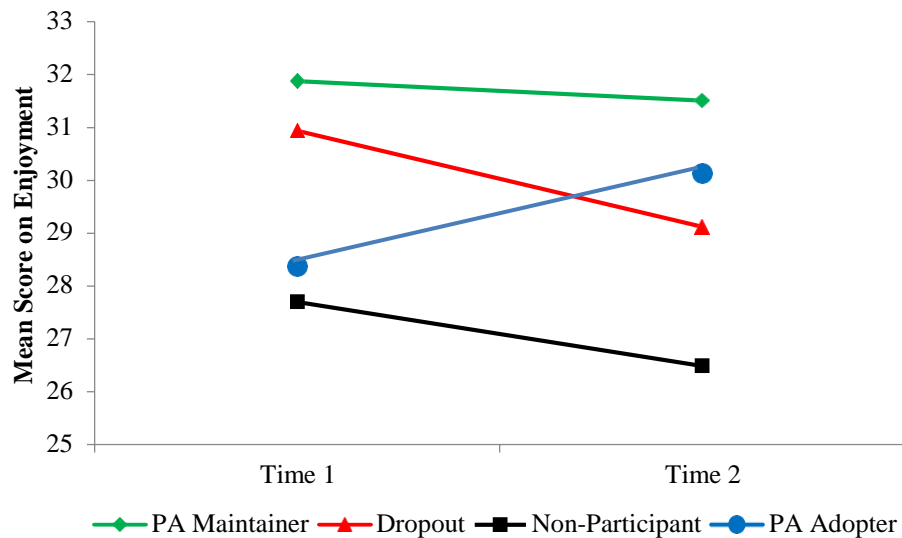


Figure 7.1. Time by physical activity trajectory group interaction for enjoyment among adolescent girls

Simple effects analyses also revealed significant differences in enjoyment levels across the physical activity trajectory groups at Time 1 ( $F(3, 498) = 16.42, p < .001, \eta^2_p = .09$ ) and Time 2 ( $F(3, 498) = 19.17, p < .001, \eta^2_p = .10$ ), with medium effect sizes evidenced at each time point. Bonferroni-adjusted post hoc tests revealed that physical activity maintainers and dropouts, who were both active at Time 1, reported significantly higher levels of enjoyment than the non-participation (both  $p < .001$ ) and adopter groups ( $p = .001; p = .042$ ) at baseline. The non-participation group continued to demonstrate significantly poorer enjoyment scores at Time 2 compared to the physical activity maintainers ( $p < .001$ ) and dropouts ( $p = .002$ ). No significant differences were found between the adopter and maintainer group at follow-up, however dropouts differed from physical activity maintainers at this point in time reporting significantly lower levels of enjoyment ( $p = .001$ ). In addition, physical activity adopters demonstrated significantly higher scores on enjoyment than non-participants at Time 2 ( $p = .002$ ).

The results indicated that different patterns of change in enjoyment levels over time underpinned transitions in physical activity behaviour. Decreased levels of enjoyment were linked to physical activity dropout and non-participation over a twelve month period. In accordance, dropouts evidenced enjoyment scores similar to that of physical activity maintainers at baseline, but reported significantly lower levels at follow-up. In addition, the non-participation group demonstrated deteriorating levels of enjoyment from Time 1 to Time 2 and remained the lowest scoring physical activity trajectory group at follow-up. In contrast, increased enjoyment scores were linked to uptake of physical activity with adopters becoming more similar to physical activity maintainers over time and subsequently less like their baseline non-participant counterparts. Dropouts and adopters also demonstrated similar levels of enjoyment at follow up despite differing initially at baseline, which was attributed to their respective roles becoming reversed over time.

In regards to motivation, a significant interaction effect between time and physical activity trajectory group was found for intrinsic motivation, which was medium in size ( $\Lambda = 0.94, F(3, 498) = 10.09, p = .001, \eta^2_p = .06$ ). As depicted in Figure 7.2, simple main effects analysis indicated that intrinsic motivation scores

significantly declined for dropouts ( $\Lambda = 0.95$ ,  $F(1, 498) = 26.96$ ,  $p < .001$ ,  $\eta^2_p = .05$ ) and non-participants ( $\Lambda = 0.99$ ,  $F(1, 498) = 6.35$ ,  $p = .012$ ,  $\eta^2_p = .01$ ) from Time 1 to Time 2, whilst adopters reported a significant increase over time ( $\Lambda = 0.98$ ,  $F(1, 498) = 8.05$ ,  $p = .005$ ,  $\eta^2_p = .02$ ). Small effects were evidenced for the non-participation and physical activity adopter groups, whereas a small-to-medium effect size was reported for dropouts. Physical activity maintainers in contrast, evidenced consistently high levels of intrinsic motivation from baseline to follow-up ( $\Lambda = 1.00$ ,  $F(1, 498) = 0.24$ ,  $p = .626$ ,  $\eta^2_p < .001$ ).

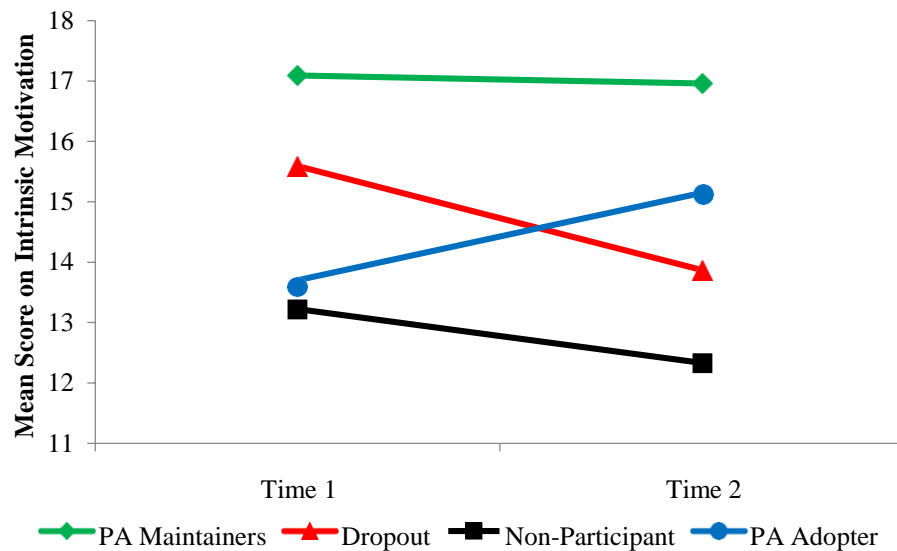


Figure 7.2 Time by physical activity trajectory group interaction for intrinsic motivation among adolescent girls

Significant differences also emerged across physical activity trajectory groups at Time 1 ( $F(3, 498) = 27.68$ ,  $p < .001$ ,  $\eta^2_p = .14$ ) and Time 2 ( $F(3, 498) = 36.83$ ,  $p < .001$ ,  $\eta^2_p = .18$ ) that reflected large effect sizes. Bonferroni-adjusted pairwise comparisons revealed that physical activity maintainers demonstrated greater levels of intrinsic motivation at each time point than the dropout ( $p = .004$ ;  $p < .001$ ), non-participation (both  $p < .001$ ) and physical activity adopter ( $p < .001$ ,  $p = .045$ ) groups. Dropouts also reported significantly higher intrinsic motivation at Time 1 in comparison to the non-participation ( $p < .001$ ) and physical activity adopter groups ( $p = .018$ ). Although these differences were maintained between the dropout and non-participation group at Time 2 ( $p = .015$ ), dropouts and physical activity adopters did not significantly differ at this point in time ( $p > .05$ ). In turn, physical activity adopters reported significantly higher intrinsic motivation at Time 2 than the non-participation group ( $p < .001$ ), from whom they did not differ at baseline ( $p > .05$ ).

The results indicated that the physical activity dropout and adopter groups changed roles over time. Dropouts demonstrated decreased levels of intrinsic motivation whereas physical activity adopters reported increased levels from Time 1 to Time 2. In addition, dropouts reported poorer intrinsic motivation in comparison to physical activity maintainers at each time point, which suggests that low intrinsic motivation underpins physical activity decline among adolescent girls over twelve months. Physical activity adopters could also be

discriminated from their non-participant counterparts at Time 2 evidencing higher levels of intrinsic motivation. In turn, non-participants continued to fare more poorly demonstrating significantly lower intrinsic motivation scores than all of the other physical activity trajectory groups at follow-up.

For identified regulation, a significant interaction effect between time and physical activity trajectory group emerged, which demonstrated a small effect size ( $\Lambda = 0.97$ ,  $F(3, 498) = 5.32$ ,  $p = .001$ ,  $\eta^2_p = .03$ ). As shown in Figure 7.3, simple main effects analysis indicated that physical activity dropouts reported a significant decline in identified regulation levels over time ( $\Lambda = 0.99$ ,  $F(1, 498) = 5.48$ ,  $p = .020$ ,  $\eta^2_p = .01$ ), whilst adopters demonstrated a significant increase in identified regulation from baseline to follow-up ( $\Lambda = 0.98$ ,  $F(1, 498) = 9.66$ ,  $p = .002$ ,  $\eta^2_p = .02$ ). Effect sizes for these differences were small. No significant changes were found among the maintainer and non-participation groups on identified regulation from Time 1 to Time 2, however ( $p > .05$ ).

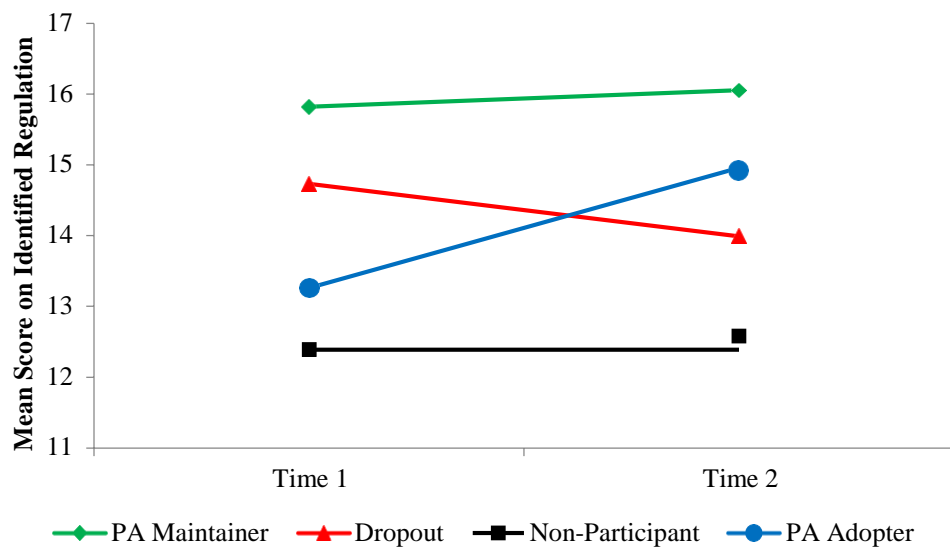


Figure 7.3. Time by physical activity trajectory group interaction for identified regulation among adolescent girls

A significant effect of physical activity trajectory group on identified regulation also emerged at Time 1 ( $F(3, 498) = 24.85$ ,  $p < .001$ ,  $\eta^2_p = .13$ ) and Time 2 ( $F(3, 498) = 24.85$ ,  $p < .001$ ,  $\eta^2_p = .13$ ), with medium-to-large effect sizes evidenced at each time point. Bonferonni post hoc tests revealed that physical activity maintainers reported significantly higher levels of identified regulation at baseline in comparison to the dropout ( $p = .038$ ), non-participation ( $p < .001$ ) and adopter groups ( $p < .001$ ). At follow-up, physical activity maintainers continued to score significantly higher than dropouts and non-participants on identified regulation (both  $p < .001$ ); however they no longer differed significantly from the adopter group ( $p > .05$ ). In turn, the non-participation and physical activity adopter groups differed at follow-up, with adopters reporting significantly higher identified regulation. The non-participation group also scored significantly below the dropout group on identified regulation at baseline ( $p < .001$ ) and follow up ( $p = .006$ ), and remained the poorest performing group over time.



The results indicated that changes in identified regulation scores over time differentially predicted transitions in physical activity behaviour. An increase in identified regulation from Time 1 to Time 2 was linked to uptake of physical activity. Physical activity adopters also changed over time relative to the other physical activity trajectory groups, becoming less like their non-participant counterparts and approximating physical activity maintainers more closely at follow-up. In contrast, decreased levels of identified regulation were associated with female physical activity decline over a twelve month period. In accordance, physical activity maintainers and dropouts differed from each other on identified regulation scores at Time 1 when both groups were active, and continued to differ at Time 2, which suggests that lower levels of identified regulation underpinned physical activity dropout over time.

Introjected regulation also evidenced a significant interaction effect between time and physical activity trajectory group that was small in size ( $\Lambda = 0.97$ ,  $F(3, 498) = 5.47$ ,  $p = .001$ ,  $\eta^2_p = .03$ ). As can be seen in Figure 7.4, the physical activity maintainer ( $\Lambda = 0.88$ ,  $F(1, 498) = 65.80$ ,  $p < .001$ ,  $\eta^2_p = .12$ ), adopter ( $\Lambda = 0.99$ ,  $F(1, 498) = 5.76$ ,  $p = .017$ ,  $\eta^2_p = .01$ ) and non-participation groups ( $\Lambda = 0.99$ ,  $F(1, 498) = 7.74$ ,  $p = .006$ ,  $\eta^2_p = .02$ ) demonstrated a significant increase in introjected regulation from baseline to follow-up, whereas introjected regulation scores did not significantly differ over time among dropouts ( $p > .01$ ). Effect sizes were small for the adopter and non-participation groups; however the physical activity maintainers demonstrated a medium to large effect.

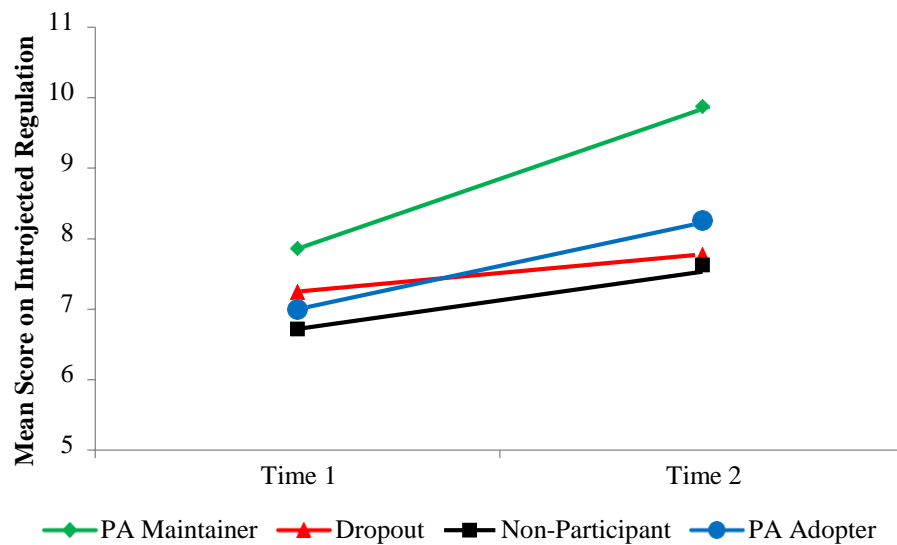


Figure 7.4. Time by physical activity trajectory group interaction for introjected regulation among adolescent girls

The physical activity trajectory groups also significantly differed on introjected regulation at Time 1 ( $F(3, 498) = 3.22$ ,  $p = .023$ ,  $\eta^2_p = .02$ ) and Time 2 ( $F(3, 498) = 16.02$ ,  $p < .001$ ,  $\eta^2_p = .09$ ), with small and medium effects evidenced, respectively. Bonferroni-adjusted pairwise comparisons revealed that physical activity maintainers reported significantly greater levels of introjected regulation than non-participants at baseline ( $p = .019$ ). These differences were maintained at follow-up ( $p < .001$ ). In addition, physical activity maintainers scored higher on

introjected regulation at Time 2 in comparison to physical activity dropouts ( $p < .001$ ) and adopters ( $p = .019$ ). The results indicated that higher introjected regulation levels underpinned sustained physical activity behaviour over time and discriminated physical activity maintainers from all of the other physical activity trajectory groups at follow-up. There was no significant time by physical activity trajectory group interaction effect found for external regulation indicating that similar scores were reported among physical activity trajectory groups at baseline and follow-up ( $\Lambda = 0.99$ ,  $F(3, 498) = 2.05$ ,  $p = .106$ ,  $\eta^2_p = .01$ ).

For amotivation however, a significant interaction effect between time and physical activity trajectory group emerged that was small-to-medium in size ( $\Lambda = 0.97$ ,  $F(3, 498) = 5.99$ ,  $p = .001$ ,  $\eta^2_p = .04$ ). As depicted in Figure 7.5, simple effects analysis indicated that amotivation scores significantly increased for the dropout ( $\Lambda = 0.96$ ,  $F(1, 498) = 22.07$ ,  $p < .001$ ,  $\eta^2_p = .04$ ) and non-participation groups ( $\Lambda = 0.95$ ,  $F(1, 498) = 25.88$ ,  $p < .001$ ,  $\eta^2_p = .05$ ) over time, with both demonstrating small effect sizes. In turn, low stable levels of amotivation were evidenced among the physical activity maintainers and adopters from baseline to follow-up ( $p > .01$ ).

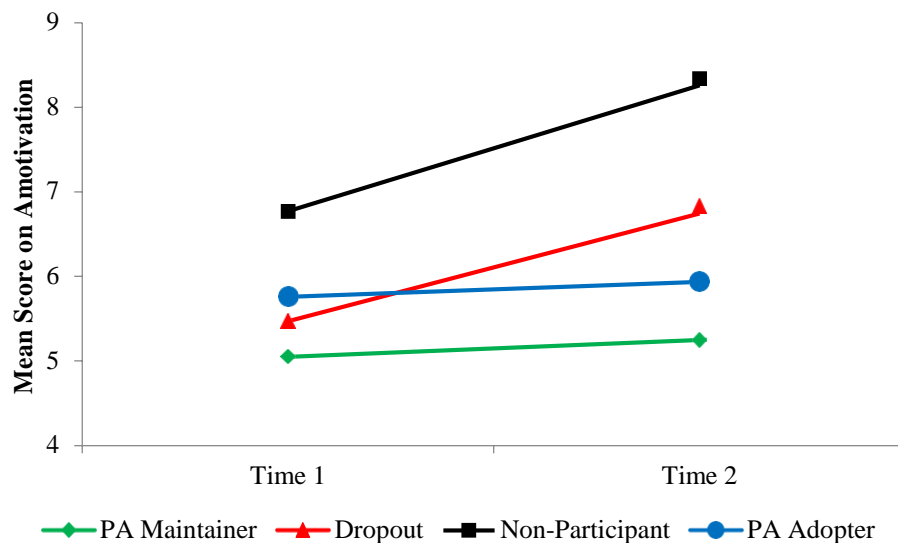


Figure 7.5. Time by physical activity trajectory group interaction for amotivation among adolescent girls

Simple effects analysis also revealed significant differences among the physical activity trajectory groups at Time 1 ( $F(3, 498) = 8.98$ ,  $p < .001$ ,  $\eta^2_p = .05$ ) and Time 2 ( $F(3, 498) = 23.43$ ,  $p < .001$ ,  $\eta^2_p = .12$ ). Small and medium-to-large effect sizes were found for the group differences at each respective time point. Post hoc Bonferroni-adjusted tests indicated that non-participants demonstrated higher amotivation scores at Time 1 in comparison to physical activity maintainers ( $p < .001$ ) and dropouts ( $p = .003$ ). At follow-up, non-participants continued to demonstrate higher amotivation than physical activity maintainers ( $p < .001$ ), however no significant differences were found between the non-participation and dropout groups at this point in time ( $p > .05$ ). In addition, physical activity dropouts and maintainers differed at Time 2, with dropouts demonstrating significantly higher levels of amotivation ( $p < .001$ ). The results indicated that increased amotivation scores were linked to physical activity dropout and continued non-participation

over time. Physical activity dropouts reported similar levels of amotivation at Time 1 as physical activity maintainers; however they significantly differed from the maintainers at follow-up. The non-participation group also continued to demonstrate poorer amotivation outcomes over time, reporting significantly higher scores at follow-up than all of the other physical activity trajectory groups.

In terms of basic psychological needs, the interaction between time and physical activity trajectory group was not found to be statistically significant for competence ( $\Lambda = 0.99, F(3, 498) = 1.72, p = .162, \eta^2_p = .01$ ) or relatedness ( $\Lambda = 0.99, F(3, 498) = 1.81, p = .145, \eta^2_p = .01$ ). In addition, a non-significant interaction effect between time and physical activity trajectory group was evidenced for autonomy support ( $\Lambda = 0.99, F(3, 498) = 1.58, p = .193, \eta^2_p = .01$ ).

However, a significant time by physical activity trajectory group interaction effect emerged for autonomy, which demonstrated a small-to-medium association ( $\Lambda = 0.95, F(3, 498) = 9.00, p < .001, \eta^2_p = .05$ ). As depicted in Figure 7.6, the physical activity trajectory groups demonstrated different patterns of change on autonomy scores from Time 1 to Time 2. Physical activity adopters reported a significant increase in autonomy over time ( $\Lambda = 0.97, F(1, 498) = 18.31, p < .001, \eta^2_p = .04$ ), whereas the dropout group evidenced a significant decline ( $\Lambda = 0.99, F(1, 498) = 5.28, p = .022, \eta^2_p = .01$ ). Small effects were evidenced for each of these trajectory groups. In contrast, physical activity maintainers and non-participants reported stable levels of autonomy from baseline to follow-up ( $p > .05$ ).

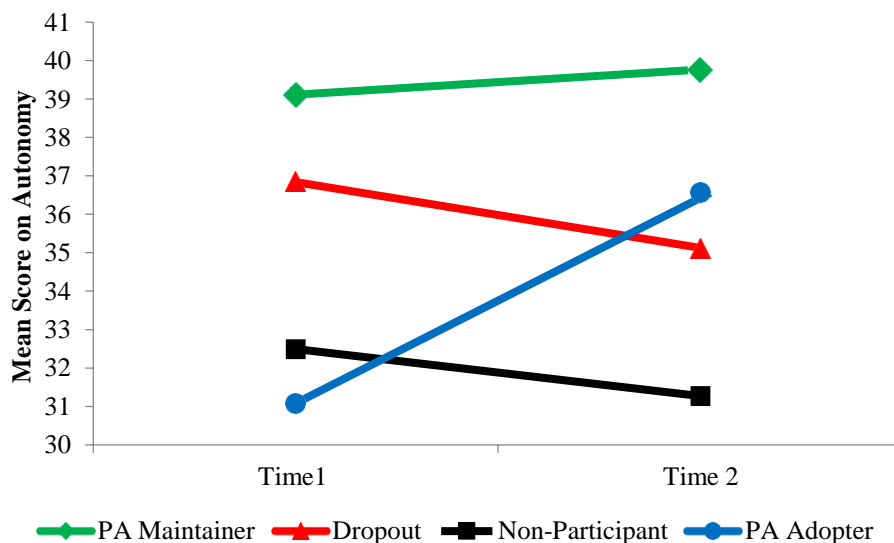


Figure 7.6. Time by physical activity trajectory group interaction for autonomy among adolescent girls

The effect of physical activity trajectory group also varied at Time 1 ( $F(3, 498) = 22.78, p < .001, \eta^2_p = .12$ ) and Time 2 ( $F(3, 498) = 29.49, p < .001, \eta^2_p = .15$ ), with medium-to-large, and large effects evidenced, respectively. Bonferroni-corrected pairwise comparisons revealed that physical activity maintainers and dropouts both significantly differed from non-participants (both  $p < .001$ ) and adopters at baseline (both  $p < .001$ ). At Time 2, physical activity maintainers and dropouts continued to report significantly higher levels of

autonomy than the non-participation group ( $p < .001$ ;  $p = .001$ ). However, physical activity maintainers and adopters no longer differed significantly at this point in time ( $p > .05$ ). In turn, physical activity adopters reported significantly higher autonomy scores than non-participants at follow-up ( $p = .001$ ), despite a lack of significant differences evidenced between these groups at baseline. In addition, no significant differences were found between physical activity adopters and dropouts at Time 2 ( $p < .05$ ). Finally, dropouts differed from physical activity maintainers at follow-up reporting significantly lower levels of autonomy ( $p < .001$ ).

The results indicated that increased perceptions of autonomy were associated with uptake of physical activity, with physical activity adopters demonstrating autonomy scores similar to that of physical activity maintainers at follow-up. In addition, decreased perceptions of autonomy underpinned withdrawal from physical activity participation. The dropout group closely approximated the maintainer group at baseline; however they reported significantly lower levels of autonomy at follow-up. In turn, physical activity adopters and dropouts did not differ at Time 2 owing to their respective pattern of autonomy scores becoming reversed over time.

#### ***7.4.1.2. Social predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent girls***

Descriptive statistics for female adolescent's physical activity maintenance and behaviour change trajectory groups on social variables at Time 1 and Time 2 are presented in Table 7.2. Low scores are shown for friend support, parental pressure and teasing while medium levels of parental and friend role modelling are displayed. In turn, low-to-medium scores were reported for mother and father support whereas medium-to-high levels of peer acceptance were evidenced.

Table 7.2 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among female adolescents on social characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
Mum Support	5 – 25	Time 1	15.01 (4.12)	12.69 (4.20)	11.13 (3.90)	11.78 (4.26)
		Time 2	14.60 (4.34)	11.47 (4.33)	9.84 (4.22)	12.02 (4.62)
Dad Support	5 – 25	Time 1	13.64 (5.44)	11.43 (4.51)	10.30 (4.55)	10.48 (4.70)
		Time 2	13.09 (5.27)	10.42 (4.49)	9.46 (4.49)	11.50 (5.38)
Mum PA Role Model	1 – 5	Time 1	3.05 (1.25)	2.86 (1.22)	2.71 (1.26)	2.59 (1.31)
		Time 2	2.81 (1.29)	2.71 (1.27)	2.44 (1.30)	2.81 (1.38)
Dad PA Role Model	1 – 5	Time 1	2.67 (1.36)	2.51 (1.37)	2.53 (1.32)	2.46 (1.30)
		Time 2	2.64 (1.43)	2.27 (1.29)	2.31 (1.30)	2.59 (1.44)
Parental Pressure	10 – 40	Time 1	16.13 (4.88)	15.88 (4.71)	15.45 (5.25)	16.28 (5.27)
		Time 2	15.96 (4.90)	15.44 (4.96)	15.56 (5.21)	14.94 (5.54)
Friend Support	4 – 20	Time 1	11.78 (3.03)	10.38 (3.13)	8.20 (3.05)	8.93 (2.86)
		Time 2	11.33 (3.00)	9.34 (3.16)	8.32 (3.14)	9.70 (2.98)
Friend PA Role Model	1 – 5	Time 1	3.07 (0.87)	2.99 (0.92)	2.65 (0.86)	2.73 (0.71)
		Time 2	3.15 (0.86)	2.90 (0.87)	2.73 (1.03)	2.98 (0.83)
Peer Acceptance	5 – 20	Time 1	15.52 (3.09)	14.90 (3.67)	15.59 (3.04)	15.05 (3.20)
		Time 2	15.00 (3.33)	14.71 (3.27)	15.14 (3.49)	14.89 (3.37)
Teasing	7 – 35	Time 1	13.01 (4.73)	13.38 (4.46)	12.78 (4.78)	13.13 (4.34)
		Time 2	14.04 (4.80)	13.81 (4.56)	14.20 (5.05)	13.70 (4.66)

Note. PA = Physical Activity

Separate mixed-design ANOVAs were conducted to investigate whether patterns of parental influences changed over time for physical activity maintainers, dropouts, non-participants and those who adopted physical activity. There were no significant interaction effects found between time and physical activity trajectory group for mother support ( $\Lambda = 0.98$ ,  $F(3, 498) = 2.68$ ,  $p = .046$ ,  $\eta^2_p = .02$ ), father support ( $\Lambda = 0.98$ ,  $F(3, 498) = 2.34$ ,  $p = .072$ ,  $\eta^2_p = .01$ ), mother physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.54$ ,  $p = .204$ ,  $\eta^2_p = .01$ ), father physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.30$ ,  $p = .275$ ,  $\eta^2_p = .01$ ), or parental pressure ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.19$ ,  $p = .313$ ,  $\eta^2_p = .01$ ).

In relation to peer influences, a significant interaction effect between time and physical activity trajectory group emerged for friend support, which was small in size ( $\Lambda = 0.98$ ,  $F(3, 498) = 4.03$ ,  $p = .008$ ,  $\eta^2_p = .02$ ). Simple main effects analysis indicated that physical activity dropouts evidenced a significant decline in friend support from Time 1 to Time 2 ( $\Lambda = 0.98$ ,  $F(1, 498) = 11.92$ ,  $p = .001$ ,  $\eta^2_p = .02$ ). The effect size for this difference was found to be small. In contrast, no significant changes ( $p > .05$ ) were found among the maintainer, non-participant and physical activity adopter groups from baseline to follow-up (Figure 7.7). In addition, significant differences in perceptions of friend support were found across physical activity trajectory groups at Time 1 ( $F(3, 498) = 25.77$ ,  $p < .001$ ,  $\eta^2_p = .13$ ) and Time 2 ( $F(3, 498) = 33.20$ ,  $p < .001$ ,  $\eta^2_p = .17$ ), with medium-to-large, and large effect sizes evidenced at each respective time point. Post-hoc Bonferroni-corrected comparisons revealed that physical activity maintainers remained the highest scoring physical activity trajectory group at Time 1 and Time 2 demonstrating significantly greater levels of friend support than dropouts (both  $p < .001$ ), non-participants (both  $p < .001$ ), and physical activity adopters ( $p < .001$ ,  $p = .007$ ). In contrast, dropouts reported higher perceptions of friend support than non-participants ( $p < .001$ ) and adopters ( $p = .033$ ) at baseline; however these group differences were not maintained at follow-up.

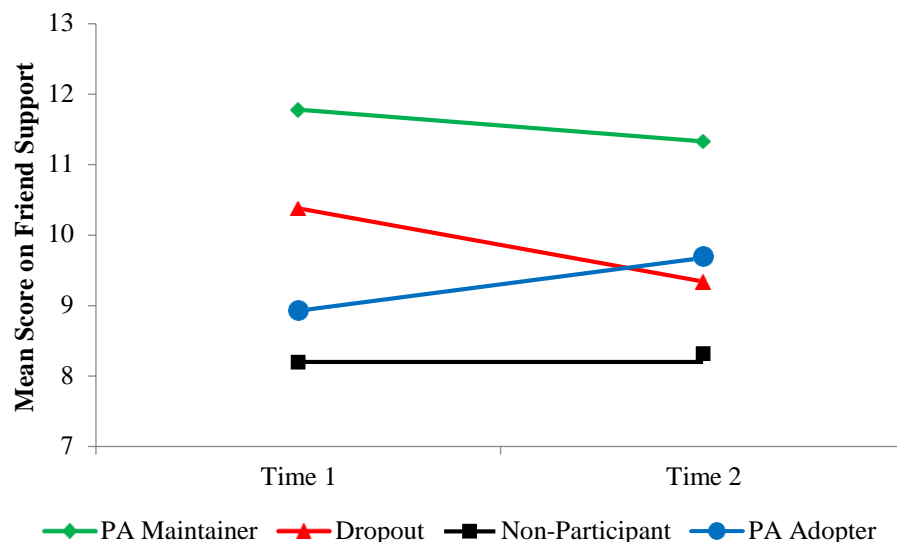


Figure 7.7 Time by physical activity trajectory group interaction for friend social support among adolescent girls

The results indicated that decreased perceptions of friend support were associated with physical activity dropout among adolescent girls. Accordingly, physical activity dropouts evidenced significantly lower levels of friend support than maintainers at Time 1 even though both groups were active at this point in time, and these significant group differences were maintained at Time 2. In addition, the dropout group closely resembled the non-participant group at follow-up, despite demonstrating significantly higher scores at baseline. Following on from this, the time by physical activity trajectory group interaction effect was non-significant for friend physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.29$ ,  $p = .277$ ,  $\eta^2_p = .01$ ), peer acceptance ( $\Lambda = 1.00$ ,  $F(3, 498) = 0.33$ ,  $p = .804$ ,  $\eta^2_p < .01$ ), and teasing ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.27$ ,  $p = .284$ ,  $\eta^2_p = .01$ ).

#### ***7.4.1.3. Body-related predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent girls***

Descriptive statistics for body-related variables among physical activity maintainers, dropouts, continued non-participants and physical activity adopters at Time 1 and Time 2 is presented in Table 7.3. BMI scores are based on gender and age-specific cut-off points for overweight and the negative scores shown indicate that female adolescents' trajectory groups on average were of normal weight. In turn, medium scores were evidenced for the different dimensions of aesthetic and functional body image.

Table 7.3 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among female adolescents on body-related characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
BMIC	-9.1 – 12.2	Time 1	-1.61 (3.37)	-1.76 (3.57)	-1.79 (3.96)	-1.43 (3.27)
		Time 2	-1.75 (3.30)	-1.82 (3.58)	-1.96 (3.96)	-1.25 (3.01)
Body Dissatisfaction	-3 – 8	Time 1	0.94 (1.26)	0.78 (1.35)	0.79 (1.15)	1.09 (1.21)
		Time 2	0.99 (1.24)	0.96 (1.28)	0.84 (1.63)	0.79 (1.78)
Aesthetic Values	3 – 15	Time 1	9.48 (3.10)	9.46 (3.06)	9.33 (2.78)	9.61 (2.96)
		Time 2	10.13 (2.75)	9.79 (2.78)	9.98 (2.80)	10.50 (2.53)
Aes. Behaviour Invest	2 – 10	Time 1	7.06 (1.98)	7.01 (2.02)	6.88 (2.19)	7.07 (2.08)
		Time 2	7.06 (1.93)	6.92 (2.01)	7.02 (2.05)	7.04 (2.09)
Aesthetic Satisfaction	3 – 15	Time 1	9.13 (3.46)	8.95 (3.47)	9.05 (3.62)	7.90 (3.18)
		Time 2	8.44 (3.24)	8.39 (3.63)	8.27 (3.74)	8.30 (3.42)
Functional Values	3 – 15	Time 1	10.60 (2.55)	9.97 (2.36)	9.40 (2.71)	9.25 (2.64)
		Time 2	10.74 (2.48)	10.08 (2.58)	9.08 (2.76)	9.85 (2.21)
Func. Behaviour Invest	3 – 15	Time 1	11.59 (2.55)	10.37 (2.63)	8.38 (2.82)	8.87 (2.97)
		Time 2	11.87 (2.59)	10.05 (2.88)	8.62 (2.94)	10.50 (2.32)
Functional Satisfaction	3 – 15	Time 1	10.96 (3.11)	9.78 (3.07)	8.73 (3.35)	8.13 (3.27)
		Time 2	10.72 (2.99)	9.44 (3.22)	7.90 (3.03)	8.84 (3.21)

*Note.* PA = Physical Activity. BMIC = BMI corrected for age and gender. Aes. Behaviour Invest = Aesthetic Behavioural Investment; Func. Behaviour Invest = Functional Behavioural Investment.

The interaction between time and physical activity trajectory group was not statistically significant for BMIc ( $\Lambda = 1.00$ ,  $F(3, 498) = 0.55$ ,  $p = .647$ ,  $\eta^2 < .01$ ), body dissatisfaction ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.53$ ,  $p = .206$ ,  $\eta^2_p = .01$ ), aesthetic values ( $\Lambda = 1.00$ ,  $F(3, 498) = 0.56$ ,  $p = .644$ ,  $\eta^2_p < .01$ ), aesthetic behaviour investment ( $\Lambda = 1.00$ ,  $F(3, 498) = 0.30$ ,  $p = .829$ ,  $\eta^2_p < .01$ ), or aesthetic satisfaction ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.78$ ,  $p = .151$ ,  $\eta^2_p = .01$ ), which indicates that similar scores were reported across physical activity maintainer, dropout, non-participation and adopter trajectory groups at Time 1 and Time 2.

In relation to functional body image, a non-significant interaction effect between time and physical activity trajectory group was evidenced for functional values ( $\Lambda = 0.99$ ,  $F(3, 498) = 1.39$ ,  $p = .245$ ,  $\eta^2_p = .01$ ) and functional satisfaction ( $\Lambda = 1.00$ ,  $F(3, 498) = 3.46$ ,  $p = .016$ ,  $\eta^2_p < .02$ ). In contrast, a significant interaction between time and physical activity trajectory group emerged for functional behavioural investment that was small-to-medium in size ( $\Lambda = 0.97$ ,  $F(3, 498) = 6.08$ ,  $p < .001$ ,  $\eta^2_p = .04$ ). As depicted in Figure 7.8, physical activity adopters demonstrated a small significant increase in levels of functional behaviour investment over time ( $\Lambda = 0.97$ ,  $F(1, 498) = 17.10$ ,  $p < .001$ ,  $\eta^2_p = .03$ ), whilst no significant changes were found among the maintainer, dropout and non-participation groups ( $p > .05$ ).

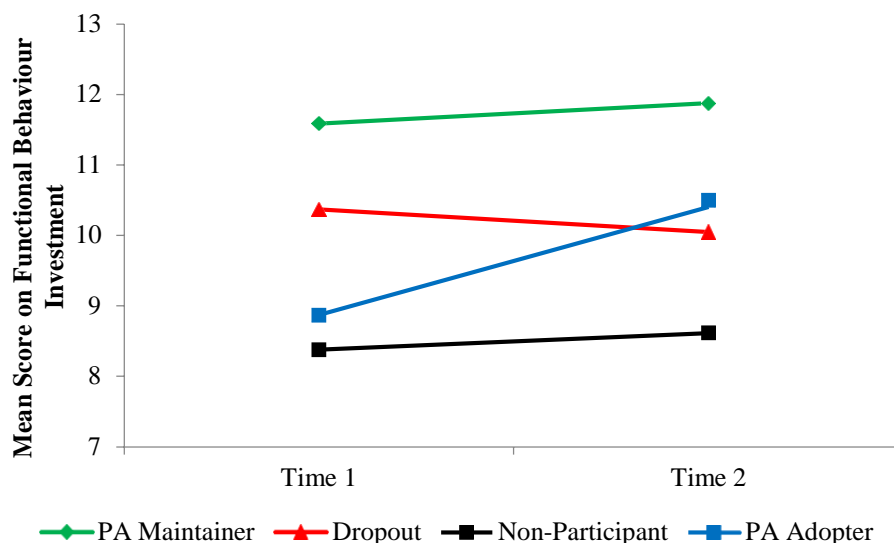


Figure 7.8. Time by physical activity trajectory group interaction for functional behaviour investment among adolescent girls

In addition, physical activity trajectory groups differed significantly on functional behaviour investment at Time 1 ( $F(3, 498) = 40.41$ ,  $p < .001$ ,  $\eta^2_p = .20$ ) and Time 2 ( $F(3, 498) = 36.65$ ,  $p < .001$ ,  $\eta^2_p = .18$ ) with large effect sizes demonstrated at each time point. Bonferroni-adjusted pairwise comparisons indicated that physical activity maintainers reported significantly higher levels of functional behaviour investment at baseline and follow-up compared to the dropout (both  $p < .001$ ), non-participation (both  $p < .001$ ) and adopter groups ( $p < .001$ ,  $p = .014$ ). Physical activity dropouts also reported greater levels of functional behaviour investment at Time 1 than non-participants ( $p < .001$ ) and physical activity adopters ( $p = .007$ ). At Time 2, dropouts continued to score significantly higher than non-participants ( $p < .001$ ) however they did not differ significantly from physical activity adopters. In addition, physical activity adopters demonstrated significantly



higher functional behaviour investment levels at follow-up in comparison to non-participants from whom they did not differ at baseline ( $p = .001$ ).

The significant interaction effect indicates that changes in functional behaviour investment scores were linked to different physical activity transition patterns over time. Increased functional behaviour investment was linked to uptake of physical activity behaviour over a twelve-month period. Physical activity adopters could be discriminated from the non-participation group at follow-up, despite scoring similarly on functional behaviour investment at baseline. In addition, dropouts evidenced significantly lower levels of functional behaviour investment in comparison to the maintainer group at both Time 1 and Time 2, suggesting that lower levels may precede dropout.

#### **7.4.2 Predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent boys**

##### ***7.4.2.1. Motivational predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent boys***

Descriptive statistics are presented in Table 7.4 for each physical activity trajectory group on the motivational variables at Time 1 and Time 2 for adolescent boys. High levels of enjoyment, intrinsic motivation and identified regulation were evidenced across the physical activity trajectory groups with non-participants demonstrating lower scores. Overall, low levels of introjected regulation, external regulation and amotivation were reported. Finally, medium to high scores are shown for competence, relatedness, autonomy and autonomy support with physical activity maintainers demonstrating higher scores.

Table 7.4 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among male adolescents on motivational characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
Enjoyment	7 – 35	Time 1	33.01 (3.38)	30.05 (6.30)	27.70 (7.59)	30.55 (5.87)
		Time 2	32.90 (2.98)	28.22 (6.51)	28.00 (6.28)	31.55 (4.48)
Intrinsic Motivation	4 – 20	Time 1	17.93 (2.71)	15.42 (3.87)	12.94 (4.36)	14.85 (3.93)
		Time 2	17.64 (2.94)	14.16 (4.39)	13.97 (4.28)	16.47 (3.66)
Identified Regulation	4 – 20	Time 1	16.77 (3.07)	13.95 (3.50)	12.33 (3.50)	14.26 (4.01)
		Time 2	16.77 (3.08)	13.46 (4.52)	12.40 (3.39)	15.32 (2.82)
Introjected Regulation	3 – 15	Time 1	7.51 (3.52)	6.73 (3.34)	5.58 (3.11)	6.50 (3.48)
		Time 2	8.53 (3.60)	6.00 (3.06)	6.49 (2.85)	7.06 (3.08)
External Regulation	4 – 20	Time 1	7.27 (3.46)	6.97 (3.35)	6.77 (2.86)	6.64 (2.74)
		Time 2	6.93 (3.12)	7.32 (3.80)	7.64 (3.17)	6.72 (2.95)
Amotivation	4 – 20	Time 1	5.33 (2.63)	5.95 (3.27)	7.36 (3.56)	5.95 (3.22)
		Time 2	5.04 (2.65)	7.18 (4.41)	7.18 (3.63)	5.79 (2.81)
Competence	5 – 20	Time 1	15.28 (3.23)	12.12 (3.62)	10.88 (3.72)	12.69 (3.32)
		Time 2	15.14 (3.26)	12.20 (3.81)	10.76 (3.43)	13.38 (3.53)
Relatedness	5 – 25	Time 1	20.66 (4.83)	19.45 (4.29)	17.98 (3.50)	17.95 (5.60)
		Time 2	20.64 (4.31)	18.89 (4.44)	17.21 (4.07)	18.97 (4.60)
Autonomy	10 – 50	Time 1	40.71 (6.59)	36.30 (7.77)	32.85 (9.84)	36.73 (8.64)
		Time 2	41.41 (6.77)	35.69 (8.54)	33.87 (6.79)	40.64 (6.06)
Autonomy Support	6 – 30	Time 1	23.58 (4.83)	20.71 (4.91)	17.88 (4.76)	19.96 (5.80)
		Time 2	23.32 (5.27)	20.14 (6.13)	18.25 (4.13)	23.15 (4.97)

Separate 2 x 4 mixed design ANOVAs were conducted to examine time by physical activity trajectory group interactions effects on motivational variables. A non-significant interaction between time and physical activity trajectory group was found for enjoyment ( $\Lambda = 0.98$ ,  $F(3, 295) = 2.55$ ,  $p = .056$ ,  $\eta^2_p = .03$ ). In relation to motivation however, a significant time by physical activity trajectory group interaction effect emerged for intrinsic motivation, which was medium in size ( $\Lambda = 0.95$ ,  $F(3, 297) = 5.73$ ,  $p = .001$ ,  $\eta^2_p = .06$ ). Simple main effects analysis indicated that the physical activity trajectory groups demonstrated different patterns of change over time in relation to intrinsic motivation.

As shown in Figure 7.9, physical activity adopters reported a significant increase in intrinsic motivation levels over time ( $\Lambda = 0.97$ ,  $F(1, 297) = 8.58$ ,  $p = .004$ ,  $\eta^2_p = .03$ ), whereas dropouts evidenced a significant decline ( $\Lambda = 0.99$ ,  $F(1, 297) = 4.60$ ,  $p = .033$ ,  $\eta^2_p = .02$ ). Effect sizes were small for each of these differences. The continued non-participation and physical activity maintainer groups demonstrated stable levels of intrinsic motivation from baseline to follow-up ( $p > .05$ ).

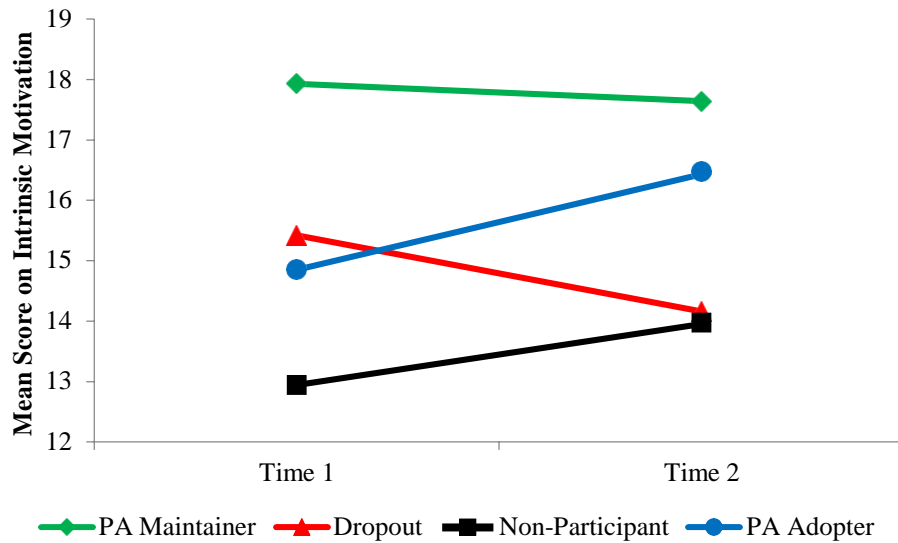


Figure 7.9. Time by physical activity trajectory group interaction for intrinsic motivation among adolescent boys

Simple effects analysis also revealed that physical activity trajectory groups varied at Time 1 ( $F(3, 297) = 29.88, p < .001, \eta^2_p = .23$ ) and Time 2 ( $F(3, 297) = 18.63, p < .001, \eta^2_p = .16$ ), with large effects associated with each time point. Bonferroni adjusted pairwise comparisons indicated that physical activity maintainers reported significantly greater levels of intrinsic motivation at Time 1 than dropouts ( $p < .001$ ), non-participants ( $p < .001$ ) and physical activity adopters ( $p < .001$ ). In addition, dropouts reported significantly higher levels of intrinsic motivation than non-participants at baseline ( $p < .001$ ). No other significant group differences were found at Time 1. Physical activity maintainers continued to demonstrate significantly higher intrinsic motivation levels at follow-up than non-participants ( $p < .001$ ) and dropouts ( $p < .001$ ), but they no longer significantly differed ( $p > .05$ ) from physical activity adopters. In addition, there was no significant group differences found between physical activity dropouts and non-participants at Time 2 on intrinsic motivation. In turn, physical activity adopters reported significantly higher intrinsic motivation scores at follow-up compared to dropouts ( $p = .018$ ) and non-participants ( $p = .011$ ) despite failing to significantly differ from these groups at baseline.

The results indicated that changing patterns of intrinsic motivation underpinned transitions in physical activity behaviour among males from baseline to follow-up. Increased levels of intrinsic motivation were associated with uptake of physical activity over an approximate twelve month period whereas decreased levels predicted physical activity dropout. Physical activity adopters and dropouts also changed over time relative to their physical activity maintainer and continued non-participant trajectory counterparts. Physical activity adopters demonstrated intrinsic motivation scores at follow-up similar to that of physical activity maintainers, and higher scores relative to the non-participant and dropout groups. In contrast, dropouts significantly differed from physical activity maintainers at baseline, when both groups were classified as physically active participants and again at follow-up, indicating that lower intrinsic motivation levels underpinned physical activity withdrawal over time.

There was no statistically significant time by physical activity trajectory group interaction effects evidenced for identified regulation ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.48$ ,  $p = .219$ ,  $\eta^2_p = .02$ ), introjected regulation ( $\Lambda = 0.97$ ,  $F(3, 297) = 2.92$ ,  $p = .035$ ,  $\eta^2_p = .03$ ), external regulation ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.30$ ,  $p = .276$ ,  $\eta^2_p = .01$ ), and amotivation ( $\Lambda = 0.98$ ,  $F(3, 297) = 2.34$ ,  $p = .073$ ,  $\eta^2_p = .02$ ). In addition the interaction between time and physical activity trajectory group was non-significant for competence ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.83$ ,  $p = .480$ ,  $\eta^2_p = .01$ ), relatedness ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.01$ ,  $p = .387$ ,  $\eta^2_p = .01$ ) and autonomy ( $\Lambda = 0.98$ ,  $F(3, 297) = 2.54$ ,  $p = .056$ ,  $\eta^2_p = .03$ ).

However, a significant interaction effect between time and physical activity trajectory group emerged for autonomy support, which was small-to-medium in size ( $\Lambda = 0.96$ ,  $F(3, 297) = 4.15$ ,  $p = .007$ ,  $\eta^2_p = .04$ ). Simple main effects analysis revealed that physical activity adopters reported a significant increase in perceived autonomy support from Time 1 to Time 2 ( $\Lambda = 0.96$ ,  $F(1, 297) = 11.74$ ,  $p = .001$ ,  $\eta^2_p = .04$ ), whereas the physical activity maintainer, low active and dropout groups did not demonstrate any significant changes over time (Figure 7.10). The effect size for the aforementioned difference was small-to-medium.

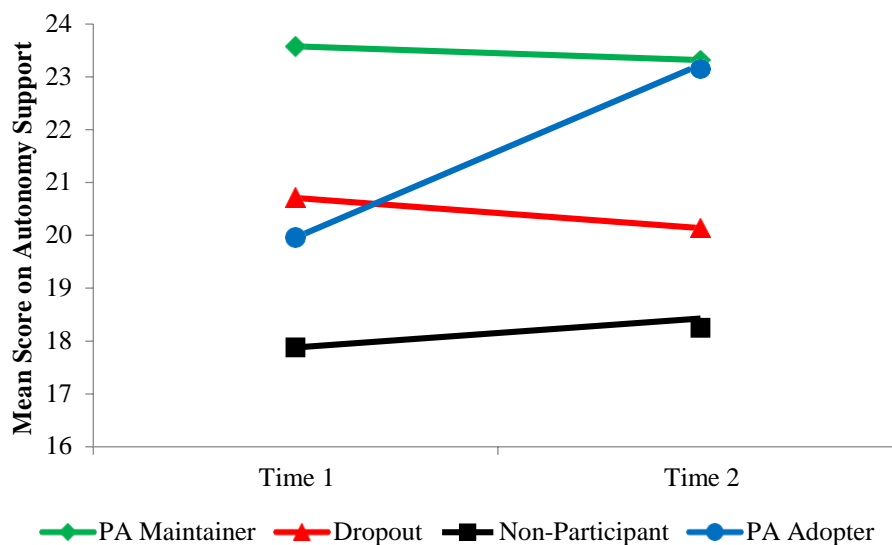


Figure 7.10. Time by physical activity trajectory group interaction for autonomy support among adolescent boys

In addition, simple main effects analysis indicated that the effect of physical activity trajectory group varied at Time 1 ( $F(3, 297) = 16.99$ ,  $p < .001$ ,  $\eta^2_p = .15$ ) and Time 2 ( $F(3, 297) = 11.45$ ,  $p < .001$ ,  $\eta^2_p = .10$ ), with large and medium effect sizes associated with each time point, respectively. Follow-up Bonferonni post hoc tests revealed that physical activity maintainers reported significantly greater perceptions of autonomy support at Time 1 in comparison to the dropout ( $p = .009$ ), non-participation ( $p < .001$ ) and physical activity adopter groups ( $p < .001$ ). In addition, dropouts reported significantly higher level of autonomy support at baseline than non-participants. No other significant group differences were found at baseline. While physical activity maintainers continued to score significantly higher on perceived autonomy support than non-participants ( $p < .001$ ) and dropouts ( $p = .005$ ) at Time 2, they did not significantly differ from the physical activity adopter group at this point in time. In addition there was no significant difference found between the dropout and non-

participant groups on autonomy support at follow-up. In turn, physical activity adopters reported significantly higher levels of autonomy support at follow-up in comparison to non-participants ( $p < .001$ ) and dropouts at Time 2 ( $p = .003$ ), despite failing to differ from these groups at Time 1.

The results indicated that increased perceptions of autonomy support were associated with uptake of physical activity from Time 1 to Time 2. Physical activity adopters also changed relative to the other physical activity trajectory groups, becoming more similar to physical activity maintainers over time and consequently more different from those who remained non-participants or dropped out over the twelve month duration. In addition, physical activity dropouts and maintainers differed at baseline and follow-up, with physical activity dropouts becoming more similar to non-participants at Time 2 suggesting that lower perceptions of autonomy support may contribute to physical activity decline.

#### ***7.4.2.2. Social predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent boys***

The descriptive statistics for the male physical activity maintainers, dropouts, non-participants and physical activity adopters at Time 1 and Time 2 on the social variables are presented in Table 7.5. Overall, low scores were reported for pressure and teasing while low-to-medium scores are shown for perceived support from mother, father and friends. In addition medium scores were evidenced for mother, father and friend role modelling with medium to high scores attained for peer acceptance.

Table 7.5 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among male adolescents on social characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
Mum Support	5 – 25	Time 1	14.07 (4.61)	12.51 (4.36)	9.70 (4.48)	12.33 (4.91)
		Time 2	13.04 (4.48)	11.05 (3.85)	9.64 (3.93)	12.50 (4.38)
Dad Support	5 – 25	Time 1	14.54 (5.20)	12.16 (5.34)	8.63 (3.98)	11.36 (4.97)
		Time 2	14.01 (5.28)	10.78 (5.04)	7.83 (3.08)	12.39 (5.31)
Mum PA Role Model	1 – 5	Time 1	2.75 (1.25)	2.81 (1.39)	2.15 (1.12)	2.74 (1.48)
		Time 2	2.62 (1.29)	2.43 (1.37)	2.24 (1.15)	2.74 (1.36)
Dad PA Role Model	1 – 5	Time 1	2.67 (1.32)	2.38 (1.36)	1.94 (1.17)	2.45 (1.35)
		Time 2	2.73 (1.33)	2.11 (1.43)	1.70 (0.98)	2.62 (1.34)
Parental Pressure	10 – 40	Time 1	18.19 (5.75)	18.53 (5.32)	15.89 (4.17)	17.53 (5.02)
		Time 2	17.09 (5.45)	16.79 (5.82)	14.79 (3.81)	15.09 (4.83)
Friend Support	4 – 20	Time 1	13.17 (3.50)	9.99 (3.09)	9.29 (3.39)	11.21 (3.38)
		Time 2	12.66 (3.51)	9.89 (4.01)	9.09 (2.98)	11.22 (3.36)
Friend PA Role Model	1 – 5	Time 1	3.69 (0.87)	3.14 (0.79)	3.15 (0.76)	3.17 (0.70)
		Time 2	3.62 (0.87)	3.11 (0.88)	2.88 (0.99)	3.17 (0.82)
Peer Acceptance	5 – 20	Time 1	16.29 (2.86)	14.57 (3.30)	14.67 (3.69)	14.24 (3.44)
		Time 2	15.64 (2.95)	15.53 (2.70)	13.73 (3.63)	14.67 (3.67)
Teasing	7 – 35	Time 1	11.44 (4.04)	12.46 (4.60)	12.52 (4.34)	12.19 (3.46)
		Time 2	11.62 (4.26)	12.38 (4.57)	12.49 (4.45)	12.74 (5.61)

Note. PA = Physical Activity

Separate 2 x 4 mixed design ANOVAs were performed to examine interaction effects between time and physical activity trajectory group on parental and peer influences. The interaction effect between time and physical activity trajectory group was not statistically significant for mother support ( $\Lambda = 0.98$ ,  $F(3, 297) = 1.77$ ,  $p = .153$ ,  $\eta^2_p = .02$ ), father support ( $\Lambda = 0.98$ ,  $F(3, 297) = 1.62$ ,  $p = .184$ ,  $\eta^2_p = .02$ ), mother physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.80$ ,  $p = .498$ ,  $\eta^2_p = .01$ ), father physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.91$ ,  $p = .436$ ,  $\eta^2_p = .01$ ), or parental pressure ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.98$ ,  $p = .404$ ,  $\eta^2_p = .01$ ). In addition, no significant time by physical activity trajectory groups interaction effects emerged for friend support ( $\Lambda = 1.00$ ,  $F(3, 297) = 0.42$ ,  $p = .742$ ,  $\eta^2_p < .01$ ), friend physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.57$ ,  $p = .636$ ,  $\eta^2_p = .01$ ), peer acceptance ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.19$ ,  $p = .315$ ,  $\eta^2_p = .01$ ), and teasing ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.24$ ,  $p = .866$ ,  $\eta^2_p < .01$ ). Thus, mean scores did not significantly differ from Time 1 to Time 2 among the male physical activity trajectory groups on any of the social variables.

#### **7.4.2.3. Body-related predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among adolescent boys**

Descriptive statistics for body-related variables are presented in Table 7.6 for each of the physical activity maintenance and behaviour change trajectory groups at Time 1 and Time 2. BMI scores are based on gender and age-specific cut-off points for overweight and the negative scores shown indicate that male adolescent's trajectory groups on average were of normal weight. In turn, medium scores were evidenced for aesthetic values and aesthetic behavioural investment whereas scores ranged from medium to high for aesthetic satisfaction. For functional body image, medium to high scores were evidenced with physical activity maintainers reporting more favourable scores.

Table 7.6 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among male adolescents on body-related characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
BMIC	-8.6 – 11.2	Time 1	-2.12 (3.21)	-0.94 (3.41)	-1.97 (3.18)	-1.40 (4.39)
		Time 2	-2.20 (3.25)	-1.12 (3.67)	-2.10 (3.73)	-1.95 (4.16)
Body Dissatisfaction	-5 – 4	Time 1	-0.01 (1.24)	0.14 (1.34)	0.18 (1.42)	0.64 (1.41)
		Time 2	-0.10 (1.10)	0.27 (1.15)	0.17 (1.27)	0.37 (1.03)
Aesthetic Values	3 – 15	Time 1	8.92 (3.04)	8.38 (3.10)	7.91 (2.58)	7.95 (3.04)
		Time 2	9.02 (2.94)	8.81 (3.26)	7.39 (2.36)	8.56 (2.86)
Aes. Behaviour Invest	2 – 10	Time 1	6.70 (2.02)	5.86 (2.31)	5.68 (1.95)	5.64 (1.65)
		Time 2	6.91 (1.97)	6.54 (2.28)	5.39 (2.36)	6.63 (1.85)
Aesthetic Satisfaction	3 – 15	Time 1	11.32 (2.97)	10.01 (3.64)	10.09 (2.83)	9.58 (2.79)
		Time 2	11.30 (2.79)	10.89 (2.85)	9.94 (3.12)	10.41 (2.74)
Functional Values	3 – 15	Time 1	11.95 (2.33)	10.82 (2.47)	9.15 (2.77)	9.93 (2.48)
		Time 2	11.83 (2.42)	10.31 (2.70)	8.82 (2.44)	10.52 (2.62)
Func. Behaviour Invest	3 – 15	Time 1	12.67 (2.39)	10.78 (2.73)	8.49 (2.90)	10.57 (2.83)
		Time 2	12.89 (2.35)	10.49 (3.05)	8.18 (2.54)	11.84 (2.42)
Functional Satisfaction	3 – 15	Time 1	12.54 (2.56)	11.36 (2.74)	9.03 (3.26)	10.02 (2.78)
		Time 2	12.63 (2.37)	11.41 (3.18)	9.61 (2.63)	11.91 (2.53)

*Note.* PA = Physical Activity. BMIC = BMI corrected for age and gender. Aes. Behaviour Invest = Aesthetic Behavioural Investment; Func. Behaviour Invest = Functional Behavioural Investment.

There was no significant time by physical activity trajectory group interaction effects evidenced for BMIC ( $\Lambda = 0.99$ ,  $F(3, 297) = 0.98$ ,  $p = .404$ ,  $\eta^2_p = .01$ ), body dissatisfaction ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.39$ ,  $p = .247$ ,  $\eta^2_p = .01$ ), aesthetic values ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.04$ ,  $p = .376$ ,  $\eta^2_p = .01$ ), aesthetic behavioural investment ( $\Lambda = 0.97$ ,  $F(3, 297) = 3.19$ ,  $p = .024$ ,  $\eta^2_p = .03$ ), or aesthetic satisfaction ( $\Lambda = 0.98$ ,  $F(3, 297) = 2.08$ ,  $p = .103$ ,  $\eta^2_p = .02$ ). For functional body image, a significant interaction between time and physical activity group emerged for functional satisfaction ( $\Lambda = 0.95$ ,  $F(3, 297) = 5.19$ ,  $p = .002$ ,  $\eta^2_p = .05$ ), that was small-to-medium in size. Non-significant interaction effects were found for functional values ( $\Lambda = 0.99$ ,  $F(3, 297) = 1.18$ ,  $p = .318$ ,  $\eta^2_p = .01$ ), and functional behavioural investment ( $\Lambda = 0.97$ ,  $F(3, 297) = 2.62$ ,  $p = .051$ ,  $\eta^2_p = .03$ ).

Simple main effects analysis indicated that physical activity adopters evidenced a significant increase in functional satisfaction over time ( $\Lambda = 0.94$ ,  $F(1, 297) = 20.12$ ,  $p < .001$ ,  $\eta^2_p = .06$ ), which was medium in size. No significant changes ( $p > .05$ ) were found among the maintainer, adopter and non-participation groups from Time 1 to Time 2, however (Figure 7.11).

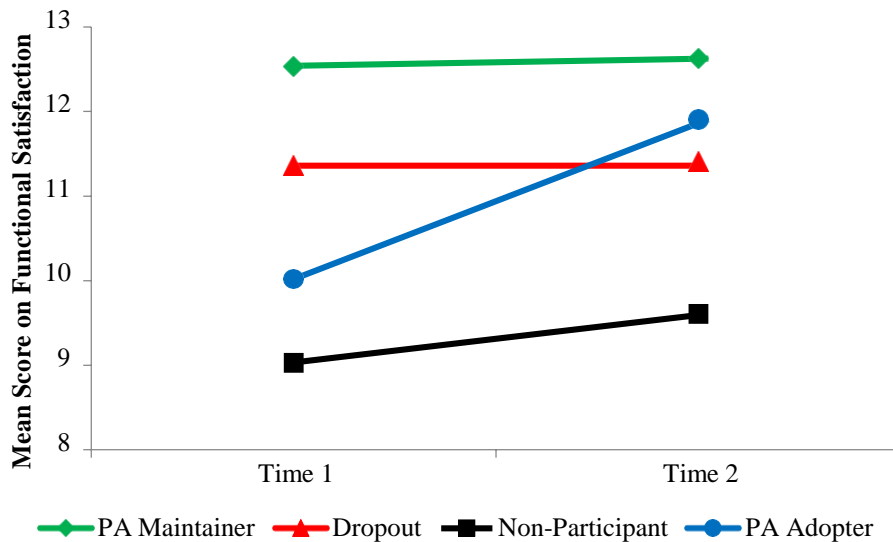


Figure 7.11. Time by physical activity trajectory group interaction for functional satisfaction among adolescent boys

In addition, simple main effects analysis revealed that physical activity trajectory groups significantly differed at Time 1 ( $F(3, 297) = 222.48$ ,  $p < .001$ ,  $\eta^2_p = .19$ ) and Time 2 ( $F(3, 297) = 14.42$ ,  $p < .001$ ,  $\eta^2_p = .13$ ), with large, and medium to large, effect sizes evidenced at each respective time point. Bonferonni-corrected pairwise comparisons indicated that physical activity maintainers demonstrated significantly greater levels of functional satisfaction at baseline, than non-participants ( $p < .001$ ) and physical activity adopters ( $p < .001$ ). The dropout group also reported significantly higher functional satisfaction than the non-participation group at Time 1 ( $p < .001$ ). No other significant differences were found between the physical activity trajectory groups at baseline. At follow-up, physical activity maintainers continued to score significantly higher on functional satisfaction in comparison to non-participants ( $p < .001$ ), but they no longer differed significantly from physical activity adopters at this time point. The dropout group also reported significantly higher functional satisfaction at Time 2 than the non-participation group ( $p = .020$ ). Physical activity maintainers and dropouts differed significantly at follow-up however, with dropouts reporting lower levels of functional satisfaction ( $p = .044$ ). In addition, despite not differing significantly from each other at Time 1, physical activity adopters and non-participants differed at Time 2 ( $p < .001$ ) with the former group demonstrating significantly higher scores on functional satisfaction.

The results indicated that increased levels of functional satisfaction predicted uptake of physical activity among adolescent boys over a twelve month period. Physical activity adopters changed over time relative to the other physical activity trajectory groups, becoming less like their initial non-participant counterparts and approximating functional satisfaction scores at follow-up of those who maintained physical activity



involvement from Time 1 to Time 2. In addition, dropouts and physical activity maintainers differed from each other on functional satisfaction at follow-up despite no significant differences evidenced at Time 1, indicating that these physical activity groups were becoming more dissimilar over time.

### 7.4.3 Predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among younger adolescents

#### 7.4.3.1. Motivational predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among younger adolescents

Descriptive statistics are presented for each of the younger adolescent physical activity trajectory groups on the motivational variables at Time 1 and Time 2 in Table 7.7. High levels of enjoyment, intrinsic motivation and identified regulation were attained among the physical activity trajectory groups with non-participants demonstrating lower scores. Overall, low levels of introjected regulation, external regulation and amotivation were reported. Finally, medium scores are shown for competence, relatedness, autonomy and autonomy support with physical activity maintainers demonstrating higher scores.

Table 7.7 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among younger adolescents on motivational characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
Enjoyment	7 – 35	Time 1	32.61 (3.81)	30.70 (5.45)	28.08 (7.72)	30.68 (5.47)
		Time 2	32.81 (3.44)	28.63 (5.12)	26.46 (6.93)	31.05 (5.26)
Intrinsic Motivation	4 – 20	Time 1	17.57 (3.10)	15.57 (2.84)	13.22 (4.51)	14.74 (3.72)
		Time 2	17.46 (2.98)	13.10 (4.41)	12.86 (4.58)	15.58 (3.95)
Identified Regulation	4 – 20	Time 1	16.33 (3.06)	13.90 (3.43)	11.66 (3.71)	13.44 (3.70)
		Time 2	16.48 (3.07)	13.23 (3.50)	11.96 (3.90)	14.73 (2.95)
Introjected Regulation	3 – 15	Time 1	7.55 (3.39)	6.57 (2.94)	6.07 (2.83)	7.12 (3.25)
		Time 2	8.94 (3.51)	7.35 (3.64)	6.55 (3.22)	8.35 (3.27)
External Regulation	4 – 20	Time 1	7.27 (3.29)	6.33 (2.14)	6.55 (2.44)	6.53 (2.60)
		Time 2	7.28 (3.02)	7.80 (3.64)	7.06 (3.62)	6.55 (2.72)
Amotivation	4 – 20	Time 1	5.28 (2.59)	5.30 (2.12)	6.99 (3.75)	5.73 (2.72)
		Time 2	5.16 (2.53)	7.30 (3.52)	8.81 (4.60)	5.52 (2.91)
Competence	5 – 20	Time 1	14.27 (3.56)	11.33 (3.46)	10.05 (3.17)	11.46 (3.41)
		Time 2	14.07 (3.56)	10.40 (3.80)	9.74 (3.23)	11.80 (3.61)
Relatedness	5 – 25	Time 1	21.36 (4.25)	19.80 (4.83)	18.21 (4.65)	19.12 (5.36)
		Time 2	20.71 (4.29)	18.17 (4.90)	16.98 (4.68)	19.38 (4.22)
Autonomy	10 – 50	Time 1	39.95 (6.52)	37.53 (8.66)	31.92 (8.02)	35.01 (8.74)
		Time 2	40.32 (6.71)	36.68 (8.66)	31.62 (8.98)	39.51 (6.94)
Autonomy Support	6 – 30	Time 1	23.00 (4.77)	21.60 (5.05)	20.04 (5.66)	20.21 (5.61)
		Time 2	23.33 (4.91)	20.43 (5.61)	18.41 (5.18)	22.12 (5.75)

Separate mixed design ANOVAs were performed to examine whether patterns of mean scores on motivational variables changed over time for the physical activity maintainer, dropout, continued non-participant and physical activity adopter trajectory groups. For enjoyment, a non-significant time by physical activity trajectory group interaction effect was evidenced ( $\Lambda = 0.98$ ,  $F(3, 395) = 3.44$   $p = .017$ ,  $\eta^2_p = .03$ ). In regards to motivation, a significant interaction between time and physical activity trajectory group emerged for intrinsic motivation, which was small-to-medium in size ( $\Lambda = 0.96$ ,  $F(3, 397) = 5.01$   $p = .002$ ,  $\eta^2_p = .04$ ). Simple main effects analysis indicated that physical activity dropouts demonstrated a significant decline in intrinsic motivation over time ( $\Lambda = 0.97$ ,  $F(1, 397) = 12.01$ ,  $p = .001$ ,  $\eta^2_p = .03$ ), whereas no significant changes ( $p > .05$ ) were found among the maintainer, non-participant and physical activity adopter groups on intrinsic motivation from Time 1 to Time 2 (Figure 7.12). The effect size for this difference was small.

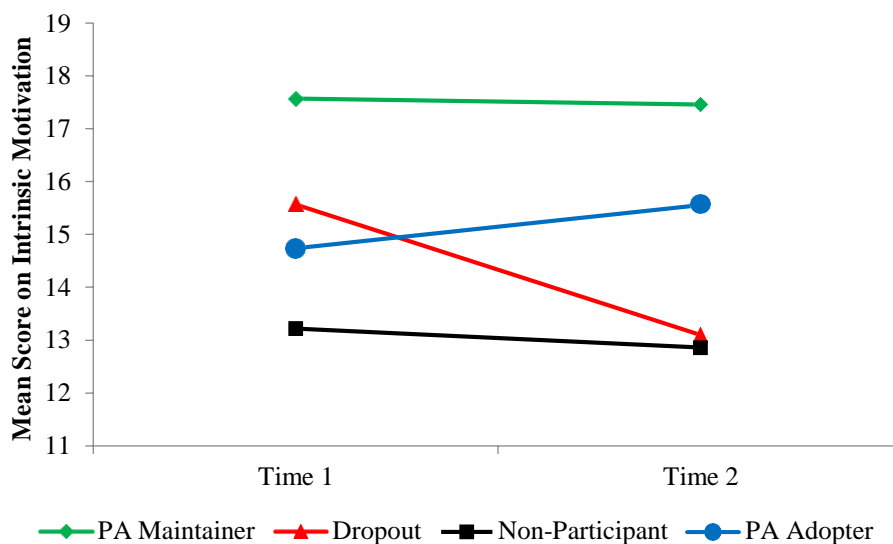


Figure 7.12. Time by physical activity trajectory group interaction for intrinsic motivation among younger adolescents

In addition, simple main effects analysis also revealed significant differences among the physical activity trajectory groups at Time 1 ( $F(3, 397) = 33.24$ ,  $p < .001$ ,  $\eta^2_p = .20$ ) and Time 2 ( $F(3, 397) = 37.39$ ,  $p < .001$ ,  $\eta^2_p = .22$ ), that corresponded to large effect sizes at each time point. Bonferroni-adjusted post hoc comparisons revealed that physical activity maintainers demonstrated significantly higher intrinsic motivation at baseline and follow-up than the dropout ( $p = .018$ ;  $p < .001$ ), non-participation (both  $p < .001$ ) and physical activity adopter ( $p < .001$ ,  $p = .001$ ) groups. Dropouts also reported significantly higher intrinsic motivation scores at Time 1 in comparison to non-participants ( $p = .013$ ), however these differences were not maintained at Time 2. In addition, physical activity adopters evidenced significantly higher levels of intrinsic motivation at follow-up compared to dropouts ( $p = .011$ ) and non-participants ( $p < .001$ ), despite not differing from these groups at baseline.

The results showed that younger adolescents' physical activity transitions over time were linked to changing patterns of intrinsic motivation scores. Physical activity dropouts scored significantly lower than physical activity maintainers at each time point and subsequently resembled the non-participation group at follow-up,

which indicated that decreased levels of intrinsic motivation underpinned dropout from physical activity over a twelve month period. In contrast, physical activity adopters became less like the non-participation and dropout groups over time, suggesting that higher levels of intrinsic motivation contributed to uptake of physical activity. In turn, physical activity maintainers remained the highest scoring group over time underscoring the role of high levels of intrinsic motivation in sustained physical activity participation.

There was no significant time by physical activity trajectory group interaction effect found for identified regulation ( $\Lambda = 0.98, F(3, 397) = 2.42, p = .065, \eta^2_p = .02$ ), introjected regulation ( $\Lambda = 0.99, F(3, 397) = 1.33, p = .265, \eta^2_p = .01$ ), or external regulation ( $\Lambda = 0.99, F(3, 397) = 1.81, p = .145, \eta^2_p = .01$ ). However, a significant interaction between time and physical activity trajectory group emerged for amotivation, with the effect being medium in size ( $\Lambda = 0.94, F(3, 397) = 8.96, p < .001, \eta^2_p = .06$ ). As shown in Figure 7.13, the interaction effect indicated that the  $p$  effect of time varied across physical activity trajectory groups. In accordance, the non-participation ( $\Lambda = 0.95, F(1, 397) = 20.18, p < .001, \eta^2_p = .05$ ) and dropout groups ( $\Lambda = 0.97, F(1, 397) = 10.72, p = .001, \eta^2_p = .03$ ) demonstrated a significant increase in amotivation scores over time that evidenced small-to-medium, and small, effects respectively. The physical activity maintainer and adopter groups in contrast, sustained low levels of amotivation from Time 1 to Time 2 ( $p > .05$ ).

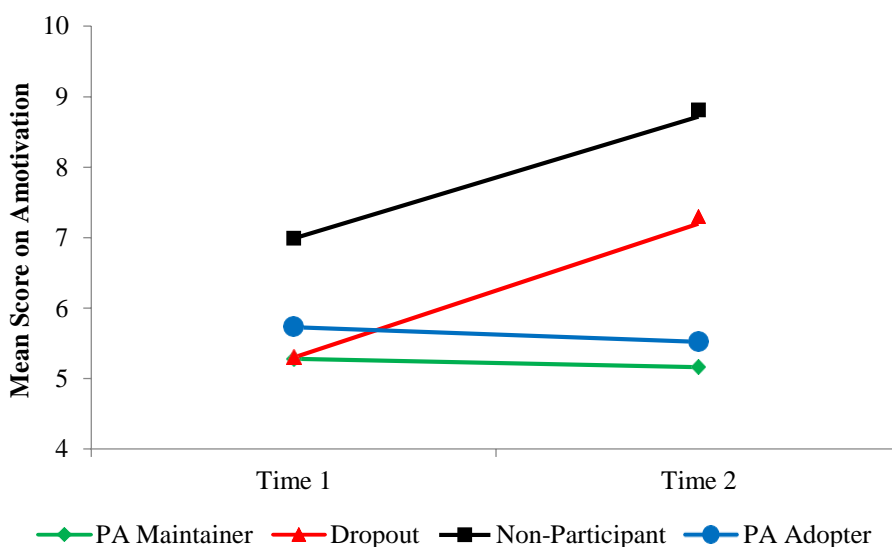


Figure 7.13. Time by physical activity trajectory group interaction for amotivation among younger adolescents

In addition, significant differences were found among the physical activity trajectory groups at baseline ( $F(3, 397) = 6.68, p < .001, \eta^2_p = .05$ ) and follow-up ( $F(3, 397) = 26.58, p < .001, \eta^2_p = .17$ ), which corresponded to small-to-medium, and large effect sizes at each respective time point. Post hoc Bonferroni comparisons revealed that non-participants demonstrated significantly higher amotivation scores than physical activity maintainers ( $p < .001$ ) and dropouts ( $p = .039$ ) at Time 1. The physical activity maintainer and non-participation groups continued to differ at Time 2 ( $p < .001$ ); however no significant differences were found between dropouts and non-participants at follow-up ( $p > .05$ ). In turn, dropouts reported significantly higher levels of amotivation than physical activity maintainers ( $p = .003$ ) at Time 2. Non-participants and physical

activity adopters also differed significantly at follow-up with the latter group demonstrating lower amotivation scores ( $p < .001$ ). The results indicated that increased amotivation scores were linked to physical activity dropout over a twelve month period. In accordance, physical activity dropouts changed over time relative to the other physical activity trajectory groups, becoming less like their initial physical activity maintainer counterparts and approximating amotivation scores of those who remained non-participants from Time 1 to Time 2. The physical activity adopter and non-participation groups also became more distinct over time owing to increased amotivation scores evidenced among non-participants from baseline to follow-up.

In relation to psychological needs, the interaction effect between time and physical activity trajectory group was non-significant for competence ( $\Lambda = 0.99$ ,  $F(3, 397) = 1.25$ ,  $p = .293$ ,  $\eta^2_p = .01$ ), and relatedness ( $\Lambda = 0.99$ ,  $F(3, 397) = 1.34$ ,  $p = .260$ ,  $\eta^2_p = .01$ ). However, a significant time by physical activity trajectory group interaction effect emerged for autonomy, which was small-to-medium in size ( $\Lambda = 0.96$ ,  $F(3, 397) = 5.10$ ,  $p = .002$ ,  $\eta^2_p = .04$ ). Simple main effects analysis indicated that physical activity adopters reported a significant increase in autonomy scores over time ( $\Lambda = 0.96$ ,  $F(1, 397) = 18.38$ ,  $p < .001$ ,  $\eta^2_p = .04$ ). The effect size for this difference was small-to-medium. In contrast, no significant changes were found for the maintainer, dropout, and non-participation groups on autonomy from Time 1 to Time 2 (Figure 7.14).

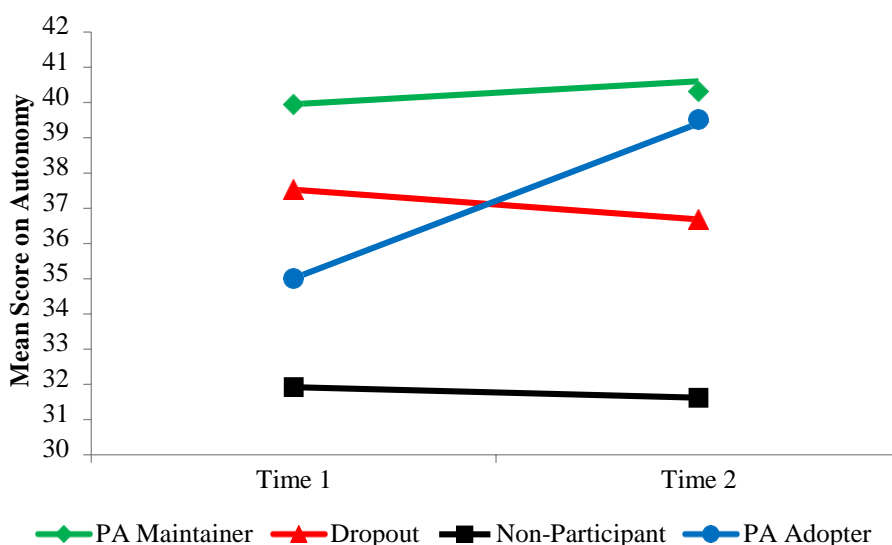


Figure 7.14. Time by physical activity trajectory group interaction for autonomy among younger adolescents

In addition, simple main effects analysis revealed significant differences across the physical activity trajectory groups at Time 1 ( $F(3, 397) = 24.33$ ,  $p < .001$ ,  $\eta^2_p = .16$ ) and Time 2 ( $F(3, 397) = 25.84$ ,  $p < .001$ ,  $\eta^2_p = .16$ ), which corresponded to large effects. Post hoc Bonferroni-adjusted comparisons revealed that physical activity maintainers reported significantly higher autonomy scores at Time 1 than non-participants ( $p < .001$ ) and physical activity adopters ( $p < .001$ ). In addition, dropouts significantly differed from non-participants at Time 1 evidencing higher levels of autonomy ( $p = .003$ ). No other significant differences were found between the physical activity trajectory groups at baseline. At Time 2, physical activity maintainers continued to demonstrate significantly higher autonomy scores than non-participants ( $p < .001$ ), but they no longer differed significantly from physical activity adopters ( $p > .05$ ). In addition, dropouts continued to report significantly higher autonomy scores at follow-up than non-participants ( $p = .011$ ). In turn, physical activity adopters and

non-participants were found to significantly differ at follow-up ( $p < .001$ ), with adopters demonstrating higher levels of autonomy. The results indicated that increased levels of autonomy were associated with uptake of physical activity over a twelve month period. Accordingly, physical activity adopters became less like their non-participant baseline counterparts over time and more closely approximated physical activity maintainers at follow-up evidencing similar levels of autonomy.

There was a significant time by physical activity trajectory group interaction effect found for autonomy support ( $\Lambda = 0.96$ ,  $F(3, 397) = 5.11$ ,  $p = .002$ ,  $\eta^2_p = .04$ ), which was small-to-medium in size. The interaction effect indicated that the physical activity trajectory groups demonstrated different patterns of change over time on autonomy support. As shown in Figure 7.15, physical activity adopters demonstrated a significant increase in perceptions of autonomy support from Time 1 to Time 2 ( $\Lambda = 0.98$ ,  $F(1, 397) = 7.69$ ,  $p = .006$ ,  $\eta^2_p = .02$ ), whereas the non-participation group evidenced a significant reduction ( $\Lambda = 0.99$ ,  $F(1, 397) = 5.78$ ,  $p = .017$ ,  $\eta^2_p = .01$ ). The effect sizes for these differences were small. In contrast, no significant changes were found for the physical activity maintainer and dropout groups over time ( $p > .05$ ).

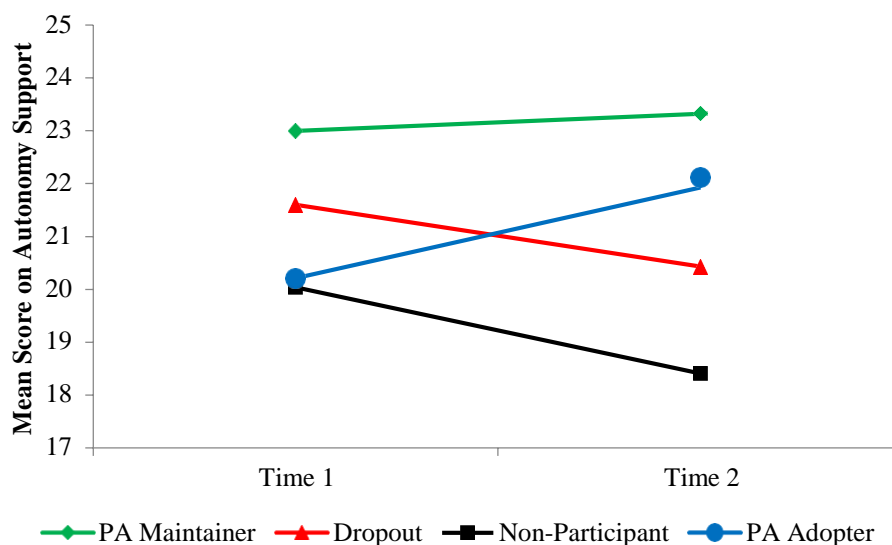


Figure 7.15. Time by physical activity trajectory group interaction for autonomy support among younger adolescents

The effect of the physical activity trajectory group was also found to significantly differ at baseline ( $F(3, 397) = 9.14$ ,  $p < .001$ ,  $\eta^2_p = .07$ ) and follow-up ( $F(3, 397) = 17.12$ ,  $p < .001$ ,  $\eta^2_p = .12$ ), with medium effect sizes evidenced at each time point. Bonferonni post hoc tests revealed that physical activity maintainers reported significantly higher perceptions of autonomy support at Time 1 in comparison to the non-participation ( $p < .001$ ) and adopter groups ( $p = .001$ ). There were no other significant group differences evidenced at baseline. Physical activity maintainers continued to score significantly higher on autonomy support at Time 2 than non-participants ( $p < .001$ ), however they did not significantly differ ( $p > .05$ ) from physical activity adopters at this time point. In turn, the physical activity adopter group reported significantly higher perceptions of autonomy support than the non-participation group at follow-up ( $p < .001$ ), despite evidencing similar scores at Time 1. Physical activity maintainers and dropouts were also found to significantly differ at Time 2, with dropouts reporting lower levels of autonomy support ( $p = .024$ ).

The results indicated that increased levels of autonomy support predicted uptake of physical activity among younger adolescents over a twelve month period. In accordance, physical activity adopters changed over time relative to the other physical activity trajectory groups, becoming less like their initial non-participant counterparts and approximating autonomy support scores at follow-up of those who maintained participation in physical activity from Time 1 to Time 2. In addition, physical activity maintainers and dropouts reported similar levels of autonomy support at Time 1 but differed at follow-up, suggesting that lower perceptions of autonomy support underpinned dropout from physical activity over time. The non-participation group also continued to get worse over time reflected in declining scores on autonomy support.

***7.4.3.2. Social predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among younger adolescents***

Descriptive statistics are presented in Table 7.8 for the physical activity maintainers, dropouts, continued non-participants and physical activity adopters at Time 1 and Time 2 on the social variables. Overall low scores were reported among younger adolescents for parental pressure and teasing. In turn, low-to-medium scores were attained for father and friend support whilst more moderate scores were shown for mother support and role modelling of physical activity by parents and friends. For peer acceptance, medium-to high scores were evidenced.

Table 7.8 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among younger adolescents on social characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
Mum Support	5 – 25	Time 1	14.99 (4.55)	14.61 (4.05)	12.12 (3.81)	12.99 (4.14)
		Time 2	14.61 (4.64)	11.69 (3.63)	10.43 (4.80)	12.88 (4.09)
Dad Support	5 – 25	Time 1	14.27 (5.41)	11.92 (4.67)	10.57 (4.72)	11.35 (4.97)
		Time 2	14.15 (5.26)	10.25 (4.29)	10.11 (5.19)	12.21 (4.83)
Mum PA Role Model	1 – 5	Time 1	2.90 (1.25)	3.00 (1.05)	2.95 (1.26)	2.89 (1.27)
		Time 2	2.80 (1.26)	2.87 (1.41)	2.56 (1.27)	2.77 (1.43)
Dad PA Role Model	1 – 5	Time 1	2.70 (1.34)	2.53 (1.38)	2.50 (1.28)	2.38 (1.41)
		Time 2	2.65 (1.33)	2.33 (1.58)	2.37 (1.38)	2.52 (1.50)
Parental Pressure	10 – 40	Time 1	17.42 (6.01)	16.12 (4.17)	15.24 (4.59)	15.67 (4.92)
		Time 2	17.07 (5.50)	15.39 (5.27)	14.33 (4.21)	15.01 (5.22)
Friend Support	4 – 20	Time 1	12.75 (2.98)	10.58 (3.73)	9.04 (3.48)	10.03 (3.07)
		Time 2	12.30 (3.10)	8.07 (2.88)	8.36 (3.51)	10.18 (3.15)
Friend PA Role Model	1 – 5	Time 1	3.45 (0.88)	3.13 (0.63)	2.66 (0.97)	2.97 (0.88)
		Time 2	3.42 (0.87)	3.13 (0.63)	2.69 (0.95)	2.96 (0.95)
Peer Acceptance	5 – 20	Time 1	16.21 (3.14)	15.27 (3.61)	14.35 (3.71)	14.73 (3.36)
		Time 2	15.52 (2.97)	14.77 (3.60)	14.57 (3.95)	14.97 (3.81)
Teasing	7 – 35	Time 1	11.52 (3.57)	12.00 (3.77)	12.40 (4.57)	12.40 (3.63)
		Time 2	12.16 (4.19)	12.48 (3.07)	13.90 (4.95)	12.81 (4.40)

Note. PA = Physical Activity

Separate mixed design ANOVAs were conducted to examine time by physical activity trajectory group interactions effects on parental influence variables. For mother support, a significant interaction between time and physical activity trajectory group emerged that was small-to-medium in size ( $\Lambda = 0.96$ ,  $F(3, 397) = 5.22$ ,  $p = .002$ ,  $\eta^2_p = .04$ ). Simple main effects analysis indicated that the non-participation ( $\Lambda = 0.97$ ,  $F(1, 397) = 11.60$ ,  $p = .001$ ,  $\eta^2_p = .03$ ), and physical activity dropout groups ( $\Lambda = 0.96$ ,  $F(1, 397) = 15.23$ ,  $p < .001$ ,  $\eta^2_p = .04$ ) demonstrated a significant reduction in perceptions of support from mother for physical activity over time (Figure 7.16). Effect sizes for these respective differences were small. In contrast, the physical activity maintainers and adopters evidenced stable levels of maternal support from baseline to follow-up ( $p > .01$ ).

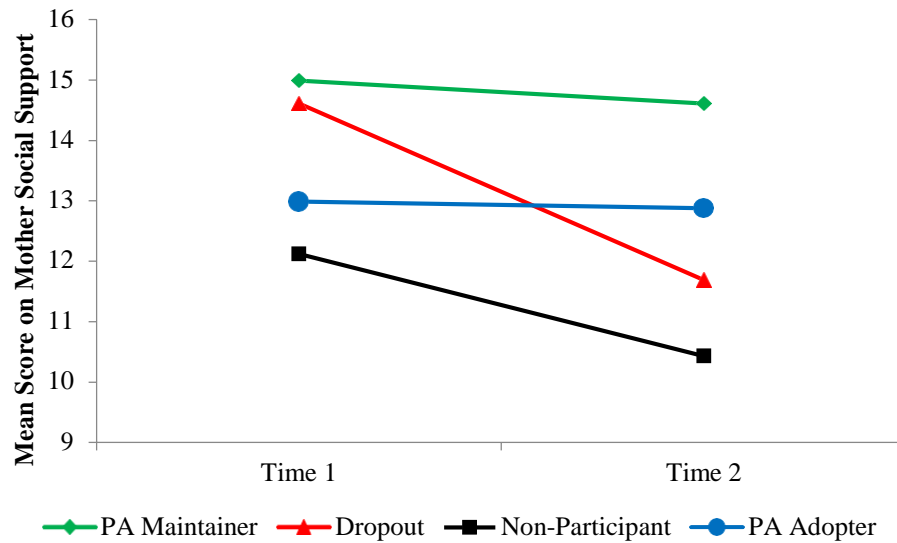


Figure 7.16. Time by physical activity trajectory group interaction for mother support among younger adolescents

Simple main effect analysis also revealed significant differences across the physical activity trajectory groups at Time 1 ( $F(3, 397) = 9.63, p < .001, \eta^2_p = .07$ ) and Time 2 ( $F(3, 397) = 17.25, p < .001, \eta^2_p = .12$ ), with medium effect sizes evidenced at each time point. Bonferroni-adjusted pairwise comparisons revealed that physical activity maintainers demonstrated significantly higher perceptions of maternal social support at Time 1 than physical activity adopters ( $p = .006$ ) and non-participants ( $p < .001$ ). There were no other significant differences evidenced among the physical activity trajectory groups at baseline. At Time 2, physical activity maintainers continued to differ significantly from non-participants and physical activity adopters ( $p = .037$ ) demonstrating higher levels of mother support. In turn, the physical activity adopter group evidenced significantly higher perceptions of maternal support at follow-up in comparison to non-participants ( $p = .011$ ), from whom they did not differ at baseline. In addition, physical activity maintainers significantly differed from dropouts at Time 2, with dropouts reporting lower levels of mother support ( $p = .006$ ). The results indicated that decreased levels of maternal social support predicted physical activity dropout and continued non-participation over a twelve month period. Accordingly, dropouts evidenced mother support scores similar to that of physical activity maintainers at baseline, but reported significantly lower levels at follow-up. The non-participants also continued to deteriorate over time evidencing diminished perceptions of maternal social support from Time 1 to Time 2.

There were no significant time by physical activity trajectory group interaction effects found for father support ( $\Lambda = 0.99, F(3, 397) = 1.74, p = .157, \eta^2_p = .01$ ), mother physical activity role model ( $\Lambda = 0.99, F(3, 397) = 0.81, p = .490, \eta^2_p = .01$ ), father physical activity role model ( $\Lambda = 0.99, F(3, 397) = 0.51, p = .675, \eta^2_p < .01$ ) or parental pressure ( $\Lambda = 1.00, F(3, 395) = 0.25, p = .862, \eta^2_p < .01$ ).

For peer influences, a significant time by group interaction effect was evidenced for perceived friend support, which was small in size ( $\Lambda = 0.97, F(3, 397) = 4.03, p = .008, \eta^2_p = .03$ ). As shown in Figure 7.17, simple main effect analysis revealed that physical activity dropouts demonstrated a significant decline in perceptions



of friend support over time ( $\Lambda = 0.96$ ,  $F(1, 397) = 15.15$ ,  $p < .001$ ,  $\eta^2_p = .04$ ). The effect size for this difference was small. There were no significant changes in friend support for physical activity found among physical activity maintainers, non-participants and dropouts from Time 1 to Time 2, however.

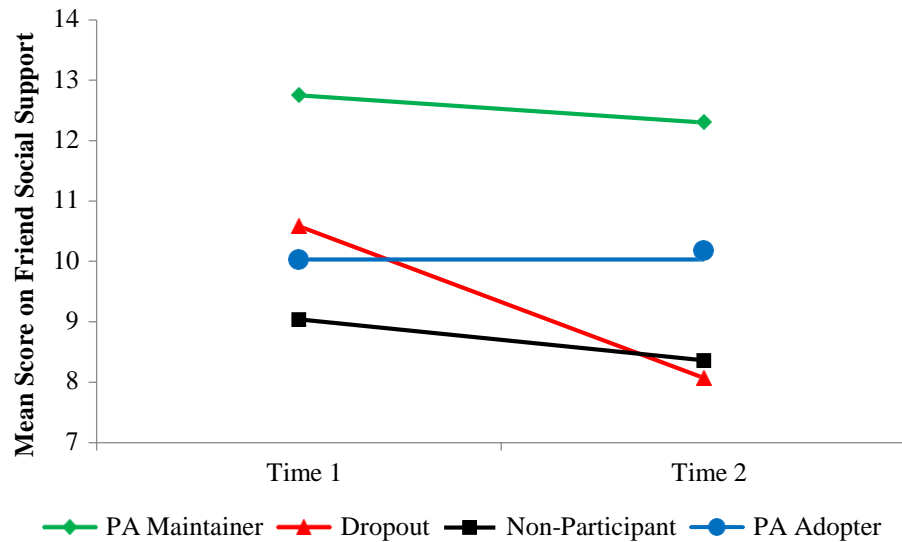


Figure 7.17. Time by physical activity trajectory group interaction for friend support among younger adolescents

In addition, simple main effect analysis also indicated that the physical activity trajectory groups significantly differed at baseline ( $F(3, 397) = 32.18$ ,  $p < .001$ ,  $\eta^2_p = .20$ ) and follow-up ( $F(3, 397) = 39.30$ ,  $p < .001$ ,  $\eta^2_p = .23$ ), with large effect sizes associated with each time point. Bonferroni post hoc tests revealed that physical activity maintainers demonstrated significantly higher levels of friend support at Time 1 than dropouts ( $p = .002$ ), non-participants ( $p < .001$ ), and physical activity adopters ( $p < .001$ ). There were no other significant differences found between the physical activity trajectory groups at Time 1. At follow-up twelve months later, physical activity maintainers continued to be the highest scoring group reporting significantly greater perceptions of friend support than dropouts ( $p < .001$ ), non-participants ( $p < .001$ ), and physical activity adopters (both  $p < .001$ ). In turn, physical activity adopters reported significantly higher levels of friend support than dropouts ( $p = .016$ ) and non-participants ( $p = .006$ ), despite not differing from these groups at baseline. The results indicated that decreased perceptions of friend support contributed to dropout from physical activity participation among younger adolescents over twelve months. In addition, the physical activity adopter and non-participant groups became more dissimilar over time. There was a non-significant time by physical activity trajectory group interaction effect evidenced for friend physical activity role modelling ( $\Lambda = 1.00$ ,  $F(3, 397) = 0.06$ ,  $p = .980$ ,  $\eta^2_p < .01$ ), peer acceptance ( $\Lambda = 0.98$ ,  $F(3, 397) = 2.17$ ,  $p = .091$ ,  $\eta^2_p = .02$ ), and teasing ( $\Lambda = 0.99$ ,  $F(3, 393) = 1.02$ ,  $p = .383$ ,  $\eta^2_p = .01$ ).

#### 7.4.3.3. Body-related predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among younger adolescents

Descriptive statistics for body-related variables are presented in Table 7.9 for each of the physical activity maintenance and behaviour change trajectory groups at Time 1 and Time 2. BMI scores are based on gender and age-specific cut-off points for overweight and the negative scores shown indicate that the younger adolescents' trajectory groups on average were of normal weight. In turn, medium scores were attained for the different dimensions of aesthetic body image. For functional body image, medium scores were evidenced with physical activity maintainers reporting higher scores.

Table 7.9 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among younger adolescents on body characteristics*

Variable	Min- Max	Time Point	PA Maintainer	Dropout	Non- Participant	PA Adopter
BMIc	-8.5 – 12.2	Time 1	-1.61 (3.41)	-1.02 (4.15)	-1.06 (3.93)	-1.12 (3.90)
		Time 2	-1.83 (3.40)	-1.09 (4.14)	-1.36 (4.27)	-1.73 (3.53)
Body Dissatisfaction	-4 – 8	Time 1	0.52 (1.28)	0.63 (1.48)	0.79 (1.50)	0.72 (1.44)
		Time 2	0.57 (1.18)	0.83 (1.12)	1.09 (1.66)	0.67 (1.20)
Aesthetic Values	3 – 15	Time 1	8.99 (3.10)	9.37 (2.90)	8.69(3.22)	8.74 (3.05)
		Time 2	9.43 (2.82)	9.50 (3.07)	9.38 (3.26)	9.75 (3.03)
Aes. Behaviour Invest	2 – 10	Time 1	6.96 (2.03)	6.65 (1.87)	6.27 (2.42)	6.24 (2.02)
		Time 2	7.07 (1.97)	7.13 (1.99)	6.63 (2.30)	6.69 (2.07)
Aesthetic Satisfaction	3 – 15	Time 1	10.67 (3.19)	8.82 (3.66)	10.19 (3.13)	8.82 (3.66)
		Time 2	10.19 (3.13)	9.43 (3.95)	8.57 (3.88)	9.06 (4.01)
Functional Values	3 – 15	Time 1	11.47 (2.38)	9.74 (2.30)	9.10 (2.55)	9.62 (2.59)
		Time 2	11.40 (2.49)	9.40 (2.47)	8.89 (2.87)	10.79 (2.57)
Func. Behaviour Invest	3 – 15	Time 1	12.09 (2.48)	10.60 (2.16)	8.08 (2.81)	9.73 (2.56)
		Time 2	12.44 (2.44)	9.50 (3.22)	8.68 (2.96)	11.26 (2.50)
Functional Satisfaction	3 – 15	Time 1	12.09 (2.67)	10.34 (3.01)	9.29 (3.38)	9.55 (2.97)
		Time 2	12.00 (2.68)	9.43 (3.63)	8.68 (3.52)	10.42 (3.33)

*Note.* PA = Physical Activity. BMIc = BMI corrected for age and gender. Aes. Behaviour Invest = Aesthetic Behavioural Investment; Func. Behaviour Invest = Functional Behavioural Investment.

The results of the mixed design ANOVAs revealed that there was no significant time by physical activity trajectory group interaction effects found for BMIc ( $\Lambda = 0.99$ ,  $F(3, 397) = 1.12$ ,  $p = .341$ ,  $\eta^2_p < .01$ ), body dissatisfaction ( $\Lambda = 0.99$ ,  $F(3, 397) = 1.47$ ,  $p = .223$ ,  $\eta^2_p = .01$ ), aesthetic values ( $\Lambda = 0.99$ ,  $F(3, 397) = 0.92$ ,  $p = .431$ ,  $\eta^2_p = .01$ ), aesthetic behavioural investment ( $\Lambda = 0.99$ ,  $F(3, 397) = 0.72$ ,  $p = .540$ ,  $\eta^2_p = .01$ ), or aesthetic satisfaction ( $\Lambda = 0.99$ ,  $F(3, 397) = 1.36$ ,  $p = .254$ ,  $\eta^2_p = .01$ ).

For functional body image, a significant interaction between time and physical activity trajectory group

emerged for functional values that evidenced a small effect ( $\Lambda = 0.97$ ,  $F(3, 397) = 4.03$ ,  $p = .008$ ,  $\eta^2_p = .03$ ). Simple main effects analysis indicated that physical activity adopters demonstrated a significant increase in levels of functional values over time ( $\Lambda = 0.97$ ,  $F(1, 397) = 11.49$ ,  $p = .001$ ,  $\eta^2_p = .03$ ), whilst no significant changes ( $p > .05$ ) were evidenced among the physical activity maintainer, non-participation and dropout groups from Time 1 to Time 2 (Figure 7.18). A small effect size was found for this difference.

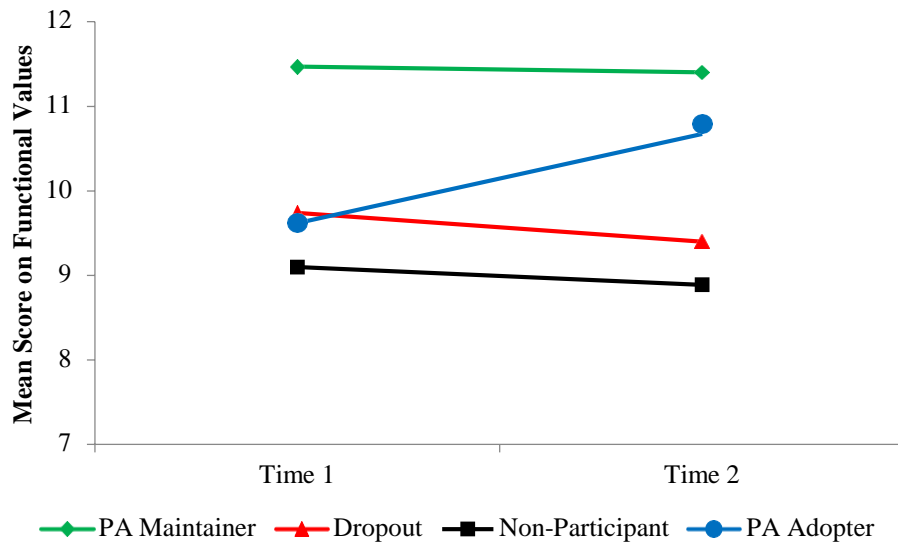


Figure 7.18. Time by physical activity trajectory group interaction for functional values among younger adolescents

Simple main effects analysis also revealed significant differences across the physical activity trajectory groups at Time 1 ( $F(3, 397) = 23.45$ ,  $p < .001$ ,  $\eta^2_p = .15$ ) and Time 2 ( $F(3, 397) = 19.77$ ,  $p < .001$ ,  $\eta^2_p = .13$ ). The effect sizes for these differences were large, and medium-to-large, respectively.

Bonferonni-adjusted pairwise comparisons indicated that physical activity maintainers evidenced significantly higher functional values scores at Time 1 than dropouts ( $p = .002$ ), non-participants ( $p < .001$ ) and physical activity adopters ( $p < .001$ ). No other significant differences were found among the physical activity trajectory groups at baseline. At Time 2, physical activity maintainers continued to demonstrate significantly higher levels of functional values in comparison to the non-participant ( $p < .001$ ) and dropout ( $p < .001$ ) groups; however they no longer significantly differed from physical activity adopters. In turn, physical activity adopters and non-participants differed at follow-up, with adopters demonstrating significantly high scores on functional values ( $p < .001$ ). The results indicated that increased levels of functional values predicted uptake of physical activity behaviour among younger adolescents over a twelve month period. In accordance, physical activity adopters changed over time relative to the other physical activity trajectory groups, becoming less like their initial non-participant counterparts and approximating functional values scores of those who maintained physical activity involvement from Time 1 to Time 2. In addition, dropouts reported significantly lower functional values than physical activity maintainers at both time points suggesting that lower levels may contribute to physical activity decline over time.

In relation to functional behaviour investment, a significant interaction between time and physical activity group emerged, which evidenced a small-to-medium effect ( $\Lambda = 0.97$ ,  $F(3, 397) = 7.07$ ,  $p < .001$ ,  $\eta^2_p = .05$ ). As shown in Figure 7.19, the interaction effect indicated that the physical activity trajectory groups demonstrated different patterns of change over time on functional behaviour investment. Physical activity dropouts reported a significant decline in functional behaviour investment from Time 1 to Time 2 ( $\Lambda = 0.99$ ,  $F(1, 397) = 5.02$ ,  $p = .026$ ,  $\eta^2_p = .01$ ), whereas scores significantly increased among the physical activity adopters ( $\Lambda = 0.95$ ,  $F(1, 397) = 21.53$ ,  $p < .001$ ,  $\eta^2_p = .05$ ), and maintainers ( $\Lambda = 0.99$ ,  $F(1, 397) = 4.03$ ,  $p = .045$ ,  $\eta^2_p = .01$ ) from baseline to follow-up. The associated effect sizes for these differences were small. The non-participants did not demonstrate any significant changes over time ( $p > .05$ ) evidencing low levels of functional behaviour investment at each time point.

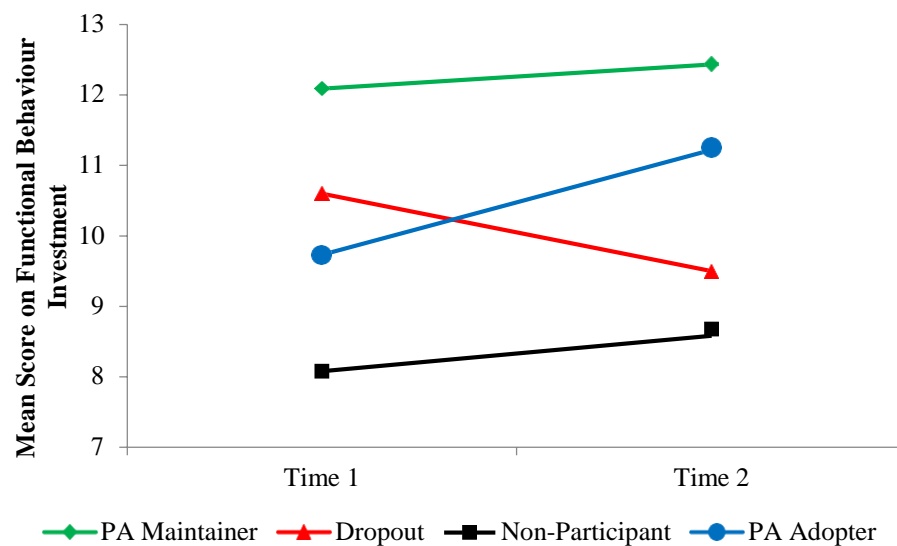


Figure 7.19. Time by physical activity trajectory group interaction for functional behaviour investment among younger adolescents

Functional behaviour investment scores also significantly differed across physical activity trajectory groups at baseline ( $F(3, 397) = 50.58$ ,  $p < .001$ ,  $\eta^2_p = .28$ ) and follow-up ( $F(3, 397) = 42.67$ ,  $p < .001$ ,  $\eta^2_p = .24$ ), with large effects evidenced at each time point. Bonferroni post hoc tests revealed that physical activity maintainers demonstrated significantly higher levels of functional behaviour investment at Time 1 and Time 2 in comparison to the dropout ( $p = .015$ ,  $p < .001$ ), non-participation (both  $p < .001$ ) and physical activity adopter ( $p < .001$ ,  $p = .008$ ) groups. In turn, physical activity adopters scored significantly higher than non-participants ( $p = .001$ ) at baseline and follow-up. Dropouts and non-participants also differed significantly from each other at Time 1 on functional behaviour investment ( $p < .001$ ); however these group differences were not maintained at Time 2.

In addition, the physical activity adopter and dropouts group differed at follow-up despite not evidencing any significant differences at baseline, with adopters evidencing significantly higher functional behaviour investment scores ( $p = .014$ ). The results revealed that physical activity adopters

and dropouts changed respective roles over time. Dropouts differed from physical activity maintainers at both time points, and closely approximated non-participants at follow-up, indicating that decreased functional behaviour investment scores predicted physical activity discontinuation over a twelve month period. In turn, physical activity adopters demonstrated higher functional behaviour investment scores in comparison to the non-participants at Time 1 and Time 2, indicating that increased functional behavioural investment levels contributed to uptake of physical activity. In addition, physical activity maintainers remained the highest scoring group over time demonstrating that enhanced levels of functional behaviour investment underpinned continued physical activity participation.

A significant time by physical activity trajectory group interaction effect was also found for functional satisfaction that was small in size ( $\Lambda = 0.97$ ,  $F(3, 397) = 4.16$ ,  $p = .006$ ,  $\eta^2_p = .03$ ). As depicted in Figure 7.20, the physical activity adopter group demonstrated a significant increase in levels of functional satisfaction from baseline to follow-up ( $\Lambda = 0.98$ ,  $F(1, 397) = 6.35$ ,  $p = .012$ ,  $\eta^2_p = .02$ ), whilst no significant changes ( $p > .05$ ) were evidenced among physical activity maintainers, dropouts and non-participants over time. The effect size for this difference was small.

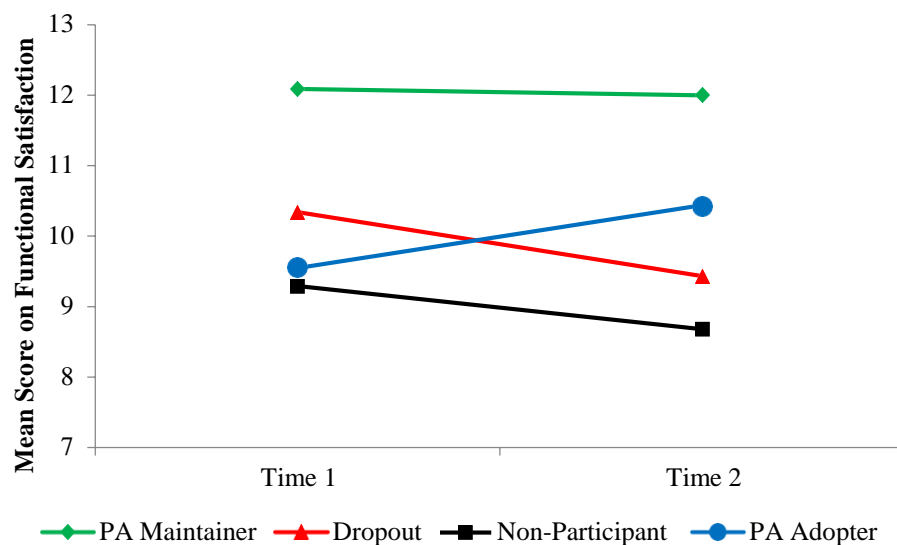


Figure 7.20. Time by physical activity trajectory group interaction for functional satisfaction among younger adolescents

Significant differences were also found across the physical activity trajectory groups at Time 1 ( $F(3, 397) = 25.39$ ,  $p < .001$ ,  $\eta^2_p = .16$ ) and Time 2 ( $F(3, 397) = 25.57$ ,  $p < .001$ ,  $\eta^2_p = .16$ ), with large effects associated with each time point. Bonferroni post hoc tests revealed that physical activity maintainers reported significantly higher levels of functional satisfaction than dropouts ( $p = .011$ ), non-participants ( $p < .001$ ) and physical activity adopters ( $p < .001$ ) at Time 1. No other significant differences were found among the physical activity trajectory groups at baseline. At Time 2, physical activity maintainers continued to be the highest scoring group demonstrating significantly greater levels of functional satisfaction in comparison to the dropout ( $p < .001$ ), non-participant ( $p < .001$ ) and physical activity adopter ( $p = .001$ ) groups. In turn, non-participants and physical activity adopters significantly differed at follow-up ( $p = .005$ ), with adopters demonstrating higher

scores on functional satisfaction. The results indicated that increased levels of functional satisfaction predicted uptake of physical activity among younger adolescents over a one-year period. In accordance, physical activity adopters were readily differentiated from the non-participants at follow-up, despite demonstrating similar functional satisfaction scores at baseline. In addition, physical activity maintainers differed from dropouts at both time points suggesting that lower levels of functional satisfaction may contribute to physical activity decline over time.

#### **7.4.4 Predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among older adolescents**

##### ***7.4.4.1 Motivational predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among older adolescents***

Descriptive statistics for the motivational variables across each physical activity maintenance and behaviour change trajectory groups at Time 1 and Time 2 are presented in Table 7.10. High scores were reported for enjoyment, intrinsic motivation, and identified regulation across the physical activity trajectory groups with the exception of the non-participation group, which demonstrated lower scores. In turn, low scores are shown for external regulation and amotivation whereas moderate scores were evidenced for introjected regulation, competence, and autonomy support whilst moderate-to-high scores were reported for relatedness and autonomy.

Table 7.10 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among older adolescents on motivational characteristics*

Variable	Min- Max	Time Point	PA Maintainers	Dropouts	Non- Participants	PA Adopters
Enjoyment	7 – 35	Time 1	32.27 (4.30)	30.78 (5.08)	27.06 (6.57)	28.95 (6.24)
		Time 2	31.27 (5.14)	28.81 (5.65)	26.18 (6.38)	30.63 (4.85)
Intrinsic Motivation	4 – 20	Time 1	17.43 (3.34)	15.48 (3.68)	12.59 (4.45)	15.48 (3.68)
		Time 2	17.06 (3.43)	13.26 (4.49)	11.80 (4.15)	15.29 (3.81)
Identified Regulation	4 – 20	Time 1	16.41 (3.20)	14.31 (3.68)	12.53 (3.75)	14.30 (3.89)
		Time 2	16.34 (3.21)	12.98 (3.79)	12.60 (3.11)	14.94 (3.27)
Introjected Regulation	3 – 15	Time 1	7.61 (3.49)	7.65 (3.60)	6.65 (3.53)	7.18 (3.33)
		Time 2	8.97 (3.59)	7.41 (3.31)	7.09 (3.21)	9.08 (3.36)
External Regulation	4 – 20	Time 1	6.91 (3.26)	6.78 (2.98)	6.93 (3.01)	6.51 (2.42)
		Time 2	6.93 (3.21)	6.85 (3.04)	7.37 (3.15)	7.33 (3.15)
Amotivation	4 – 20	Time 1	5.08 (2.39)	5.74 (3.10)	7.13 (3.98)	5.20 (2.38)
		Time 2	5.31 (2.76)	7.38 (4.17)	8.15 (3.55)	5.55 (2.31)
Competence	5 – 20	Time 1	13.82 (3.78)	11.27 (3.13)	10.02 (3.04)	11.43 (3.44)
		Time 2	13.64 (3.96)	10.30 (3.37)	9.66 (2.87)	11.84 (3.68)
Relatedness	5 – 25	Time 1	19.76 (4.87)	18.55 (4.63)	16.65 (5.39)	17.11 (5.61)
		Time 2	19.99 (4.58)	17.56 (4.46)	16.67 (4.88)	17.13 (4.96)
Autonomy	10 – 50	Time 1	39.69 (7.76)	35.91 (7.22)	32.38 (10.00)	34.37 (9.31)
		Time 2	39.99 (7.31)	33.41 (8.33)	31.60 (8.94)	36.92 (7.15)
Autonomy Support	6 – 30	Time 1	22.80 (5.50)	20.56 (5.68)	18.19 (5.27)	19.65 (5.36)
		Time 2	22.11 (5.24)	19.85 (6.01)	17.97 (6.10)	21.28 (4.85)

Note. PA = Physical Activity

Separate mixed design ANOVAs were conducted to examine whether patterns of enjoyment, motivation, basic psychological needs and autonomy support changed over time for the physical activity maintainer, dropout, non-participation and physical activity adopter groups. For enjoyment, a significant interaction between time and physical activity group emerged, which was small in size ( $\Lambda = 0.97$ ,  $F(3, 398) = 4.63$ ,  $p = .003$ ,  $\eta^2_p = .03$ ). As shown in Figure 7.21, the effect of time varied across physical activity trajectory group. Physical activity adopters reported a significant increase in enjoyment levels from Time 1 to Time 2 ( $\Lambda = 0.98$ ,  $F(1, 398) = 5.05$ ,  $p = .025$ ,  $\eta^2_p = .01$ ), whereas dropouts demonstrated a significant decline ( $\Lambda = 0.96$ ,  $F(1, 398) = 7.38$ ,  $p = .007$ ,  $\eta^2_p = .02$ ). Small effect sizes were evidenced for these differences. In contrast, there were no significant changes in enjoyment levels found over time among the non-participation and physical activity maintainer groups ( $p > .05$ ).

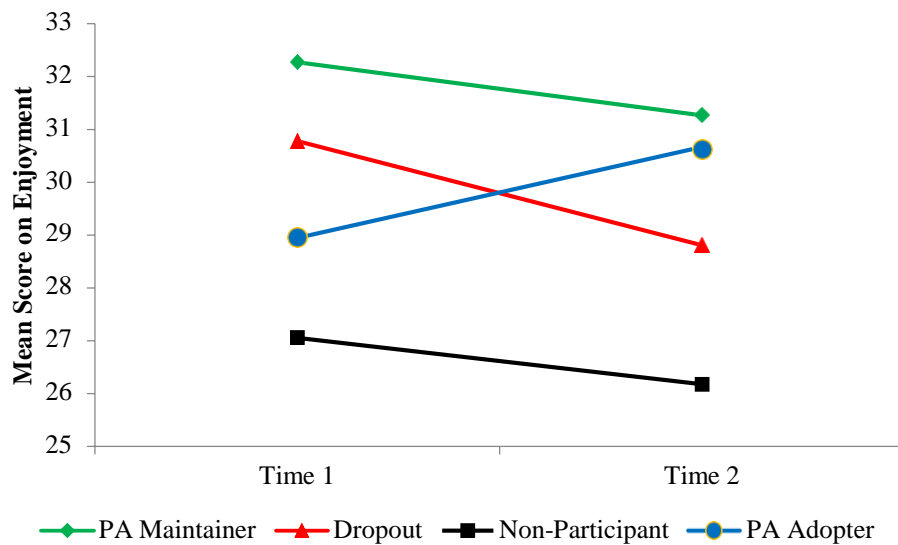


Figure 7.21. Time by physical activity trajectory group interaction for enjoyment among older adolescents

The effect of physical activity trajectory group also varied at Time 1 ( $F(3, 398) = 22.61, p < .001, \eta^2_p = .15$ ) and Time 2 ( $F(3, 398) = 19.67, p < .001, \eta^2_p = .13$ ), corresponding to large and medium-to-large effect sizes, respectively. Bonferroni-adjusted pairwise comparisons indicated that physical activity maintainers reported significantly greater levels of enjoyment at Time 1 in comparison to the non-participation and adopter groups (both  $p < .001$ ). At follow up, maintainers continued to score significantly higher on enjoyment than non-participants ( $p < .001$ ); however they no longer significantly differed from physical activity adopters. Dropouts also demonstrated significantly higher enjoyment scores compared to the non-participation group at baseline but these differences did not remain at follow-up ( $p > .05$ ). In turn, dropouts scored significantly lower on enjoyment at Time 2 than physical activity maintainers ( $p = .023$ ). In addition, the non-participation and physical activity adopter groups significantly differed at follow up ( $p < .001$ ), with adopters reporting enhanced levels of enjoyment. The results indicated that physical activity adopter and dropout roles changed over time, with increased levels of enjoyment linked to uptake of physical activity and decreased levels related to dropout. Physical activity adopters became less like their non-participation baseline counterparts over time and more closely resembled physical activity maintainers at follow-up, evidencing similar levels of enjoyment. In contrast, physical activity maintainers and dropouts became more discrepant over the twelve month period, whereas non-participants and dropouts were more closely matched on enjoyment scores at Time 2.

A significant interaction between time and physical activity trajectory group also emerged for intrinsic motivation that demonstrated a small-to-medium effect size ( $\Lambda = 0.95, F(3, 398) = 7.14, p = .001, \eta^2_p = .05$ ). As shown in Figure 7.22, the non-participation ( $\Lambda = 0.99, F(1, 398) = 4.60, p = .033, \eta^2_p = .01$ ), and physical activity dropout groups ( $\Lambda = 0.95, F(1, 398) = 19.96, p < .001, \eta^2_p = .05$ ) demonstrated a significant reduction in intrinsic motivation over time whereas physical activity maintainers evidenced stable levels from Time 1 to Time 2 ( $p > .05$ ). In addition, a marginally significant effect was found for physical activity adopters indicating that they experienced an increase in intrinsic motivation over time



( $\Lambda = 0.99$ ,  $F(1, 398) = 3.85$ ,  $p = .050$ ,  $\eta^2_p = .01$ ). Small effect sizes were associated with each of these differences.

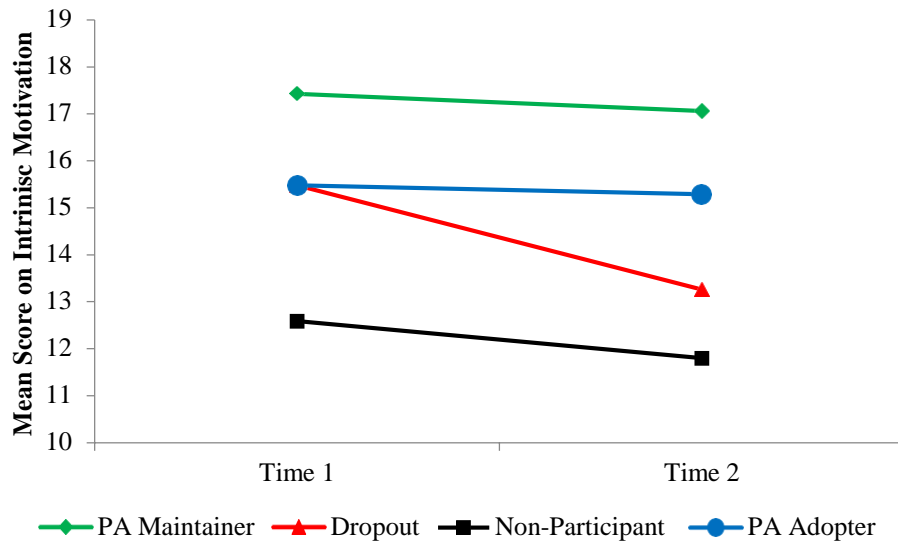


Figure 7.22. Time by physical activity trajectory group interaction for intrinsic motivation among older adolescents

Significant differences were also found across physical activity trajectory groups at baseline ( $F(3, 398) = 37.89$ ,  $p < .001$ ,  $\eta^2_p = .22$ ) and follow-up ( $F(3, 398) = 46.02$ ,  $p < .001$ ,  $\eta^2_p = .26$ ), with large effect sizes evidenced at each time point. Bonferroni adjusted pairwise comparisons revealed that physical activity maintainers continued to be the highest scoring group over time demonstrating greater levels of intrinsic motivation at Time 1 and Time 2 in comparison to the dropout ( $p = .006$ ;  $p < .001$ ), non-participation (both  $p < .001$ ) and adopter ( $p < .001$ ,  $p = .021$ ) groups. Dropouts also reported significantly higher intrinsic motivation scores than non-participants at Time 1 ( $p < .001$ ), however these differences were not maintained at follow up. In addition, the physical activity adopter group demonstrated significantly enhanced levels of intrinsic motivation at Time 2 compared to dropouts ( $p = .040$ ) and non-participants ( $p < .001$ ), despite evidencing similar levels at baseline.

The results indicated that sustained participation in physical activity was associated with high levels of intrinsic motivation whereas the non-participation group continued to deteriorate over time evidencing declining levels of intrinsic motivation. Physical activity behaviour transitions were also linked to changing patterns of intrinsic motivation. In accordance, physical activity dropouts, in addition to scoring significantly lower on intrinsic motivation than physical activity maintainers at Time 1 and Time 2, more closely approximated non-participants at follow-up indicating that decreased intrinsic motivation scores underpinned dropout over a twelve-month period.

There was no significant time by physical activity trajectory group interaction effect found for identified regulation ( $\Lambda = 0.98$ ,  $F(3, 398) = 3.12$ ,  $p = .026$ ,  $\eta^2_p = .02$ ), external regulation ( $\Lambda = 0.99$ ,  $F(3, 398) = 0.98$ ,  $p = .402$ ,  $\eta^2_p = .01$ ) or amotivation ( $\Lambda = 0.98$ ,  $F(3, 398) = 3.31$ ,  $p = .020$ ,  $\eta^2_p = .02$ ). However, a significant interaction between time and physical activity trajectory group emerged for introjected regulation that was

small-to-medium in size ( $\Lambda = 0.96$ ,  $F(3, 398) = 5.05$ ,  $p = .002$ ,  $\eta^2_p = .04$ ). The interaction effect is plotted in Figure 7.23. Simple main effects analysis revealed that physical activity maintainers ( $\Lambda = 0.93$ ,  $F(1, 398) = 30.76$ ,  $p < .001$ ,  $\eta^2_p = .07$ ) and adopters ( $\Lambda = 0.96$ ,  $F(1, 398) = 15.39$ ,  $p < .001$ ,  $\eta^2_p = .04$ ) demonstrated a significant increase in introjected regulation over time, which reflected medium and small effect sizes, respectively. The dropout and non-participation physical activity trajectory groups did not report any significant changes in introjected regulation scores from baseline to follow-up ( $p > .05$ ), however.

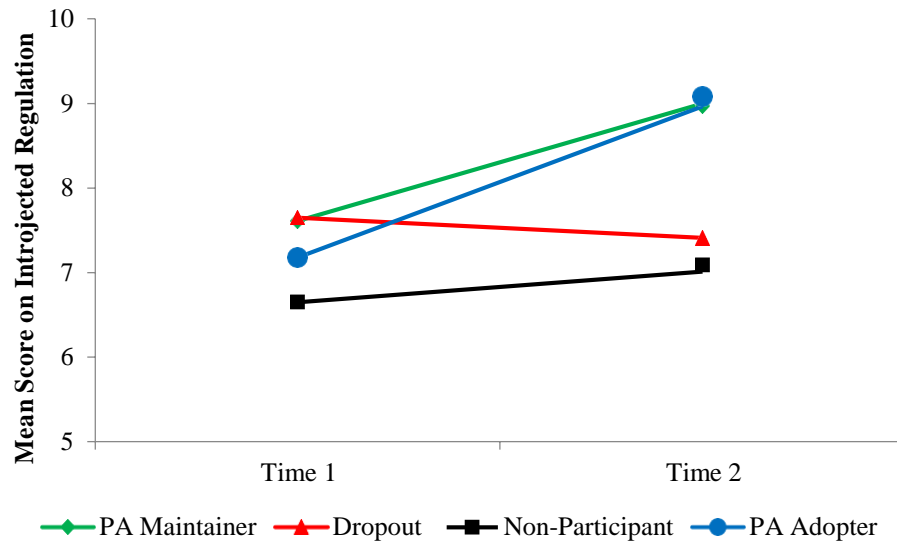


Figure 7.23. Time by physical activity trajectory group interaction for introjected regulation among older adolescents

Simple effects analysis also indicated that physical activity trajectory groups differed significantly at Time 2 ( $F(3, 398) = 8.70$ ,  $p < .001$ ,  $\eta^2_p = .06$ ), whereas no significant differences were found among the physical activity trajectory groups at Time 1 ( $F(3, 398) = 1.85$ ,  $p = .381$ ,  $\eta^2_p = .01$ ). The effect size for the physical activity trajectory group differences at Time 2 was medium. Bonferroni-corrected pairwise comparisons revealed that physical activity maintainers demonstrated significantly higher levels of introjected regulation than dropouts ( $p = .019$ ) and non-participants ( $p < .001$ ) at follow-up. In addition, physical activity adopters reported significantly higher introjected regulation scores at Time 2 in comparison to those who remained non-participants over time ( $p = .005$ ). The results indicated that increased levels of introjected regulation were related to uptake of physical activity and sustained participation in physical activity among older adolescents over a twelve month period. In relation to basic psychological needs, the interaction effect between time and physical activity trajectory group was not found to be statistically significant for competence ( $\Lambda = 0.99$ ,  $F(3, 398) = 2.05$ ,  $p = .106$ ,  $\eta^2_p = .02$ ), relatedness ( $\Lambda = 0.99$ ,  $F(3, 398) = 0.81$ ,  $p = .488$ ,  $\eta^2_p = .01$ ) or autonomy ( $\Lambda = 0.97$ ,  $F(3, 398) = 3.58$ ,  $p = .014$ ,  $\eta^2_p = .03$ ). In addition, a non-significant time by physical activity trajectory group interaction was evidenced for autonomy support ( $\Lambda = 0.99$ ,  $F(3, 398) = 2.02$ ,  $p = .111$ ,  $\eta^2_p = .02$ ).

#### 7.4.4.2 Social predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among older adolescents

Descriptive statistics are presented in Table 7.11 for the social variables across the physical activity maintenance and behaviour change trajectory groups at Time 1 and Time 2. Overall older adolescents reported low scores on pressure, friend support and teasing and moderate levels of physical activity role modelling by mother, father and friends. In addition, low levels of mother and father support were evidenced among the physical activity trajectory groups with more moderate scores found for the physical activity maintainers. Finally, medium-to-high scores were shown for peer acceptance.

Table 7.11 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among older adolescents on social characteristics*

Variable	Min- Max	Time Point	PA Maintainer <i>n</i> = 199 <i>M</i> ( <i>SD</i> )	Dropout <i>n</i> = 54 <i>M</i> ( <i>SD</i> )	Non- Participant <i>n</i> = 98 <i>M</i> ( <i>SD</i> )	PA Adopter <i>n</i> = 51 <i>M</i> ( <i>SD</i> )
Mum Support	5 – 25	Time 1	13.70 (4.26)	11.57 (4.01)	9.71 (3.81)	11.80 (4.29)
		Time 2	12.55 (4.05)	10.01 (3.62)	9.50 (3.83)	11.76 (4.77)
Dad Support	5 – 25	Time 1	13.50 (5.24)	11.35 (4.76)	9.19 (3.92)	10.98 (4.41)
		Time 2	12.45 (5.14)	9.47 (4.42)	8.71 (3.62)	10.59 (5.35)
Mum PA Role Model	1 – 5	Time 1	2.79 (1.30)	2.69 (1.49)	2.53 (1.21)	2.65 (1.31)
		Time 2	2.56 (1.31)	2.67 (1.32)	2.44 (1.29)	2.43 (1.14)
Dad PA Role Model	1 – 5	Time 1	2.61 (1.34)	2.35 (1.32)	2.30 (1.30)	2.71 (1.36)
		Time 2	2.51 (1.38)	2.48 (1.37)	2.07 (1.13)	2.53 (1.43)
Parental Pressure	10 – 40	Time 1	17.15 (4.83)	16.73 (4.97)	15.34 (4.64)	16.39 (4.25)
		Time 2	16.17 (4.83)	15.32 (4.70)	15.20 (4.64)	15.03 (4.60)
Friend Support	4 – 20	Time 1	11.88 (3.48)	9.49 (3.30)	8.39 (3.18)	9.63 (2.97)
		Time 2	11.67 (3.34)	8.63 (3.26)	8.50 (3.15)	9.96 (2.68)
Friend PA Role Model	1 – 5	Time 1	3.20 (0.91)	3.01 (0.95)	2.85 (0.82)	2.88 (0.86)
		Time 2	3.29 (0.89)	2.91 (0.96)	2.76 (0.94)	2.98 (0.95)
Peer Acceptance	5 – 20	Time 1	15.72 (2.77)	14.72 (3.45)	14.90 (3.46)	14.94 (2.81)
		Time 2	15.21 (3.16)	14.98 (3.25)	14.45 (3.33)	14.73 (3.07)
Teasing	7 – 35	Time 1	12.80 (4.76)	14.36 (5.16)	13.33 (4.94)	13.26 (4.31)
		Time 2	13.17 (4.78)	14.02 (4.19)	14.20 (5.38)	14.86 (5.43)

Separate mixed design ANOVAs were performed to investigate interaction effects between time and physical activity trajectory group for parental and peer influence variables. In relation to parental influences, the time by physical activity trajectory group interaction was not statistically significant for mother support ( $\Lambda = 0.98$ ,  $F(3, 398) = 2.60$ ,  $p = .052$ ,  $\eta^2_p = .02$ ), father support ( $\Lambda = 0.99$ ,  $F(3, 398) = 1.49$ ,  $p = .216$ ,  $\eta^2_p = .01$ ), mother physical activity role model ( $\Lambda = 1.00$ ,  $F(3, 398) = 0.42$ ,  $p = .737$ ,  $\eta^2_p < .01$ ), father physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 398) = 0.77$ ,  $p = .511$ ,  $\eta^2_p = .01$ ), or parental pressure ( $\Lambda = 0.99$ ,  $F(3, 398) = 1.42$ ,  $p = .236$ ,  $\eta^2_p = .01$ ).

=.236,  $\eta^2_p = .01$ ). In addition, there was no significant interaction effects found between time and physical activity trajectory group for friend support ( $\Lambda = 0.99$ ,  $F(3, 398) = 1.49$ ,  $p = .216$ ,  $\eta^2_p = .01$ ), friend physical activity role model ( $\Lambda = 0.99$ ,  $F(3, 398) = 1.06$ ;  $p = .364$ ,  $\eta^2_p = .01$ ), peer acceptance ( $\Lambda = 0.99$ ,  $F(3, 398) = 0.88$ ,  $p = .451$ ,  $\eta^2_p = .01$ ) and teasing ( $\Lambda = 0.98$ ,  $F(3, 398) = 2.47$ ,  $p = .061$ ,  $\eta^2_p = .02$ ). Thus, mean scores did not significantly differ from Time 1 to Time 2 among the physical activity trajectory groups on any of the social variables.

#### ***7.4.4.3 Body-related predictors of physical activity maintenance and behaviour change trajectories from Time 1 to Time 2 among older adolescents***

Descriptive statistics for body-related characteristics are presented in Table 7.12 for physical activity maintainers, dropouts, non-participants and adopters at Time 1 and Time 2. BMI scores are based on gender and age-specific cut-off points for overweight and the negative scores shown indicate that older adolescents' trajectory groups on average were of normal weight. Medium scores were reported for the remaining aesthetic and functional body image dimensions, with physical activity maintainers demonstrating higher scores on functional body image.

Table 7.12 *Descriptive statistics for physical activity maintenance and behaviour change trajectories among older adolescents on body-related characteristics*

Variable	Min- Max	Time Point	PA Maintainer <i>n</i> = 199	Dropout <i>n</i> = 54	Non- Participant <i>n</i> = 98	PA Adopter <i>n</i> = 51
BMIC	-8.8 – 12.2	Time 1	-2.11 (3.04)	-2.74 (3.25)	-1.97 (3.35)	-1.59 (4.33)
		Time 2	-2.03 (3.27)	-2.56 (2.99)	-2.03 (3.50)	-1.63 (3.86)
Body Dissatisfaction	-5 – 6	Time 1	0.41 (1.40)	0.47 (1.22)	0.76 (1.11)	1.02 (1.16)
		Time 2	0.36 (1.32)	0.65 (1.39)	0.83 (1.33)	0.87 (1.49)
Aesthetic Values	3 – 15	Time 1	9.43 (2.95)	9.32 (3.14)	9.12 (2.92)	9.47 (2.89)
		Time 2	9.66 (2.79)	9.59 (3.17)	9.42 (2.62)	10.02 (3.04)
Aes. Behaviour Invest	2 – 10	Time 1	6.75 (2.01)	6.87 (2.13)	6.84 (2.19)	6.92 (1.80)
		Time 2	6.86 (1.89)	6.51 (2.26)	6.74 (2.12)	7.22 (1.95)
Aesthetic Satisfaction	3 – 15	Time 1	9.72 (3.46)	8.61 (3.58)	8.90 (3.20)	8.77 (3.31)
		Time 2	9.70 (3.33)	8.35 (3.39)	8.17 (3.33)	8.80 (3.57)
Functional Values	3 – 15	Time 1	11.02 (2.59)	10.21 (2.66)	9.23 (2.50)	9.75 (2.66)
		Time 2	11.06 (2.43)	9.52 (2.73)	9.05 (2.49)	10.06 (2.40)
Func. Behaviour Invest	3 – 15	Time 1	12.08 (2.64)	10.20 (2.43)	8.59 (2.93)	9.71 (2.98)
		Time 2	12.10 (2.72)	9.24 (2.86)	8.59 (2.62)	10.66 (2.38)
Functional Satisfaction	3 – 15	Time 1	11.30 (3.04)	9.84 (3.06)	8.20 (3.13)	8.57 (3.55)
		Time 2	11.26 (2.94)	9.24 (3.05)	8.06 (2.81)	9.42 (3.05)

*Note.* PA = Physical Activity. BMIC = BMI corrected for age and gender. Aes. Behaviour Invest = Aesthetic Behavioural Investment; Func. Behaviour Invest = Functional Behavioural Investment.

A non-significant interaction effect for time and physical activity trajectory group was found for BMIC ( $\Lambda = 1.00, F(3, 398) = 0.37, p = .778, \eta^2_p < .01$ ). In addition, there was no statistically significant interaction between time and physical activity trajectory group for aesthetic values ( $\Lambda = 1.00, F(3, 398) = 0.16, p = .924, \eta^2_p < .01$ ), aesthetic behavioural investment ( $\Lambda = 0.99, F(3, 398) = 1.31, p = .272, \eta^2_p = .01$ ) and aesthetic satisfaction ( $\Lambda = 0.99, F(3, 398) = 1.35, p = .258, \eta^2_p = .01$ ). The interaction effect between time and physical activity trajectory group was also non-significant for functional values ( $\Lambda = 0.99, F(3, 398) = 1.39, p = .247, \eta^2_p = .01$ ) and functional satisfaction ( $\Lambda = 0.98, F(3, 398) = 2.60, p = .052, \eta^2_p = .02$ ).

A significant interaction between time and physical activity trajectory group emerged however, for functional behaviour investment ( $\Lambda = 0.97, F(3, 398) = 4.19, p = .006, \eta^2_p = .03$ ), which demonstrated a small effect. Simple main effects analysis indicated that the physical activity trajectory groups demonstrated different patterns of change over time on functional behaviour investment. As depicted in Figure 7.24, physical activity dropouts demonstrated a significant decrease ( $\Lambda = 0.98, F(1, 398) = 6.52, p = .011, \eta^2_p = .02$ ), whereas physical activity adopters evidenced a significant increase in functional behaviour investment scores from Time 1 to

Time 2 ( $\Lambda = 0.99$ ,  $F(1, 398) = 6.04$ ,  $p = .014$ ,  $\eta^2_p = .02$ ). The effect size for these differences were both small. In contrast, the physical activity maintainer and non-participation groups reported stable levels of functional behaviour investment over time ( $p > .05$ ).

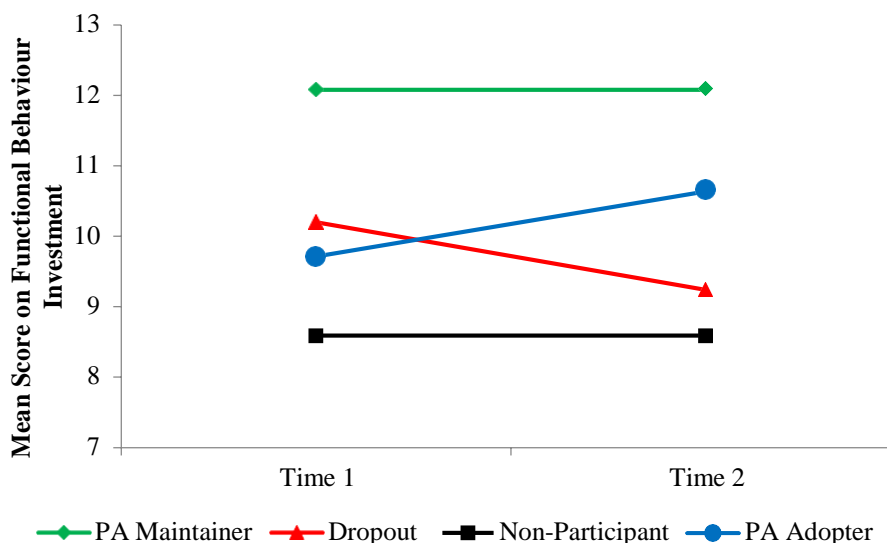


Figure 7.24. Time by physical activity trajectory group interaction for functional behaviour investment among older adolescents

Simple main effects analysis also revealed that physical activity trajectory groups differed significantly on functional behaviour investment scores at Time 1 ( $F(3, 398) = 39.27$ ,  $p < .001$ ,  $\eta^2_p = .23$ ) and Time 2 ( $F(3, 398) = 43.66$ ,  $p < .001$ ,  $\eta^2_p = .25$ ) with large effects evidenced at each time point. Bonferroni-corrected pairwise comparisons revealed that physical activity maintainers demonstrated significantly higher levels of functional behaviour investment at baseline and follow-up than dropouts (both  $p < .001$ ), non-participants (both  $p < .001$ ) and adopters ( $p < .001$ ,  $p = .004$ ). Dropouts also reported significantly higher functional behaviour investment scores at Time 1 in comparison to non-participants ( $p = .003$ ), however these significant group differences were not maintained at Time 2. In addition, physical activity adopters significantly differed from the dropout ( $p = .041$ ) and non-participation group ( $p < .001$ ) at follow-up, demonstrating higher levels of functional behaviour investment.

The results indicated that changing patterns of functional behaviour investment scores predicted transitions in physical activity behaviour over time. Physical activity adoption was associated with increased levels of functional behaviour investment whereas decreased levels were related to dropout. Physical activity dropouts scored significantly lower than the physical activity maintainers at each time point and subsequently resembled the non-participation group at follow-up, which suggests that lower levels of functional behaviour investment underpinned physical activity withdrawal. In contrast, physical activity adopters became less like the non-participation and dropout trajectory groups over time. Physical activity maintainers in turn, continued to differ from all of the trajectory groups at Time 2 suggesting that continued participation in physical activity is linked to high levels of functional behaviour investment.

## 7.5 Discussion

In summary, different motivational, social and body-related factors were associated with physical activity maintenance and behaviour change among male and female, and younger and older adolescents, which are highlighted in Table 7.13. In relation to motivational characteristics gender and age-related differences emerged. For girls, changes in a range of different types of motivation, enjoyment and autonomy were related to physical activity maintenance, dropout, continued non-participation and adoption of physical activity over one year whilst among boys, intrinsic motivation and autonomy support evidenced significant associations. In turn, whilst transitions in physical activity over time were associated with a range of motivational factors among younger adolescents, self-determined and controlling motives in addition to enjoyment underpinned physical activity adoption and dropout among older adolescents. In respect to social variables, friend support was significantly related to female adolescent's physical activity maintenance and behaviour change over time whereas this association was not significant among males. In contrast, among younger adolescents, declining levels of mother and friend support were related to physical activity dropout, whilst none of the peer or parental influence variables were significantly related to older adolescent's physical activity transitions. Finally, for body-related factors, functional body image dimensions were significantly associated with young people's physical activity changes over time, with different aspects related to male, female, and younger and older adolescent's participation. In this final section of the chapter, these findings will be discussed with respect to the hypotheses outlined at the beginning of the chapter and existing research.

Table 7.13 Summary of significant interaction effects between time and physical activity trajectory group on motivational, social and body-related characteristics for gender and age-specific adolescent cohorts

Variable	Girls	Boys	Younger	Older
<i>Motivational</i>				
Enjoyment	✓	-	-	✓
Intrinsic Motivation	✓	✓	✓	✓
Identified regulation	✓	-	-	
Introjected regulation	✓	-	-	✓
External regulation	-	-	-	-
Amotivation	✓	-	✓	-
Competence	-	-	-	-
Relatedness	-	-	-	-
Autonomy	✓	-	✓	-
Autonomy Support	-	✓	✓	-
<i>Social</i>				
Mother Support	-	-	✓	-
Father Support	-	-	-	-
Mother PA Role Model	-	-	-	-
Father PA Role Model	-	-	-	-
Parental Pressure	-	-	-	-
Friend Support	✓	-	✓	-
Friend PA Role Model	-	-	-	-
Peer Acceptance	-	-	-	-
Teasing	-	-	-	-
<i>Body-related</i>				
BMIc	-	-	-	-
Body Dissatisfaction	-	-	-	-
Aesthetic Values	-	-	-	-
Aes. Behaviour Invest.	-	-	-	-
Aesthetic Satisfaction	-	-	-	-
Functional Values	-	-	✓	-
Func. Behaviour Invest.	✓	-	✓	✓
Functional Satisfaction	-	✓	✓	-

Note. ✓ denotes a significant time by physical activity trajectory group interaction effect. PA = Physical Activity; Aes = Aesthetic; Invest = Investment; Func = Functional.



Many psychosocial characteristics have been identified as playing a central role in adolescents' physical activity behaviour patterns. However, few longitudinal studies have investigated the factors underpinning changes in physical activity over time with the majority of studies implementing cross-sectional designs that do not facilitate examination of physical activity transitions and related predictors. The purpose of this chapter was therefore, to investigate motivational, social and body-related variables associated with maintained physical activity, dropout, continued non-participation or uptake of physical activity over twelve months among male and female, and younger and older adolescents.

In respect to motivation it was hypothesised that changes in intrinsic motivation and identified regulation would be associated with physical activity behaviour change over twelve months. Our expectations were supported, however the significance of results varied across the teenage cohorts. Firstly, it is noteworthy that intrinsic motivation was the only factor that was significantly related to continued physical activity participation across each of the gender and age-specific adolescent groups with effects ranging from small to medium. In addition, consistent with prior research, decreased levels of intrinsic motivation were related to physical activity dropout whereas increased scores were associated with adoption of physical activity (Gillison et al., 2011; 2012; Pelletier et al., 2001; Rodgers et al., 2010; Sarrazin et al., 2002). The results indicate that the inherent pleasure obtained from taking part in physical activity reflects a primary motive underpinning continued youth physical activity participation over time. It was also hypothesised that declining levels of enjoyment would underpin physical activity dropout among adolescents over twelve months. The results were in line with our hypothesis as decreased enjoyment was associated with dropout among female and older adolescents. In addition, increased levels of enjoyment were also associated with uptake of physical activity among these gender and age specific groups. These findings underscore the need for young people to engage in activities which they find enjoyable. Furthermore, to aid interventions efforts, qualitative research should be undertaken with young people to determine what it is that makes physical activity enjoyable and the subsequent reasons why it is no longer considered fun (Crane & Temple, 2015).

Identified regulation, which reflects engagement in an activity in order to attain personally valued goals (e.g. increased physical fitness) was also significantly related to female physical activity transitions over twelve months, although this relationship was not significant for males, or younger or older adolescents. The results indicate that self-endorsed physical activity outcomes that are perceived as being chosen by oneself can motivate initial and continued physical activity participation among girls, whereas declining levels of identified regulation are related to physical activity dropout over time.

In addition, in accordance with our hypothesis, introjected regulation, reflecting a more pressurised form of motivation in which individuals are driven to act in order to reduce negative feelings or to achieve contingent self-worth (Deci & Ryan, 1985a, 2008b) was related to adoption of physical activity and sustained participation over twelve months with further differences evidenced as a consequence of gender and age. For girls and older adolescents, increased levels of introjected regulation underpinned uptake of physical activity and continued participation over time, whereas this form of motivation was not related to male or younger

adolescents' physical activity patterns. Qualitative findings indicate that teenage girls that are regulated by introjection are primarily motivated by guilt (Gillison et al., 2009). In other words, they feel that they should be physically active in order to attain health outcomes or look a certain way and consequently engage in physical activity to alleviate feelings of guilt and shame. Other reasons that have been cited as underpinning introjected regulation among adolescents include attainment of peer approval or feeling obligated to persist in group physical activities in order to avoid letting others down (Gillison et al., 2009). It should be acknowledged however, that introjected regulation for physical activity was also accompanied by more self-determined motives among the relevant adolescent cohorts, indicating that distinct types of motivation can simultaneously contribute to physical activity maintenance and behaviour change over time. In addition, while introjected regulation was related to adolescents' continued physical activity participation over twelve months in the present study, prior research indicates that controlling regulations are unlikely to maintain persistence in physical activity over longer durations of time (Pelletier et al., 2001).

In turn, contrasting our expectations external regulation, which reflects participation in an activity in order to achieve external rewards or avoid punishment, was unrelated to young people's changing patterns of physical activity over twelve months. These findings contradict prior research indicating that external regulation predicts sport and physical activity dropout over time among adolescents (Calvo et al., 2001; Gillison et al., 2011; Pelletier et al., 2001). Finally in respect to amotivation, as hypothesised, increased levels were associated with dropout from physical activity and continued non-participation over time. Gender and age-related differences were also evidenced for this association, with female and younger adolescents reporting higher levels of amotivation at greater risk of physical activity discontinuation. These findings contrast prior research however that has revealed that higher levels of amotivation underpin dropout from sport among adolescent males (Calvo et al., 2010).

In relation to psychological needs it was hypothesised that decreased levels of competence, relatedness and autonomy would underpin physical activity dropout among adolescents over twelve months. However, this hypothesis was only partially supported as contrary to prior research, competence and relatedness were not related to changes in physical activity among young people (Crane & Temple, 2015; Gillison et al., 2011; Jõesaar & Hein, 2011; Sarrazin et al., 2002). In contrast, autonomy was the only psychological need that was related to continued participation in physical activity over time with declining levels of autonomy underpinning dropout whilst increased levels were associated with initiation of physical activity among those classified as non-participants at baseline. The significance of this factor further varied as a consequence of gender and age, with changes in autonomy related only to female and younger adolescents' longitudinal physical activity change patterns. The findings indicate that fostering perceptions of volition and ownership over one's physical activity participation, which involves offering physical activity choices, may facilitate increasing physical activity participation among inactive youth and further serve to reduce physical activity withdrawal.

In addition, in line with self-determination theory it was hypothesised that perceptions of autonomy support, which reflects adolescents' beliefs that significant others in the physical activity domain (e.g. coach, instructor) acknowledge their perspective and provide them with choices, would be associated with changes in physical

activity participation among young people over one year. This proposition was supported, however the importance of this factor varied across male and female, and younger and older adolescent cohorts. In accordance, increases in perceptions of autonomy support typically provided by a coach or instructor were related to uptake of physical activity and sustained participation among male and younger teenagers, whereas lower levels were associated with dropout. However, changes in female and older adolescents' physical activity were not related to changes in autonomy support from baseline to follow-up. Nonetheless, together these findings underscore the salience of promoting autonomy supportive environments that encourage choice and decision making in order to foster uptake of physical activity and sustained involvement among young people. In agreement with these findings, previous studies indicate that interventions promoting autonomy supportive teaching styles were associated with more frequent exercise participation and increased physical activity among teenagers and adults (Edmunds et al., 2007; Lonsdale et al., 2013).

Prior research has suggested that parents and peers also represent key socialising agents for young people's physical activity behaviours (Duncan et al., 2005; Fitzgerald et al., 2012; Kirby et al., 2011; Mendonça et al., 2014). As such, it was expected that decreased perceptions of parental support would be associated with physical activity dropout over time with higher levels underpinning sustained participation. This hypothesis was supported among younger adolescents; however parental support was not related to physical activity maintenance or change across older or gender-specific cohorts. Furthermore the association between sustained physical activity participation and parental support differed depending on the parent in question. In accordance, while decreased levels of mother support were associated with physical activity dropout, father support was not significantly related to changes in young people's physical activity over time.

Prior research indicates that each parent facilitates youth physical activity participation through different forms of support. Fathers are more likely to directly partake in activity with child whereas mothers provide higher levels of logistic support (Davison et al., 2003). Therefore, it is plausible to suggest that disparities evidenced in relation to perceived parental support and subsequent physical activity participation over time may be a consequence of the underlying types of support provided. However, the present data do not allow for an examination of the discrete support strategies adopted by each parent therefore these claims remain speculative in nature. Rather, it can be concluded that higher levels of maternal support reflecting a combination of behaviours such as praise, viewing practices, direct participation in physical activity with child and provision of transport to places where physical activity can be performed, was associated with sustained physical activity participation among younger adolescents over twelve months whilst decreased perceptions were related to discontinuation of physical activity and subsequent non-participation. In addition, the results indicate that the relation between parental support and adolescents' physical activity behaviour diminishes over time as maternal support was not related to older adolescents' physical activity maintenance and change patterns despite higher levels underpinning sustained involvement among younger teenagers. In line with these findings, older teenagers consistently report lower levels of parental support relative to their younger counterparts (Beets et al., 2006; Davison & Jago, 2009; Garcia et al., 1995).

It was also hypothesised that higher levels of parental physical activity role modelling would be related to uptake of physical activity and maintained participation among girls while this relationship would not be supported among boys. In partial support of our hypothesis, perceived levels of mother and father physical activity were not significantly associated with physical activity maintenance, dropout, non-participation or adoption of physical activity across any of the adolescent cohorts. Taken together these findings indicate that parental support is more strongly related to continued physical activity participation among young people than perceived levels of parental physical activity. In line with these findings, Trost et al. (2003) found that parental physical activity was insufficient in itself to promote adolescent's physical activity levels, with more direct instrumental parental behaviours necessary to achieve this aim. In addition, contrasting our hypothesis that increases in perceived parental pressure would be associated with physical activity dropout; parental pressure was not significantly related to changes in physical activity over a twelve months period during adolescence. Thus, interventions attempting to reduce physical activity withdrawal could focus specifically on strategies to promote parental support.

In relation to peer influences, it was expected that decreased levels of friend support and friend role modelling would underpin dropout from physical activity among young people. Contrary to expectations however, perceived level of friend physical activity was not significantly related to physical activity maintenance and behaviour change during adolescence. In contrast, in accordance with our hypothesis, decreased perceptions of friend support were related to physical activity dropout, whilst higher levels underpinned continued physical activity participation one year later. This effect varied as a function of gender and age; however with significant associations evidenced among female and younger adolescents, while friend support was unrelated to male and older adolescents' physical activity change patterns. In support of these findings, Coakley and White (1992) indicated that gender moderated the influence of peers on adolescent physical activity participation with girls more likely than boys to cite peer support as central to their uptake of sport and continued participation. In addition, decreased perceptions of support for physical activity from friend and mother was associated with dropout among younger adolescents highlighting the importance of significant others for helping this age-cohort to remain involved in physical activity over time. Interventions that include components, which involve undertaking physical activity with friends, may subsequently prove beneficial in preventing withdrawal from physical activity.

It was also hypothesised that interpersonal interactions with the wider peer group would be associated with physical activity behaviour change; however peer acceptance and teasing were not significantly related to continued non-participation, dropout or sustained physical activity among boys and girls, or younger and older adolescents. Ullrich-French & Smith (2009) previously reported that young people that sustained team sport participation over one year reported higher levels of peer acceptance than those who dropped out. Therefore, it is possible that the association between perceived acceptance from peers and sustained physical activity participation may differ as a consequence of the type of activity undertaken over time.

Body image and body mass also represent psychological and individual factors that have motivational implications for physical activity behaviour. Contrary to our predictions however, BMI was not related to

adolescents' physical activity maintenance and behaviour change over a twelve month period. Notwithstanding this it is important to note that mixed findings have previously been reported in respect to BMI and physical activity change across adolescence. For instance, Rangul et al. (2011) found that excess adiposity was associated with physical activity dropout and continued non-participation among adolescent males over a four year period whereas BMI did not emerge as a significant predictor of female physical activity. In contrast, other studies revealed that overweight girls were more likely to drop out of physical activity or remain inactive over time (Gillison et al., 2011; Zook et al., 2014). The discrepant findings may be attributed in part to variations across studies regarding method of physical activity assessment and threshold implemented for physical activity dropout and sustained participation. In addition, in the present analysis physical activity maintainers were characterised as participants in some form of physical activity at each time point without consideration of the total level of physical activity undertaken. As a result, there is likely to be a high degree of variability evidenced among physical activity maintainers in terms of the amount of physical activity undertaken. Moreover, previous research indicates that daily participation in recommended moderate-to-vigorous physical activity levels is necessary to discriminate normal and overweight or obese adolescents (Martinez-Gomez et al., 2010). Thus, it is possible that if a more stringent physical activity threshold had been used to define physical activity participation at baseline and follow-up, differences in BMI may have emerged among the physical activity trajectory groups over time. Nonetheless, it is important to acknowledge that the relation between BMI and physical activity is a complex one with systematic reviews demonstrating inconsistent associations (Biddle et al., 2005; Sallis et al., 2000; Strong et al., 2005; Van der Horst et al., 2007).

In terms of body image it was expected that higher levels of body dissatisfaction would be related to continued non-participation over time however this finding was not supported. In addition, in contrast to our hypothesis aesthetic satisfaction was not associated with physical activity maintenance and change among adolescent boys over twelve months. Prior research indicates that young people that engage in organised sport are more satisfied with their appearance (Ferron et al., 1999; Jaffe & Lutter, 1995), thus it may be that the relationship between sustained physical activity and aesthetic satisfaction over time may differ as a function of the type of activity performed. Additional research is need however to explore this possibility further. Moreover, aesthetic satisfaction, aesthetic behavioural investment, and aesthetic values did not significantly differ among physical activity maintainers, dropouts, non-participants or physical activity adopters over time irrespective of age or gender, indicating that changes in aesthetic body image is not related to physical activity transitions during adolescence.

In contrast, changes in various dimensions of functional body image were linked to changing patterns of physical activity over time. In accordance, with expectations, higher levels of functional values, functional behavioural investment and functional satisfaction were associated with sustained physical activity while lower levels were related to dropout over twelve months among adolescents. Moreover, and of importance, the findings indicated that increases in various dimensions of functional body image were related to uptake of physical activity. Differences also emerged across gender and age-specific adolescent cohorts regarding significance of different dimensions of functional body image. For girls, changes in functional behavioural

investment were related to physical activity behaviour transitions over twelve months whilst increases in functional satisfaction was positively related to changes in physical activity participation among boys. Greater behavioural investment in the body's functionality reflects efforts to maintain physical aspects whereas functional satisfaction is underpinned by positive evaluation regarding the body's capacity (Abbott & Barber, 2010). Higher levels of functional behavioural investment and functional satisfaction subsequently foster appreciation for what the body can do, which in turn was associated with uptake and sustained physical activity participation among male and female adolescents (Abbott & Barber, 2010). In line with these findings, Abbott, Barber & Dziurawiec (2012) revealed that male adolescents demonstrated higher levels of functional satisfaction than females, whereas younger adolescents were more satisfied with the functional qualities of their body than older adolescents.

In turn, increased valuing and investing in the functional qualities of the body in addition to increased satisfaction with the body's physicality were associated with uptake of physical activity and sustained participation among younger adolescents whereas lower levels were related to discontinuation of physical activity. Among older adolescents however, increased and decreased levels of functional behaviour investment were related to physical activity adoption and dropout, respectively over one year. These findings offer initial support that changes in functional body image are positively related to adolescents' physical activity behaviour transitions over time. In addition, it is clear that efforts to reduce physical activity withdrawal should be focused on promoting functional as compared to aesthetic dimensions of body image, as focusing on how the body feels and what it can do is inextricable implicated in young people's continued physical activity participation over time.

In summary, different psychosocial factors were related to maintained physical activity participation, dropout, continued non-participation or uptake of physical activity over twelve months across the adolescent cohorts with further variations evidenced dependent on the young person's gender and age. In addition, the findings indicate that self-determination theory provides an effective framework within which to investigate young people's physical activity maintenance and behaviour change over one year. For girls, self-determined and controlling motives, in addition to enjoyment and feelings of autonomy were associated with uptake and continued physical activity participation over twelve months while decreased levels were associated with dropout. In contrast, intrinsic motivation and support from authoritative agents within the physical domain emerged as central factors underpinning changes in physical activity participation among adolescent boys. In turn, while enjoyment, alongside self-determined and controlling motives were associated with changes in older adolescents' physical activity over twelve months; for younger adolescents changes in intrinsic motivation, amotivation, autonomy and autonomy support were all related to uptake of physical activity, dropout and sustained participation one year after baseline. In respect to social factors, decreased perceptions of friend support were related to physical activity dropout among girls whereas higher levels were associated with continued physical activity participation. In addition, perceived friend and mother support were related to younger adolescents' physical activity participation and change over twelve months; however this association was not supported among older adolescents suggesting that the significance of perceived support

among teenagers may diminish as they get older. In turn, different aspects of functional body image were related to continued physical activity and changes over time across each of the adolescent cohorts indicating that functional as opposed to aesthetic body image plays a greater role in adoption and sustained physical activity among young people.

## **Chapter 8. General Discussion**

### **8.1 Chapter Overview**

The purpose of this chapter is to discuss the aims and key findings of the present research in light of the existing empirical literature. The limitations of this research will then be addressed followed by a discussion of the theoretical and practical implications of these findings.

### **8.2 Summary of Rationale and Key Aims of the Current Research**

In line with findings from Europe, North America and Australia, national school based surveys indicate that the majority of adolescents in Ireland are currently insufficiently active to meet recommended physical activity guidelines of 60 minutes of moderate- to-vigorous physical activity daily (Brooks et al., 2015; Currie et al., 2015; Fakhouri et al., 2014; Kalman et al., 2015; Kelly et al., 2012; NaSSDA, 2010; Woods et al., 2010). In addition, the proportion of youth achieving required amounts of physical activity decreases with age, with the dropout occurring earlier for girls than boys (Nader et al., 2008). Prior research has typically focused on overall levels of physical activity among young people without taking account of the different types of physical activity that constitute total involvement. This has resulted in a limited understanding of the patterns of physical activity in which young people engage. Person-orientated approaches have recently been adopted within the literature to identify sub-groups of adolescents that engage in similar patterns of physical activity, however only two studies to date have focused exclusively on young people's profiles of physical activity participation. In accordance, Agans and Geldhof (2012) identified five distinct clusters of organised sport participation among a sample of secondary school students that reflected participation in team sport, individual sport, a combination of team and individual sports, dance undertaken alongside or in the absence of other sports, and a pattern of non-participation. However, failure to address involvement in organised non-sport (e.g. gym, aerobics) and non-organised physical activity (e.g. walking, jogging) provides an incomplete picture of adolescents' physical activity behaviours. Moreover, Liu et al. (2013) revealed discrete classes of moderate-to-vigorous physical activity participation among boys and girls that differed in respect to preferred types of physical activity undertaken, which underscores the need to explore gender specific profiles of physical activity participation. Therefore, the first aim of the current research was to address this gap in the literature by investigating patterns of physical activity involvement among male and female and younger and older adolescents using multiple indicators of physical activity including type, context, frequency, duration and intensity.

This research was underpinned by self-determination theory (Deci & Ryan, 1985a, 2000) which provides a conceptual framework within which to explore motivational and social contextual factors underpinning physical activity behaviour. It has also been widely evidenced that significant others can play an important role in young people's physical activity (Edward et al., 2013, 2014; Mendonça et al., 2014; Park & Kim, 2008; Sallis & Patrick, 1994), and as such parental and friend influences reflecting perceived support, role modelling of physical activity, acceptance from the wider peer group and negative experiences such as pressure and teasing were explored. In turn, given that the adolescent period plays a decisive role in the development



of body image (Ata et al., 2007; Thompson & Chad, 2000; Voelker et al., 2015), body mass alongside aesthetic, functional and perceptual body image dimensions were additionally considered to facilitate a detailed understanding of the factors associated with discrete patterns of physical activity involvement and changes in physical activity over twelve months. A secondary aim of this thesis was to compare profiles of physical activity participation on a range of psychosocial and individual characteristics among male and female, and younger and older adolescents. Prior studies have typically examined correlates of overall physical activity without consideration of the underlying type of physical activity performed (e.g. Biddle et al., 2011; Sallis et al., 2000; Van der Horst et al., 2007). Therefore it is unclear whether discrete profiles of participation differ from each other on psychosocial characteristics. However, in a study comparing organised and non-organised physical activity among adolescents, Spink and colleagues (2006) revealed that certain psychosocial predictors were differentially related to each context of participation. In addition, it is unknown whether young people characterised by involvement in organised sport and physical activity differ on motivational, social and body related characteristics as these discrete profiles of participation have often been considered simultaneously despite reflecting distinct patterns of behaviour.

A third aim of this thesis was to explore stability and changes in profiles of adolescents' physical activity participation over one year, in addition to investigating gender and age-related differences in maintained physical activity and dropout over time. Although longitudinal findings pertaining to quantitative changes in adolescents' physical activity levels are available, a lack of research has explored how patterns of involvement in physical activity change over the teenage years. Indeed, only one study to date, has adopted a person-orientated approach to characterise the nature and course of physical activity patterns during adolescence. In line with this, Agans and Geldhof (2012) replicated discrete patterns of organised sport participation at three successive time points approximately one year apart and subsequently grouped adolescents into trajectories reflecting continued participation or changes in physical activity over time. However, consistent with other studies in which adolescents were classified longitudinally as physical activity maintainers, dropouts, adopters or non-participants, no information was available regarding the types of physical activity underpinning these transitions therefore it is unclear whether certain patterns of physical activity participation are more likely to be dropped or sustained over time (Gillison et al., 2011; Rangul et al., 2011; Zook et al., 2014).

A final aim of this research was to investigate the psychosocial and individual characteristics related to physical activity dropout, uptake and sustained participation among adolescents over twelve months. While different factors have been acknowledged as playing a central role in youth physical activity, the majority of studies have adopted a cross-sectional approach which precludes an examination of physical activity transitions and associated factors underpinning change. Identification of modifiable psychosocial characteristics associated with changes in physical activity is therefore necessary to inform interventions aimed at promoting adoption of physical activity and continued participation across adolescence as well as targeting those at risk of dropout. The present research offers important advances to the youth physical activity literature by furthering our understanding of the different patterns of physical activity in which young people engage in addition to examining multiple psychosocial characteristics associated with continued participation and physical activity

change over twelve months.

### **8.2.1. Patterns of involvement in physical activity among adolescents**

Five discrete patterns of physical activity emerged among the overall adolescent sample in the present research that corresponded to active participation in team sport, individual sport, non-organised physical activity, a less active profile of organised dance and fitness activities, and non-participation. Active engagement was defined as meeting recommended physical activity guidelines of 60 minutes of moderate-to-vigorous physical activity on at least three days over the past week. The emergence of a profile of active non-organised physical activity (e.g. walking, running) that represented 16% of the overall sample underscores this pattern of behaviour as a distinct and valid form of physical activity among teenagers. Given that limited research has addressed this context of participation, the present findings make an important contribution to the literature by illustrating that undertaking non-organised physical activity can help adolescents to accumulate active levels of moderate-to-vigorous physical activity daily. This finding is particularly noteworthy given that this type of activity requires little organisation, commitment or cost and as such represents a means of accumulating recommended levels of physical activity that is accessible to all young people. In addition, consistent with prior research and in line with our hypothesis, organised sport participation was associated with higher levels of moderate-to-vigorous physical activity (Machado-Rodrigues et al., 2012; Pfeiffer et al., 2006). However, contrary to expectations, organised non-sport physical activity participation was characterised by less active levels of moderate-to-vigorous physical activity. Research examining organised sport and physical activity participation has typically examined these behaviours in combination without discriminating the underlying type of activity, which may account for the discrepant findings evidenced (e.g. Joesaar & Hein, 2011).

#### ***8.2.1.1 Gender and age differences in patterns of physical activity***

In addition, multiple group models revealed in accordance with our hypotheses that patterns of physical activity involvement differed between male and female, and younger and older adolescents. As predicted boys demonstrated more active patterns of moderate-to-vigorous physical activity than girls, which is in line with robust findings from the empirical literature indicating that male adolescents are more physically active than females (e.g. Brooks et al., 2015; Currie et al., 2015; Kelly et al., 2012; Woods et al., 2010). In accordance, boys were characterised by five discrete participation profiles, four of which were classified as ‘active’, meaning that recommended levels of moderate-to-vigorous physical activity were achieved on at least three days over the past week. These four profiles corresponded to *active team sport*, *active individual sport*, *active organised fitness*, *active non-organised physical activity & team sport*, and *non-participation*. The results indicate that boys can acquire recommended levels of physical activity through various types of physical activity participation. In contrast, female physical activity participation was represented by six discrete profiles, only two of which were classified as ‘active’. These six profiles reflected *active team sport*, *active individual sport*, *organised dance & fitness*, *non-organised physical activity*, *organised individual sport & physical activity*, and *non-participation*. These findings indicated that active levels of moderate-to-vigorous physical activity were attained only through organised sport participation among girls, underscoring the benefits of this mode of physical activity participation for enhancing female adolescents’ health

enhancing physical activity levels. However, undertaking structured dance and fitness classes, or informal exercise like walking and jogging, which reflected a unique pattern of participation among girls, also contributed to daily physical activity levels albeit to a somewhat lesser extent.

A greater proportion of the female sample was classified as non-participants in comparison to males (35% v 23%), with non-participation reflecting the most prevalent physical activity profile among girls. In contrast, active team sport participation reflected the most popular pattern of male physical activity involvement (31.3%). In line with this finding, approximately twice as many males as females were characterised by patterns of participation in team sport, offering support for previous studies that have found that boys are more likely to engage in moderate-to-vigorous intensity team based activities than girls (Aaron et al., 2002; Bradley et al., 2000; Woods et al., 2010). In addition, as hypothesised a greater proportion of girls (13%) than boys (2.5%) were represented by profiles of organised dance and fitness activities. Liu and colleagues (2013) previously reported differences in respect to preferred patterns of moderate-to-vigorous physical activity among adolescents revealing that while most females are represented by a profile of participation in dance/walking/running, the majority of males are characterised by a pattern of basketball and running. These profiles in turn reflect underlying gender differences in respect to team and individual based activity preferences. The present research extends these findings by providing additional information on the context in which physical activity is performed and further highlights that physical activity levels differ among girls based on the type of activity in which they engage.

Younger adolescents were characterised by more active patterns of moderate-to-vigorous physical activity participation than their older counterparts. Despite a profile of *non-participation* reflecting the most prevalent pattern of physical activity among both the younger (33.5%) and older (36.6%) adolescent cohorts, the remaining profiles of younger adolescent's physical activity involvement were characterised by active levels of moderate-to-vigorous physical activity, while this was not the case among older adolescents. As such, younger adolescents were represented by participation in *active organised physical activity and sports*, *active non-organised physical activity & team sport*, *active individual sport*, and *active team sport*. In contrast, older adolescents were readily discriminated based on type and level of moderate-to-vigorous physical activity undertaken as characterised by six discrete profiles reflecting *individual sport*, *active mixed sports*, *active non-organised physical activity*, *organised dance & fitness*, *active team sport* and *non-participation*. Moreover consistent with predictions a greater proportion of younger than older adolescents were characterised by profiles of organised sport participation. Furthermore, with the exception of the non-participation class, all of the remaining younger adolescent physical activity classes reflected participation in organised sport to some extent.

The older adolescent cohort in turn, was more likely to be characterised by patterns of engagement in individual activities than younger adolescents with a quarter of the sample participating in *active non-organised physical activity* like walking, running and swimming, or *organised dance and fitness* classes (e.g. gym, circuits). In line with these findings, Lunn et al. (2013) revealed that personal exercise reflecting swimming, jogging and going to the gym was the only type of activity in which participation increased throughout the secondary school

years among Irish students suggesting that participation in individual type activities may reflect a preferred mode of physical activity among older teenagers. The present findings also demonstrated that older adolescents can acquire active levels of moderate-to-vigorous physical activity through organised sports in addition to non-organised physical activity, which is especially pertinent given the age-related decline in physical activity levels that have been widely evidenced. Moreover, non-organised physical activity may represent an alternative means of acquiring recommended levels of activity among those who may dislike competitive sports. Thus, by adopting a person-orientated approach to explore the multidimensional nature of physical activity this research offers a novel and more nuanced insight into the underlying type of activities that constitute overall patterns of physical activity among Irish adolescents. In addition, the results further reveal gender and age-specific differences in profiles of physical activity participation with each of the adolescent cohorts accumulating physical activity in various ways.

### **8.2.2 Psychosocial and individual factors associated with discrete patterns of adolescents' physical activity involvement**

It was hypothesised that adolescents characterised by profiles of active sport participation would demonstrate higher levels of self-determined motivation, competence, relatedness, autonomy and autonomy support in comparison to those classified by other patterns of physical activity and these predictions were broadly supported. Of note, intrinsic motivation and identified regulation demonstrated a large effect among each of the gender and age specific adolescent cohorts, with active sport participants reporting higher levels of self-determined motivation relative to those characterised by less active profiles of physical activity participation. In addition, individuals characterised by active engagement in non-organised physical activity and organised dance and fitness activities reported higher levels of intrinsic motivation relative to non-participants indicating that participation in other activities in addition to sport were associated with feelings of fun and pleasure derived from the activity itself. These findings are consistent with prior research that has found that self-determined motivation is associated with physical activity among young people (e.g. Owen et al., 2014). This study extends this body of literature by delineating how adolescents characterised by different profiles of physical activity participation vary from each other on motivational characteristics. Moreover, while prior investigations have compared sport and fitness (e.g. aerobics) motives among adults, to date, this area has received little attention among young people (Frederick & Ryan, 1993; Ryan et al., 1997).

It was also hypothesised that active organised sport and physical activity participants would report higher levels of enjoyment than non-organised physical activity participants. However this hypothesis was only partially supported with differences emerging as a consequence of the associated level of moderate-to-vigorous physical activity performed. Thus, individuals that demonstrated active levels of participation in sport or non-organised physical activity did not differ, whereas active sport participants demonstrated higher levels of enjoyment than those who reported low active levels of non-organised participation. Thus, the level of physical activity undertaken in addition to the type of activity engaged may be a source, or alternatively a consequence of enjoyment. However, these findings contradict Spink et al. (2006) who found that active adolescents that

engaged in non-organised physical activity reported lower levels of enjoyment than organised physical activity participants. It is possible that the type of activities undertaken within a non-organised context differed across studies and participants (e.g. walking, running, informal games (e.g. tip-the-can) and sport) and this in turn may be associated with level of physical activity enjoyment. Future studies should therefore examine specific types of non-organised physical activity undertaken to increase knowledge of this under researched pattern of participation.

Competence, relatedness, and autonomy, in addition to autonomy support demonstrated medium to large effect sizes across adolescent cohorts with young people characterised by profiles of organised sport participation demonstrating higher perceptions of basic psychological needs compared to those represented by less active profiles. These findings are in line with predictions and support previous studies that have found that higher levels of competence, relatedness, autonomy and autonomy support satisfaction are associated with sport involvement (Dwyer et al., 2006; Lonsdale et al., 2013; Pelletier et al., 2001; Reinbooth et al., 2004; Sarrazin et al., 2002). However, notable gender and age-related differences also emerged for the relation between psychosocial characteristics and pattern of physical activity participation. For girls, active involvement in sport was associated with more adaptive motivational characteristics relative to other profiles of participation. However, among boys, those that engaged in team sport reported significantly more positive psychosocial indices than individual sport and fitness participants suggesting that team sport may be particularly salient for adolescent males. Prior research exploring motivational correlates has typically grouped individuals that performed different types of sport together (e.g. Jõesaar & Hein, 2011), which has not allowed for differences across sport formats to be uncovered. Thus, the present findings make an important contribution to the literature on youth sport by highlighting gender differences in respect to type of sport engaged and motivational characteristics.

In addition, age-related differences were also evidenced in relation to psychosocial characteristics and physical activity patterns. Among the younger cohorts, non-participants differed from those represented by active patterns of physical activity with few differences noted among these active classes, which is likely due to the fact that each of these classes reflected participation in organised sport to some extent. In respect to older adolescents, discrete profiles of active participation in organised sport, and non-organised physical activity, were associated with more adaptive motivational characteristics relative to less active peers, highlighting informal exercise as a positive alternative to sport participation that was unique to this age group. The present findings therefore contribute to the existing literature by highlighting motivational processes associated with different patterns of adolescents' physical activity behaviour, and non-organised participation in particular, which has received limited attention to date.

In respect to peer and parental influences, a consistent finding across all of the adolescent cohorts was that team sport participants demonstrated higher levels of support, role modelling, peer acceptance and lower levels of teasing and pressure relative to non-participants and those characterised by other patterns of physical activity involvement. It has previously been evidenced that organised sport participation is associated with higher levels of parental support (Davison & Jago, 2009; Duncan et al., 2005) parental physical activity (Cleland et

al., 2005; Marques et al., 2014) and increased feelings of peer acceptance (Chase & Drummer, 1992; Craft et al., 2003) among young people. Thus findings from the present study were broadly in support of what has emerged in previous research. Clear gender differences also emerged for parental factors, as perceptions of mother and father support had a large effect on female physical activity, which contrasted with the medium effect evidenced among males. In addition, for parental role modelling and pressure, small effects were evidenced among the female cohort only, indicating that parent behaviours are related more to girls' than boys' physical activity, and team sport participation in particular. In line with these findings, prior research indicates that parental physical activity and encouragement has been found to exert a greater influence on girls' physical activity levels than boys (Trost et al., 1997; Rangul et al., 2011). The results also revealed that friend support evidenced a large effect across the entire adolescent cohort, and was more strongly related to young people's physical activity patterns than parental support. Past studies indicate that peers exert a greater influence over adolescents' physical activity patterns than parents, which supports the current finding (Beets et al., 2006; 2007; Edwardson et al., 2013). Furthermore, all of the female physical activity profiles reported higher friend support relative to non-participants indicating that friend support is especially pertinent for girls' physical activity participation. In support of this finding, previous qualitative research has indicated that girls are more likely to mention 'needing a friend to be physical active with' than boys (Coakley & White, 1992).

In respect to body-related characteristics, contrary to our hypothesis, BMI did not differ across profiles of physical activity participation. This may reflect physical activity cut-off points not being stringent enough. Alternatively, it may indicate that other factors such as diet also influence body mass, and that consequently diet and physical activity need to be considered simultaneously. Aesthetic aspects of body image were more strongly related to male than female physical activity patterns, with team sport participants reporting higher levels of aesthetic satisfaction and aesthetic behavioural investment than those that did not engage in physical activity. In addition the findings from the present study revealed that participants in organised sport participation reported higher levels of functional values, functional behavioural investment and functional satisfaction than organised physical activity (e.g. dance and fitness) and non-participants, with mostly large effects sizes evidenced for each of the functional dimensions across the adolescent cohorts. In turn, as hypothesised adolescents characterised by profiles of non-organised physical activity (e.g. walking, jogging), regardless of level of moderate-to-vigorous physical activity undertaken demonstrated higher levels of functional body image compared to non-participants. Thus, participation in non-organised physical activity even at low levels of engagement fosters appreciation of the functional qualities of the body and in turn is associated with more positive functional body image. These findings add to the existing literature that has evidenced such associations among female adolescents (Abbott & Barber, 2011) by highlighting that similar relations are also found between functional body image and physical activity participation for males. In addition, contrary to predictions organised non-sport participants did not differ from non-participants on any functional dimensions suggesting that dance or fitness activities may be undertaken for more aesthetic reasons (e.g. enhanced appearance) or alternatively differences may exist regarding the delivery or focus of these classes, which may detract attention from the function of the body (Abbott & Barber, 2010; 2011; Frederick

& Ryan, 1993; Ryan et al., 1997).

### 8.2.3 Stability and transitions in adolescents' patterns of physical activity over twelve months

A dearth of research has examined stability and changes in adolescents' physical activity participation profiles over time thus this study was the one of the first to explore this issue. Overall, the findings demonstrated some stability in patterns of physical activity from Time 1 to Time 2, with the most prevalent patterns of participation among each adolescent cohort replicated at follow-up. However, additional variations in profiles of physical activity participation also emerged twelve months after baseline reflecting changing patterns of involvement. Among girls, the proportion of youth classified as non-participants increased steadily from Time 1 to Time 2, with half of the sample subsequently represented by a pattern of *non-participation* at follow-up. The results are in line with existing research which demonstrates that girls become less physically active as they get older. In addition, the *organised dance and fitness* profile was replicated at each time point. Prior research indicates that dance represents a prevalent pattern of engagement among girls (Fahey et al., 2005; O'Neill et al., 2011; Woods et al., 2010). Sport participation however, declined over time as a quarter of the female sample were represented by an active profile of team and individual sport participation at follow-up despite roughly one third of girls characterised by discrete patterns of active participation in team or individual sport at baseline. These findings are consistent with past research that has found that organised sport participation declines among adolescent girls as they get older (Bailey et al., 2005; Eime et al., 2013; Woods et al., 2010). An additional pattern reflecting active participation in a combination of organised non-sport (e.g. dance, gym) and non-organised physical activities (e.g. walking, jogging) emerged at follow-up, underscoring the potential benefit of promoting informal exercise alongside organised physical activity participation as a viable means for increasing adolescent girls' moderate-to-vigorous physical activity levels.

For boys, *active team sport* and *non-participation* represented stable patterns of physical activity over time, with team sport reflecting the most prevalent pattern of male participation at each time point. Consistent with this finding, previous research conducted in Ireland found that male adolescent sport involvement is dominated by team games (Lunn et al., 2013; Woods et al., 2010). The emergence of a less active pattern of *non-organised physical activity* however, was indicative of declining levels of physical activity participation. This profile reflecting unstructured engagement in activities such as running, cycling and swimming, represented a move for some towards non-competitive physical activity participation. Lunn et al (2013) previously indicated that engagement in personal exercise increases as adolescents get older, which is consistent with the emergence of this pattern of activity. The remaining baseline patterns were replaced by an *active* profile of *individual sport and non-organised physical activity*, and a combination of active participation in team and individual sports. The majority of males were characterised at follow-up however, by a profile of active participation in sport, and team sport in particular, reflecting sustained levels of active organised sport involvement among adolescent boys over twelve months.

Among the younger adolescent cohort, profiles of *active team sport*, *active mixed sport* and *non-participation* established at follow-up were conceptually similar to baseline patterns of physical activity. In addition, two discrete patterns of physical activity reflecting *active organised physical activity and team sport* and a less

active pattern of *non-organised physical activity* emerged at follow-up, which were more differentiated and less active than the baseline patterns they replaced. Thus, although younger adolescents continued to be a highly active cohort over twelve months, there was a subtle shift towards more discrete and less numerous physical activity combinations underpinning profiles of participation at Time 2. In contrast to the younger cohort, five of the six physical activity patterns established among older adolescents at baseline were replicated at follow-up, which reflected *active team sport*, *active mixed sports*, *active non-organised physical activity*, *organised dance & fitness*, and *non-participation*. The findings suggest that teenagers' physical activity patterns become more differentiated during mid-to-late adolescence. Moreover, these profiles of participation are conceptually similar to the five distinct clusters of organised sport participation identified by Agans and Geldhof (2012) among a similarly aged cohort, which were subsequently, replicated over three time points. The former study did not however, assess non-organised physical activity participation or amount of moderate-to-vigorous activity performed. Therefore the present research extends these findings by examining multiple dimensions of physical activity and exploring gender and age-specific variations in adolescents' patterns of involvement over twelve months.

Adolescents were subsequently grouped longitudinally into trajectory groups reflecting maintained physical activity, dropout, continued non-participation or uptake of physical activity based on whether they were classified as physical activity participants or non-participants at each time point. While this approach has been adopted previously to classify young people's physical activity behaviour over time, little attention has been placed on the types of activities that are likely to be maintained or subsequently discontinued reflecting a key limitation of the existing literature (e.g. Agans & Geldhof, 2012; Gillison et al., 2011; Zook et al., 2014). In accordance with our hypothesis, a greater proportion of girls (26.9%) than boys (12.3%) dropped out of physical activity over twelve months. The results further indicated that roughly two thirds of those characterised by a profile of *non-organised physical activity* at Time 1 subsequently transitioned into the non-participation group at Time 2. In contrast, the majority of girls that engaged in organised sport and physical activity at baseline were classified at follow-up as physical activity maintainers. Moreover, team sport participants were least likely to discontinue physical activity at follow-up, with similarly low rates of dropout also evidenced among male counterparts for this pattern of involvement. The results from Chapter 5 revealed that girls engaged in team sport were more likely to have a friend or parent that was physically active in addition to higher perceptions of support and acceptance from other, which suggests that being part of a group and feeling cared for and supported may contribute to sustained participation over time (Trilk et al., 2012). Thus, organised physical activity contexts appear to represent a more effective means of fostering continued physical activity participation over time among girls. These findings have implications for interventions targeting sustained physical activity participation among girls by illustrating patterns of activity that are likely to be dropped or maintained over time among this at-risk group of adolescents.

In addition, in accordance with our hypothesis, age-related differences emerged in respect to physical activity dropout as nearly double the proportion of older adolescents (13.5%) discontinued participation in physical activity twelve months after initial assessment in comparison to their younger peers (7.5%). Moreover, while



the majority of older adolescents that demonstrated a profile of active team or mixed sport participation at Time 1 continued to maintain physical activity participation at Time 2, nearly half of those characterised by a less active pattern of individual sport at baseline became non-participants at follow-up. In addition, a roughly equivalent proportion (29%) of youth characterised by non-organised physical activity (e.g. walking, jogging, cycling) or organised non-sport physical activity (gym, dance classes) involvement at baseline subsequently dropped out of physical activity twelve months later. Thus, irrespective of context or associated level of moderate-to-vigorous physical activity, individual type physical activities are less likely than organised team sports to be maintained among older adolescents over twelve months. These findings contradict prior research by Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley (2009) who found that adolescents were more likely to sustain involvement in individual sport and physical activity throughout secondary school in comparison to team based activities. However, the present research spanned only twelve months, which may not have been long enough to capture true variation in respect to the type of activities that are likely to be dropped or sustained across adolescence. In addition, the current study examined patterns of distinct physical activity participation over twelve months as opposed to simply dichotomising adolescents as team or individual based physical activity participants, which may also contribute to the discrepant findings evidenced.

#### **8.2.4 Factors associated with adolescents' physical activity maintenance and behaviour change trajectories over twelve months**

Changes in motivational, social and body related characteristics were associated with maintained physical activity participation, dropout and uptake of physical activity over twelve months with factors varying in significance among male and female and younger and older adolescents. In terms of motivation, as hypothesised, decreased levels of intrinsic motivation and identified regulation were related to dropout whilst increased scores were associated with uptake of physical activity. The present findings extend past research that has shown that higher levels of self-determined motivation are related to exercise initiation among adults (Roger et al., 2010; Teixeira et al., 2012), by offering support for this association among a younger population of secondary school students. In addition, intrinsic motivation emerged as the one psychosocial factor that was significantly related to changes in physical activity among each of the gender and age-specific adolescent cohorts. Moreover, intrinsic motivation was the only type of motivation related to sustained physical activity over twelve months among adolescent boys, suggesting that diminished feelings of fun and satisfaction derived from sport and physical activity participation reflects a central reason why males dropout of physical activity during adolescence. In contrast, among girls multiple motives were associated with physical activity maintenance and behaviour change, with higher levels of self-determined motives and controlling introjected regulation in addition to enjoyment related to uptake of physical activity and sustained participation, whilst decreased levels underpinned dropout. In support of these findings, Gillison and colleagues (2013) found that teenage girls who increased physical activity participation over one year reported different reasons for doing so such as the satisfaction engendered from reaching physical activity goals in addition to feeling like they should be more active, which reflect both autonomous and controlled motives for behaviour. In addition,

consistent with prior research, increased levels of amotivation were also associated with female physical activity dropout over twelve months (Sarrazin et al., 2002). External regulation, in contrast to our hypothesis however was not related to physical activity changes among adolescents over twelve months indicating that external rewards and punishments did not reflect central reasons for young people's continued participation in physical activity.

In addition, while intrinsic motivation and amotivation were related to changes in younger adolescents' physical activity participation over twelve months, increased levels of intrinsic motivation, introjected regulation and enjoyment were related to uptake of physical activity and persistence over time among older adolescents. Inconsistent findings have previously been evidenced regarding introjected regulation and sustained physical activity behaviour (e.g. Calvo et al., 2010; Pelletier et al., 2002), however the present research indicates that older adolescents are motivated to continue taking part in physical activity for more controlling reasons such as to alleviate negative feelings like guilt or to attain conditional self-worth by seeking approval from others. Nonetheless, this behavioural regulation is also experienced in the presence of more intrinsic motives. In line with recommendation by Deci and Ryan (2007), efforts should be made to enhance autonomous motivation for physical activity among young people whilst avoiding more controlling strategies to facilitate interest and sustained physical activity across adolescence and adulthood.

It was also hypothesised that decreased perceptions of competence, relatedness and autonomy in addition to autonomy support would be associated with reductions in physical activity over twelve months; however these hypotheses were only partially supported. In accordance with predictions, increased levels of autonomy and autonomy support were associated with adoption and maintained physical activity whereas declining levels were related to dropout. This is in line with prior research indicating that adolescents that sustained participation in sport and physical activity over time compared to those who dropped out were more autonomous demonstrating a greater sense of volition, in addition to perceiving the physical activity environment as more supportive of their needs for choice and ownership (Bengoechea & Streaan, 2007; Jöesaar & Hein, 2011; Pelletier et al., 2001).

Perceptions of competence however, were not related to physical activity change contrasting prior research that has consistently revealed that lower levels underpin dropout among youth (e.g. Crane & Temple, 2015; Sarrazin et al., 2002). In addition, perceived relatedness was not significantly associated with changes in physical activity over time. However, most of the studies that have evidenced an association between psychological needs and sustained participation have focused on sport participants. Therefore, it is possible that the relative importance of the aforementioned motivational characteristics for sustained participation differ dependent on the type and level of activity performed. For instance, adolescents may be able to continue participating in individual type activities (e.g. jogging) irrespective of whether or not they feel connected to others. In addition, perceived levels of competence may be less important for maintaining participation in non-competitive physical activities (e.g. aerobics) or informal exercise (e.g. walking). As such, classifying adolescents as physical activity maintainers in the present study based simply on whether they engaged in any type of physical activity at Time 1 and Time 2 without taking account of the amount or underlying type of

activity performed, may have masked significant differences that may otherwise have emerged in respect to physical activity maintenance and behaviour change. A possible avenue for future research is therefore to explore whether such motivational characteristics differentially predict uptake and dropout of various patterns of sport and physical activity participation among adolescents. Nonetheless, the findings underscore the significance of fostering self-determined motivation and a sense of ownership over one's physical activity which can be facilitated by coaches and physical activity leaders structuring the physical activity environment appropriately. The present findings also indicate that these factors are differentially associated with male and female, and younger and older adolescents' continued physical activity participation.

Social factors were also related to physical activity maintenance and change over time. In line with our hypotheses decreased perceptions of support from friend and mother were related to physical activity dropout over twelve months. However the importance of significant others differed between male and female, and younger and older adolescents. In accordance, declining levels of friend support were associated with dropout among girls, whilst this finding was not supported among boys suggesting that friends play a more salient role in female physical activity behaviours. In line with these results, prior qualitative research indicates that girls are more likely than boys to identify support from friends as important to their continued physical activity participation (Coakley & White, 1992).

In addition, perceived friend and mother support was related to younger adolescents' physical activity over time with lower levels underpinning dropout. Previous longitudinal studies indicate that decreased levels of parental support are related to physical activity decline across adolescence (Davison & Jago, 2009; Dowda et al., 2007). The relative importance of support from others appears to diminish over time however, as parental and peer support was unrelated to physical activity maintenance or changes among older adolescents. In turn, contrary to our predictions none of the other parental or peer behaviours including role modelling, pressure, teasing or feeling accepted by the wider peer group were associated with changes in young people's physical activity over one year. Thus, it appears that direct instrumental forms of support from significant others are of particular importance for sustaining physical activity involvement in the early teenage years.

Body image was also significantly related to transitions in physical activity among adolescents over one year. In line with our hypothesis, functional aspects of body image were associated with physical activity dropout and uptake over time, with specific dimensions differing in significance across gender and age-specific cohorts. In accordance changes in functional behavioural investment were associated with positive transitions in physical activity among girls whilst increases in functional satisfaction were linked to adoption of physical activity among boys. Gender differences in respect to satisfaction with the body's functionality have previously been reported among adolescents with males demonstrating higher levels of functional satisfaction than girls (Abbott et al., 2012). Moreover, qualitative findings indicate that males are most satisfied with aspects of their body that are necessary for successful sport performance or functionality (Ricciardelli & McCabe, 2006).

For younger adolescents, higher valuing and investing in the functional aspects of the body in addition to increased satisfaction with the body's physicality were related to uptake of physical activity. In contrast, for

older adolescents increases and decreases in levels of functional behavioural investment were associated with adoption of physical activity and dropout over twelve months, respectively. In support of these findings Abbott and colleagues (2012) revealed that younger adolescents reported greater functional satisfaction than older peers. The present findings also indicate that instrumentality of the body was more strongly related to changes in younger as opposed to older adolescents' physical activity participation over time. Nonetheless, fostering functional aspects of body image by emphasising what the body can do as opposed to what it looks like is linked to uptake of physical activity and sustained participation among adolescents irrespective of age and gender. In contrast, aesthetic and perceptual aspects of body image in addition to BMI were not significantly related to changes in young people's physical activity. Little research has previously examined the relationship between body image and physical activity longitudinally, and functional aspects of body image in particular, thus the present findings contribute to the empirical literature by underscoring the significance of this dimension of body image for promoting participation in physical activity among non-active youth. Moreover, the results suggest that attempts to promote physical activity participation should focus on changing functional as opposed to aesthetic aspects of body image (Abbott & Barber, 2011).

### **8.3 Revisiting Theory**

The present research was underpinned by self-determination theory (SDT; Deci & Ryan, 1985a, 1991; Ryan & Deci, 2000), which provided an effective conceptual framework from which to explore social-contextual and psychological characteristics associated with adolescents' physical activity participation and change over twelve months. SDT posits that autonomy supportive environments promote autonomous motivation through satisfaction of psychological needs (Deci & Ryan, 1985a, 2002, 2008a). Prior empirical assessments offer support for the hypothesised pathways delineated within this model among children, adolescent and adult populations across various physical activity contexts (Álvarez et al., 2009; Amorose & Anerson-Butcher, 2007; Standage et al., 2003, 2005; Vierling et al., 2007). In turn, this thesis was concerned with how theoretical constructs outlined within self-determination theory were directly related to physical activity patterns and change over time, representing a novel theoretical contribution to the existing literature on youth physical activity.

The evidence summarised in the preceding section indicates that autonomy support, competence, relatedness, autonomy, and various forms of motivation are differentially related to young people's profiles of physical activity participation with further differences arising as a consequence of age and gender (Chapter 5). For instance, while active involvement in sport was related to positive motivational characteristics among girls, differences emerged for boys in respect to the type of sport performed with team sport participation associated with significantly more adaptive motivational outcomes than individual sport. Previous studies have found that adult sport participants demonstrate higher levels of self-determination and competence motivation than those engaged in fitness activities (e.g. aerobics, weightlifting), however comparisons among adolescents characterised by different patterns of physical activity have been lacking (Frederick & Ryan, 1993; Ryan et al., 1997).

The prospective longitudinal design implemented in the present study also facilitated an examination of changes in theoretical constructs outlined in self-determination theory and their association with adolescents' physical activity maintenance and behaviour change over twelve months. Many of the key constructs proposed in SDT were supported by the findings in Chapter 7 with changes in intrinsic motivation, identified regulation, introjected regulation, amotivation, autonomy and autonomy support associated with uptake of physical activity and dropout over time. Nonetheless, other aspects of self-determination theory were not supported, as competence, relatedness and external regulation were not related to physical activity change over twelve months. It is possible however, that relatedness and competence may play a more indirect role in physical activity by supporting autonomous motivation, which is consistent with the hypothesised pathways outlined in self-determination theory. Moreover, medium to large effects were evidenced for these constructs in explaining differences among adolescents' physical activity patterns at Time 1 (Chapter 5) indicating that psychological needs for competence and relatedness contribute to our understanding of variations in physical activity behaviour despite failing to explain transitions over time. In contrast, external regulation was the only component of self-determination theory that was unrelated to physical activity participation at each time point, which suggests that external rewards or pressures were of little relevance for volitional physical activity participation among youth in this study. The present findings reveal how changes in modifiable constructs such as intrinsic motivation, identified regulation, introjected regulation, autonomy and autonomy support are related to physical activity behaviour change. Given these findings interventions underpinned by self-determination theory could pay special attention to these issues. Moreover, the findings further highlight that these processes may vary in importance among male and female and younger and older adolescents, contributing to the literature on physical activity and theoretical underpinnings.

A critique of self-determination theory however, is that social-contextual factors have received less attention relative to other components of the theory (Wilson et al., 2008). Moreover, it has been argued that autonomy support represents a mere subset of supportive behaviours that underpin young people's physical activity (George et al., 2013). Therefore various peer and parental behaviours not explicitly outlined within self-determination theory were additionally explored in this thesis in respect to adolescents' physical activity and behaviour change. Decreased perceptions of support from mother and friend were significantly related to dropout over twelve months illustrating the importance of more instrumental types of support in facilitating continued youth participation in physical activity over time. It has been previously argued that perceptions of support from others may be interpreted as confirmation that others care about them, which satisfies feelings of relatedness and in turn helps individuals to enact their own autonomous motives for physical activity (Deci & Ryan, 2014; Sarason et al., 1990). In line with these postulations, prior research by George et al. (2013) found that greater perceptions of social support were associated with higher level of relatedness, in addition to competence and autonomy need satisfaction, which positively predicted perceptions of self-determination and physical activity intentions among a sample of undergraduate students.

These findings may be accounted for by relationships motivation theory, a mini-theory contained within self-determination theory, which posits that social interactions with others that support feelings of relatedness alongside

competence and relatedness promote high quality close relationships and greater psychological well-being (Deci & Ryan, 2014). To date, this sub-component of self-determination theory has received limited attention, however the findings underscore the need for future studies to place greater emphasis on interpersonal influences and consequently relationships motivation theory, to facilitate a more detailed insight into the way in which social processes influence teenagers' physical activity behaviours.

In addition to examining social factors, the present research also explored the role of body-related characteristics in physical activity behaviour. A limitation of self-determination is the lack of attention directed at such intrapersonal factors, despite prior research indicating that body image concerns are likely to have motivational consequences, and in turn, behavioural consequences. Accordingly, Markland and Ingledew (2007) found that body dissatisfaction resulting from a perceived discrepancy between current and ideal body shape undermined self-determined motivation for exercise among male and female adolescents. The present study, in addressing the multidimensional nature of body image, revealed that functional aspects of body image were positively related to uptake of physical activity and sustained participation, whilst lower levels underpinned dropout over twelve months among young people. Thus, valuing and investing in the functionality of the body in addition to evaluating it in a positive manner is related to positive physical activity outcomes over time. In addition to the direct association evidenced between functional body image and physical activity it is plausible to suggest that appreciation for what the body can do may indirectly impact behaviour change by fostering feelings of competence and self-determined motives representing challenge, interest and satisfaction inherent within the physical activity itself. Thus, while body image reflects an under-researched area in respect to motivation and physical activity behaviour, the findings suggest that incorporating functional body image measures within SDT could expand the framework in a meaningful way.

In turn it should be noted that some commonalities emerged in respect to the psychosocial factors that were associated with adolescents' patterns of physical activity involvement and transitions over time. Although the significance of these characteristics differed across gender and age-specific adolescent cohorts, self-determined and introjected motivation in addition to amotivation, autonomy, autonomy support, friend support, maternal support and functional body image aspects were associated with discrete patterns of physical activity as well as changes in physical activity over time, within the relevant adolescent cohort. In contrast, some factors were unique to understanding patterns of physical activity participation. Namely, peer acceptance, role modelling, aesthetic satisfaction, and aesthetic behavioural investment were unrelated to changes in physical activity over time but discriminated across profiles of physical activity participation with team sport participants by and large demonstrating more favourable outcomes relative to their less active counterparts. Other individual and psychological indices pertaining to external regulation, BMI, body dissatisfaction and aesthetic values however, were not significantly related to adolescents' physical activity patterns or change over time.

Overall, self-determination theory represented a useful perspective from which to assess the relationship between psychological processes and physical activity, in addition to facilitating identification of psychosocial

determinants associated with adoption of physical activity, dropout and continued participation. Moreover, the research highlighted specific theoretical components that should be targeted in interventions aimed at promoting physical activity participation across adolescence. However, given that no one theory can effectively capture all aspects relevant to physical activity, the findings offer support for integration of additional social and individual factors within the framework of SDT to enable a greater understanding of mechanisms of young people's physical activity behaviour change.

#### **8.4 Limitations**

The findings from the present research need to be considered in view of the limitations inherent with the methodological and statistical approaches adopted. First, despite the large sample sizes recruited, the study was restricted to secondary schools in predominantly urban regions across Dublin, and as such the findings regarding physical activity behaviour may not generalise to young people from less densely populated rural areas, where access to facilities and classes may be more limited. The majority of participants were also born to parents of Irish origin and white ethnicity, thus generalisability to other races and cultures cannot be assumed. In addition, while the sample was diverse in terms of maternal educational attainment of participating students, potential differences in socioeconomic factors were not examined. Findings from national and international research indicate that adolescents from higher social classes are more likely to meet recommended physical activity guidelines and participate in organised sport and physical activity than those from lower social classes (Bengoechea et al., 2010; Borraccino et al., 2009; Kalman et al., 2015; Santos et al., 2004). Thus, social class reflects an important demographic factor to consider in future research given its potential role in young people's physical activity patterns.

Another primary limitation of this research was that physical activity was evaluated using a self-report questionnaire that required adolescents to recall any physical activity they had performed over the past seven days. Subjective measures of physical activity have previously been criticised as they are susceptible to errors in memory recall, overestimation of physical activity levels and socially desirable responses (Sallis & Saelens, 2000; Sirard & Pate, 2001; Slootmaker et al., 2009; Welk et al., 2000). Moreover, young people may evaluate the intensity of a physical activity differently depending on their own level of physical fitness. In contrast, objective methods of physical activity facilitate a more reliable, accurate measure of young people's physical activity as they reduce the subjectivity inherent in survey methods (Reilly, Penpraze, Hislop, Davies, Grant et al., 2008; Trost et al., 2000). While the rate of error is low with objective instruments however, they are more time and cost intensive than self-report measures, and consequently may not represent a feasible option for evaluating physical activity when resources are limited (Dollman et al., 2009). Thus it is evident that no single measure of physical activity is suitable for all situations rather selection of the method of physical activity assessment is dependent on the research question being asked, age and number of participants, and available resources (Sallis & Owen, 1999). Furthermore, although the limitations of self-report methods of physical activity are acknowledged, previous studies offer support for the validation of self-report physical activity recall surveys against objective measures indicating that there is some level of comparability across these instruments (e.g. Pate et al., 2003). Nevertheless, it should be noted

that other studies that have used different measures of physical activity may yield different results. Efforts were undertaken however, to enhance comparability of findings across other studies comprising self-report physical activity measures through application of the Compendium of Physical Activity for Youth (Ridley et al., 2008), which facilitated estimation of energy costs associated with different adolescent physical activities.

The lack of validity and reliability data available on the PAR-7DD that was developed for the present study also represents another methodological limitation. While efforts were made to evaluate the survey to ensure that it was suitable for use among secondary school students, future studies are needed to assess the psychometric properties of this tool. For example, validation of the PAR-7DD could be achieved by supplementing this measure with additional objective physical activity assessments conducted on a random subsample of adolescent participants. In addition, adopting multiple simultaneous approaches of physical activity assessment would contribute to a more accurate and detailed description of youth physical activity behaviour (Dollman et al., 2009; Sallis & Saelens, 2000).

Self-report questionnaires were also used to assess predictors of physical activity thus it is possible that the observed associations between physical activity and psychosocial characteristics were inflated due to shared method variance, reflecting another potential limitation of the study (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Future research should guard against this by incorporating reports from parents, peers and coaches or physical activity leaders, which will also prove useful in determining whether adolescents' perceptions, and actions of significant others (e.g. supportive behaviours), are in accordance. Nonetheless it should be noted that all of the measures used within this research demonstrated good internal reliability including the teasing scale, which was modified for use within the present study.

In turn, while latent class analyses enabled variations in young people's physical activity patterns to be captured in Chapter 4 and Chapter 6, the limitations of this statistical approach must be acknowledged. Firstly, latent class analysis is a data-driven analytic technique, which means that profiles will be generated irrespective of whether or not meaningful classes of physical activity participation exist in the population under study. In addition, latent class analysis is exploratory in nature and while different measurement indices are available to guide selection of the optimal fitting model, there is no definitive test to facilitate identification of the 'true' number of latent classes (Nylund et al., 2007). The results presented in Chapter 5, based on data collection at Time 1 however, offer support for the validity of the latent physical activity classes. In accordance, profiles of adolescents' physical activity participation were readily discriminated on motivational, social and body-related characteristics indicating that there were meaningful differences among classes (Patnode et al., 2011). Replication of findings among additional samples of secondary school students would offer further support for the validity of these profiles. In the present thesis, latent class analysis was repeated at two time points twelve months apart, which revealed both similarities and inconsistencies in patterns of physical activity involvement over time. Although profiles of adolescents' physical activity participation were not exactly replicated over time, it is possible that the divergent latent classes of physical activity evidenced at each time point may be a



consequence of attrition or alternatively may reflect developmental changes in physical activity involvement during the teenage years. In support of the latter proposition, the results revealed that older adolescents' physical activity participation profiles were, for the most part, replicated at follow-up twelve months after baseline, which suggests that physical activity behaviours become more stable during mid-to-late adolescence. Nonetheless, a dearth of research has adopted a person-orientated approach to explore the nature and course of young people's physical activity patterns over time, therefore further validation of these profiles is required.

Another potential limitation pertains to the dichotomous categorisation of moderate-to-vigorous physical activity in which a threshold of 60 minutes per day achieved on a minimum of three days over the past week was applied in the present latent class analyses to distinguish active and low active adolescents. It is possible however, that different models of latent statuses would have resulted if a higher moderate-to-vigorous cut-point had been employed (Metzger, Catellier, Evenson, Treuth, Rosamond et al., 2008; Patnode et al., 2011). In addition, for some adolescents the probability of membership in a particular latent physical activity class was less than 100% indicating a degree of uncertainty in assigning individuals to their respective classes, which may have resulted in misclassification (McDonald, Hearst, Farbakhsh, Patnode, Forysth et al., 2012; Patnode et al., 2011).

An additional limitation pertains to the choice of statistical analyses implemented in Chapter 5, in which profiles of adolescents' physical activity participation were compared across a range of psychosocial factors using One-way Kruskal Wallis tests. It is important to note that this approach facilitated only a crude assessment of univariate relationships or correlates of sub-group membership. In contrast, if a more sophisticated multivariate approach such as Multinomial logistic regression had been employed, it would have been possible to identify the proportion of variance explained by a combination of multiple variables as opposed to exploring each factor separately. In addition, the relative importance of various psychosocial factors could have been examined, which was not possible using the current statistical technique. Nonetheless, Multinomial logistic regression was not feasible in the present study as sample size guidelines recommend a minimum of 10 cases per independent variable (Schwab, 2002), a criterion that was not met among some of the smaller gender-specific latent classes. It is recommended however, that future studies exploring the relation between psychosocial factors and discrete types of physical activity incorporate multivariate statistical approaches when possible, in an effort to advance the existing empirical literature base.

Following on from this, the way in which adolescents were categorised longitudinally into one of four physical activity trajectories reflecting maintained physical activity, dropout, continued non-participation or adoption of physical activity in Chapter 6 reflects another limitation of this research. Participants were allocated to a trajectory based on whether they were classified as a physical activity participant or non-participant at each time point, which was determined by identifying the latent class that they were assigned to at Time 1 and Time 2. However, this approach did not take account of the amount of physical activity undertaken and consequently individuals undertaking low levels of physical activity or those that had transitioned into a less active profile of physical activity participation from Time 1 to Time 2 were classified as physical activity maintainers

alongside those who continued to engage in active levels of moderate-to-vigorous physical activity at each time point. As such, the physical activity maintainer group reflected a diverse group of adolescents that demonstrated highly variable levels of activity. Previous studies that have adopted a similar approach in classifying adolescents into physical activity change trajectories over time have used stringent cut-offs at each time point to discriminate adolescents as active or inactive (e.g. Gillison et al., 2011; Zook et al, 2014). In the present study however, the method of categorising adolescents at Time 1 and Time 2 simply discriminated adolescents who participated in physical activity to any degree from those who did not. As such, it is possible that had a stricter threshold been used to define physical activity at each time point, individuals may have been assigned to different trajectory groups and consequently different findings would have resulted. It is therefore recommended that future studies examine high physical activity maintenance and low physical activity maintenance separately among young people to take account of the varied levels of physical activity undertaken and sustained across adolescence.

Furthermore, owing to the prospective longitudinal design implemented in the present research, it was not possible to draw causal conclusions regarding the direction of the relationship between psychosocial factors and physical activity changes over one year (Chapter 7). For example, decreased levels of friend and maternal support for physical activity may be a consequence of physical activity discontinuation as opposed to a cause of physical activity dropout. Further research implementing experimental longitudinal designs would enable examination of this issue in more detail. An additional avenue for future research would be to explore the psychosocial factors associated with uptake and dropout of various profiles of adolescents' physical activity participation over time, which would make a valuable contribution to the existing literature concerned with physical activity changes across adolescence.

Finally, owing to differences in adolescents' physical activity patterns, all analyses were stratified according to gender or age. A major shortcoming of this study however, is that both variables were not stratified simultaneously, which may have resulted in confounding effects. That is, analyses stratified by gender may have been confounded by age, and in a similar manner the analyses stratified by age may have been confounded by gender. For example, discrete sub-groups of physical activity participation were found for males and females however, it is possible that had age been accounted for the profiles may have differed. Thus, in order to fully understand disparities in physical activity, the confounding effects of age and gender must be considered. As such, it is recommended that multivariate analysis, which allows for adjustment of multiple variables simultaneously (Skelly, Dettori, & Brodt, 2012), be implemented in future studies to control for confounding demographic variables, which in turn will facilitate a deeper understanding of young people's physical activity patterns and trajectories.

### **8.5 Practice and Policy Implications**

The present findings have implications for those who work directly with young people in physical activity settings including physical education teachers, sport leaders and those who are involved in coordinating and providing sport and physical activity across school and community contexts. The empirical findings can also

be used to address a number of key objectives outlined by government bodies and national policies. For instance, a key goal of Healthy Ireland: A framework for improved health and well-being 2013-2025, is to promote the proportion of people who are healthy at all stages of life by increasing physical activity levels among specific subpopulations including primary and secondary school students. In addition, a core objective of the Irish Sports Council is to achieve lifelong engagement in sport and physical activity. The findings from this research may therefore be used to inform proactive health promotion interventions targeting declining levels of physical activity and encouraging uptake of physical activity and continued participation across adolescence.

The various profiles of physical activity participation that emerged at each time points also have relevance for policies addressing young people's physical activity levels within the areas of physical education, extra-school, and extra-curricular sport and physical activity. A consistent finding across adolescent cohorts in the present research was that team sport participation was associated with higher levels of moderate-to-vigorous physical activity suggesting that this pattern of activity should be promoted to enhance overall activity levels. However, adopting such a strategy subsequently neglects individuals who dislike group sports and competitive activities. Indeed, the results from Chapter 4 and Chapter 6 indicated that adolescents exhibit different patterns of participation in physical activity with preferences regarding type and level of activity differing by age and gender, while also varying over time. Thus, it is evident that a simple 'one size fits all' approach is not sufficient for promoting participation among teenagers and consequently interventions need to be tailored to reflect different subgroups of adolescents (Liu et al., 2013). A possible means of facilitating this is to provide adolescents access to a range of physical activities within the school and community settings. Whilst many chances exist for young people to take part in sport at an extracurricular or extraschool level, limited opportunities are available for participation in non-sport fitness orientated physical activity classes like spinning, circuits and aerobics. Thus, it is suggested that free or reduced cost exercise classes (e.g. Zumba, bootcamp) are offered within the community and school setting to enable teenagers who most likely cannot afford to join expensive gyms, the chance to avail of these facilities and services. In addition, non-organised physical activities such as walking, jogging and cycling could be fostered by increasing the ease with which such activities can be performed. This could be achieved for example, by developing walking and cycling friendly routes that can be easily and safely navigated among adolescents in addition to increasing necessary bike parking facilities (Woods et al., 2010). In addressing these considerations, a broader range of students' needs will be met and adolescents who dislike competitive sports may be able to identify enjoyable physical activity related alternatives that they can sustain throughout adolescence and adulthood (Woods et al., 2010). Moreover, in addition to establishing classes of physical activity behaviour that exists among secondary school students, the findings from Chapter 5 revealed the psychosocial characteristics which differentiated these participation profiles. This information in turn could be incorporated into existing physical activity programmes to enhance adherence outcomes among youth.

Furthermore, in Chapter 7, the findings revealed distinct characteristics related to physical activity dropout, uptake and sustained participation over twelve months, which further varied in terms of relative importance

across gender and age-specific cohorts. Collectively, the results highlighted the need to develop interventions that address changes in multiple psychosocial characteristics simultaneously, in addition to offering support for self-determination theory as a guiding framework. A number of strategies are subsequently recommended to target those at risk of physical activity dropout and to promote adoption of physical activity among non-participants. In accordance, efforts should be made to increase self-determined motivation by highlighting positive outcomes associated with physical activity such as enhanced fitness and health, in addition to providing activities that emphasise fun, enjoyment and skill development (Dwyer et al., 2006; Grieser, Vu, Bedimo-Rung, Neumark-Sztainer, Moody et al., 2006). In addition, perceptions of autonomy and autonomy support should be fostered to promote uptake of physical activity and sustained participation, which can be attained through provision of a range of activities from which adolescents can choose and structuring physical activity environments to facilitate decision-making opportunities (Edmunds et al., 2007; Lonsdale et al., 2013; Standage et al., 2005). These actions in turn can help adolescents to develop a sense of volition over their physical activity behaviours such that they feel as if they are behaving of their own accord. One possible means of facilitating this within schools is to allow student committees the opportunity to provide input into the design of physical activity and sport curriculums. Furthermore, interventions should include peer and parental based components which may prove particularly effective for preventing dropout among adolescents currently engaged in physical activity. To take account of the influence of friend support, strategies could be implemented that encourage adolescents to drop by with friends or involve adolescents undertaking activities with friends. In addition, an element designed to elicit parental support should be integrated within intervention efforts perhaps by informing parents directly via newsletter or social media about how they can help young people to be active. Finally, fostering an appreciation for what the body can do, by increasing personal values and investment in the body's functionality in addition to satisfaction with one's instrumentality should comprise a core component of physical activity interventions designed to promote participation among youth (Abbott & Barber, 2010). It is also important to determine who the intervention is aimed at as certain components can be excluded based on the gender and age of the target population. Thus, addressing these factors will likely improve the effectiveness and quality of physical activity intervention programmes offered and subsequent participation across adolescence.

## **8.6 Conclusions**

The present research offers important advances to the physical activity literature by furthering our understanding of the different patterns of physical activity in which adolescents engage, in addition to examining psychosocial characteristics associated with continued participation and physical activity change over twelve months. Although underpinned by self-determination theory, social and body-related characteristics were also explored to facilitate a more detailed investigation into young people's physical activity behaviour. This research offers a novel and more nuanced insight into the underlying type of activities that constitute overall patterns of physical activity among Irish adolescents by adopting a person-orientated approach to address the multidimensional nature of physical activity. Gender and age-specific differences in physical activity participation profiles emerged, which reflected variations in level and type of activity

performed. In addition, profiles of adolescents' participation were compared across a range of factors, with active involvement in team sport consistently associated with more adaptive psychosocial characteristics relative to other physical activity patterns. This research also addressed critical gaps in the literature by examining stability and changes in adolescents' physical activity patterns over one year and identifying psychosocial characteristics related to physical activity maintenance and behaviour change. The results indicated that in line with previous research a greater proportion of girls than boys and older than younger adolescents dropped out of physical activity over one year. Moreover, those characterised by a profile of team sport participation were least likely to discontinue physical activity twelve months after baseline. In addition, the findings underscore the importance of fostering self-determined motivation, autonomy, autonomy support, maternal and friend support, and functional aspects of body image for promoting youth physical activity and reducing physical activity decline, whilst further indicating gender and age-specific differences in the relative importance of these psychosocial characteristics for sustained participation over time. In turn, it is hoped that that the present study has revealed some fruitful avenues for future research and practice, which can contribute to reducing physical activity decline and promoting participation across adolescence.

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## Appendices

### Appendix A: Letter Granting Ethical Approval to Conduct the Study



COLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH | TRINITY COLLEGE DUBLIN  
Ollscoil Átha Cliath | The University of Dublin

31<sup>st</sup> March 2011

F.A.O. Margaret Lawler

#### School of Psychology Research Ethics Committee

Dear Margaret,

I am pleased to inform you that your application entitled "Physical activity transitions during adolescence" has been approved by the School of Psychology Research Ethics Committee.

Yours sincerely,

Dr. Tim Trimble  
Chair  
School of Psychology Research Ethics Committee

SCHOOL OF PSYCHOLOGY  
Aras an Phairsaigh  
Trinity College

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## Appendix B: School Recruitment Letter

Dear Principal,

My name is Margaret Lawler and I am a PhD student on the Child and Youth Research programme in the Children's Research Centre and School of Psychology, Trinity College Dublin. I'm currently conducting a research study investigating physical activity patterns among Irish adolescents and how these patterns change over time. In particular, we are interested in exploring the factors that influence young people's physical activity levels, including parental and peer influences, perceived level of competence, autonomy, motivation, and body image. This study has been awarded funding by the Irish Research Council for Humanities and Social Sciences.

The present research is warranted in light of recent findings, which indicate that physical activity levels diminish with increasing age across adolescence, particularly among girls. Longitudinal research suggests that the critical age point at which physical activity begins to diminish among boys and girls lies somewhere between the age of 12 and 14 years. However, there is a lack of information around why this drop out occurs. The current study therefore proposes to explore the factors that predict maintenance or drop out from physical activity among Irish adolescents.

In order to complete this research, we are hoping to ask secondary school students (1<sup>st</sup>- 5<sup>th</sup> years) to complete a questionnaire in class. The questionnaire will involve some simple questions about sport and exercise, the role of family and friends and young people's own feelings around motivation, autonomy, body image and perceptions of competence.

Students' height and weight will also be measured within the school, as this will provide essential information on the growth and development of young Irish people. In addition, it will enable examination of how young people's physical attributes influence physical activity behaviours. Each student will be weighed and their height measured in the most appropriate place within the school organised in consultation with you. A trained researcher will collect these measurements and individual results will remain completely confidential. The results obtained in this study will only be used at a group level. Only students whose parents have agreed will be invited by the researcher to take part in the study.

A summary of the findings of the study will be provided to all schools that take part following completion of the study. Youth friendly material (e.g. posters) will also be sent to the school to provide students with the results. I hope this study will be of interest to you and I would greatly appreciate if you would consider allowing this valuable research to be carried out within your school. If you have any questions or would like further details about any aspect of the research please contact me, Margaret Lawler, on +353 87 9042053 or by email at [lawlerma@tcd.ie](mailto:lawlerma@tcd.ie).

Thank you for your time and consideration in this matter,

All the best,  
Margaret Lawler  
Ph.D. Candidate  
Government of Ireland IRCHSS Postgraduate  
Scholar School of Psychology & Children's Research  
Centre Trinity College Dublin, Dublin 2

## Appendix C: Parent Information Sheet and Consent Form

### School Children and Physical Activity

#### Information Sheet for Parents

##### **What is the study about?**

The study aims to improve our understanding of physical activity behaviours among Irish youth. In addition, we are interested in exploring the factors that influence young people's physical activity behaviours over time. Children and adolescents will be asked to complete a questionnaire during the current school year and again 12 months later to determine whether any changes in physical activity patterns have taken place.

##### **Who are the study researchers?**

Margaret Lawler, a PhD student in Psychology and Dr Elizabeth Nixon, a lecturer in Developmental Psychology in Trinity College.

##### **What happens if I agree to my child taking part?**

We are asking parents for permission to invite their children to take part in our study. Children who return parental consent forms will be invited to take part in the study. They are free to decide whether they are happy to take part in the study or not.

We also request parents to provide basic family background details in order to give us a profile of the child's/adolescent's background – this means that young people will not be asked for any details on their families.

##### **What happens if my child agrees to take part?**

If a child or teenager decides to take part, he/she will be asked to fill out a questionnaire during class time that will assess their level of physical activity. The questionnaire will involve some questions about sport and exercise involvement, the influence of family and friends and what young people think about themselves and whether it may influence their physical activity patterns.

We would also like to measure students' height and weight within the school. Each student will be weighed and height will be measured in an appropriate room organised in consultation with the school. This is a simple procedure and involves using a height chart to measure the young person's height and weighing scales to measure the young person's weight. Young people will be asked to remove their shoes before stepping on the weighing scales. A trained researcher will collect these measurements. This information will be kept private and not shared with anyone else. The purpose of measuring young people's height and weight is to determine Irish adolescents' growth and development. In addition it will enable us to explore how young people's physical attributes influence physical activity behaviours. Your child is free to decide whether or not he/she wants to get his/her height and weight measured.

##### **What will happen to the information?**

All information will be stored, on a confidential basis, on a computer and used for the purpose of the research only. In addition all questionnaires will be coded, further protecting participants' identities. No child will be identified in anything that is published from the study.

We hope that the results of the study will make an important contribution to our understanding of children's physical activity behaviours and inform health and sport related policy decisions.

If you have any queries or require any further information please feel free to contact us:

Margaret Lawler on (01) 896 2902 or email: [lawlerma@tcd.ie](mailto:lawlerma@tcd.ie) or

Dr Elizabeth Nixon, on (01) 896 2867 or email: [enixon@tcd.ie](mailto:enixon@tcd.ie)

School Children and Physical Activity



**PARENTAL CONSENT FORM**

I confirm that I have read the information provided

I agree for my child to be invited to complete a questionnaire at school

I agree for my child's weight and height to be measured by a trained researcher

I agree for my child to take part in this study again next year (12 months time)

Child's Name.....

Child's Date of birth.....

Child's Age & Class Level.....

Parent's Name (Please Print).....

Parent's Signature.....

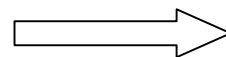
Date.....

Are you the child's: Mother  Father

If other, please specify.....

We would be very grateful if you could provide some general background information on the form overleaf

Please Turn Over



To avoid asking children about their own family backgrounds, we would be very grateful if you could fill in the details on your child's family below. This information is **confidential** and will **only** be used to build an overall profile of the study population and the overall family contexts of the children in the study. Individual answers will not be used under any circumstances. These answers will help us understand how different factors influence a child's life.

**Ethnic & Cultural Background**

Were you born in Ireland?

Yes  No

If No, in which country were you born? .....

Please indicate your race/ethnicity:

White  Mixed  Asian  Black  Chinese

Other (please specify) .....

**Socio-Demographic Information**

What is the highest level of education the child's mother or female guardian has completed to date?

Primary or less.....

Intermediate/ Group/ Junior Certificate or equivalent.....

Leaving Certificate or equivalent.....

Diploma/Certificate.....

Primary Degree.....

Postgraduate/Higher Degree.....

Professional Qualification.....

Other not listed (please specify).....

**Health and Development**

In order to obtain more information on children's growth and development in Ireland, could you please answer the following questions about your child's health and weight:

How tall is your child? .....feet.....inches OR .....centimetres

How much does your child weigh? .....pounds OR .....stone OR.....kg

**Thank you for your time  
Please return to school**



## Appendix D: Student Information Sheet and Consent Form



### School Children and Physical Activity Information Sheet for Children & Young People

#### Who are we?

I am a postgraduate student in Psychology and Dr Elizabeth Nixon is a lecturer in Psychology in Trinity College.

We are doing research to find out about children and young people's lives.

#### What do we want to find out?

We want to find out about the different types of physical activity that young people do every day. We are also interested in finding out how friends and family, and how you think about yourself, influence your involvement in physical activity. In addition, we are interested in looking at how physical activity levels change over time among teenagers. We are asking young people to complete a questionnaire during this school year and again in 12 months time to find out if teenagers' involvement in physical activity changes over a year.

#### What happens if you agree take part?

Your parent has already read our letter and sent back a form saying that we can ask you whether you would like to take part in our study. But this does not mean that you have to – you do not have to take part if you do not want to. Also if you decide that you do want to be part of the study and then you change your mind, that's okay!

If you decide to take part you will be asked to fill out a questionnaire at school. This will involve some questions about the types of physical activity you do and how often you do them. It will also have some questions about how your friends and family influence you and your own reasons for taking part or choosing not to participate in sport and exercise.

We would also like to measure your height and weight. This information will be kept private and will not be shared with anyone else. It is a very simple procedure and will take only take a few minutes to complete. A height chart will be used to measure your height and a weighing scales will be used to measure your weight. This will be carried out in a separate room or behind a screen so your classmates will not be watching you and no one will know your results. If you do not want to get your height and weight measured then that is okay you do not have to!

The information provided by you and other students may then be used to write a report about physical activity patterns among Irish teenagers. But don't worry we will not use your name as all information provided is private.

If you have any questions, you can telephone or email us:

Margaret Lawler – 01 896 2902, [lawlerma@tcd.ie](mailto:lawlerma@tcd.ie) or

Dr Elizabeth Nixon – 01 896 2867, [enixon@tcd.ie](mailto:enixon@tcd.ie)

Thank you very much for your time!!!



**School Children and Physical Activity**  
**Child/Young Person CONSENT FORM**

- I have read the information sheet
  
- I agree to complete a questionnaire at school
  
- I agree to get my weight and height measured
  
- I agree to take part in this study again next year  
(But If I decide I no longer want to take part next year I do not have to)
  
- I understand that I am free to withdraw from participation at any time

Student's Name [Printed].....

Age..... Date of Birth:.....

Student's signature.....

Date.....

If you want any more information please contact:

Margaret Lawler on (01) 896 2902 or email: [lawlerma@tcd.ie](mailto:lawlerma@tcd.ie)

Dr Elizabeth Nixon on (01) 896 2867 or email: [enixon@tcd.ie](mailto:enixon@tcd.ie)

School of Psychology, Aras an Phiarsaigh, Trinity College, Dublin 2

**Appendix E: Survey**

CODE NUMBER

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**Participation in Sport and Physical Activity among Teenagers in Ireland**



**School Year:** 1<sup>st</sup>  2<sup>nd</sup>  3<sup>rd</sup>  4<sup>th</sup>  5<sup>th</sup>  6<sup>th</sup>

**Age:**.....

**Date of Birth (Day/Month/Year):**.....

**Gender:**      **Male**       **Female**

We hope you will help us find out about young people's physical activity patterns by answering the questions in this survey. We are interested in hearing the views of all young people - those who take part in sport and physical activity and those who don't. This is NOT a test. No one will look at your answers apart from the survey team. Please be as honest as you can in your responses.

We are trying to find out more about the different physical activities that you did over the last 7 days.

Remember Physical activity includes:

Exercise: Aerobics, jogging, dancing, weight training.....

Sports: Hurling, football, athletics, swimming, soccer.....

**Please fill out the diary on the next page as best you can**

Each weekday is divided up into 3 sections to take account of any sport or exercise that you did BEFORE school, DURING school and AFTER school.

How to fill out the diary:

Tick "✓" YES or NO to indicate whether you did any sport or physical activity BEFORE school, DURING school or AFTER school on each day last week.

If you did not do any physical activity tick 'NO' and move down to the next day.

**If you did some physical activity tick 'YES' and**

1. Write down the physical activity that you did (example, soccer, Irish dancing)

2. Tick one box to describe the physical activity that you did. For example:

If you played sport (e.g. gaelic football) as part of a training session you would tick 'Training'

If you did a physical activity class or lesson (e.g. dance, martial arts) you would tick 'Class/Lesson'

If you had a match or a competitive event (e.g. cross-country race, soccer match) you would tick 'Match'

If you did not do this activity as part of a lesson, class, training or competitive match for example, you played football with friends at lunch time or went for a jog by yourself you would tick "unstructured".

3. Write down how many minutes you spent doing the activity (for example, 30 mins)

4. Tick one box that best describes how hard the activity felt (light, moderate, vigorous)

- **Light effort** - heart rate and breathing are normal. There is some movement and it feels easy. Golf is a good example.
- **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.

5. Write down who did the activity with you. For example, mum, dad, sister, brother, cousin, classmates, friends, team mates, coach or by yourself.

\* Remember: When filling out the diary only include walking that you did for the purpose of exercise (e.g. speed walking). Do not include time spent walking between classes or hanging around with friends.

Think back over the last 7 days

Day	NO	YES	Physical Activity	Type of activity	Minutes in Activity	Effort			Who did you do this activity with?
						Light	Mod	Vig	
Monday BEFORE school			.....	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	.....				.....
Monday DURING school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
Monday AFTER school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
Tuesday BEFORE school			.....	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	.....				.....
Tuesday DURING school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
Tuesday AFTER school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
Wednesday BEFORE school			.....	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	.....				.....
Wednesday DURING school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2

Day	NO	YES	Physical Activity	Type of activity	Minutes in Activity	Effort			Who did you do this activity with?
						Light	Mod	Vig	
Wednesday AFTER school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1 .....
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2 .....
Thursday BEFORE school			.....	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	.....				.....
Thursday DURING school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1 .....
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2 .....
Thursday AFTER school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1 .....
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2 .....
Friday BEFORE school			.....	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	.....				.....
Friday DURING School			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1 .....
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2 .....
Friday AFTER school			1 .....	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1 .....
			2 .....	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2 .....

Now think back over last weekend

Day	NO	YES	Physical Activity	Type of activity	Minutes in Activity	Effort			Who did you do this activity with?
						Light	Mod	Vig	
Saturday			1	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
			3	3. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	3	3			3
Sunday			1	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1	1			1
			2	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2	2			2
			3	3. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	3	3			3

*Physical activity clubs, teams and classes*

Do you play on any sport or physical activity teams in school? Yes  No  **If yes**, please state the school teams that you are on (e.g. soccer, cross-country running):

.....

Are you a member of any sport or physical activity clubs? Yes  No  **If yes**, please state the club teams that you belong to (e.g. swimming, hurling):

.....

Do you currently attend any physical activity classes (e.g. Irish dancing, aerobics)? Yes  No  **If yes**, please state the physical activity classes that go to:

.....

Please take your time to read each question carefully and pick the answer that is true for you.

Do not spend too much time on any one question. If anything is not clear please ask for an explanation.

For most questions you will be asked to circle the response that best fits your answer as shown in the example below.

**Example:**

How strongly do you agree with the following statement?

I enjoy playing sports

Strongly disagree

Disagree

Agree

Strongly agree

If it is difficult to choose just one answer, please think about what is true most of the time.

**Section 2: You and your friends**

Now we are going to ask you some questions about how your friends and classmates influence your involvement in physical activities.

**During a typical week how often:**

1. Do you **encourage your friends** to do physical activities or play sports?

Not at all

Once a week

Some days

Almost every day

Every day

2. Do your **friends do physical activities or play sports themselves?**

Not at all

Once a week

Some days

Almost every day

Every day

3. Do your **friends encourage you** to do physical activities or play sports?

Not at all

Once a week

Some days

Almost every day

Every day

4. Do your friends do physical activities or play sports **with you?**

Not at all

Once a week

Some days

Almost every day

Every day

5. Do friends **tell you** that you are doing well in physical activities or sports?

Not at all

Once a week

Some days

Almost every day

Every day



**Section 3.** Now we are going to ask you some questions to find out more about you.  
 Each question below describes two different types of teenagers.  
 Read each statement and draw a circle around the teenager that sounds most like you.  
 Then tick "✓" one box to indicate whether the statement is *sort of true* or *really true* for you.

Remember all teenagers are different and there are no right or wrong answers

<b>Example:</b>			Sort of True for me	Really True for me
Some teenagers would rather play outdoors in their spare time	<b>BUT</b>	Other teenagers would rather watch TV	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Q1. Some teenagers find it hard to make friends	<b>BUT</b>	For other teenagers it's pretty easy	<input type="checkbox"/>	<input type="checkbox"/>
Q2. Some teenagers do very well at all kinds of sports	<b>BUT</b>	Other teenagers don't feel that they are very good when it comes to sports	<input type="checkbox"/>	<input type="checkbox"/>
Q3. Some teenagers have a lot of friends	<b>BUT</b>	Other teenagers don't have very many friends	<input type="checkbox"/>	<input type="checkbox"/>
Q4. Some teenagers think they could do well at just about any new athletic activity	<b>BUT</b>	Other teenagers are afraid they might not do well at a new athletic activity	<input type="checkbox"/>	<input type="checkbox"/>
Q5. Some teenagers are kind of hard to like	<b>BUT</b>	Other teenagers are really easy to like	<input type="checkbox"/>	<input type="checkbox"/>
Q6. Some teenagers do not feel that they are very athletic	<b>BUT</b>	Other teenagers feel that they <u>are</u> very athletic	<input type="checkbox"/>	<input type="checkbox"/>
Q7. Some teenagers are popular with others their age	<b>BUT</b>	Other teenagers are not very popular	<input type="checkbox"/>	<input type="checkbox"/>
Q8. Some teenagers feel that they are better than others their age at sports	<b>BUT</b>	Other teenagers don't feel they can play as well	<input type="checkbox"/>	<input type="checkbox"/>
Q9. Some teenagers feel that they are socially accepted	<b>BUT</b>	Other teenagers wished that more people their age accepted them	<input type="checkbox"/>	<input type="checkbox"/>
Q10. Some teenagers don't do well at new outdoor games	<b>BUT</b>	Other teenagers are good at new outdoor games right away	<input type="checkbox"/>	<input type="checkbox"/>

**Section 4. Now we are going to ask you some questions to find out if you have ever been teased during sports and exercise.** Circle the answer that is most true for you. If your answer is different from *Never* - please indicate who made the comments or teased you. Choose as many people as you wish.

**When you are playing sport or doing physical activity:**

1. Have people made fun of you or laughed at you because of how you look?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

2. Have people made fun of you for not being good at physical activity or sport?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

3. Have people called you names that referred to your size or weight?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

4. Have people laughed at you or made fun of you for not being fit enough?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

5. Have people made fun of you or laughed at you for being uncoordinated (clumsy)?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

6. Have people laughed at you because you are not fast enough?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

7. Have you felt that people are staring at you because of how you look?

*Never*                      *Rarely*                      *Sometimes*                      *Often*                      *Very Often*

Who? Other girls  Other boys  Family members  Coach/instructor  Teammates

**Section 5. Now we are going to ask you some questions to find out the reasons why you do or do not take part in physical activities and sport. Circle the answer that describes you best**

1. I do physical activities/sport because other people say I should

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

2. I feel guilty when I don't do physical activities/sport

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

3. I value the benefits of physical activity/sport (for example, being fit and healthy)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

4. I feel under pressure from my friends/family to take part in physical activities/sport

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

5. I do physical activity/sport because it is consistent (fits in) with my life goals

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

6. I do physical activity/sport because it is fun

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

7. I don't see why I should have to do physical activities/sport

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

8. I take part in physical activities/sport because my friends or family say I should

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

9. It's important to me to do physical activities/sport regularly

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

10. I feel ashamed when I miss a physical activity/sport session

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

11. I consider physical activity/sport to be part of who I am

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

12. I can't see why I should bother doing physical activities/sport

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

13. I enjoy my physical activity/sport sessions

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

14. I do physical activities/sport because if I don't others will not be pleased with me

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

15. I feel like a failure when I haven't done any physical activities/sport in a while

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

16. I think it's important to make the effort to do physical activity/sport regularly

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

17. I consider physical activity/sport an important part of who I am

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

18. I find physical activity/sport a pleasurable (enjoyable) activity

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

19. I don't see the point in doing physical activities/sport

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

20. I get restless if I don't do physical activities /sport regularly

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

21. I get pleasure and satisfaction from participating in physical activities/sport

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

22. I consider physical activity/sport to be consistent (fit in) with my values

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

23. I think that physical activities/sport is a waste of time

Not true for me Rarely true for me Sometimes true for me Often true for me Very true for me

**Section 6.** Now we want you to think about how you feel when you are doing physical activity or sport. Tick "✓" the answer that is most true for you

<u>When I am physically active:</u>	Disagree a lot	Disagree a bit	Don't disagree or agree	Agree a bit	Agree a lot
a. I feel bored					
b. I dislike it					
c. It's no fun at all					
d. It makes me depressed (sad, unhappy)					
e. It frustrates (annoys) me					
f. It's not at all interesting					
g. I feel as though I would rather be doing something else					

**Section 7.** Think about how you feel when you are doing physical activity with others. When answering each question:

- Think about your teammates if you play sport
- Think about the other members of your class if you take part in physical activity lessons or classes (example dance, judo etc)
- Think about the other students in your PE class if you do not take part in any sport or physical activities

**With the other members of my team, the other members of my physical activity class or the other students in my PE class:**

	Disagree a lot	Disagree a little	Don't disagree or agree	Agree a little	Agree a lot
a. I feel supported					
b. I feel understood					
c. I feel listened to					
d. I feel valued (appreciated)					
e. I feel safe					

**Section 8: Think about how you feel when it comes to taking part in physical activities and sport. If you do not take part in any sports or physical activities in your spare time, think about your PE class.**

1. I feel I participate in sport and physical activities willingly (because I want to)

Not true at all      Rarely true      Sometimes true      Often true      Very true

2. I choose whether or not to participate in sports and physical activities according to my own free will

Not true at all      Rarely true      Sometimes true      Often true      Very true

**In the sports and physical activities that I do:**

3. I get opportunities to make choices

Not true at all      Rarely true      Sometimes true      Often true      Very true

4. I have a say in how things are done

Not true at all      Rarely true      Sometimes true      Often true      Very true

5. I feel I am pursuing goals that are my own

Not true at all      Rarely true      Sometimes true      Often true      Very true

6. I feel that I am being forced to do things that I don't want to do.

Not true at all      Rarely true      Sometimes true      Often true      Very true

7. I can take part in the decision-making process

Not true at all      Rarely true      Sometimes true      Often true      Very true

8. I really have a sense of wanting to be there

Not true at all      Rarely true      Sometimes true      Often true      Very true

9. I feel I am doing what I want to be doing

Not true at all      Rarely true      Sometimes true      Often true      Very true

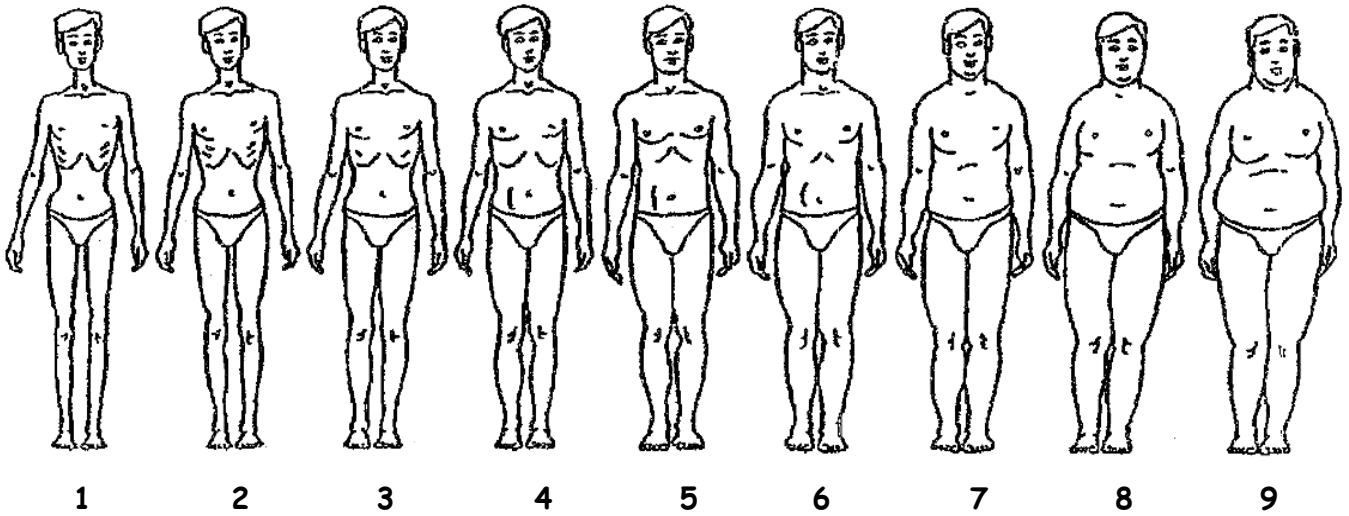
10. I get opportunities to make decisions

Not true at all      Rarely true      Sometimes true      Often true      Very true

**Section 9.1 is to be completed by BOYS ONLY. Girls skip to Q9.2**

**9.1 BOYS ONLY:** For the next 2 questions you must look at the pictures below.

Each boy has a number below him. Use the numbers to help you answer the next 2 questions.

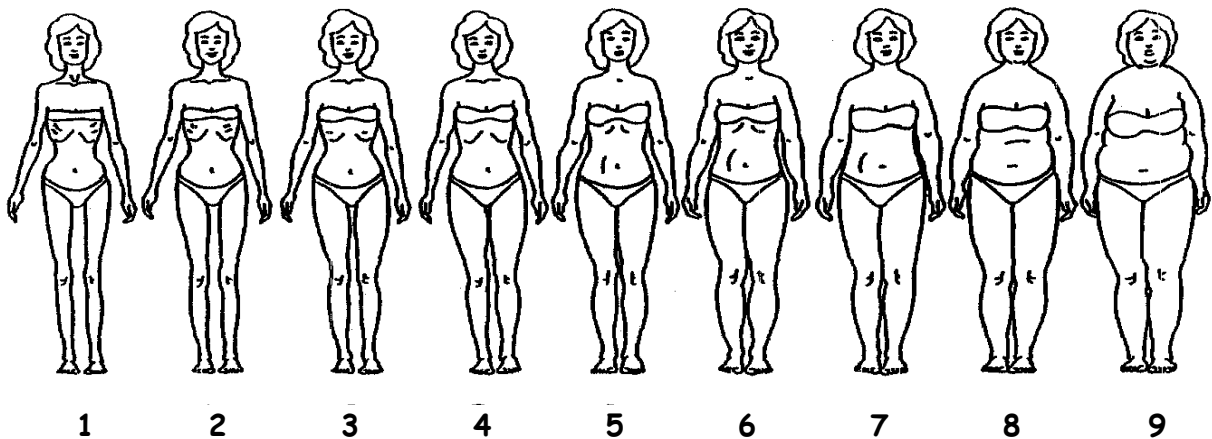


Put a ✓ in the box that is most true for you	1	2	3	4	5	6	7	8	9
Which picture looks the most like you?									
Which picture would you most like to look like?									

**Section 9.2 is to be completed by GIRLS ONLY - Boys please turn over the page**

**9.2 GIRLS ONLY:** For the next 2 questions you must look at the pictures below.

Each girl has a number below her. Use the numbers to help you answer the next 2 questions.



Put a ✓ in the box that is most true for you	1	2	3	4	5	6	7	8	9
Which picture looks the most like you?									



## Section 10: You and your family

Now we are going to ask you some questions about how your parents influence your involvement in sport and physical activities. For each question, circle the answer that best describes your mum and then circle the answer that best describes your dad. If your mum or your dad are not around then please circle n/a.

During a typical week how often has your MUM and DAD:

1. Encouraged you to do physical activities or play sports?

Mum: Not at all    Once a week    Some days    Almost every day    Every day    n/a

Dad: Not at all    Once a week    Some days    Almost every day    Every day    n/a

2. Done a physical activity or played sports with you?

Mum: Not at all    Once a week    Some days    Almost every day    Every day    n/a

Dad: Not at all    Once a week    Some days    Almost every day    Every day    n/a

3. Provided transportation to a place where you can do physical activities or play sports?

Mum: Not at all    Once a week    Some days    Almost every day    Every day    n/a

Dad: Not at all    Once a week    Some days    Almost every day    Every day    n/a

4. Watched you participate in physical activities or sports?

Mum: Not at all    Once a week    Some days    Almost every day    Every day    n/a

Dad: Not at all    Once a week    Some days    Almost every day    Every day    n/a

5. Told you that you are doing well in physical activities or sports?

Mum: Not at all    Once a week    Some days    Almost every day    Every day    n/a

Dad: Not at all    Once a week    Some days    Almost every day    Every day    n/a

6. Done physical activities themselves or with friends, like going for long walks or playing sports?

Mum: Not at all    Once a week    Some days    Almost every day    Every day    n/a

Dad: Not at all    Once a week    Some days    Almost every day    Every day    n/a



For each question below, circle the answer that best describes your parents

a. My mum or dad push me to sign up for sports or physical activity lessons that I'm not sure I want to do

Strongly disagree      Disagree      Agree      Strongly agree

b. My mum or dad get upset when I don't do as well as they would like me to in sports and physical activities

Strongly disagree      Disagree      Agree      Strongly agree

c. When it comes to sport and physical activities, my mum or dad expect too much from me

Strongly disagree      Disagree      Agree      Strongly agree

d. My mum or dad sign me up for sport or physical activity lessons without asking me if it's okay.

Strongly disagree      Disagree      Agree      Strongly agree

e. My mum or dad want me to be in too many sports or physical activities

Strongly disagree      Disagree      Agree      Strongly agree

f. My mum or dad might be mad at me if I don't sign up for certain sports or physical activity lessons

Strongly disagree      Disagree      Agree      Strongly agree

g. My mum or dad only pay attention to some of my sports or physical activities

Strongly disagree      Disagree      Agree      Strongly agree

h. My mum or dad would be upset if I dropped out of a sport or physical activity

Strongly disagree      Disagree      Agree      Strongly agree

i. When it comes to sport or physical activities, my mum or dad think that the most important thing is that I have fun

Strongly disagree      Disagree      Agree      Strongly agree

j. My mum or dad want me to spend too much time in sports and physical activities outside of school.

Strongly disagree      Disagree      Agree      Strongly agree

## Section 11. Body Image and Physical Activity

Now we are going to ask you a few questions about your involvement in physical activity and your feelings toward your body and the way you look.

Circle the answer that is most true for you

1. How good I feel about my body depends a lot on how I look

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

2. I do physically active things often (example, sports, jogging, exercise)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

3. How good I feel about my body depends a lot on whether people consider me good looking

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

4. I always try to physically challenge (push) myself during physical activities

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

5. I feel really good about the way I look

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

6. I participate in physical activities whenever I can (example, sports, exercise)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

7. One of the most important reasons why people should take care of their bodies is so they can look good

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

8. Overall I am very satisfied with my physical abilities (skills, fitness)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

9. I wear certain things to make myself look as attractive as I can

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

10. How good I feel about my body depends a lot on what my body can do physically  
(example, my strength, speed, fitness)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

11. I always try to look the best I can

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

12. I feel really good about what I can do physically (example, my strength, my fitness...)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

13. I am very happy with the appearance of my body

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

14. One of the most important reasons why people should take care of their bodies is so  
they can be physically active (for example, play sports, exercise)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

15. Overall I am very satisfied with my appearance

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

16. I am very happy with my performance in physical activities

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

17. One of the most important reasons why people should take care of their bodies is so  
they can feel good about their physical abilities (for example, being fit, strong, fast)

Not true for me   Rarely true for me   Sometimes true for me   Often true for me   Very true for me

**Section 12. The next few questions are all about your experiences with your coach or instructor in sport or physical activities. When answering each question:**

- Think about your coach or mentor if you play sports
- Think about your instructor or leader if you take part in physical activity lessons
- Think about your PE teacher if you do not take part in any sport or physical activities

**1. I feel that my coach/instructor/PE teacher provides me choices and options**

Disagree a lot    Disagree a little    Neither agree or disagree    Agree a little    Agree a lot

2. I feel understood by my coach/instructor/PE teacher

Disagree a lot    Disagree a little    Neither agree or disagree    Agree a little    Agree a lot

**3. My coach/instructor/PE teacher expresses confidence in my ability to do well at sport and physical activities**

Disagree a lot    Disagree a little    Neither agree or disagree    Agree a little    Agree a lot

4. My coach/instructor/PE teacher encourages me to ask questions.

Disagree a lot    Disagree a little    Neither agree or disagree    Agree a little    Agree a lot

**5. My coach/instructor/PE teacher listens to how I would like to do things**

Disagree a lot    Disagree a little    Neither agree or disagree    Agree a little    Agree a lot

6. My coach/instructor/PE teacher tries to understand how I see things before suggesting a new way to do things.

Disagree a lot    Disagree a little    Neither agree or disagree    Agree a little    Agree a lot

**You have reached the end of the survey**

**Thank you for taking part!**

## Appendix F: Physical Activity Index Card



- BEFORE School
- DURING School
- AFTER School



**Physical Activity includes:**

- **Exercise:** yoga, walking, dancing, weight-training.....
- **Sport:** Soccer, swimming, athletics, hurling, rugby..... kayaking, rollerblading, cycling, rounders, handball, tennis, badminton, gaelic football, judo, horse-riding, golf, gymnastics

**Did you do the activity as part of...?**

- **A class or lesson** (e.g. PE, dance, judo...)
- **A training session** (e.g. club training)
- **A match or competition**
- **Unstructured activity** (e.g. fast walk, football kick about in park)

**Light (easy)**  
Heart rate & breathing are normal

**Moderate (medium)**  
Heart rate & breathing are faster than normal - may sweat a little

**Vigorous (hard)**  
Heart rate much faster, have to breathe deeper & faster - will probably sweat

Classmates, mum, dad, sister, coach, friends, brother, did it by myself, teammates

Day	NO	YES	Name of Activity/Sport	Type of activity	Minutes in Activity	Effort			Who did you do this activity with?
						Light	Mod	Vig	
Monday <b>BEFORE</b> school		✓	Walked to school	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input checked="" type="radio"/>	20mins	✓			Sister
Monday <b>DURING</b> School		✓	1. Played football at lunch	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input checked="" type="radio"/>	1. 30mins	1		✓	1. Friends
			2. PE (basketball)	2. Class/Lesson <input checked="" type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2. 80mins	2		✓	2. Classmates
Monday <b>AFTER</b> School		✓	1. Walked home	1. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input checked="" type="radio"/>	1. 20mins	✓			1. Sister
			2. Hip Hop Dance class	2. Class/Lesson <input checked="" type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	2. 60mins	2		✓	2. Friends
Tuesday <b>BEFORE</b> school	✓			Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>					
Tuesday <b>DURING</b> School		✓	1. Gaelic Football Match	Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input checked="" type="radio"/> Unstructured <input type="radio"/>	70mins	1		✓	1. Teammates
Tuesday <b>AFTER</b> School		✓	1. Soccer Training	1. Class/Lesson <input type="radio"/> Training <input checked="" type="radio"/> Match <input type="radio"/> Unstructured <input type="radio"/>	1. 60mins	1		✓	1. Teammates & coach
			2. Speed walk	2. Class/Lesson <input type="radio"/> Training <input type="radio"/> Match <input type="radio"/> Unstructured <input checked="" type="radio"/>	2. 20mins	2		✓	2. Mum

## Appendix G: Debriefing Card



### School Children and Physical Activity

#### DEBRIEFING FORM

#### Thank you for your help!

Many thanks for giving us your time to participate in this study. Remember that the information you have shared is confidential and will be used only for the purpose of this research. All identifying details will be changed to protect your anonymity.

In the event that your participation has caused you upset or worry about something, please contact the psychological support services for young people listed below:

#### *Support Groups*

##### **Bodywhys**

Provides help, support and understanding for people with eating disorders

(Helpline: Mon and Wed 7.30pm – 9.30pm, Tues and Fri 12.30pm – 2.30pm Thurs 10.00am – 12.00pm)

Tel: 1890-200-444

Web: [www.bodywhys.ie](http://www.bodywhys.ie) Email: [info@bodywhys.ie](mailto:info@bodywhys.ie)

##### **Aware**

Provides information and support to people who experience depression

Helpline (10.00am – 10.00pm, 7 days) Tel: 1890-303-302

Web: [aware@iol.ie](mailto:aware@iol.ie) Email: [www.aware.ie](http://www.aware.ie)

#### **Useful Websites and numbers:**

**Spunout** - Irish youth website covering all aspects of health and lifestyle. See [www.spunout.ie](http://www.spunout.ie) for more information

**Mental Health Ireland** -The Mental Health Ireland site provides information about mental health and illnesses services and lots more. [www.mentalhealthireland.ie](http://www.mentalhealthireland.ie)

**Bullying at school** - Don't suffer in silence

See [www.education.gov.uk/popularquestions/schools/Attendanceanddiscipline/bullying](http://www.education.gov.uk/popularquestions/schools/Attendanceanddiscipline/bullying) for ideas for helping to tackle bullying

##### **Childline**

Available to call at any time, you can talk about anything and the call is free.

Tel: 1800 666 666

See [www.childline.ie](http://www.childline.ie) for information on one-to-one web and text services.

If you require further information about the research, please contact: Margaret Lawler on (01) 896 2902 or email: [lawlerma@tcd.ie](mailto:lawlerma@tcd.ie) Dr Elizabeth Nixon on (01) 896 2867 or email: [enixon@tcd.ie](mailto:enixon@tcd.ie)  
School of Psychology, Aras an Phiarsaigh, Trinity College, Dublin 2

## **Appendix H: Height and weight protocol for the main study**

### **Height and weight protocol for Phase 2 Weight**

- Instruct child to remove any excess clothing e.g. overcoats etc
- Remove shoes
- Empty pockets containing keys, money, coins etc
- Remove any heavy jewellery
- Instruct pt to stand on scales free of any objects and walls etc
- Ask the child to stand still with both feet in the center of the platform
- Record weight to one decimal point in kg

### **Height**

- Wipe head part of the measure with alcohol wipes between pts.
- Remove shoes
- Hairstyles should allow height measure to fit comfortably on head
- Stand with heels together against the heel backstop, hands at sides. Feet should be flat on the floor with weight evenly distributed. The buttocks, upperback and shoulder blades should touch the upright Stand as tall as possible unsupported and clear of any furniture
- Position head in Frankfurt Plane position (pts head should be parallel to the ground, eyes look straight ahead)
- Ask the child to take a deep breath in and maintain his/her position, stretch up as far as possible, keep heels on ground
- Lower the headpiece until it firmly touches the crown of the head and is at a right angle with the measurement surface (Ask child: Is this height measure comfortable against your head?).
- Check to ensure that the lower body stays in the proper position and the heels remain flat Record height in cms to one decimal point
- Repeat to check accuracy (“That’s great, thank you”)
- Make a notation if the measurement is comprised due to hair accessories/ hairstyle.
- Make a notation if the child has an abnormal condition that may interfere with measurement.
- If the difference between the 2 measurements is greater than 1cm then take the measurement again
- If the difference is less than 1 cm then get the mean of the 2 measures