Predicting Physical Activity in Young Adult University Students: The Role of Social-cognitive and Affective Correlates

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Summary

Declining or insufficient physical activity is frequently reported among young adults, particularly among university students. Because behaviour patterns established during this period often continues into adulthood, affecting later healh outcomes, understanding the determinants of physical activity participation in young adult university students could assist in developing targeted interventions aimed at increasing physical activity participation in this demographic. This thesis presents five empirical studies that investigate the prediction of physical activity behaviour in young adult university students, using social-cognitive and affective predictors, based upon the theory of planned behaviour, social-cognitive theory and previous research.

A three wave longitudinal study of physical activity and predictors in first year university students is discussed in Chapter 2. The majority of participants were found to be sufficiently active, and physical activity participation remained stable throughout the year, contrasting with previous research. Past behaviour, theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control and intentions), self-efficacy, social support, and positive affect emerged as important predictors, with each significantly predicting differences in physical activity behaviour between individuals, but not changes over time. The time one, cross-sectional data from this same sample is the focus of chapters 3 and 4.

In Chapter 3, the moderating roles of past behaviour, self-efficacy, social support, and positive affect on the intention-behaviour gap is explored. In this study each of these predictors was found to significantly assist the translation of intent into behaviour. In Chapter 4, the roles of past behaviour, self-efficacy and social support are further examined in an extension of the theory of planned behaviour model. The addition of past behaviour, self-efficacy and social support explain additional

variance in intentions and physical activity. Past behaviour and self-efficacy each predict both intentions and physical activity, after controlling for theory of planned behaviour constructs and social support, supporting their inclusion in the augmented model. Attitudes remain a significant predictor of intentions after including past behaviour, self-efficacy and social support, highlighting their strength as a predictor of intentions.

In a new cross-sectional sample of young adult university students examined in Chapter 5, the roles of attitudes, intentions, self-efficacy and social support are examined. The results highlight intentions as the mediator between each predictor (attitudes, self-efficacy, and social support) and physical activity, suggesting that social support can counteract the deficits associated with low self-efficacy.

Finally, in Chapter 6, the respective roles of implicit and explicit attitudes in the prediction of intentions and physical activity is examined in a third cross-sectional sample of young adult university students. Implicit attitudes are shown to predict physical activity indirectly through both explicit attitudes and intentions in a causal chain.

Collectively these studies suggest that Australian young adult university students are typically more active than cohorts studied elsewhere. The findings underscore the importance of attitudes, past behaviour, self-efficacy, social support, and positive affect in the prediction of physical activity behaviour in young adult university students, and present several mechanisms by which these factors contribute to physical activity. These findings provide valuable insights into intervention techniques which have the potential to influence physical activity behaviour in young adults studying at university, and therefore impact future adult activity levels and health.

Declaration

"I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text."

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Rosemary Walsh

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Statement of Co-authorship

Chapters 2, 3, 5 and 6 of this thesis are presented in manuscript form, of which, Chapter 5 and 6 have been submitted for review in peer-review journals. I am the primary author of all these manuscripts; the co-authors include members of my supervisory committee. I took the lead in conceiving and designing each study, analysing and interpreting the results, and writing the manuscripts, with input and guidance from Eva Kemps. Carlene Wilson and Ivanka Prichard, also provided contribution and direction for Chapters 2, 3 and 4. Following is a list of the bibliographic details of each chapter, including a list of co-authors.

Chapter 2

Walsh, R., Kemps, E., Wilson, C., & Prichard, I. Longitudinal tracking of physical activity and correlates in first year university students.

Chapter 3

Walsh, R., Kemps, E., Wilson, C., & Prichard, I. The contribution of past behaviour, self-efficacy, social support, and positive affect to the intention-behaviour gap for physical activity in young adult university students.

Chapter 5

Walsh, R., & Kemps, E. Attitudes, intentions, self-efficacy and social support: Relationships and influential pathways relating to physical activity in young adults. *Manuscript under review, submitted August 2016 to Journal of Sport and Exercise Psychology.*

Chapter 6

Walsh, R., & Kemps, E. Implicit and explicit attitudes towards physical activity in first year university students. *Manuscript under review, submitted August 2016 to Journal of Health Psychology.*

CHAPTER 1: Physical Activity Behaviour in Young Adult University Students: Associated Correlates and Theoretical Predictions

1.1 Introduction

Physical activity is well established as a key component of a healthy lifestyle (Scarmeas et al., 2009; Sherwood & Jeffery, 2000; Zunft et al., 1999). However, physical activity participation is often inadequate, and as a result individuals do not receive the numerous physical and psychological benefits associated with being physically active (Plotnikoff, Costigan, Karunamuni, & Lubans, 2013; Rhodes & Kates, 2015; Sherwood & Jeffery, 2000; Treiber et al., 1991; Wallace, Buckworth, Kirby, & Sherman, 2000). Specifically, regular physical activity has been reported to reduce and manage disease, such as cardiovascular disease and type 2 diabetes; build strong bones, muscles and joints; manage weight; and reduce the risk of some cancers (Brown, Bauman, Bull, & Burton, 2012; Leslie et al., 1999; Sherwood & Jeffery, 2000). In addition to the physical benefits, regular physical activity is also known to have positive effects on psychological factors, such as mood, self-esteem, confidence, as well as reducing stress (Brown et al., 2012; Ekkekakis, Hargreaves, & Parfitt, 2013; Rhodes & Kates, 2015; Sherwood & Jeffery, 2000). Due to the positive health benefits associated with physical activity, and the notable inactivity commonly reported, further understanding of physical activity behaviour could have significant implications for health outcomes.

Physical activity is a dynamic behaviour that changes over time, with longitudinal and cross-sectional research noting declines across the lifespan (Brown et al., 2012; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008; Wallace et al., 2000). The steepest declines are typically reported between adolescence and young adulthood, with very few individuals meeting the recommended physical activity guidelines, and less than half of adults aged 18 to 25 successfully maintaining an active lifestyle after their secondary education (Lewis et al., 1997; Nelson et al., 2008; Wallace et al., 2000). The years spanning from the late teens through to the twenties are characterised by profound change and the exploration of self-identity and life directions (Arnett, 2000; Nelson et al., 2008). This period may be critical for the adoption of regular physical activity patterns because these ‘emerging adults’ are establishing their independence, health habits and beliefs during this time (Arnett, 2000; Nelson et al., 2008; Wallace et al., 2000). Behaviour adopted during this period is likely to have a long-term impact on future behavioural patterns and health outcomes, and therefore this cohort may be of particular importance for addressing the establishment of regular physical activity behaviour.

The transition from adolescence to young adulthood requires adjustment to the many changes to established environments resulting from the introduction of new educational, occupational, social and living settings during this period (Bray & Born, 2004; Nelson et al., 2008). These changes can result in disruptions to previous physical activity patterns established during childhood and early adolescence, and may present additional barriers to maintaining or adopting regular physical activity (Bray & Born, 2004; Nelson et al., 2008). One change that commonly occurs during young adulthood is the transition from high school to university, and research has noted fluctuations and declines in physical activity during this transition (Bray & Born, 2004; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003; Irwin, 2004; Jung, Bray, & Ginis, 2008; Wallace et al., 2000). Further to this, it is commonly reported that university students do not meet the recommended amount of physical activity, and participation is unlikely to spontaneously improve due to physical activity rates typically declining with age (Nelson et al., 2008; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008; Wallace et al., 2000).

Several studies of university students in the United States (US) that have examined physical activity behaviour have concluded that large percentages of students were not active, or that physical activity participation was inadequate for health benefits, (Huang et al., 2003; Lowry et al., 2000; Racette et al., 2008; Wallace et al., 2000). For example, Wallace et al. (2000) found that 52.3% of undergraduate university students reported being inactive or only participated in physical activity irregularly, and only one third of the sample had maintained regular physical activity for at least six months. Lowry et al. (2000) indicated that only 38% and 20% of undergraduate students participated in vigorous or moderate physical activities respectively, suggesting that large percentages of students do not engage in vigorous or moderate physical activities. Racette et al. (2008) found that a third of first year students were not doing regular physical activity, and Huang et al. (2003) reported that participation in physical activity was not sufficient to meet recommended guidelines.

Furthermore, other studies have indicated that physical activity participation reduces between high school and university, as well as across the first year of university (Bray & Born, 2004; Butler et al., 2004; Jung et al., 2008; Leslie et al., 1999). For example, in a study comparing vigorous physical activity patterns in a group of Canadian young adults from the end of high school to the transition to first year university, the overall sample demonstrated significant declines in vigorous physical activity from high school to university (Bray & Born, 2004). Specifically, this study reported that approximately 66% of students were classified as active at the end of high school, whereas as only 44% were found to be active in the first eight weeks of university, indicating that 56% of first year university students were inactive. Additionally, Bray and Born (2004) reported that approximately one third of students were found to be continuously active across the transition period, 23%

were continuously inactive, 11% changed from being insufficiently active during high school to active during university, and approximately one third of students changed from being active during high school to inactive during university. Similar findings were reported by Leslie et al. (1999), who reported that approximately 70% of Australian undergraduate students reported doing less physical activity at university compared to levels in high school. Other studies have similarly reported declines across first year university (Butler et al., 2004; Jung et al., 2008).

A large proportion of research regarding physical activity behaviour in undergraduate university cohorts has been conducted in North America and Europe with limited literature examining such behaviour elsewhere. A few studies that have examined physical activity behaviour in university students internationally have suggested that the prevalence of inactivity is noted across many countries and cultures; however, the prevalence in physical activity participation did vary significantly cross-culturally (Haase, Steptoe, Sallis, & Wardle, 2004; Steptoe et al., 2002; Steptoe et al., 1997). For example, Haase et al. (2004) reported that between one fifth and one half of university students across 23 countries (including Belgium, Bulgaria, Columbia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, the Netherlands, Poland, Portugal, Romania, Slovakia, South Africa, Spain, Thailand, United Kingdom, US, and Venezuela) did not engage in leisure time physical activity, with women typically being more likely to be inactive than men. This study further reported that levels of inactivity varied markedly across the different countries with percentages ranging between 23% in North Western European countries and the US, to 44% in developing countries. Steptoe et al. (1997) also reported that engagement in purposeful physical activities was typically low in young adult university students across 21 European countries, but that the prevalence rates varied substantially across the countries examined.

These findings highlight that the prevalence in physical inactivity in young adult university students is widespread internationally, but as behaviour appears to differ cross-culturally, it is important to examine alternative university cohorts, due to potential cultural and environmental differences. This point is further supported by a systematic review conducted by Irwin (2004), who determined that while young adults internationally were not sufficiently active, Australian young adults emerged as having the highest rate of adherence to global physical activity guidelines, at 60%. This suggests that Australian young adults at university may be a worthwhile alternative cohort to examine, as the Australian health culture may differ from that reported elsewhere, which may influence the participation in physical activity.

University students are not simply a sample of convenience, but represent a large section of the young adult population (Leslie et al., 1999). In the 2011 Australian census 26% of Australian young adults aged 18 to 25 attended tertiary education institutions, and just over 60% of 18 year olds attended universities (Australian Bureau of Statistics, 2013). Furthermore, university settings provide unique environments in which delivery of physical activity and health promotion information could have particular success, due to the ability to target large cohorts of young adults before they commence in the workforce (Nelson et al., 2008; Wallace et al., 2000). Therefore, understanding physical activity behaviour in young adults within university settings may assist in the development of programs and interventions which may support the adoption and maintenance of regular physical activity patterns within this cohort.

In order to develop programs and interventions to target physical activity behaviour in young adults at university, first requires an understanding of the determinants that predict the engagement in physical activity, specifically within this cohort. The next section of this chapter, therefore, discusses a selection of social-cognitive and affective correlates which have been identified as important in the prediction of physical activity behaviour. These predictors will be addressed in relation to their inclusion in social cognitive models commonly applied in physical activity research, particularly the theory of planned behaviour, as well as social-cognitive theory. This selection of correlates does not aim to be an exhaustive list of the determinants of physical activity behaviour, nor are these theoretical models the only models which apply to the study of physical activity behaviour, but these present the foundation for the focus of the subsequent empirical chapters. The majority of the following discussion will note the importance of the selected social cognitive and affective correlates within physical activity behaviour in general; however, the specific importance of these factors in young adult university students will be addressed throughout.

1.2 Theoretical Approaches and Influential Correlates of Physical Activity

1.2.1 The Theory of Planned Behaviour

As the previous section of this chapter has highlighted, understanding the antecedents of physical activity in young adults at university in order to develop targeted interventions has the potential to shape and improve health outcomes not just within this cohort but further into adulthood as well. Many social cognitive models have been developed with the aim to understand behaviour, and these models have often been applied to health behaviours, such as physical activity. The theory of planned behaviour is one theoretical model which has shown particular success in predicting both intentions and behaviour in the physical activity domain. See *Figure 1* for a visual representation of this model (Armitage & Conner, 2000; McEachan, Conner, Taylor, & Lawton, 2011; Plotnikoff et al., 2013; Plotnikoff, Lubans, Trinh, & Craig, 2012; Sniehotta, Scholz, & Schwarzer, 2005).

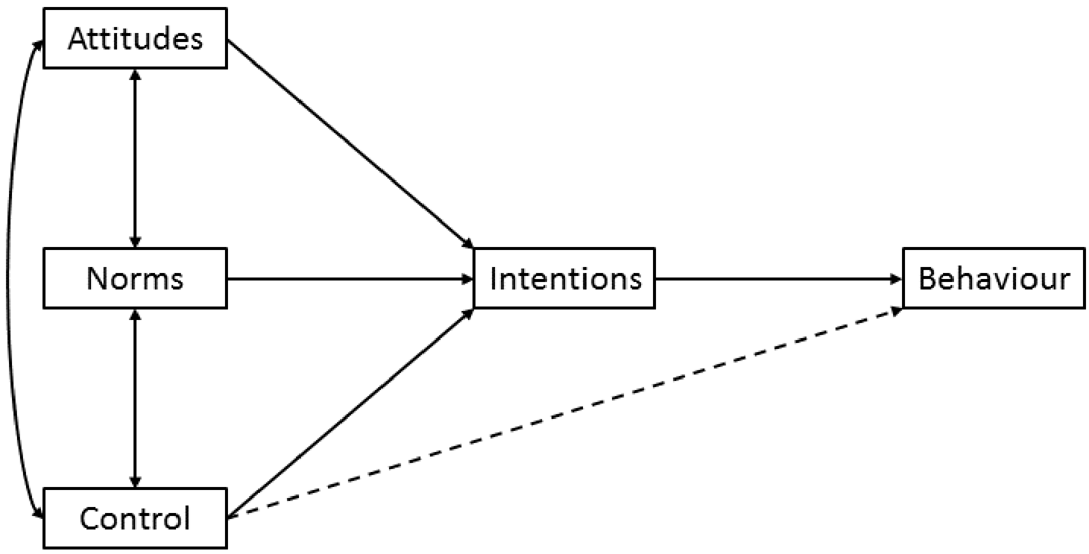

Figure 1. CHAPTER 1: The Theory of Planned Behaviour Model

Intentions are considered the central factor within the theory of planned behaviour model, which asserts that intentions to engage in a specific behaviour are the proximal antecedent in predicting behaviour (Ajzen, 1991). Intentions are considered to be the motivational force behind behaviour and determine how hard individuals are willing to try to perform a behaviour. Typically, stronger intentions result in higher likelihood of performance in said behaviour (Ajzen, 1991). However, the theory of planned behaviour also emphasises that the behavioural expression of intentions is also dependent on whether the target behaviour is under volitional control, which highlights the role of perceived behavioural control (i.e. the extent of controllability one has over behaviour) in predicting behaviour (Ajzen, 1991). Therefore, behaviour is considered to be influenced by one's intentions and perceived behavioural control towards a specific behaviour, with perceived behavioural control predicting behaviour both directly and indirectly through intentions (Ajzen, 1991). Behaviour is also thought to be influenced by attitudes and subjective norms, which predict behaviour indirectly through their effects on intentions to engage in the target behaviour (Ajzen, 1991). Attitudes are defined as the degree to which an individual evaluates a particular behaviour favourably or unfavourably, and subjective norms relate to one's perceived social pressure to engage in the target behaviour or not (Ajzen, 1991). In general, it is assumed that more favourable attitudes, greater subjective norms, and higher perceived behavioural control predict stronger intentions to engage in a particular behaviour, and thus predict higher likelihood of engagement in the behaviour in question (Ajzen, 1991).

Reviews of the application of the theory of planned behaviour in health-related behaviours, including physical activity have indicated that this theoretical model is successful in predicting both intention and behaviour, with the model predicting between 41% and 44% in intentions, and 19% and 34% in behaviour, across health behaviours (Godin & Kok, 1996; McEachan et al., 2011). A meta-analysis by McEachan et al. (2011) indicated that physical activity behaviour was particularly well predicted by the theory of planned behaviour compared to other health behaviours, suggesting that the model components are particularly important in this domain. Furthermore, attitudes are typically the strongest predictor of intentions, followed by perceived behavioural control, particularly noted in relation to physical activity (Godin & Kok, 1996; McEachan et al., 2011).

Subjective norms are shown to be the weakest predictor of intention, and in some cases fails to reach significance; however, its role in predicting intentions has been shown to be stronger in adolescence compared to adult samples (Godin & Kok, 1996; McEachan et al., 2011). In these reviews, intentions consistently emerged as the most important predictor of behaviour, but perceived behavioural control did play a significant role, and was noted to be an important addition in relation to physical activity (Godin & Kok, 1996; McEachan et al., 2011). Moreover, McEachan et al. (2011) further found that the theory of planned behaviour constructs predicted physical activity behaviour particularly well in student samples, compared to adolescents and adults. This suggests that attitudes, subjective norms, perceived behavioural control and intentions are particularly important predictors of physical activity behaviour within a student sample, and as such provide a strong predictive base to build upon.

Despite the theory of planned behaviour model demonstrating success in predicting intention and behaviour, particularly in relation to physical activity, reviews typically report that the model predicts intentions better than it does behaviour (Armitage & Conner, 2000; McEachan et al., 2011; Plotnikoff et al., 2013; Plotnikoff et al., 2012; Sniehotta et al., 2005). Additionally, a meta-analysis by Rhodes and de Bruijn (2013) indicated that nearly twice as many people failed to translate their intentions into action compared to those who had no intention to be physically active. This suggested that the gap between intention and behaviour is predominantly made up of people with positive intentions who nonetheless fail to engage in physical activity behaviour, a notion which has been supported by other researchers (Amireault, Godin, Vohl, & Pérusse, 2008; Chatzisarantis & Hagger, 2007; McBroom & Reid, 1992; Orbell & Sheeren, 1998; Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Rhodes, Plotnikoff, & Courneya, 2008). As a result, researchers have criticised the model's sufficiency to predict behaviour, stating that although intentions are necessary, they are not sufficient to produce behavioural engagement (Reuter et al., 2010; Rhodes & de Bruijn, 2013; Rhodes et al., 2008; Sniehotta, Presseau, & Araújo-Soares, 2014; Sniehotta et al., 2005). Therefore, research has turned its attention to other correlates which may further explain variance in behaviour in addition to that provided by the theory of planned behaviour (Amireault et al., 2008; Jackson, Smith, & Conner, 2003; Reuter et al., 2010; Rhodes & Dickau, 2013; Sniehotta et al., 2014; Sniehotta et al., 2005).

Consequently, the following section of this chapter will discuss a selection of additional variables which have shown importance in the prediction of physical activity, as well as their roles in the extension of the theory of planned behaviour. The following section will also address the use of social-cognitive theory to provide further explanation for how these additional factors may influence physical activity behaviour.

1.2.2 Additional Correlates, Extension of the Theory of Planned Behaviour, and Social-Cognitive Theory

1.2.2.1 Past Behaviour. One correlate which has been shown to be particularly important in the prediction of physical activity behaviour is past behaviour. Previous research has demonstrated that individuals who maintained regular engagement in physical activity had higher reports of physical activity participation during the previous 12 months (Wallace et al., 2000). Additionally, research has reported that past behaviour has been shown to provide unique variance, over and above that of the theory of planned behaviour constructs in the prediction of physical activity intentions and behaviour, with some reporting that past behaviour fully attenuates the role of intentions (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger, Chatzisarantis, & Biddle, 2001; Hamilton & White, 2008; McEachan et al., 2011; Norman & Smith, 1995; Wallace et al., 2000). Given the frequent reports of changes to, and declines in, physical activity behaviour within young adulthood, including past behaviour in prediction models is likely to provide an important contribution to the understanding of physical activity participation.

However, as past behaviour cannot be manipulated, it may not be as useful in practical applications compared to other influential correlates; it does nevertheless help to better explain future engagement in physical activity, and may be useful in identifying individuals at risk of inactivity (McEachan et al., 2011). This is highlighted by research by Rhodes et al. (2008) who examined the intention-physical activity behaviour relationship, and found that non-intenders were entirely composed of people who were previously inactive. Therefore, it is clear that future behaviour can be predicted, at least in part, by past behaviour. This has been further supported by research on the moderating effects of past behaviour on the intention-behaviour gap, which has indicated that past behaviour indeed functions as a moderator of this relationship (Amireault et al., 2008; Rhodes & Dickau, 2013). However, research investigating the moderating effects of past behaviour on the intention-behaviour gap, in relation to physical activity behaviour, has reported different interaction effects. In some cases high levels of past behaviour strengthened the intention-behaviour relationship, and in others it weakened it (Amireault et al., 2008; Rhodes & Dickau, 2013). This highlights the need to further investigate the moderating role of past behaviour in relation to physical activity, to gain further understanding of the processes that guide this interaction within this domain.

Two explanations for how or why past behaviour drives future behaviour have been proposed in the literature. One explanation for the significance of past behaviour within the theory of planned behaviour, is that it controls for previous cognitive processes (e.g. past attitudes, subjective norms, perceived behavioural control, and intention formation), provides information regarding the relative ease or difficulty of a particular behaviour, and offers feedback on past performance (Hagger, Chan, Protogerou, & Chatzisarantis, 2016; Hagger et al., 2001; Jackson et al., 2003). This explanation suggests that past behaviour increases the likelihood of forming intentions and engaging in behaviour, because less cognitive effort is required to form intentions, as they have been made previously (Hagger et al., 2016; Hagger et al., 2001). However, past behaviour does not always completely extinguish the roles of social cognitive constructs (e.g. attitudes, subjective norms, perceived behavioural control, self-efficacy) in the prediction of intentions, suggesting that situation specific cognitions continue to play an important role (Hagger et al., 2016; Hagger et al., 2001). The second idea behind the role of past behaviour in the prediction of behaviour is related to the potential for behaviour to become under habitual control. Habitual control processes can potentially weaken the role of social-cognitive antecedents such as attitudes, subjective norms, perceived behavioural control, and intentions, and thus emerge as a strong predictor of behaviour (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger et al., 2016; Hagger et al., 2001; Norman & Smith, 1995; Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Verplanken & Orbell, 2003). It is important to note, however, that while the terms 'past behaviour' and 'habits' have been used interchangeably in earlier research, the current opinion is that these constructs should be clearly distinguished given that even if a behaviour is performed frequently, it does not mean that the behaviour is habitual (Conner & Armitage, 1998; Norman & Smith, 1995; Verplanken & Orbell, 2003). Therefore, within this thesis, the term past behaviour refers to the frequency of behaviour performed in the past, and does not assume the behaviour to be habitual in nature.

1.2.2.2 Self-efficacy. Self-efficacy is another correlate which has strong links to the participation in physical activity behaviour, with research commonly reporting that higher levels of self-efficacy predict higher levels of physical activity (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; McAuley & Blissmer, 2000; Reuter et al., 2010). Self-efficacy is defined as the confidence in one's ability to carry out a specific behaviour, particularly in the face of situational obstacles, determining which behaviour people engage in, how much effort they exert, and the degree of persistence they apply (Bandura, 1998; Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005; Williams & French, 2011).

Self-efficacy is a similar construct to the theory of planned behaviours' perceived behavioural control; however, these constructs have been clearly distinguished empirically (Conner & Armitage, 1998; Hagger et al., 2001; Terry & O'Leary, 1995). In this distinction, perceived behavioural control refers to the perceived extent of controllability an individual has over their behaviour, while self-efficacy is more concerned with an individual's belief in their competence to carry out a specific behaviour (Conner & Armitage, 1998; Hagger et al., 2001; Terry & O'Leary, 1995). Moreover, research has indicated the importance of including self-efficacy in addition to perceived behavioural control as self-efficacy often emerges as a stronger predictor of physical activity than perceived behavioural control, and in some cases fully attenuates the role of perceived behavioural control (Hagger et al., 2001). This indicates that confidence in one's abilities may be more pertinent to successful engagement in physical activity behaviour than the extent of perceived controllability over being active. This distinction between self-efficacy and perceived behavioural control has further been made in a recent expansion of the theory of planned behaviour, known as the reasoned action approach (Fishbein & Ajzen, 2011; McEachan et al., 2016). Within this framework self-efficacy and perceived behavioural control are referred to as capacity (i.e. self-efficacy) and autonomy (i.e. perceived behavioral control), respectively. These are each represented as subcomponents of an overarching measure of control factors (Fishbein & Ajzen, 2011; McEachan et al., 2016).

Self-efficacy has been shown to be particularly predictive of behaviours that require overcoming barriers, compared to behaviours that are controlled by habits (McAuley & Blissmer, 2000). This highlights the importance of including self-efficacy as a predictor of physical activity behaviour within a young adult population, due to the unique challenges that are present during young adulthood, such as changes in educational, occupational, social, and living environments. Therefore, self-efficacy may be a crucial factor that drives the success in engaging in, and maintaining, regular physical activity within young adult cohorts.

One proposed role for self-efficacy in the prediction of physical activity behaviour is that it moderates the relationship between intentions and physical activity behaviour (Amireault et al., 2008; Luszczynska et al., 2010; Rhodes & Dickau, 2013). This proposal is based on findings demonstrating that individuals with high levels of self-efficacy showed more consistency between their intentions and behaviour than those with low levels (Amireault et al., 2008). In further support of this, Rhodes et al. (2008) identified self-efficacy as the most consistent predictor of intention-behaviour profiles in individuals who had adopted and/or maintained regular physical activity behaviour. In addition to the moderating role, self-efficacy also plays a central role in social-cognitive theory, and its involvement within this theoretical model will be discussed later in this chapter.

1.2.2.3 Social Support. Social support, defined as any action provided by someone to assist another in achieving their goals, has also been identified as an important factor in the prediction of physical activity behaviour (Hamilton & White, 2008; Jackson et al., 2003; McNeill, Kreuter, & Subramanian, 2006; Molloy, Dixon, Hamer, & Sniehotta, 2010; Okun et al., 2003; Treiber et al., 1991). The importance of social support in physical activity behaviour stems from findings indicating that higher perceptions of social support from others (such as friends and/or family members) are typically associated with higher rates of physical activity and more success in adhering to physical activity programs (Booth et al., 2000; McNeill et al., 2006; Molloy et al., 2010; Okun et al., 2003; Treiber et al., 1991). Social support is distinguished from the theory of planned behaviour’s construct subjective norms, with each representing a distinct element of one’s social environment behaviour

(Hamilton & White, 2008; Okun et al., 2003; Treiber et al., 1991). While subjective norms convey information regarding what others think about a specific behaviour, such as physical activity, social support is more concerned with the assistance or encouragement provided by others to engage in a particular behaviour like being active (Hamilton & White, 2008; Okun et al., 2003; Treiber et al., 1991). Furthermore, research has reported that both subjective norms and social support independently contribute to the understanding of physical activity behaviour within models of the theory of planned behaviour (Okun et al., 2003).

Additionally, social support may be a particularly important factor to consider for young adults given the changes that occur in their social, educational, occupational and living environments. For instance, young adults' social environment may vary considerably from childhood and adolescence due to the potential for meeting new people and entering new social groups associated with different educational settings or the workforce. Furthermore, while some young adults may remain within the family home during young adulthood, others become independent, living alone or with housemates, potentially shifting the role and influence that family members play in their day-to-day activities. These changes suggest the likelihood of changing roles of social support for physical activity, particularly during this time of life, and therefore, different sources of social support should be considered.

In young adults, social support from both friends and family have been identified as predictors of physical activity participation (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000). However, research has indicated that the source of social support can play an important role, with different sources affecting individuals differently (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000). For example, Leslie et al. (1999) reported that support from both friends and family members showed important predictive weight in regards to Australian undergraduate students being sufficiently active. While both sources were important for men and women, women appeared to be more strongly influenced by lack of family support compared to friend support, with female students 55% more likely to be insufficiently active with low levels of family support, but only 23% more likely to be insufficiently active when friend support was low (Leslie et al., 1999). By contrast, Wallace et al. (2000) found that for women, engagement in physical activity was best predicted by family support, whereas for men, friend support was the best predictor. Treiber et al. (1991) also found that the source of social support affected individuals differently, with differences found both between genders and ethnicity. These findings emphasise the importance of examining the roles of different sources of social support, with both friends and family members appearing to be influential in young adult samples.

As highlighted above, the translation of intention to action is one area which demands attention. Social support has been raised as a worthy candidate to consider in the further understanding of the intention-behaviour relationship; however, at this stage, does not appear to have been formally investigated (Molloy et al., 2010; Rhodes et al., 2008). As such, the investigation of the potential moderating effects of social support within the intention-behaviour relationship, in the physical activity domain, is a current gap in the literature which should be addressed. Other hypothesised mechanisms for how social support may affect physical activity behaviour have been proposed in the context of social-cognitive theory. As such, the following section will discuss social cognitive theory, and how the interplay of factors such as social support, self-efficacy and attitudes may have an important role in further understanding physical activity behaviour.

1.2.2.4 Social-cognitive Theory. A full review of this theoretical model is beyond the scope of this thesis (but see Bandura (1986, 1989, 1998, 2004). However, key elements of this theory and their application to understanding physical activity behaviour within the larger theoretical context previously discussed will now follow. Social-cognitive theory posits that cognitive, affective, personal and environmental factors all operate as interacting determinants of action and each other, termed reciprocal determinism (Bandura, 1989; Leslie et al., 1999; McAuley & Blissmer, 2000; Okun et al., 2003; Wallace et al., 2000). Previous researchers have asserted that the factors in social-cognitive theory should be viewed in the context of other theoretical frameworks, such as the theory of planned behaviour, which may provide a fuller understanding of behaviour (Bandura, 1998; McAuley & Blissmer, 2000). Therefore, while self-efficacy is the central construct within social-cognitive theory, the contribution of self-efficacy in predicting physical activity should be evaluated along with other personal cognition and environmental factors, which could include factors such as attitudes, intentions, and support from family and friends (Bandura, 2004; Leslie et al., 1999; McAuley & Blissmer, 2000).

In support of these reciprocal relationships, previous research has found that self-efficacy positively influences cognitive (including attitudes and intentions), affective and social factors (Bandura, 2004; Duncan & McAuley, 1993; McAuley & Blissmer, 2000; Schwarzer & Fuchs, 1996; Sniehotta et al., 2005). Likewise, social support has also been found to influence self-efficacy, functioning as a coping resource (Bandura, 1998; Duncan & McAuley, 1993; Gruber, 2008; Okun et al., 2003). Within this context, social support represents available external coping resources, whereas self-efficacy signifies one’s own internal coping resources (Duncan & McAuley, 1993). Bandura theorised that social support influences physical activity indirectly through self-efficacy by increasing perceptions of competence and autonomy, and previous research has supported this claim (Anderson, Winett, & Wojcik, 2007; Bandura, 1997; Duncan & McAuley, 1993; Gruber, 2008; McAuley & Courneya, 1993; Okun et al., 2003; Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002). However, Bandura (1998) also suggested that the effects of self-efficacy and social support on physical activity may strengthen each other bi-directionally, and in support of this, the relationship between self-efficacy and physical activity has been shown to function indirectly through social support (Dishman, Saunders, Motl, Dowda, & Pate, 2009). While there is evidence of bidirectional relationships between some of the factors discussed above, reciprocal effects between each of these factors do not appear to have been investigated. This presents an opportunity to further understand how the factors discussed in this chapter may operate in concert to predict physical activity behaviour.

While the mediating role of self-efficacy in the relationship between social support and physical activity has been empirically established, social-cognitive theory implies that self-efficacy may function as a moderator of this relationship (Bandura, 2004; Dishman et al., 2009). In this case, self-efficacy and social support may interact whereby the level of self-efficacy may determine the extent to which social support affects physical activity participation. For example, individuals with high levels of self-efficacy may easily engage in physical activity, even in the absence of social support, due to stronger beliefs in their capabilities to overcome obstacles, such as lack of support. By contrast, social support may be more influential on physical activity participation when levels of self-efficacy are low, by providing assistance, company and social modelling. Supporting this claim, Dishman et al. (2009) longitudinally tracked physical activity, self-efficacy and social support in adolescent girls, and found that self-efficacy operated as a moderator of the relationship between perceived social support and physical activity participation, where higher levels of self-efficacy predicted lesser declines in physical activity levels.

1.2.2.5 Affect. Social cognitive theories in general have been criticised for their exclusive focus on cognitive, rational factors, at the exclusion of affective constructs (Armitage, Conner, & Norman, 1999; Conner, 2013; Conner, Godin, Sheeran, & Germain, 2013; Conner, McEachan, Taylor, O'Hara, & Lawton, 2015; Conner, Rhodes, Morris, McEachan, & Lawton, 2011; Ekkekakis et al., 2013; Helfer, Elhai, & Geers, 2015; Mohiyeddini, Pauli, & Bauer, 2009; Sainsbury, Mullan, & Sharpe, 2013). More recently, however, researchers are recommending that affective factors be linked to, and integrated into social cognitive models (Armitage et al., 1999; Conner, 2013; Conner et al., 2013; Conner et al., 2015; Conner et al., 2011; Ekkekakis et al., 2013; Helfer et al., 2015; Jackson et al., 2003; Mohiyeddini et al., 2009). The relationship between physical activity and mood, has long been established, with previous research predominantly focussing on the positive influence of physical activity on affective states (Bryan, Hutchison, Seals, & Allen, 2007; Ekkekakis et al., 2013; Guérin & Fortier, 2012; Salmon, 2001). This research indicated that physical activity has a positive influence on mood states (such as increase in positive affect, and decrease in negative affect) as well as the alleviation of psychosocial stress, anxiety and depressive symptomatology (Bryan et al., 2007; Ekkekakis et al., 2013; Guérin & Fortier, 2012; Salmon, 2001). Affective qualities can be attributed to particular behaviours, resulting from the experience of emotions while previously enacting that behaviour (Conner et al., 2015; Lawton et al., 2009). These affective qualities can be used to modulate mood state and provide behavioural motivation (Conner et al., 2015; Lawton et al., 2009). For example, if previous experiences have led an individual to attribute being physically active with feeling energised or happy, they may engage in physical activity (or become motivated to be active) as a result of feeling tired or flat in order to modulate their mood state.

Therefore, recent shifts in thinking have begun to focus on the potential role of mood and other affective states in predicting physical activity (Bryan et al., 2007; Ekkekakis et al., 2013; Ekkekakis, Lind, & Vazou, 2010; Focht, 2009; Guérin & Fortier, 2012; Mohiyeddini et al., 2009). In part, this stems from evidence suggesting a close link between affect and beliefs. Affect has been shown to anchor and shape cognition, through cognitive priming, affecting the valence of beliefs, as well as influencing cognitive processing style (Armitage et al., 1999; Forgas, 2013; Lawton, Conner & McEachan, 2009). As beliefs are the drivers for cognitive factors such as attitudes, perceived behavioural control and subjective norms (as per the therory of planned behaviour), this has implications for the development of intentions and subsequently behavioural engagement (Ajzen, 1991).

Recent research has shown that affective variables strongly influence physical activity behaviour, often more so than cognitive factors, and as such emphasises the positive impact that affect (particularly positive affect) has on intentions and behaviour (Bryan et al., 2007; Conner, 2013; Conner et al., 2011; Ekkekakis et al., 2013; Focht, 2009; Helfer et al., 2015; Keer, Conner, Van den Putte, & Neijens, 2014; Kwan & Bryan, 2010; Lawton et al, 2009). One new area of research focuses on the importance of pleasure and positive affective states on influencing motivational factors, such as intentions, as well as the engagement in physical activity (Bryan et al., 2007; Ekkekakis et al., 2013; Ekkekakis et al., 2010; Focht, 2009; Guérin & Fortier, 2012; Mohiyeddini et al., 2009).

Another area of research is concerned with the distinction between cognitive attitudes and affective-based attitudes, and their respective roles on intention and behaviour. Research has shown that intentions differ in the extent to which they are based on affective versus cognitive based attitudes, with some individuals more inclined to base their intentions on affective information, whereas others rely on cognitive rational evaluations (Keer et al., 2014). This distinction between cognitive and affective-based attitudes is reflected in the reasoned action approach. Within this framework, the overarching attitude construct is represented by both cognitive and affective based attitudinal measures (Fishbein & Ajzen, 2011; McEachan et al., 2016). In this approach, cognitive attitudes are referred to as instrumental attitudes, and affective attitudes labelled as experiential attitudes (Fishbein & Ajzen, 2011; McEachan et al., 2016).

Affective attitudes and anticipated affective reactions have been shown to be strong predictors of health-related intentions and behaviour, including physical activity, demonstrating both direct and indirect (via intention) effects on behaviour (Conner, 2013; Conner et al., 2013; Conner et al., 2015; Lawton et al., 2009; McEachan et al., 2016). The importance of affective attitudes is further strengthened by experimental research demonstrating that affective attitudes can be successfully manipulated through affective-based messaging, which have, in turn, been effective in producing physical activity behaviour change (Conner et al., 2011; Morris, Lawton, McEachan, Hurling, & Conner, 2016).

A new potential area, is the likely role for affective states in post-intentional mechanisms (i.e. the processes occurring after intention formation which translate intentions into action), which may explain some of the unexplained variance in the intention-behaviour gap (Ekkekakis et al., 2013; Keer et al., 2014; Kwan & Bryan, 2010; Mohiyeddini et al., 2009). Mohiyeddini et al. (2009) investigated the mediating role of affective responses to intentions to engage in physical activity, on the intention-behaviour relationship, and found that affective responses partially mediated this relationship. They further mentioned that potential moderating effects on this relationship should also be explored. Kwan and Bryan (2010) found support for the moderating role of affective response to physical activity in the intention-behaviour relationship, with affective response strengthening the translation of intentions into action. Additionally, Keer et al. (2014) found that intentions were more temporally stable for people who strongly based their intentions on affect, and that this improved temporal stability resulted in a greater likelihood that their intentions would be translated into behaviour. This new research provides initial evidence for the role of affective states in the greater understanding of engagement in physical activity; however, as this research is in its infancy, further exploration of the role of affective states in the prediction of both intentions and physical activity behaviour is warranted.

Examining the role of affective states in the prediction of physical activity may be particularly important in young adult cohorts, with research finding that undergraduate university students (particularly those in their first year of university) exhibit high levels of psychological distress (Bray & Born, 2004). Since affective states significantly affect the prediction of intentions and physical activity behaviour, the high rates of compromised well-being within this population, may have negative implications for participation and adherence in physical activity.

1.2.2.6 Implicit Attitudes and Automaticity. As this chapter has already established, how people behave can be predicted by self-reported, conscious thoughts and feelings. However, in addition to these explicit factors, behaviour can also be guided by automatic associations, referred to as implicit attitudes (Gawronski & Bodenhausen, 2006; Greenwald & Nosek, 2001; Karpinski & Hilton, 2001; Maison, Greenwald, & Bruin, 2001; Smith & Nosek, 2010). As highlighted earlier, attitudes play a significant role in predicting behaviour through their effects on intentions, and attitudes have been consistently identified as the strongest predictor of intentions to be physically active (Godin & Kok, 1996; McEachan et al., 2011). However, these findings are based on explicit attitudes, and the role of implicit attitudes within this process is in its infancy, and therefore an important direction for research.

The inclusion of implicit attitudes in the evaluation of a target concept (such as physical activity) is important, as compared to explicit attitudes, which are easily influenced by response bias and social desirability, implicit attitudes are resistant to such self-presentation strategies. Therefore, their inclusion provides a more complete evaluation of a target concept (Brunel, Tietje, & Greenwald, 2004; Craeynest et al., 2005; Greenwald, McGhee, & Schwartz, 1998; Karpinski & Hilton, 2001; Maison et al., 2001; Schwartz, Vartanian, Nosek, & Brownell, 2006). The Implicit Association Task (IAT) is an example of an implicit measure which has been commonly applied in research assessing implicit attitudes across a variety of domains (Greenwald et al., 1998). Implicit measures, such as the IAT, are based on performance on reaction time tasks, where the attitudinal construct is implied from the speed or accuracy of the response to specific stimuli, which takes into account the automatic nature of implicit attitudes. (Craeynest et al., 2005; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Greenwald et al., 1998; Karpinski & Hilton, 2001).

Research has suggested that implicit attitudes are related to explicit measures, and can often reveal the same underlying preference; however, implicit and explicit attitudes are considered distinct constructs (Brunel et al., 2004; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Karpinski & Hilton, 2001; Nosek & Smyth, 2007). Implicit and explicit attitudes are therefore considered to be complementary constructs, each with the potential to predict behaviour (Brunel et al., 2004). Dual-systems models provide a model explaining the distinction between the implicit and explicit pathways affecting health-related behaviours, where explicit measures function through a deliberative, reflective system, and implicit measures reflect an impulsive system (Conner, Perugini, O'Gorman, Ayres, & Prestwich, 2007; Keatley, Clarke, & Hagger, 2012; Keatley, Clarke, & Hagger, 2013a, 2013b; Strack & Deutsch, 2004). Within this framework, implicit atttitudes may have greater influence on spontaneous behaviours, whereas explicit attitudes are likely to have a greater effect on deliberate, planned behaviours (Conner et al., 2007; Keatley et al., 2012; Keatley et al., 2013a, 2013b; Strack & Deutsch, 2004).

Research examining both implicit and explicit attitudes with regard to physical activity is limited; however, previous research has suggested that implicit attitudes indeed provide a worthwhile contribution to understanding health behaviours, including physical activity (Berry, Spence, & Clark, 2011; Calitri, Lowe, Eves, & Bennett, 2009; Conroy, Hyde, Doerksen, & Ribeiro, 2010; Forrest, Smith, Fussner, Dodd, & Clerkin, 2016; Goldstein et al., 2014; Keatley et al., 2012; Keatley et al., 2013a, 2013b; Maison et al., 2001; Markland, Hall, Duncan, & Simatovic, 2015). For example, Conroy et al. (2010) investigated implicit and explicit attitudes related to physical activity and found that implicit attitudes predicted physical activity behaviour, after controlling for explicit motivational processes regulating intentional activity. Furthermore, Berry et al. (2011) found that individuals who reported higher levels of physical activity participation exhibited biases toward ‘exercisers’ over ‘couch potatoes’ in an IAT, whereas individuals who reported low levels of physical activity did not show this bias. Research by Keatley et al. (2012) also found that physical activity behaviour was predicted by both implicit and explicit motivational-based attitudes. This research highlights that implicit attitudes may provide a unique contribution to physical activity behaviour, alongside the role of explicit attitudes. Due to the absence of automatic associations within social cognitive theories, such as the theory of planned behaviour, exploring the involvement of implicit attitudes, in addition to the explicit attitudes, may therefore provide a novel contribution to the understanding of physical activity behaviour.

1.3 Conclusion and Summary of Chapters

This thesis contributes to the literature on physical activity behaviour in young adult university students. Specifically, this thesis includes an investigation of the respective roles of the influential social-cognitive and affective correlates identified within this chapter in predicting purposeful physical activity behaviour, and examines the mechanisms by which these correlates contribute to physical activity behaviour. It should be noted, that in the context of this thesis, physical activity behaviour refers to the engagement in purposeful or leisure based physical activities, rather than incidental physical activity resulting from occupational or transportational means.

Chapters 2, 3, 5 and 6 outline empirical studies which are written in manuscript format and can be read as stand-alone papers. Due to this, some of the arguments presented and the evidence provided may be repeated as they apply to the individual papers. Additionally, Chapters 5 and 6 have been submitted for publication, and details are outlined in the declaration of co-authorship. The remainder of this chapter will summarise the aims and focus of each subsequent chapter, and how it relates and contributes to the aforementioned literature and the understanding of physical activity behaviour in young adult university students.

As outlined in this chapter, the majority of research on physical activity in this cohort has been conducted using US samples. As such, Chapter 2 presents a longitudinal study examining physical activity behaviour in a sample of Australian young adult, first year university students. Specifically, the focus of this chapter is to establish whether physical activity behaviour changes throughout the first year at university, and assesses whether physical activity participation in first year university significantly differs from reports of past physical activity. The longitudinal component of the study described in this chapter is important, as it takes into account the dynamic nature of physical activity behaviour across a period of time. Furthermore, a selection of predictors, based on theory of planned behaviour and social-cognitive theory constructs are also examined in Chapter 2, with the aim of establishing their importance in predicting differences in physical activity behaviour between individuals, and whether these constructs predict changes in physical activity over time. Chapter 2 highlights the importance of the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control and intentions), as well as past behaviour, self-efficacy, social support from both friends and family, and positive affect in the prediction of physical activity behaviour in young adults in their first year of university.

Chapter 3 focuses on examining the model fit of the theory of planned behaviour using the time one cross-sectional data from the sample presented in Chapter 2. Possible extensions of this model are also tested in this chapter, focusing on the potential moderating effects of past behaviour, self-efficacy, social support and positive affect on the relationship between intention and physical activity behaviour. This chapter provides the novel contribution of examining the role of social support as a moderator of the intention-behaviour gap in physical activity behaviour. It also provides further support for past behaviour, self-efficacy and positive affect functioning as moderators, to assist the translation of intent into action.

An additional analysis of the data presented in Chapter 3 is discussed in Chapter 4. Specifically, the contribution of past behaviour, self-efficacy and social support in the prediction of both intentions and physical activity behaviour, after controlling for the original theory of planned behaviour constructs is examined. This chapter provides support for the extension of the theory of planned behaviour model, by highlighting that past behaviour, self-efficacy and social support make important contributions to the understanding of both intentions and physical activity behaviour in young adult university students, which have not been accounted for by the theory of planned behaviour. This emphasises that past behaviour, self-efficacy and social support should be included in prediction models alongside the theory of planned behaviour constructs.

In Chapter 5, the roles of attitudes, intentions, self-efficacy and social support in the prediction of physical activity behaviour in young adult university students was further examined in a new cross-sectional sample. Specifically, predictions based on components of the theory of planned behaviour model and social-cognitive theory, namely the mediating role of intentions, and the moderating role of self-efficacy in the relationship between social support and intentions are addressed within this chapter. This chapter highlights pathways and mechanisms by which social-cognitive factors predict physical activity behaviour, with the findings having important implications for applied interventions.

As attitudes are emphasised in Chapters 2 to 5 as playing an important role in the prediction of physical activity behaviour in young adult university students, the focus of Chapter 6 is on the contribution of attitudes in the prediction of intentions and physical activity behaviour, working within a theory of planned behaviour framework. Specifically, the respective roles of both implicit and explicit attitudes are examined, using a computerized IAT and questionnaire. While the contribution of attitudes in physical activity is well established, the role of implicit attitudes is largely unexplored. Thus this chapter provides a unique addition to the literature by exploring the relationship between implicit and explicit attitudes, and their respective roles in predicting intentions and physical activity behaviour in a new sample of young adult university students.

Lastly, a general discussion on the findings of this thesis is presented in Chapter 7, integrating the results of each chapter and presenting their contributions as a whole. Specifically, the theoretical and practical implications of this research, a discussion of methodological issues pertaining to the work presented, and directions for future theoretical and applied research are outlined in this chapter.

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CHAPTER 2: Longitudinal Tracking of Physical Activity and Correlates in First-year University Students

Objectives: Using a longitudinal design, this study examined physical activity and related correlates in young adults across their first year of university to determine differences between individuals and changes over time. **Methods:** Participants (Baseline *N*=201; 159 female, 41 male, aged 17-25) were invited to complete three online surveys at the beginning, middle and end of their first year at university. Surveys measured past and present physical activity, theory of planned behaviour variables (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support, and mood. **Results:** Physical activity significantly declined from retrospective reports of past physical activity during the year prior to university commencement; however, participants met physical activity guidelines for both past and present physical activity, and behaviour remained stable across the academic year. Attitudes, subjective norms, perceived behavioural control, intentions, past behaviour, self-efficacy, social support and positive affect significantly predicted differences in physical activity between participants. **Conclusions:** The current cohort of young adults was uniquely active compared to international samples (e.g. North America and Europe). Results demonstrate the importance of a selection of social-cognitive and affective factors in the prediction of physical activity, which have the potential to guide future intervention programs.

2.1 Introduction

Engaging in regular physical activity provides a strong foundation for good health (Scarmeas et al., 2009; Zunft et al., 1999). Regular physical activity (i.e. accumulating between 2.5 and 5 hours activity per week) has been shown to have significant health benefits, which include the prevention and management of disease, such as cardiovascular disease, type 2 diabetes, and some cancers; building strong bones, muscles and joints; and weight management (Brown, Bauman, Bull, & Burton, 2012; Leslie et al., 1999). In addition, regular physical activity has been shown to positively affect psychological factors including mood, self-esteem, and confidence, as well assisting in stress management (Brown et al., 2012). Because of its positive role in improving physical and psychological health, understanding the determinants of physical activity is important.

The years from the late teens through to the twenties are ones of profound change characterised by the exploration of potential life directions and identities (Arnett, 2000; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). These are critical years when young adults (17-25 years of age) establish their independence and adopt patterns of behaviour such as physical activity. Young adults are therefore an important cohort in which to address the establishment of long-term health behaviour (Nelson et al., 2008).

Physical activity behaviour within the university environment has been a focus of considerable research in North America and Europe, with physical activity participation typically reported as being below recommended guidelines and declining over time (Haase, Steptoe, Sallis, & Wardle, 2004; Huang et al., 2003; Steptoe et al., 1997; Wallace et al., 2000). In particular, the transition from high school to university has been noted as presenting unique challenges for young adults, involving the adaptation to the university lifestyle, which is less structured than the high school environment. This transition can disrupt established behaviour patterns across a number of significant life domains, including engagement in physical activity (Bray & Born, 2004; Nelson et al., 2008). Previous research on physical activity in first year university students has shown fluctuations in physical activity patterns, most notably a decline in, as well as insufficient levels of, physical activity, and as a result is a worthwhile cohort to investigate (Bray & Born, 2004; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003; Irwin, 2004; Jung, Bray, & Ginis, 2008; Lewis et al., 1997; Wallace et al., 2000).

However, as the majority of research in this population has largely been limited to North America and Europe, it is important to consider examining physical activity patterns in similar cohorts elsewhere. The reason for this is that first-year university students in other countries may exhibit differences in physical activity patterns due to potential cultural and environmental differences that may occur in alternative university settings. For example, although research by Irwin (2004) determined that young adults internationally were insufficiently active, Australian young adults emerged as having the highest rate of adherence to global physical activity guidelines, at 60%. This suggests that Australian health culture, in particular, may differ from that reported elsewhere and as such may be a worthwhile alternative cohort to examine.

Understanding the antecedents of physical activity in young adults has the potential to improve and shape health outcomes in later adulthood, through the development of targeted intervention. Many social cognitive models have been developed to better understand behaviour and have been successful in predicting physical activity behaviour. An example is the theory of planned behaviour model, which has been frequently applied to the physical activity domain, and has demonstrated success in predicting both intentions to engage in physical activity and physical activity itself (Armitage & Conner, 2000; McEachan, Conner, Taylor, & Lawton, 2011; Plotnikoff, Costigan, Karunamuni, & Lubans, 2013; Plotnikoff, Lubans, Trinh, & Craig, 2012; Sniehotta, Scholz, & Schwarzer, 2005). This model links attitudes, subjective norms, and perceived behavioural control to behaviour indirectly through their effects on intentions to engage in the target behaviour (Ajzen, 1991). Perceived behavioural control is also thought to affect physical activity directly (Ajzen, 1991). The theory of planned behaviour constructs have been found to predict physical activity particularly well in student samples (McEachan et al., 2011). This suggests that attitudes, subjective norms, perceived behavioural control and intentions are particularly important predictors of physical activity for young adults. Therefore, it was predicted that attitudes, subjective norms, perceived behavioural control, and intentions would each individually, positively predict physical activity behaviour over time. Furthermore, it was predicted that the inclusion of intentions alongside attitudes, subjective norms and perceived behavioural control would mediate their effects on physical activity behaviour across first year university.

Although the theory of planned behaviour model has been shown to predict intentions and behaviour within the physical activity domain quite well, reviews typically report that the model provides better prediction of intentions than it does of the actual behaviour (Armitage & Conner, 2000; McBroom & Reid, 1992; McEachan et al., 2011; Orbell & Sheeren, 1998; Plotnikoff et al., 2013; Plotnikoff et al., 2012; Sniehotta et al., 2005). Researchers have consequently turned their attention to additional correlates which may further explain variance in behaviour, in addition to that provided by the theory of planned behaviour variables (Jackson, Smith, & Conner, 2003; Reuter et al., 2010; Sniehotta, Presseau, & Araújo-Soares, 2014; Sniehotta et al., 2005).

Past behaviour is an example of a correlate that has been identified as an important predictor of physical activity. Previous research has confirmed that individuals who maintain engagement in regular physical activity also report higher rates of physical activity during the previous 12 months (Wallace et al., 2000). Additionally, past behaviour has been shown to provide unique variance over and above that of the theory of planned behaviour variables in the prediction of physical activity behaviour (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger, Chatzisarantis, & Biddle, 2001; Hamilton & White, 2008; Norman & Smith, 1995; Wallace et al., 2000).

The role of past behaviour in the prediction of subsequent behaviour is thought to be a result of past behaviour accounting for previous cognitive processes related to the behaviour in question or related to habitual control. Both of these factors are known to lessen the required cogntive effort to form intentions resulting in behavioural engagement (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger, Chan, Protogerou, & Chatzisarantis, 2016; Hagger et al., 2001; Jackson et al., 2003; Norman & Smith, 1995; Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Verplanken & Orbell, 2003). As such, habits have the potential to weaken the role of attitudes, subjective norms, perceived behavioural control, and intentions (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger et al., 2001; Norman & Smith, 1995; Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Verplanken & Orbell, 2003). Although the terms 'past behaviour' and 'habit' have been used interchangeably in earlier research, past behaviour does not always become habitual, even if it has been frequently performed (Conner & Armitage, 1998; Norman & Smith, 1995; Verplanken & Orbell, 2003). Therefore, it is important that past behaviour be considered as a unique construct, and be included in models predicting physical activity. As such, within the current study, it was predicted that past behaviour would be a significant positive predictor of physical activity behaviour across first year university. Furthermore, past behaviour would remain a significant predictor after controlling for the theory of planned behaviour contructs (attitudes, subjective norms, perceived behavioural control and intentions).

Another correlate that has been strongly linked to physical activity participation is self-efficacy, with high levels of self-efficacy consistently found to predict higher levels of physical activity (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; McAuley & Blissmer, 2000; Reuter et al., 2010). While self-efficacy is a similar construct to perceived behavioural control, these constructs have been clearly distinguished empirically, and are included as separate components of recent extensions to the theory of planned behaviour, such as the reasoned action approach (Conner & Armitage, 1998; Fishbein & Ajzen, 2011; Hagger et al., 2001; Terry & O'Leary, 1995). Within this approach, perceived behavioural control is defined as the extent of controllability an individual perceives to have over their behaviour, whereas self-efficacy is more concerned with an individual's belief in their competence to carry out a specific behaviour (Conner & Armitage, 1998; Hagger et al., 2001; McEachan et al., 2016; Terry & O'Leary, 1995). Self-efficacy, therefore, refers to the confidence in one's ability to carry out the behaviour, particularly in challenging circumstances (Bandura, 1998; Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005; Williams & French, 2011). Self-efficacy governs whether a person will engage in a behaviour, the effort they will exert on this behaviour, and the amount of perseverance they apply when faced with failure or barriers (Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005).

Previous research has found that self-efficacy often emerges as a more important factor in predicting physical activity behaviour than perceived behavioural control (Hagger et al., 2001), with frequent reports of self-efficacy attenuating the role of perceived behavioural control (Hagger et al., 2001). Self-efficacy is most predictive of behaviour within situations that have barriers, compared to those under habitual control (McAuley & Blissmer, 2000). Due to the unique challenges of first-year university life (e.g. changes in educational, occupational, social, and living environments), self-efficacy may be essential for success in engaging in and maintaining regular physical activity during this period. Therefore, it was predicted that self-efficacy would be a positive predictor of physical activity behaviour across first year university. Furthermore, self-efficacy was expected to remain a significant predictor alongside the theory of planned behaviour constructs (attitudes, subjective norms, perceived behavioural control, and intentions).

Social support has also been identified as an important predictor of physical activity behaviour. Individuals who receive higher levels of support from friends and/or family consistently show more success in physical activity programs, and higher rates of participation in physical activity (Booth et al., 2000; Okun et al., 2003; Treiber et al., 1991). Social support is defined as any action provided by someone to assist another person in achieving their goals and has been differentiated from subjective norms empirically, with each factor representing two distinct elements of one's social environment (Hamilton & White, 2008; Okun et al., 2003; Treiber et al., 1991). In contrast to social support, subjective norms convey information concerning what others think in relation to a specific activity (Hamilton & White, 2008; Okun et al., 2003).

Although social support from both friends and family members have been identified as important predictors of physical activity participation in young adults, research suggests that the source of support may affect individuals differentially, with some studies reporting gender differences, but others reporting equal importance of friend and family support (Leslie et al., 1999; Treiber et al., 1991;

Wallace et al., 2000). This highlights the need to investigate the individual roles of social support from both friends and family. It was therefore predicted that social support from both friends and family would positively predict physical activity behaviour across first year university.

Social-cognitive theories, such as the theory of planned behaviour focus exclusively on cognitive, rational factors, at the exclusion of affective constructs (Armitage, Conner, & Norman, 1999; Conner, 2013; Conner, Godin, Sheeran, & Germain, 2013; Conner, McEachan, Taylor, O'Hara, & Lawton, 2015; Conner, Rhodes, Morris, McEachan, & Lawton, 2011; Ekkekakis, Hargreaves, & Parfitt, 2013; Helfer, Elhai, & Geers, 2015; Mohiyeddini, Pauli, & Bauer, 2009; Sainsbury, Mullan, & Sharpe, 2013). As a result, current researchers in the field have recommended that cognitive models of behaviour integrate affective components (Armitage et al., 1999; Conner, 2013; Conner et al., 2013; Conner et al., 2015; Conner et al., 2011; Ekkekakis et al., 2013; Helfer et al., 2015; Jackson et al., 2003; Mohiyeddini et al., 2009). Previous research has predominantly focused on the positive impact of physical activity on affective states, and this connection has been strongly supported (Bryan, Hutchison, Seals, & Allen, 2007; Ekkekakis et al., 2013; Guérin & Fortier, 2012; Salmon, 2001). Recently focus has shifted to the potential role that mood and affective states may have in the prediction of physical activity (Bryan et al., 2007; Ekkekakis et al., 2013; Ekkekakis, Lind, & Vazou, 2010; Focht, 2009; Guérin & Fortier, 2012; Mohiyeddini et al., 2009). Affective variables have previously been shown to strongly affect physical activity behaviour, often more so than cognitive factors, and demonstrate the positive impact that affect (particularly positive affect) has on behaviour (Conner, 2013; Conner et al., 2011; Bryan et al., 2007; Ekkekakis et al., 2013; Focht, 2009; Helfer et al., 2015; Keer, Conner, Van den Putte, & Neijens, 2014; Kwan & Bryan, 2010; Lawton et al., 2009). Affective variables have been shown to affect behaviour both directly and indirectly through influencing cognition, for example by affecting the valence of belief structures, guiding information processing styles and influencing motivational constructs such as intentions (Armitage et al., 1999; Conner et al., 2013; Forgas, 2013; Keer et al., 2014; Lawton et al., 2009). As such, it was predicted that mood state (i.e. positive and negative affect) would emerge as a significant predictor of physical activity behaviour throughout first year university.

Physical activity and related determinants are dynamic, potentially modifiable constructs, changing over time, with relation to changes within the environmental context (Wallace, Buckworth, Kirby, & Sherman, 2000). As such, it is important to evaluate these constructs longitudinally to take such fluctuations into account (Wallace, Buckworth, Kirby, & Sherman, 2000). Previous studies have demonstrated that the theory of planned behaviour model has predictive validity longitudinally in relation to health behaviours, including physical activity (Armitage & Conner, 1999; Hagger, Chatzisarantis, Biddle, & Orbell, 2001; Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002). Furthermore, as previous research on physical activity in first-year university students has shown that physical activity behaviour fluctuates and declines over time, this highlights the importance of observing physical activity behaviour and its related predictors longitudinally within this cohort. (Bray & Born, 2004; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003; Irwin, 2004; Jung, Bray, & Ginis, 2008; Lewis et al., 1997; Wallace et al., 2000). Longitudinal tracking of behaviour and determinants may provide a greater understanding of changes that occur in physical activity behaviour amongst this cohort, providing greater utility in developing strategies to counter inactivity and related poor health outcomes in this population.

This study was part of a larger study examining the utility of the theory of planned behaviour and other social cognitive and affective constructs (i.e. self-efficacy, social support, and affect) for predicting physical activity behaviour in young adult university students. The specific focus of this study was to examine physical activity behaviour and correlates longitudinally. Therefore, the current study tracked physical activity, and related predictors, longitudinally among a sample of Australian young adults over the course of their first year at university. There were three main aims of this study. First, this study aimed to observe physical activity behaviour specifically to determine (a) whether physical activity during first-year university differed significantly from retrospective reports of past physical activity levels during the previous year, and (b) whether physical activity rates declined over time. Second, this study aimed to identify which correlates significantly predicted differences in physical activity behaviour between individuals and whether these correlates predicted rates of change in physical activity over time. The correlates of interest within this study included the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support from friends and family, mood state (i.e. positive and negative affect), as well as demographic characteristics. Lastly, this study aimed to assess whether (a) the theory of planned behaviour model was supported longitudinally, and (b) whether self-efficacy and past behaviour would remain influential while controlling for the theory of planned behaviour constructs.

2.2 Method

2.2.1 Participants

Two hundred and one young adult, first-year university students from Australian universities (159 female, 41 male, mean age = 19.23, age range: 17-26 years) were recruited through the Flinders University first year psychology participant pool, and via email as well as flyers around Flinders University, after receiving appropriate ethics approval. Participants included students from all disciplines. The majority were from South Australian Universities (97.5%), with the remainder from Victoria and New South Wales.

2.2.2 Measures

Physical activity and correlates were measured using an online self-report questionnaire across three time points: at the beginning (February/March), middle (June/July) and end (November/December) of students' first-year at university. The questionnaire included a range of measures: demographic information and health, past and present physical activity behaviour, the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support, and mood state. Responses on all measures were collected at each time point, except for past physical activity, which was only measured at time one.

2.2.2.1 Demographics and Health. Demographic information collected included age, gender, as well as height and weight to calculate body mass index (BMI). General health was rated using a five-point Likert scale with 1 'Much worse than others' and 5 'Much better than others'.

2.2.2.2 Past and Current Physical Activity Behaviour. Physical activity behaviour was assessed by asking participants to list any purposeful physical activities they typically engaged in at the current time, as well as during the previous 12 months. For each item listed participants were asked to report the frequency with which they participated in these activities during a typical week, and the average duration of participation on each occasion. A total physical activity score for both past and current behaviour was calculated by multiplying the frequency and duration data for each physical activity listed, and then summing these scores. Total physical activity was reported in minutes per week.

2.2.2.3 Attitudes. Participants were asked two questions, based on previous research, to ascertain their attitudes towards engaging in regular physical activity (i.e. exercising three times a week), and responses rated on seven-point scales (Ajzen, 2001; Courneya & McAuley, 1995; Hamilton & White, 2008; Jackson et al., 2003; Rhodes & Blanchard, 2008). Questions were (1) whether participants like to engage in regular physical activity, with 1 'Definitely do not like to do this' and 7 'Definitely do like to do this', and (2) whether they find doing regular physical activity enjoyable, with 1 'Not enjoyable' and 7 'Enjoyable'. These two items were averaged to create a composite attitudes score, with higher scores indicating more positive attitudes. The resulting Cronbach's *a* was .87, .81, .86, at time 1, time 2 and time 3, respectively.

2.2.2.4 Subjective Norms. Subjective norms for regular physical activity, based on close friends and family members, were assessed using two items, with responses rated on seven-point scales (Ajzen & Sheikh, 2013; Courneya & McAuley, 1995; Jackson et al., 2003; Wing Kwan, Bray, & Martin Ginis, 2009). Participants were asked whether (1) their close friends and (2) immediate family members think they should engage in regular physical activity, with 1 'They definitely think I should not', and 7 'They definitely think I should'. These two items were averaged to create a composite norms score, with higher scores indicating stronger social norms to engage in regular physical activity. Within this sample, the Cronbach's *a* for this scale was .72, .75, .75, at time 1, time 2 and time 3, respectively.

2.2.2.5 Perceived Behavioural Control. Participants were asked two questions to establish their perceived behavioural control in relation to regular physical activity, with responses rated on seven-point scales (Ajzen & Sheikh, 2013;

Courneya & McAuley, 1995; Jackson et al., 2003; Rhodes & Blanchard, 2008; Wing Kwan et al., 2009). Students were asked (1) whether or not they do regular physical activity was entirely up to them, with 1 'Strongly disagree' and 7 'Strongly agree', and (2) whether if they wanted to do regular physical activity they could, with 1 'Definitely false' and 7 'Definitely true'. These two items were averaged to create a composite perceived behavioural control score, with higher scores indicating stronger perceived behavioural control. The resulting internal consistency scores, however, were poor (Cronbach's *a* = .52, .59, .64, at time 1, time 2, and time 3, respectively), and as a result, only item two was used for analysis as this item had stronger correlations with physical activity. The use of a single item for the theory of planned behaviour variables is common practice and has been used in previous research to counter low internal consistency (Ajzen, 1991; Courneya & McAuley, 1995).

2.2.2.6 Intentions. Participants were questioned about their intentions and plans to engage in regular physical activity (i.e. exercising at least three times per week) within the following month, on two seven-point Likert scales (Ajzen & Sheikh, 2013; Hamilton & White, 2008; Hobbs, Dixon, Johnston, & Howie, 2013; Jackson et al., 2003; Kuijer & Boyce, 2014; Plotnikoff et al., 2012). Participants were asked (1) whether they intended to engage in regular physical activity within the next month, with 1 'Definitely do not intend to do this' and 7 'Definitely intend to do this', and (2) how often they planned to engage in regular physical activity, with 1 'Never', and 7 'Everyday'. These two items were averaged to create a composite intentions score, with higher scores suggesting stronger intentions. The resulting Cronbach's *a* was .82, .87, .87 at time 1, time 2 and time 3, respectively.

2.2.2.7 Self-Efficacy. Self-efficacy for physical activity was recorded using Schwarzer and Renner's (2009) Exercise Self-Efficacy Scale. Participants were asked to rate the certainty of carrying out their exercise intentions across five potential barriers (i.e. having worries and problems, feeling depressed, feeling tense, feeling tired, and being busy) on four-point scales ranging from 'Very uncertain' to 'Very certain'. A 'not applicable' option, scored as 0, was also provided. A total self-efficacy score was calculated by summing each item, with possible scores ranging from 0 to 20, and larger scores indicating higher levels of self-efficacy. This scale has been found to be both a valid (construct validity demonstrated by correlations to exercise behaviour and intentions) and reliable (internal consistency: Cronbach's a = .88) tool for assessing exercise self-efficacy (Schwarzer & Renner, 2009). Within this sample, the Cronbach's a for this scale was .86, .88, .88 at time 1, time 2 and time 3, respectively.

2.2.2.8 Social Support. Social support for physical activity was examined using the Social Support Survey for Exercise Behaviour (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). Participants were asked to rate how often (1) their family and (2) their friends engage in ten various exercise related interactions with them (e.g. 'exercised with me', 'discussed exercise with me', 'planned exercise on recreational activities') using five-point scales ranging from 1 'Never' to 5 'Very often'. A 'Not applicable' option was also offered as a response, and was scored as 0. Total scores for support from friends and family were calculated, with scores of 0 indicating no support from friends or family, and scores of 50 indicating very high support levels from friends and family. This scale has been shown to demonstrate both criterion-related and construct validity, and good reliability (internal consistency: Cronbach's a = 0.61-0.91; test-retest reliability: r = 0.55-0.79) (Sallis et al., 1987). Within this sample, the Cronbach's a for the friend support scale was .89, .92, and .92, at time 1, time 2 and time 3, respectively, and the Cronbach's a for the family support scale was .91, .94, and .94 at time 1, time 2 and time 3, respectively.

2.2.2.9 Mood. Mood state was measured using the Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). The scale comprises of 20 emotions or mood states, with both positive and negative valences. Participants were asked to rate the extent to which they had felt those emotions over the past week on a five-point Likert scale, with 1 ‘Very slightly or not at all’ and 5 ‘Extremely’. Scores range from 5 to 50, with higher scores indicating greater levels of positive or negative affect. The PANAS has been found to be a reliable (internal consistency: Cronbach’s a =.87 for both positive and negative affect scales) and valid (convergent and discriminant validity) measure of positive and negative affect (Watson et al., 1988). Within this sample, the Cronbach’s a for positive affect was .92, .91, and .92 at time 1, time 2 and time 3, respectively; and the Cronbach’s a for negative affect was .86, .89, and .89 at time 1, time 2 and time 3, respectively.

2.2.3 Procedure

Participants were provided with a link to the initial online survey in the recruitment materials (i.e. participant pool brief, email, and flyers). They were asked to access it within the first few weeks of first semester (February/March). At the end of the survey, participants were prompted to record their email address as a contact point for follow-up surveys. Participants were sent an email in the middle (June/July) and again at the end of the year (November/December) inviting them to complete each of the follow-up surveys.

2.2.4 Statistical Analyses

Linear mixed modelling in SPSS was conducted to assess the longitudinal trends in physical activity and correlates across first-year university. Mixed modelling techniques are unique in that they take into account missing data, therefore, enabling the retention of all participants in the analyses assessing all three time points (Gerstorf, Herlitz, & Smith, 2006). Models estimated both the residual (i.e. within-person change) and intercept (i.e. between subjects variance) parameters, using a maximum likelihood estimation algorithm, and an unstructured covariance matrix for random effects. All continuous variables were mean centered and categorical variables dichotomised. All analyses were run twice, once using the unstandardised data, and again using standardardised values obtained by converting each variable into Z-scores, to provide an estimate of effect size (Hox, 2010).

Initially, time was added to a model predicting each correlate (i.e. health rating, BMI, attitudes, subjective norms, perceived behavioural control, intentions, self-efficacy, family and friend support, positive and negative affect) as a fixed effect to assess whether each correlate changed across time periods (see Table 1). Supplementary models were run including time as a random effect; however, these additions provided no significant improvement to the models and therefore were not retained. Results are reported along with descriptive statistics for each correlate.

Additionally, time was added to a model predicting current physical activity levels as a fixed effect to assess whether physical activity changed across time periods. Subsequently, an additional model was run including time as a random effect; however, this addition provided no significant improvement to the model. As a result, all subsequent models included time as a fixed effect only. Each covariate (i.e. age, gender, health rating, BMI, past physical activity, attitudes, subjective norms, perceived behavioural control, intentions, self-efficacy, family and friend support, positive and negative affect) was added to the base model as an individual fixed effect, to determine their exclusive predictive value for physical activity. These models were repeated, this time including an interaction term between the relevant covariate and time to assess the role of each covariate in the prediction of rates of change in physical activity across first-year university.

Table 1

CHAPTER 2: Unstandardised and Standardised Fixed Effects, Intercept, and Residual Covariance Parameters for Influential Correlates across First-year University

Predictor	Fixed Effect Estimate (SE)	Intercept Estimate (SE)	Residual Estimate (SE)	Standardised Coefficient (SE)
Health Rating	.001 (.009)	.481 (.064)	.203 (.024)	.006 (.037)
BMI	-.052 (.128)	61.54 (11.05)	33.37 (4.70)	-.018 (.046)
Attitudes	.037 (.020)	1.49 (.233)	.873 (.106)	.078 (.043)
Subjective Norms	.064 (.019)**	1.62 (.243)	.773 (.096)	.034 (.040)
PBC	-.002 (.024)	1.69 (.303)	1.30 (.163)	-.004 (.047)
Intentions	.050 (.021)*	1.55 (.245)	.932 (.114)	.103 (.043)
Self-efficacy	.068 (.055)	9.08 (1.54)	6.66 (.809)	.056 (.045)
Family Support	-.366 (.118) **	60.92 (8.81)	28.87 (3.50)	-.123 (.040)
Friend Support	-.240 (.127)	39.37 (7.31)	35.85 (4.37)	-.090 (.048)
Positive Affect	-.294 (.111)**	41.78 (6.98)	25.38 (3.27)	-.118 (.045)
Negative Affect	-.133 (.105)	30.37 (5.38)	23.12 (2.92)	-.059 (.047)

Note: Main fixed effects: * p <.05; ** p<.01; *** p<.001; Time predictor entered alone as a fixed effect; SE = Standard Error; PBC = Perceived Behavioural Control

The final models assessed the predictive validity of the theory of planned behaviour model. In the initial model, attitudes, subjective norms, and perceived behavioural control were added as fixed effects, alongside time, to a model predicting current physical activity levels to assess the collective role of these factors in predicting behaviour across time periods. Intentions, self-efficacy, and past behaviour were then added stepwise to the previous model to assess the change in the respective roles of the theory of planned behaviour constructs in the prediction of behaviour, attributed to the addition of each of these variables.

2.3 Results

2.3.1 Descriptive Statistics

Approximately fifty percent of the initial sample (*N*=201) completed the initial survey only, 18.4% completed surveys one and two, approximately one-third completed all three surveys, and the remaining 3.5% completed surveys one and three only. The distribution of students across each survey was similar in age, gender, and occupation during the previous year. The majority of students were aged 17-18 years and had transitioned straight from high school. See *Figure 2* for a breakdown of participation in each survey, and participant distributions (i.e. age, gender, and occupation during the previous year) at each time period.

Descriptive data for all variables at each of the three time points can be found in Table 2. Participants rated their health as about the same as their peers, and BMI scores fell within the normal weight range. Both health rating and BMI remained stable across first-year university (Table 1). On average, participants had positive attitudes to physical activity, supportive subjective norms, good levels of perceived behavioural control, and positive intentions to engage in physical activity three times per week, at each time period. Longitudinal trends (see Table 1) indicated that subjective norms and intentions significantly increased over time. This suggested that

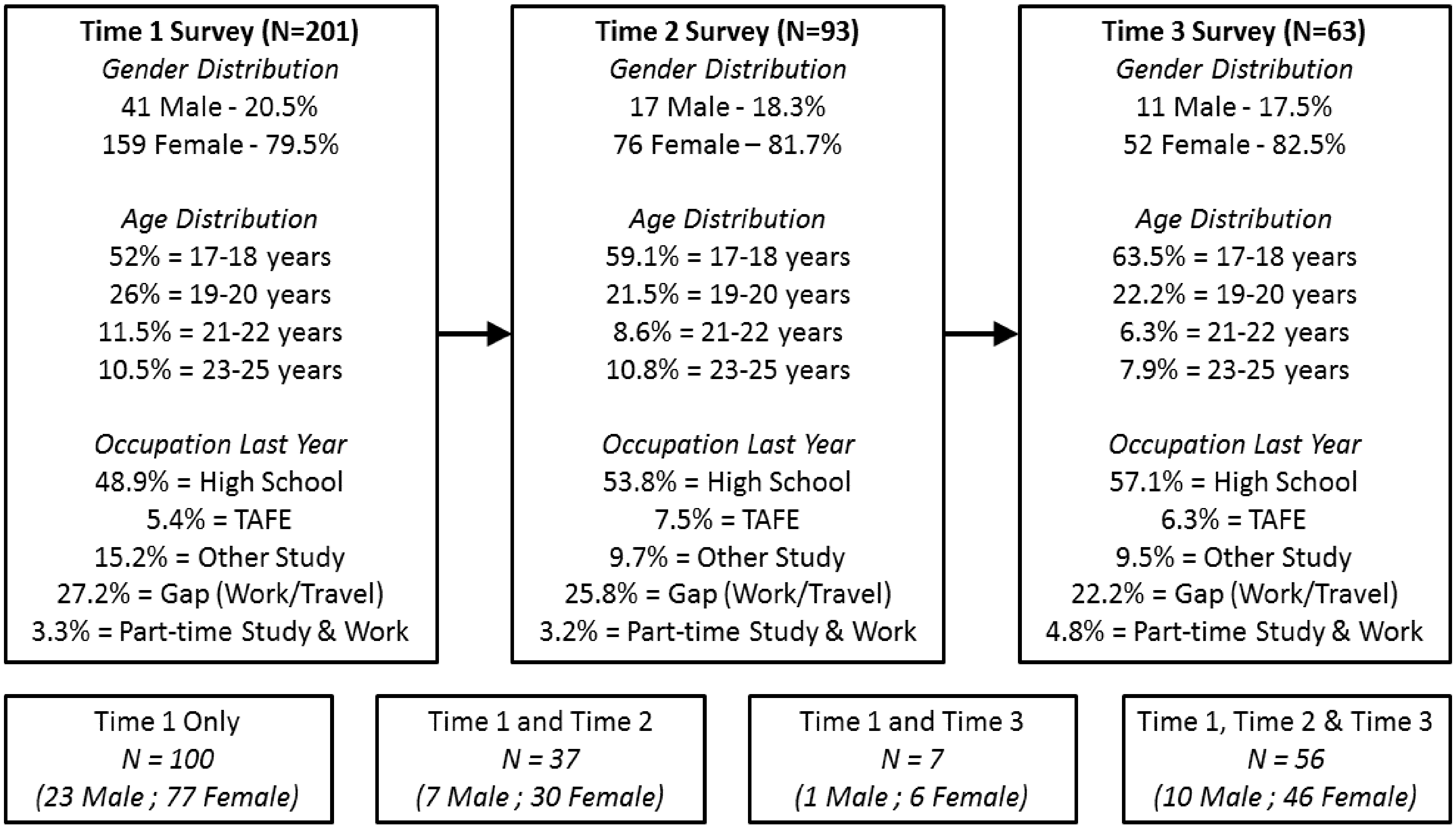

Figure 2. CHAPTER 2: CONSORT Flow Diagram Outlining Participant Distributions at Time 1, Time 2 and Time 3

Table 2

CHAPTER 2: Descriptive Data for Current Physical Activity and Influential Correlates at Time 1, Time 2 and Time 3

	Time 1 M (SD)	Time 2 M (SD)	Time 3 M (SD)
Past Physical Activity	396.2 (371.7) *N*=179	-	-
Current Physical Activity	264.7 (301.1) *N*=171	248.2 (280.3) *N*=85	262.3 (267.9) *N*=59
BMI	23.0 (5.1) *N*=156	23.2 (5.0) *N*=76	23.0 (5.1) *N*=51
Health Rating	3.1 (0.8) *N*=199	3.2 (0.8) *N*=91	3.1 (0.9) *N*=58
Attitudes	5.7 (1.5) *N*=162	5.6 (1.7) *N*=80	5.8 (1.4) *N*=51
Subjective Norms	4.5 (1.6) *N*=162	4.7 (1.6) *N*=80	4.9 (1.5) *N*=52
PBC	5.5 (1.8) *N*=163	5.5 (1.6) *N*=80	5.4 (1.7) *N*=52
Intentions	4.9 (1.6) *N*=162	4.8 (1.7) *N*=80	5.2 (1.5) *N*=152
Self-efficacy	12.0 (3.9) *N*=164	11.6 (4.2) *N*=81	12.7 (3.7) *N*=52
Friend Support	20.5 (8.4) *N*=163	17.9 (9.1) *N*=80	18.4 (8.9) *N*=52
Family Support	20.1 (9.1) *N*=162	18.3 (10.4) *N*=79	18.2 (10.5) *N*=52
Positive Affect	32.7 (8.3) *N*=161	32.0 (8.0) *N*=76	30.5 (7.8) *N*=50
Negative Affect	23.2 (7.2) *N*=161	21.0 (7.3) *N*=77	22.7 (7.3) *N*=50

Note: M = Mean; SD = Standard Deviation; PBC = Perceived Behavioural Control students felt stronger pressure to engage in physical activity from their friends and/or family and increased their intentions to engage in physical activity over their first-year at university. Attitudes and perceived behavioural control both remained stable over time.

Participants' on average, had moderate levels of self-efficacy to engage in regular physical activity throughout first-year university, and self-efficacy scores remained stable over time (Table 1), The average social support levels provided for physical activity were consistent for both friends and family, suggesting that students received low to moderate levels of social support from both their friends and family to engage in physical activity throughout first-year university. Social support from family was shown to significantly decrease over time; however, no significant change was observed for friend support across time (see Table 1). This suggests that family members had less involvement in participants' physical activity patterns as students progressed throughout their first-year of university.

Participants experienced moderate levels of positive affect, and low to moderate levels of negative affect on average across each time period. Positive affect was shown to significantly decrease over first-year university; however, negative affect remained stable throughout the year (Table 1). This suggests that students experienced less positive mood states over the year, but these did not correspond with increases in negative mood.

Approximately 77% of participants reported that they engaged in purposeful physical activities throughout their first year of university (i.e. across time periods 1 to 3), spending on average just over four hours being physically active per week at each time period. This suggested that a significant proportion of students were likely meeting the recommended amount of purposeful physical activity outlined by the Australian physical activity guidelines, which recommend between 150 minutes (2.5

hours) and 300 minutes (5 hours) of physical activity per week (Brown et al., 2012). However, the large standard deviations indicate that these values are highly variable. This, along with the self-reported nature of the data, warrants caution in interpreting that this sample were on average meeting physical activity guidelines.

Although the average purposeful physical activity levels during first-year university fell within the recommended guidelines, the results showed a self-reported reduction of 12.7% in purposeful physical activity participation from the previous year. This represented a change in average physical activity rates from approximately six and half hours, as retrospectively reported from the previous year. This finding suggests that participants were likely highly active during the previous year, potentially exceeding the recommended guidelines for physical activity in the year prior to starting university. Paired samples t-tests determined that the reductions in current physical activity (i.e. during university) significantly differed from past physical activity at both time one, and time two, but was not statistically different at time 3 (see Table 3).

2.3.2 Relationships between current physical activity and correlates at each time point

Significant positive correlations were found at each time point between current physical activity and past physical activity, health rating, the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support from both friends and family, and positive affect (see Table 4). No significant correlations were found between current physical activity and either BMI or negative affect.

Table 3

CHAPTER 2: Differences between Past Physical Activity and Current Physical Activity at Time 1, 2 and 3

Comparison	Past Physical Activity *Mean* *(SD)*	Current Physical Activity *Mean* *(SD)*	Mean Difference *(SD)*	95%*CI*	*t*	*df*
Time 1 *N*=170	391.81 (349.97)	266.24 (301.29)	125.57 (262.18)	85.88 to 165.27	6.25***	169
Time 2 *N*=85	346.14 (288.79)	248.18 (280.29)	97.96 (239.60)	46.28 to 149.64	3.77***	84
Time 3 *N*=58	313.47 (316.99)	266.12 (268.61)	47.35 (278.40)	-25.85 to 120.56	1.30	57

Note: * p <.05; ** p<.01; *** p<.001. The analyses only included participants who had completed data at each respective time point.

2.3.3 Longitudinal trends in, and the prediction of current physical activity behaviour

As mentioned above, linear mixed modelling was conducted to assess the longitudinal trends in physical activity behaviour across first-year university, while also assessing the individual role of correlates in the prediction of current physical activity both between individuals and over time (e.g. predicting rates of change in physical activity across the span of the academic year).

The results, reported in Table 5, indicated a slight positive trend for physical activity across each time period; however, this effect was not significant. This suggests that physical activity rates largely remained stable throughout first-year

Table 4

CHAPTER 2: Correlations between Demographic Characteristics, Past Physical Activity, The Theory of Planned Behaviour Constructs, Social-cognitive Constructs, and Mood with Current Physical Activity at each Time Point.

	Time 1 (*N*=162-171)	Time 2 (*N*=76-85)	Time 3 (*N*=50-59)
Gender	-.213**	-.137	-.099
Age	-.105	-.121	-.274*
BMI	-.076	.103	.089
Health Rating	.300***	.439***	.368**
Past Physical Activity	.685***	.646***	.559***
Attitudes	.402***	.452***	.456**
Subjective Norms	.294***	.488***	.384**
PBC	.401***	.439***	.428**
Intentions	.513***	.510***	.613***
Self-efficacy	.511***	.516***	.524***
Friend Support	.214**	618***	.348*
Family Support	.360***	.552***	.383**
Positive Affect	.357***	.294*	.292*
Negative Affect	-.043	.082	-.251

Note: * p <.05; ** p<.01; *** p<.001. PBC = Perceived Behavioural Control

university. All correlates were found to significantly predict between person differences in physical activity behaviour across time, except for age, BMI, and negative affect. While these predictors significantly predicted differences in physical activity behaviour between individuals, none of the correlates significantly interacted

Table 5

CHAPTER 2: Unstandardised and Standardised Fixed Effects, Intercept and Residual Covariance Parameters, and Interactions with Time for Physical Activity across First-year University

Predictor	Fixed Effect Estimate (SE)	Intercept Estimate (SE)	Residual Estimate (SE)	Time Interaction Estimate (SE)	Standardised Coefficient (SE)
Time	5.15 (3.35)	64634.91 (9356.38)	25780.49 (3160.48)	-	.058 (.038)
Age	-17.20 (10.12)	63519.32 (9295.24)	25853.32 (3178.90)	-1.77 (1.57)	-.128 .075
Female	-133.48* (53.80)	61.773.11 (9084.54)	25825.37 (3170.63)	11.68 (8.65)	-.187 .075
Health Rating	82.37*** (19.30)	51889.36 (8266.19)	26106.52 (3297.80)	-4.10 (4.22)	.235 (.055)
BMI	.864 (1.75)	62332.99 (9429.52)	26075.45 (3395.31)	.367 (.610)	.027 (.056)
Past Physical Activity	.573*** (.045)	22458.80 (5378.20)	27489.52 (3554.32)	-.009 (.010)	.737 (.058)
Attitudes	63.56*** (10.35)	50565.47 (8381.18)	26062.54 (3439.65)	-.740 (2.48)	.341 (.056)

Note: Main fixed effects: * p <.05; ** p<.01; *** p<.001; Time predictor entered alone as a fixed effect, all other predictors were added individually to this model as additional fixed effects with Time.

Table 5 *Continued.*

CHAPTER 2: Unstandardised and Standardised Fixed Effects, Intercept and Residual Covariance Parameters, and Interactions with Time for Physical Activity across First-year University

Predictor	Fixed Effect Estimate (SE)	Intercept Estimate (SE)	Residual Estimate (SE)	Time Interaction Estimate (SE)	Standardised Coefficient (SE)
Subjective Norms	57.54*** (10.63)	27271.28 (8792.98)	24530.16 (3182.42)	3.87 (2.36)	.309 (.057)
PBC	52.85*** (8.89)	50726.19 (8346.85)	26073.53 (3417.71)	-1.09 (2.18)	.313 (.053)
Intentions	81.43*** (9.61)	40918.33 (7351.71)	25850.34 (3445.23)	-1.20 (2.37)	.448 (.053)
Self-efficacy	28.15*** (3.83)	39621.39 (7997.46)	28888.92 (4006.18)	-1.05 (.958)	.388 (.053)
Family Support	9.08*** (1.71)	59429.67 (9068.91)	22317.51 (2978.40)	-.158 (.345)	.306 (.058)
Friend Support	6.02** (1.79)	57345.31 (9374.82)	27021.02 (3583.84)	.427 (.439)	.182 (.054)
Positive Affect	7.77*** (2.03)	56730.37 (9282.51)	27557.44 (3705.88)	-.840 (.485)	.219 (.057)
Negative Affect	-.790 (2.24)	67121.92 (9962.08)	26133.24 (3398.67)	.136 (.522)	-.020 (.057)

Note: Main fixed effects: * *p* <.05; ** *p*<.01; *** *p*<.001; Time predictor entered alone as a fixed effect, all other predictors were added individually to this model as additional fixed effects with Time. PBC = Perceived Behavioural Control with time, indicating that these correlates did not predict rates of change in physical activity over time during first-year university.

Examining the specific contribution of each significant correlate across first-year university (i.e. across each time point) indicated that all correlates positively predicted physical activity participation, except for gender which negatively predicted physical activity across first-year university (Table 5). The results showed that women do approximately 2.2 hours less physical activity per week than men during first-year university, with a small effect size.

Each of the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions) positively predicted differences in physical activity participation across first-year university, demonstrating small to moderate effect sizes (Table 5). These results indicated that students who reported having positive attitudes towards regular physical activity perceived higher social pressure (i.e. subjective norms) from friends and family members to be active, had higher levels of perceived behavioural control and reported positive intentions to engage in regular physical activity, engaged in higher rates of physical activity than those with lower scores on these variables. Specifically, participants with positive attitudes participated in approximately 64 minutes more physical activity compared to participants with negative attitudes. Participants reporting higher levels of subjective norms participated in approximately 58 minutes more physical activity than students with lower levels of subjective norms. Participants who reported higher levels of perceived behavioural control were shown to do approximately 53 minutes more physical activity per week than those who reported lower levels of control. Lastly, students who reported positive intentions were found to participate in more physical activity at a rate of 1.4 hours more per week compared to students with lower intention levels.

Health rating, self-efficacy, family and friend support, positive affect, and past physical activity level, were also shown to positively predict differences in physical activity behaviour across first-year university (Table 5). Small to moderate effects were shown for health rating, self-efficacy, family and friend support, and positive affect, and moderate to large effects for past physical activity. Results show that students with higher self-ratings of health did approximately 82 minutes more physical activity per week than students with lower health ratings. Students with higher levels of self-efficacy for physical activity participated in approximately 28 minutes per week more physical activity than students with lower levels of self-efficacy. Individuals who received more support from family and friends to be active were shown to do approximately nine minutes and six minutes more per week, respectively, compared to students with lower levels of family and friend support. Students who reported higher levels of positive affect did approximately eight minutes more physical activity per week, compared to students reporting lower levels of positive affect. Lastly, those who had higher rates of physical activity in the past were more active during first-year university; however, while significant, the difference was small (i.e. rate of approximately half a minute more per week).

2.3.4 Theory of planned behaviour model testing

As mentioned above, linear mixed modelling was conducted to assess the predictive value of the theory of planned behaviour model longitudinally, as well as to determine the effects of the addition of self-efficacy and past behaviour.

First, to assess the theory of planned behaviour model, Model 1 was conducted including attitudes, subjective norms and perceived behavioural control, alongside time, in the prediction of physical activity (see Table 6). Results indicated that

Table 6

CHAPTER 2: Unstandardised and Standardised Fixed Effects, Intercept, and Residual Covariance Parameters for Longitudinal Mixed Models 1 and 2

		Model 1		
Predictors	Fixed Effect Estimate (SE)	Standardised Coefficient (SE)	Model Intercept Estimate (SE)	Model Residual Estimate (SE)
Time	2.04 (3.51)	.023 (.040)	43904.14 (7549.30)	24743.91 (3294.23)
Attitudes	36.61** (11.29)	.197 (.061)	43904.14 (7549.30)	24743.91 (3294.23)
Subjective Norms	33.57** (11.13)	.180 (.060)	43904.14 (7549.30)	24743.91 (3294.23)
PBC	36.85*** (9.09)	.218 (.054)	43904.14 (7549.30)	24743.91 (3294.23)
		Model 2		
Time	.521 (3.51)	.006 (.040)	38466.24 (7057.22)	24793.64 (3353.86)
Attitudes	15.44 (12.28)	.083 (.066)	38466.24 (7057.22)	24793.64 (3353.86)
Subjective Norms	25.98* (11.00)	.140 (.059)	38466.24 (7057.22)	24793.64 (3353.86)
PBC	24.48* (9.46)	.145 (.056)	38466.24 (7057.22)	24793.64 (3353.86)
Intentions	50.92*** (12.42)	.280 (.068)	38466.24 (7057.22)	24793.64 (3353.86)

Note: Main fixed effects: * p <.05; ** p<.01; *** p<.001; Model 1: Time, Attitudes, Subjective Norms, and PBC added as Fixed Effects in the prediction of physical activity. Model 2: Time, Attitudes, Subjective Norms, PBC, and Intentions added as Fixed Effects in the prediction of physical activity. SE = Standard Error; PBC = Perceived Behavioural Control.

attitudes, subjective norms, and perceived behavioural control each positively, significantly predicted physical activity behaviour, each demonstrating small effect sizes. Second, the addition of intentions to the model (Model 2 – see Table 6) resulted in attitudes no longer being a significant predictor. However, subjective norms and perceived behavioural control remained significant, albeit with smaller effect sizes, suggesting some mediation effects via intentions. Intentions were a significant predictor of physical activity, and showed a small to moderate effect size.

The following model (Model 3) added self-efficacy to Model 2, which resulted in subjective norms and perceived behavioural control no longer being significant (see Table 7). However, self-efficacy and intentions were significant predictors of physical activity, each showing a small effect size. Model 4 included the addition of past behaviour (see Table 7). Both intentions and self-efficacy remained significant predictors, alongside past behaviour, albeit with smaller effect sizes. Past behaviour was a significant predictor of physical activity and had a moderate effect size.

2.4 Discussion

This study had three primary aims. First, it aimed to longitudinally track physical activity in Australian first-year university students to determine whether a) differences between current physical activity and retrospective accounts of past participation occur during this transition year, and b) physical activity participation changes over first year university. Second, the study aimed to highlight potential influential correlates of physical activity within this cohort and determine their individual function to predict rates of change in physical activity participation across first-year university. The correlates examined included past physical activity, the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support, mood and demographic features. Third, the study aimed to assess whether (a) the theory of planned behaviour model was supported longitudinally, and (b) whether the self-efficacy and past behaviour would remain influential while controlling for the theory of planned behaviour constructs.

Table 7

CHAPTER 2: Unstandardised and Standardised Fixed Effects, Intercept, and Residual Covariance Parameters for Longitudinal Mixed Models 3 and 4

		Model 3		
Predictors	Fixed Effect Estimate (SE)	Standardised Coefficient (SE)	Model Intercept Estimate (SE)	Model Residual Estimate (SE)
Time	-.325 (3.55)	-.004 (.040)	30535.66 (6546.56)	26076.66 (3630.26)
Attitudes	14.49 (14.15)	.078 (.065)	30535.66 (6546.56)	26076.66 (3630.26)
Subjective Norms	19.82 (10.78)	.107 (.058)	30535.66 (6546.56)	26076.66 (3630.26)
PBC	17.62 (9.42)	.104 (.056)	30535.66 (6546.56)	26076.66 (3630.26)
Intentions	43.20** (12.69)	.238 (.070)	30535.66 (6546.56)	26076.66 (3630.26)
Self-efficacy	17.02*** (3.94)	.235 (.054)	30535.66 (6546.56)	26076.66 (3630.26)

Note: Main fixed effects: * p <.05; ** p<.01; *** p<.001; Model 3: Time, Attitudes, Subjective Norms, PBC, Intentions and Self-efficacy, added as Fixed Effects in the prediction of physical activity. SE = Standard Error; PBC = Perceived Behavioural Control.

Table 7 *Continued.*

CHAPTER 2: Unstandardised and Standardised Fixed Effects, Intercept, and Residual Covariance Parameters for Longitudinal Mixed Models 3 and 4

	Model 4			
Predictors	Fixed Effect Estimate (SE)	Standardised Coefficient (SE)	Model Intercept Estimate (SE)	Model Residual Estimate (SE)
Time	2.93 (3.45)	.033 (.039)	14281.50 (4779.49)	26115.47 (3704.94)
Attitudes	10.66 (10.92)	.057 (.059)	14281.50 (4779.49)	26115.47 (3704.94)
Subjective Norms	10.54 (9.45)	.057 (.051)	14281.50 (4779.49)	26115.47 (3704.94)
PBC	13.07 (8.41)	.077 (.050)	14281.50 (4779.49)	26115.47 (3704.94)
Intentions	28.66* (11.54)	.158 (.063)	14281.50 (4779.49)	26115.47 (3704.94)
Self-efficacy	10.63** (3.67)	.146 (.051)	14281.50 (4779.49)	26115.47 (3704.94)
Past Physical Activity	.427*** (.047)	.548 (.060)	14281.50 (4779.49)	26115.47 (3704.94)

Note: Main fixed effects: * p <.05; ** p<.01; *** p<.001; Model 4: Time, Attitudes, Subjective Norms, PBC, Intentions, Self-efficacy, and Past Behaviour, added as Fixed Effects in the prediction of physical activity. SE = Standard Error; PBC = Perceived Behavioural Control.

The results highlighted that a significant proportion of participants were highly active, with the average physical activity rates being consistent with meeting physical activity guidelines. Additionally, physical activity participation remained stable throughout first-year university; however, physical activity participation was significantly reduced compared to reports of physical activity in the year preceding entry to first-year university. All correlates except for age, BMI and negative affect were found to predict significant differences in physical activity between individuals across first-year university; however, these correlates were not shown to predict rates of change in physical activity over time. Lastly, the primary predictions based on the theory of planned behaviour model, and the inclusion of self-efficacy and past behaviour to the model were supported.

The high average physical activity rates found both throughout first year university and during the previous year (consistent with meeting physical activity guidelines), contrasts with previous research from both Australia and overseas, which has shown insufficient physical activity levels during adolescence and young adulthood (Bray & Born, 2004; Butler et al., 2004; Huang et al., 2003; Jung et al., 2008; Leslie et al., 1999). This result is, however, consistent with research by Irwin (2004), who reported that Australian young adults had the highest physical activity guideline adherence rates when compared with an international sample. This therefore supports the notion that Australian young adults may be more inclined to live active lifestyles, possibly the result of cultural and environmental influences.

Nevertheless, the significant reduction in physical activity during first year university, compared to the previous 12 months, is consistent with the declines that are repeatedly reported in early adulthood and during the transition into university (Bray & Born, 2004; Butler et al., 2004; Huang et al., 2003; Jung et al., 2008; Leslie et al., 1999; Wing Kwan et al., 2009). However, in our sample, despite the significant reduction in physical activity during first-year university compared to past behaviour, physical activity rates during first-year university did not decline, but remained fairly stable, with a slight but non-significant positive trend. Our findings showed that students' physical activity rates continued to be consistent with the recommended guidelines for physical activity throughout the first year of university, even though the level of physical activity had reduced from the previous year. This suggests that the reduction in physical activity behaviour likely occurred prior to, rather than as a result of entry into university; however, it appeared that previous levels of activity were not re-established once in the university environment.

This cohort of first-year university students was found to have clear positive attitudes, supportive subjective norms, good perceived behavioural control and positive intentions to engage in regular physical activity, which is consistent with other university student samples, which used similar measures (Wing Kwan et al., 2009). In addition, participants reported moderate levels of self-efficacy and positive affect, and low to moderate levels of negative affect and social support, from both friends and family. These levels are similar to those reported in previous research using similar methods, and therefore our results are comparable to other young adult and university student samples in this regard (Charles, Reynolds, & Gatz, 2001; Molloy, Dixon, Hamer, & Sniehotta, 2010; Röcke, Li, & Smith, 2009; Steptoe, Wardle, Pollard, Canaan, & Davies, 1996; Treiber et al., 1991; Wing Kwan et al., 2009).

Positive correlations were found at each time period between the extent of participation in physical activity and scores on the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control and intentions). In addition, physical activity was also related to past participation in physical activity, self-efficacy for physical activity, social support from both friends and family, positive affect and health rating. This is also consistent with previous findings (Dishman, Saunders, Motl, Dowda, & Pate, 2009; Ekkekakis et al., 2013; Hagger et al., 2001; Okun et al., 2003; Wing Kwan et al., 2009). Furthermore, each of these significant correlates were found to predict significant differences in physical activity throughout the first year of university, confirming the importance of these variables for physical activity participation in young adults (Bryan et al., 2007; Conner & Armitage, 1998; Ekkekakis et al., 2013; Godin & Kok, 1996; Hagger et al., 2001; McAuley & Blissmer, 2000; McEachan et al., 2011; Okun et al., 2003; Wallace et al., 2000; Zunft et al., 1999). These findings could be used to inform intervention research that aims to improve physical activity participation rates within the university environment, which could lead to university-based interventions or support programs in the future.

Although the theory of planned behaviour constructs, past behaviour, self-efficacy, social support from both friends and family, positive affect and health rating were all found to significantly predict differences in physical activity between individuals across first-year university, these correlates were not shown to predict rates of change in physical activity behaviour. In this cohort, physical activity behaviour remained stable across first-year university, resulting in no change for these correlates to predict. However, tracking student physical activity behaviour over a longer period of time, for example, from high school, throughout undergraduate education through to commencement in the workforce, may better highlight changes that occur during young adulthood, and shed more light on which correlates are the most reliable predictors of physical activity over time.

The predictions based on the theory of planned behaviour were largely supported, providing further evidence for the utility of this model in predicting physical activity, including significant effects over time. Attitudes, subjective norms, and perceived behavioural control each positively, significantly predicted physical activity behaviour; however, the addition of intentions appeared to mediate these relationships, demonstrating a reduction in effect sizes, and rendering attitudes non-significant. The remaining significance of perceived behavioural control is consistent with the theory, and previous research, which suggests that perceived behavioural control affects behaviour directly as well as indirectly through intentions (Ajzen, 1991; McEachan et al., 2011). However, subjective norms are typically shown to be the weakest predictor within the theory and are theorised to only function indirectly via intentions; therefore, the finding that they remained significant after the addition intentions contrasts with the theory and previous research (McEachan et al., 2011). This effect, however, may be explained by the significant positive trend found for subjective norms over time, which may have increased this variable's influence within this sample.

Furthermore, the addition of self-efficacy to the model attenuated the effects of subjective norms and perceived behavioural control. This highlights the importance of self-efficacy in the prediction of physical activity, and supports our hypothesis that self-efficacy would remain a significant predictor after controlling for the theory of planned behaviour constructs. Additionally, this further supports previous research which had determined that self-efficacy is a stronger predictor of physical activity than perceived behavioural control (Hagger et al., 2001). Lastly, after the inclusion of past behaviour, self-efficacy and intentions remained significant predictors of physical activity. This provides strong support for the value of the theory of planned behaviour model in predicting behaviour over time, with the primary concepts of direct effects for intentions and control factors (in this case self-efficacy) remaining influential across first year university, even after controlling for the effects of past behaviour.

This study highlighted multiple important factors that predict participation in physical activity within a first-year university student cohort, including attitudes, subjective norms, perceived behavioural control, intentions, self-efficacy, social support, and positive affect. Many of these factors have the potential for modification and therefore, could be manipulated to improve physical activity participation and maintenance within this cohort. Previous research has documented success in manipulating attitudes, self-efficacy, social support, and positive affect (Ajzen & Fishbein, 2000; Ekkekakis et al., 2013; Kahn et al., 2002; McAuley & Blissmer, 2000; McNeill, Kreuter, & Subramanian, 2006; Task Force on Community Preventive Services, 2002). For example, there are a number of approaches to attitudinal change, such as evaluative conditioning tasks, affective priming and persuasive communication methods, all of which have shown success in changing attitudes at either implicit and/or explicit levels in other health behavior domains (Gawronski & Bodenhausen, 2006; Haynes, Kemps, & Moffitt, 2015a, 2015b; Houben, Havermans, & Wiers, 2010; Houben, Schoenmakers, & Wiers, 2010).

Self-efficacy can also be successfully manipulated through shaping the environment (e.g. via a socially enriched group environment) and providing positive performance feedback (McAuley & Blissmer, 2000; McAuley, Talbot, & Martinez, 1999; Turner, Rejeski, & Brawley, 1997). These types of interventions have demonstrated improved self-efficacy and improved physical activity adherence (McAuley & Blissmer, 2000; McAuley et al., 1999; Turner et al., 1997). Social support is another factor that can be modified by using interventions which encourage supportive relationships and therefore increase the frequency and duration of physical activity participation. The use of ‘buddy’ systems, making ‘contracts’, and/or organising physical activity groups working through the creation of new social networks or working within pre-existing ones have all been effective in this regard (Kahn et al., 2002; McNeill et al., 2006; Task Force on Community Preventive Services, 2002). The manipulation of positive affect has also been successfully demonstrated in laboratory and clinical settings using therapeutic techniques such as listening to pleasant music or recalling past positive memories (Ekkekakis et al., 2013; Johnson, Gooding, Wood, Fair, & Tarrier, 2013; Robinson, Grillon, & Sahakian, 2012).

Therefore, future intervention research could focus on any one of the above factors, investigating techniques to bring about positive attitude change, boost self-efficacy, foster supportive relationships from friends and family members, or induce positive affect, with the aim of improving rates of physical activity. Intervention research such as this could then form the basis of intervention and support programs designed to improve physical activity within university settings in the future. Furthermore, the significant role of past behaviour in this study highlights the importance of encouraging physical activity behaviour in childhood or adolescence, as behaviour during these early periods has the potential to strongly drive future participation in physical activity, in young adulthood and beyond.

Despite the strength of using a longitudinal design, this study does have its own limitations which should be acknowledged. Namely, the self-selected nature of the sample, and the use of self-reported measures. Each of these limitations could have weakened the generalisability of the findings as they may have resulted in higher rates of health-inclined students participating, and exaggerated or inflated reports of physical activity behaviour as a result. Future research may want to examine these factors longitudinally using a random sample, and using more objective measures.

In conclusion, this study tracked the physical activity behavior of a group of young adults in Australia through their first year of university. The study established that these students, on average, differed from similar cohorts outside Australia, showing physical activity patterns consistent with physical activity guidelines throughout this period, and high rates of activity in the year prior to starting university. Physical activity levels remained stable over the first year university, another result that contrasts with studies elsewhere. These findings suggest that culturally Australian students may be more likely to be physically active than similar student groups in other locations.

Because of the many physical and psychological benefits of regular physical activity, which can positively impact health throughout adult life, the development of regular physical activity behaviour in early adulthood has profound implications for long-term health outcomes. This study identified a selection of correlates which significantly predicted physical activity in young adults, including theory of planned behavior constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), past behavior, self-efficacy, social support from both friends and family, and positive affect. As several of these correlates can be modified, these findings can be used to inform intervention research that aims to increase participation in physical activity for students in university contexts. Additionally, the theory of planned behaviour model appeared to hold well longitudinally after controlling for past behaviour, demonstrating the value and utility of this model in predicting behaviour. The impact of past behaviour on physical activity is particularly notable, suggesting that the establishment of regular physical activity in childhood and adolescence has the potential to improve future physical activity rates, thus improving physical and psychological health, not only in young adulthood but throughout life.

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CHAPTER 3: Moderators of the relationship between intentions and physical activity in young adults: The roles of past physical activity, self-efficacy, social support and positive affect

Objectives: This study reviewed the prediction of physical activity behaviour in young adults, based on the theory of planned behaviour model, and further examined the role of past behaviour, self-efficacy, social support, and positive affect as moderators of the intention-behaviour relationship. **Methods:** Participants (*N*=201; 159 female, 41 male, aged 17-25) completed an online survey measuring past and present physical activity behaviour, theory of planned behaviour variables (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support, and mood. **Results:** The results supported the central tenets of the theory of planned behaviour model; attitudes, subjective norms, and perceived behavioural control predicted physical activity indirectly via intentions and perceived behavioural control additionally predicted variance in physical activity directly. Furthermore, past behaviour, self-efficacy, family support and positive affect were identified as moderators of the relationship between intentions and physical activity behaviour. **Conclusions:** This study adds to the body of knowledge examining moderators of the intention-behaviour gap in physical activity behaviour. The results support the inclusion of past behaviour, self-efficacy, social support and positive affect as moderators in theoretical models, with each predictor found to assist the translation of intent into action. These findings provide valuable insights for future intervention studies.

3.1 Introduction

Engaging in regular physical activity is known to be important for good health due to numerous physical and psychological benefits that result from maintaining an active lifestyle (Scarmeas et al., 2009; Zunft et al., 1999). In particular, regular physical activity has been shown to protect from chronic disease, build strong bones and connective tissue, assist in weight management, and boost mood, self-esteem, and confidence, while reducing stress (Brown, Bauman, Bull, & Burton, 2012; Leslie et al., 1999). Previous research in young adults report insufficient participation in physical activity, based on recommended guidelines, and declines in physical activity across this period of life (Bray & Born, 2004; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003; Irwin, 2004; Jung, Bray, & Ginis, 2008; Lewis et al., 1997).

Adolescence through to early adulthood is a period of life that is characterised by profound change marked by investigation of new directions and self-identity (Arnett, 2000; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). During this critical period, young adults (aged 17-25) establish their independence and health behaviour patterns, including physical activity behaviour. Consequently, this is an important cohort in which to target the formation of long-term lifestyle behaviour practices (Nelson et al., 2008). As behaviour established during this period are likely to extend into adulthood, the subsequent outcomes of declining physical activity could have detrimental effects on adult health. As such, research has turned its attention to understanding the determinants of physical activity behaviour in young adults with the hope that further knowledge within this cohort may help guide successful interventions designed to increase the adoption of regular physical activity during young adulthood, which has the potential to have beneficial flow on effects for adult health.

Social cognitive theories have been commonly applied to understand predictors of behaviours linked to physical health, including physical activity. One such theory is the theory of planned behaviour (Ajzen, 1991), which describes behaviour as rational and driven by intentions. Intentions, in turn, are influenced by attitudes towards the target behaviour, subjective perceptions of what is "normal" (subjective norms), and perceived behavioural control over the behaviour. The theory of planned behaviour suggests that perceived behavioural control influences physical activity indirectly through intentions, but also can affect behaviour directly (Ajzen, 1991).

The theory of planned behaviour has been shown to be useful in the prediction of intentions and behaviour within the physical activity domain; however, reviews typically report that intentions are much better predicted than actual behaviour (Armitage & Conner, 2000; McBroom & Reid, 1992; McEachan, Conner, Taylor, & Lawton, 2011; Orbell & Sheeren, 1998; Plotnikoff, Costigan, Karunamuni, & Lubans, 2013; Plotnikoff, Lubans, Trinh, & Craig, 2012; Sniehotta, Scholz, & Schwarzer, 2005). This has led researchers to question the theory, due to the unexplained variance in the intention-behaviour gap, and theoretical claims that intentions alone are not sufficient for successful goal attainment (Jackson, Smith, & Conner, 2003; Reuter et al., 2010; Sniehotta, Presseau, & Araújo-Soares, 2014; Sniehotta et al., 2005).

A previous meta-analysis focusing on the intention-behaviour gap in the physical activity domain highlighted that compared to non-intenders, nearly twice as many intenders failed to translate their intentions into action (Rhodes & de Bruijn, 2013). Therefore, the intention-behaviour gap is predominantly made up of individuals with positive intentions, who nonetheless fail to engage in physical activity (Amireault, Godin, Vohl, & Pérusse, 2008; Chatzisarantis & Hagger, 2007;

Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Rhodes, Plotnikoff, & Courneya, 2008). This supports the notion that intentions are necessary, but not sufficient to produce behavioural engagement (Rhodes & de Bruijn, 2013; Rhodes et al., 2008). As a result, research has turned its attention to identifying potential moderating variables involved in turning intent into action, which has important implications for intervention (Amireault et al., 2008; Rhodes & Dickau, 2013; Sniehotta et al., 2014; Sniehotta et al., 2005). We hypothesise that these factors include past behaviour (Hagger, Chatzisarantis, & Biddle, 2001), self-efficacy (Hagger et al., 2001), social support (Amireault et al., 2008), and positive affect (Mohiyeddini, Pauli, & Bauer, 2009).

Past behaviour has been noted to be an important factor in the prediction of future physical activity behaviour, and has been shown to predict unique variance over and above that of the theory of planned behaviour variables (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger, Chan, Protogerou, & Chatzisarantis, 2016; Hagger et al., 2001; Hamilton & White, 2008; Norman & Smith, 1995; Wallace, Buckworth, Kirby, & Sherman, 2000). One idea behind the role of past behaviour in the prediction of subsequent behaviour is related to the development of habits, which have the potential to attenuate the role of social-cognitive antecedents such as attitudes, subjective norms, perceived behavioural control, and intentions (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger et al., 2016; Hagger et al., 2001; Jackson et al., 2003; Norman & Smith, 1995; Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Verplanken & Orbell, 2003). While research has previously used the terms ‘past behaviour’ and ‘habit’ interchangeably, it is important to note that not all past behaviour becomes habitual, even if it has been repeated frequently, and as such it is important to distinguish these constructs (Conner & Armitage, 1998; Norman & Smith, 1995; Verplanken & Orbell, 2003).

Wallace et al. (2000) found that individuals maintaining regular physical activity behaviour had reported the greatest number of hours of physical activity during the previous 12 months. This suggests that past behaviour may have an important role in the facilitation of, and adherence to, physical activity. Additionally, Rhodes et al. (2008) found that within the intention-behaviour relationship, non-intenders were entirely made up of people who were previously inactive, thus highlighting the importance of considering the moderating effects of past behaviour. Previous research has found moderating effects of past behaviour on the intention-behaviour relationship; however, different interactions have been reported (Amireault et al., 2008; Rhodes & Dickau, 2013). For example, some studies have found that the relationship between intention and physical activity in adults is stronger when past behaviour was high, confirming that non-intenders were previously inactive (Amireault et al., 2008). Conversely, a systematic review in the area reports that other studies have shown that the intention-relationship is weaker when past behaviour is high, suggesting that habitual processes are at work (Rhodes & Dickau, 2013). Further research is needed to clarify the mechanism that guides the role of past behaviour in physical activity behaviour in young adults.

In addition to past behaviour, self-efficacy for physical activity has been acknowledged as having a central role in physical activity participation. Research consistently reports that individuals with higher levels of self-efficacy have higher levels of physical activity (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; McAuley & Blissmer, 2000; Reuter et al., 2010). Self-efficacy is defined as the confidence in one’s ability to carry out a specific behaviour, particularly when faced with situational obstacles (Bandura, 1998; Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005; Williams & French, 2011). Self-efficacy determines which behaviours people engage in, how much effort they exert in these activities, as well as the degree of persistence they demonstrate in the face of failure or situational barriers (Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005). While self-efficacy bears some similarities to the perceived behavioural control construct in the theory of planned behaviour, there is an empirically robust clear distinction between these factors (Conner & Armitage, 1998; Hagger et al., 2001). The distinction between self-efficacy and perceived behavioural control is reflected in recent extensions of the theory of planned behaviour, known as the reasoned action approach. Within this theoretical model, self-efficacy and percieved behavioural control are considered separate components of a larger overarching control construct (Conner & Armitage, 1998; Fishbein & Ajzen, 2011; Hagger et al., 2001; Terry & O'Leary, 1995). Specifically, perceived behavioural control refers to the perceived extent of controllability an individual has over their behaviour, whereas self-efficacy is more concerned with an individual's belief in their competence to carry out a specific behaviour (Conner & Armitage, 1998; Hagger et al., 2001; McEachan et al., 2016; Terry & O'Leary, 1995). Self-efficacy has been shown to be most predictive of behaviours that require overcoming barriers, compared to behaviours that are under habitual control (McAuley & Blissmer, 2000). As young adulthood is a time which provides unique challenges related to changes in educational, occupational, social, and living environments (Nelson et al., 2008), self-efficacy may play a crucial role in young adults' success in engaging in, and maintaining regular physical activity.

Previous research has highlighted the potential for self-efficacy to operate as a moderator of the intention-behaviour relationship (Amireault et al., 2008; Luszczynska et al., 2010; Rhodes & Dickau, 2013). Specifically, individuals with high self-efficacy showed more consistency between their intentions and physical activity behaviour (Amireault et al., 2008). In addition, Rhodes et al. (2008) showed that self-efficacy was the most consistent predictor of the intention-behaviour profiles of individuals who adopt and maintain physical activity behaviour. This implies that self-efficacy is an important moderating factor in post-intentional processes for physical activity behaviour, and should be considered within future models.

Social support has also been found to be an important predictor of physical activity behaviour. Individuals who receive higher levels of support to be active from friends and/or family are consistently more successful in physical activity programs, and are more likely to be active (Booth et al., 2000; Okun et al., 2003; Treiber et al., 1991). Social support is defined as any actions taken by an individual to help another person achieve their goals, for example, providing assistance or encouragement (Hamilton & White, 2008; Okun et al., 2003; Treiber et al., 1991). Social support is different from subjective norms, which convey information regarding what others think about an activity, as well as what others do in relation to this activity (Hamilton & White, 2008; Okun et al., 2003; Treiber et al., 1991).

Although previous research (Rhodes et al., 2008) has suggested that it is worth investigating the role of social support in understanding the intention-behaviour gap, at present this has been largely unexamined. Therefore, investigating the potential moderating effects of social support on the intention-behaviour relationship may further the understanding of the mechanisms which guide the translation of intention into behaviour. Additionally, research confirms that support from both friends and family can predict physical activity participation in young adults (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000), but the source of support affects individuals differently. Some studies have reported that importance of the source of social support appears to differ as a function of gender (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000). For example, females were reported as typically more influenced by family, whereas males were reportedly more influenced by friends (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000). Thus, it is important to investigate both friends and family as sources of social support when examining physical activity in young adults.

One criticism of the theory of planned behaviour is its exclusive focus on cognitive, rational factors, at the exclusion of affective constructs (Armitage, Conner, & Norman, 1999; Conner, 2013; Conner, Godin, Sheeran, & Germain, 2013; Conner, McEachan, Taylor, O'Hara, & Lawton, 2015; Conner, Rhodes, Morris, McEachan, & Lawton, 2011; Ekkekakis, Hargreaves, & Parfitt, 2013; Helfer, Elhai, & Geers, 2015; Mohiyeddini et al., 2009; Sainsbury, Mullan, & Sharpe, 2013). Therefore, current researchers have recommended that an affective component be linked to, and integrated into, the theory (Armitage et al., 1999; Conner, 2013; Conner et al., 2013; Conner et al., 2015; Conner et al., 2011; Ekkekakis et al., 2013; Helfer et al., 2015; Jackson et al., 2003; Mohiyeddini et al., 2009). Research has long supported the relationship between physical activity and mood, focusing predominantly on the positive influence of physical activity on mood and the alleviation of psychosocial stress, anxiety and depressive symptoms (Bryan, Hutchison, Seals, & Allen, 2007; Ekkekakis et al., 2013; Guérin & Fortier, 2012; Salmon, 2001). However, recent research has begun to shift in focus to the potential role of mood and affective states in predicting physical activity, with a particular focus on how pleasure influences intention and engagement in activity (Bryan et al., 2007; Ekkekakis et al., 2013; Ekkekakis, Lind, & Vazou, 2010; Focht, 2009; Guérin & Fortier, 2012; Mohiyeddini et al., 2009). Previous research has found that affective variables strongly influence physical activity behaviour, often over and above that of cognitive factors, and highlights the positive influence that pleasure and positive affect have on intention and behaviour (Conner, 2013; Conner et al., 2011; Bryan et al., 2007; Ekkekakis et al., 2013; Focht, 2009; Helfer et al., 2015; Keer, Conner, Van den Putte, & Neijens, 2014; Kwan & Bryan, 2010; Lawton et al., 2009). Furthermore, affective variables have been shown to both directly and indirectly (via influencing cognition) affect behaviour (Armitage et al., 1999; Conner et al., 2013; Forgas, 2013; Keer et al., 2014; Lawton et al., 2009). Affective states, therefore, may shed light on potential post-intentional mechanisms that explain the intention-behaviour relationship (Ekkekakis et al., 2013; Kwan & Bryan, 2010; Mohiyeddini et al., 2009). In support, recent research has shown that affective responses can function as moderators of the intention-behaviour relationship, with positive affect facilitating the translation of intent into action (Kwan & Bryan, 2010; Mohiyeddini et al., 2009).

The present study aimed to explore the contribution of past behaviour, self-efficacy, social support from friends and family, and positive affect to physical activity behaviour in young adults, working within the conceptual framework of the theory of planned behaviour. More specifically, this study first aimed to assess the application of the theory of planned behaviour model to physical activity behaviour in a young adult cohort. Specifically, it sought to investigate whether attitudes, subjective norms and perceived behavioural control each affect behaviour through an indirect pathway, namely through intentions. Additionally, it also examined whether perceived behavioural control continued to maintain direct effects on behaviour, after controlling for intentions. Second, the study aimed to extend the theory, by assessing whether past behaviour, self-efficacy, social support from friends and family, and positive affect function as moderators of the intention-behaviour relationship. This study will help to further understand the mechanisms behind the translation of intent into action, provide additional support for past behaviour, self-efficacy, and positive affect in facilitating action, and determine whether social support also functions as a moderator of the intention-behaviour relationship for physical activity.

3.2 Method

3.2.1 Participants

Participants were recruited as part of a larger longitudinal study which included two hundred and one young adult, first-year tertiary students (159 female, 41 male, mean age = 19.22, age range: 17-26 years). They were recruited from the Flinders University first year psychology participant pool, and via email and flyers around the Flinders University campus. Students from the first year psychology pool received course credit for their participation. The majority of students were from South Australian Universities (97.5%), with the remaining students from Victoria and New South Wales. Participants included students from all university disciplines, with 66.2% from the Social and Behavioural Sciences. There was a significant bias towards female participants, likely a result of the large sampling of Social and Behavioural Sciences students, fields of study which are commonly dominated by women. On average students rated their health as about the same as their peers (M=3.08; SD=.81; Range=1-5). Average BMI scores of the sample were in the normal weight range (M=23.03; SD=5.08; Range=14.68-47.65).

3.2.2 Measures

Physical activity behaviour and correlates were measured using an online self-report questionnaire at the beginning of students' first year at university. This questionnaire was the first of three surveys which were collected over the students' first year at university as part of a larger longitudinal study. The questionnaire comprised of several sections encompassing demographic information, past and present physical activity behaviour, theory of planned behaviour variables (i.e.

attitudes, subjective norms, perceived behavioural control, and intentions), self-efficacy, social support and mood.

3.2.2.1 Past and Present Physical Activity. Physical activity was assessed by asking participants to list any purposeful physical activities they engaged in, the frequency with which they participated in these activities, and the average duration of participation on each occasion. Both past and present physical activity were measured with the same method. For past behaviour, participants were asked to report their participation in physical activities (e.g. type, duration and frequency) during a typical week in the previous year (i.e. the past 12 months). The same question was posed for present behaviour; however, specifying to record their typical participation in physical activities per week at the current time. A total physical activity score for both past and present behaviour was calculated separately by multiplying the frequency and duration data for each physical activity listed, and then these scores were summed. Total physical activity was reported in minutes, with higher scores reflecting higher participation in physical activity.

3.2.2.2 Attitudes. Based on previous research (Ajzen, 2001; Courneya & McAuley, 1995; Hamilton & White, 2008; Jackson et al., 2003; Rhodes & Blanchard, 2008), Participants were asked two questions to ascertain their attitudes towards engaging in "regular" physical activity (i.e. exercising three times a week), with responses rated on seven-point scales. Questions included (1) whether participants like to engage in regular physical activity, with 1 = 'Definitely do not like to do this' and 7 = 'Definitely do like to do this', and (2) whether they think doing regular physical activity is enjoyable, with 1 = 'Not enjoyable' and 7 = 'Enjoyable'. These two items were averaged to create a composite attitudes score, with higher scores indicating more positive attitudes. The resulting Cronbach's *a* was .87.

3.2.2.3 Subjective Norms. Subjective norms for regular physical activity, based on close friends and family members, were assessed using two items, with responses rated on seven-point scales (Ajzen & Sheikh, 2013; Courneya & McAuley, 1995; Jackson et al., 2003; Wing Kwan, Bray, & Martin Ginis, 2009). Participants were asked whether (1) their close friends and (2) immediate family members think they should engage in regular physical activity, with 1 = 'They definitely think I should not', and 7 = 'They definitely think I should'. These two items were averaged to create a composite norms score, with higher scores indicating stronger subjective norms to engage in regular physical activity. Within this sample, the Cronbach's *a* for this scale was .72.

3.2.2.4 Perceived Behavioural Control. Participants were asked two questions to establish their perceived behavioural control in relation to regular physical activity, with responses rated on seven-point scales (Ajzen & Sheikh, 2013; Courneya & McAuley, 1995; Jackson et al., 2003; Rhodes & Blanchard, 2008; Wing Kwan et al., 2009). Participants were asked (1) whether or not engaging in regular physical activity was entirely up to them, with 1 = 'Strongly disagree' and 7 = 'Strongly agree', and (2) whether if they wanted to do regular physical activity they could, with 1 = 'Definitely false' and 7 = 'Definitely true'. These two items were averaged to create a composite perceived behavioural control score, with higher scores indicating stronger perceived behavioural control. The resulting internal consistency score, however, was poor (Cronbach's a = .52), and as a result, only item two was used for analysis. This was due to question two having a stronger correlation with physical activity than question one. The use of a single item for the theory of planned behaviour variables is common practice to counter low internal consistency (Ajzen, 1991; Courneya & McAuley, 1995).

3.2.2.5 Intentions. Participants were questioned about their intentions and plans to engage in regular physical activity (i.e. exercising at least three times per week) within the following month, on two 7 point Likert scales (Ajzen & Sheikh, 2013; Hamilton & White, 2008; Hobbs, Dixon, Johnston, & Howie, 2013; Jackson et al., 2003; Kuijer & Boyce, 2014; Plotnikoff et al., 2012). Participants were asked (1) whether they intended to engage in regular physical activity within the next month, with 1 = 'Definitely do not intend to do this' and 7 = 'Definitely intend to do this', and (2) how often they planned to engage in regular physical activity, with 1 = 'Never', and 7 = 'Everyday'. These two items were averaged to create a composite intentions score, with higher scores suggesting stronger intentions. The resulting Cronbach's *a* was .82.

3.2.2.6 Self-Efficacy. Self-efficacy for physical activity was measured using Schwarzer and Renner's (2009) Exercise Self-Efficacy Scale. Participants are asked to rate their certainty they could carry out their exercise intentions when faced with five potential barriers (having worries and problems, feeling depressed, feeling tense, feeling tired, and being busy), on four point scales ranging from 1 = 'Very uncertain' to 4 = 'Very certain'. A 'Not applicable' option was also provided, scored as 0. A total self-efficacy score was calculated by summing each item, with possible scores ranging from 0 to 20, and larger scores indicating higher levels of self-efficacy. This scale has been found to be both a valid (construct validity demonstrated by correlations with exercise behaviour and intentions) and reliable (internal consistency: Cronbach's *a* = .88) tool for assessing exercise self-efficacy (Schwarzer & Renner, 2009). Within the present sample, the Cronbach's *a* for this scale was .86.

3.2.2.7 Social Support. Social support for physical activity was examined using the Social Support Survey for Exercise Behaviour (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). Participants were asked to rate how often (1) their family and (2) their friends engage in ten exercise-related interactions with them (e.g. 'Exercised with me', 'Discussed exercise with me', 'Planned exercise on recreational activities') using five-point scales ranging from 1 = 'Never' to 5 = 'Very Often'. 'Not applicable' was also offered as a response, scored as 0. Total scores for support from friends and family range from 0 indicating no support, to 50 indicating very high support levels. This scale has been shown to demonstrate both criterion-related and construct validity, and good reliability (internal consistency: Cronbach's *a* = 0.61-0.91; test-retest reliability: *r* = 0.55-0.79). Within this sample, the Cronbach's *a* for the friend support scale was .89, and the score for the family support scale was .91.

3.2.2.8 Positive Affect. Mood was measured using the Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). The scale comprises of 20 emotions or mood states, with both positive and negative valences. Participants were asked to rate the extent to which they felt those emotions over the past week on a five-point Likert scale, with 1 = 'Very slightly or not at all' and 5 = 'Extremely'. The PANAS has been found to be a reliable (internal consistency: Cronbach's *a* = .87 for both positive and negative affect scales) and valid measure of positive and negative affect (Watson et al., 1988). This study focused only on the positive affect scale, due to previous research highlighting stronger influence from positive affect in the context of physical activity (Ekkekakis et al., 2013). Scores range from 5 to 50, with higher scores indicating greater levels of positive affect. Within the present sample, the Cronbach's *a* for this scale was .92.

3.2.3 Procedure

Students were provided with a link to the online survey on the recruitment materials. They were asked to complete the survey at a convenient time of their choice within the first few weeks of the academic year. The survey took approximately 25 minutes to complete.

3.3 Results

3.3.1 Descriptive Results

Descriptive and correlational data for physical activity behaviour, the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), and potential correlates (i.e. past behaviour, self-efficacy, social support from friends and family, positive affect), are shown in Table 8.

Australian physical activity guidelines specify that individuals aged 18 and above should aim to engage in physical activities for 150 minutes (i.e. 2.5 hours) to 300 minutes (i.e. 5 hours) per week (Brown et al., 2012). This guideline is similar to the one endorsed by the World Health Organization (World Health Organization, 2011). The majority of participants met these guidelines, both for past and present physical activity behaviour. On average, students participated in just over four hours of physical activity per week at the time of the study (i.e. current physical activity), a statistically significant reduction from approximately six and half hours in the previous year (i.e. past physical activity; *Mean Difference*=125.57; *95%CI*=85.88 to 165.27 $t(169)$=6.25; p=.000). Approximately 23% of students indicated that they currently did not engage in purposeful physical activity, which was a statistically significant increase in physical *in*activity from the previous year (11%; *Mean Difference*=.112; *95%CI*=.045 to .179 $t(169)$=3.30; p=.001).

Participants held positive attitudes towards physical activity, reflected by mean scores falling well above the mid-point of the scale. They also reported moderate to high levels of pressure from friends and family to be active, based on the mean scores on subjective norms being above the mid-point of the scale. Mean

Table 8

CHAPTER 3: Descriptive and Correlational Data

Inter-correlations between Theory of Planned Behaviour Variables						
	M (SD)	Current Physical Activity	Attitudes	Subjective Norms	PBC	Intentions
Current Physical Activity	264.68 (301.09)		.402***	.294***	.401**	.513***
Attitudes	5.68 (1.53)			.558***	.406***	.682***
Subjective Norms	4.45 (1.56)				.318***	.486***
PBC	5.48 (1.77)					.451***
Intentions	4.86 (1.55)					
Correlations between Correlates & Theory of Planned Behaviour Variables						
	M (SD)	Current Physical Activity	Attitudes	Subjective Norms	PBC	Intentions
Past Physical Activity	396.24 (371.74)	.685***	.303***	.297***	.340***	.457***
Self-efficacy	11.95 (3.93)	.511***	.375***	.314***	.376***	.491***
Friend Support	20.54 (8.40)	.214**	.161*	.225**	.056	.192*
Family Support	20.11 (9.14)	.360***	.164*	.344***	.234**	.328***
Positive Affect	32.70 (8.28)	.357***	.321***	.285***	.303***	.313***

Note: PBC = Perceived Behavioural Control; Significance: * = *p*<.05; ** = *p*<.01; *** = *p*<.001; Current physical activity reported in minutes per week.

perceived behavioural control scores were also above the mid-point of the scale, indicating high levels of perceived control over physical activity. Lastly, participants reported positive intentions towards engaging in physical activity three times per week, with mean scores falling well above the mid-point of the scale. These results suggested very clear positive inclinations towards being physically active.

Mean self-efficacy scores fell just above the mid-point of the scale, indicating that participants reported moderate levels of self-efficacy to engage in regular physical activity. The average support levels provided for physical activity were consistent across friends and family. Mean social support scores fell just below the mid-point of both scales, indicating that students received low to moderate levels of social support from both friends and family to engage in physical activity. On average, participants experienced moderate levels of positive affect, reflected by mean positive affect scores that fell just above the mid-point of the scale.

3.3.2 Correlational Data

Current physical activity behaviour was significantly positively inter-correlated with all of the theory of planned behaviour constructs (Table 8). Past behaviour, self-efficacy, social support from friends and family, and positive affect each had positive significant correlations with the theory of planned behaviour constructs and current physical activity behaviour. Only one correlation was not statistically significant, which was between friend support and perceived behavioural control.

3.3.3 Testing the Association between Theory of Planned Behaviour Variables and Current Physical Activity

The correlational data provide preliminary support for the theory of planned behaviour model, with all of the correlational pathways proposed in the model statistically significant and consistent with the model. To test the prediction that intentions are the proximal predictor of behaviour, a series of mediation analyses were conducted. Specifically, the SPSS macro PROCESS (Hayes, 2012) was used to assess whether intention to be active mediated the relationship between physical activity and attitudes towards physical activity (model 1), perceived subjective norms towards physical activity (model 2) and perceived behavioural control over physical activity (model 3). Indirect effects were based on bias-corrected 95% confidence intervals, using 5000 bootstrap samples. Significant effects were deemed present when confidence intervals did not straddle zero.

The results indicated that each of the independent variables (i.e. attitudes, subjective norms, and perceived behavioural control) significantly predicted intentions (coefficients are displayed in Table 9). Furthermore, in models 1 and 2, only intentions were shown to significantly predict physical activity confirming a full mediation; however, in model 3, both perceived behavioural control and intentions significantly predicted physical activity (see Table 9). Furthermore, significant indirect effects were found for each of the models (see Table 10). These results show that intentions fully accounted for the relationship between attitudes and physical activity, and the relationship between subjective norms and physical activity. However, intentions only partially accounted for the relationship between perceived behavioural control and physical activity.

3.3.4 Moderators of the Intention-Behaviour Gap

A series of moderation analyses were run, using the SPSS macro PROCESS (Hayes, 2012), to determine whether the proposed correlates (i.e. past behaviour, self-efficacy, social support from friends and family, and positive affect) moderated the relationship between intentions and physical activity behaviour. Significant interactions were found for each moderation model except for friend support (see

Table 9

CHAPTER 3: Simple Mediation Models Coefficients and Model Summaries

Model 1	Outcome Variables			
	Mediator: Intentions		DV: Current Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Attitudes	.691***	.059	20.42	18.64
M: Intentions			87.63***	18.40
Constant	.938**	.345	-272.87**	81.84
	R^2 =.465, F(1, 159) = 138.24***		R^2 = .268, F(2, 158) = 28.98***	
Model 2	**Outcome Variables**			
	M: Intentions		DV: Current Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Subjective Norms	.483***	.069	12.13	15.29
Mediator: Intentions			95.19***	15.36
Constant	2.72***	.325	-247.25**	75.47
	R^2 = .236, F(1, 159) = 49.05***		R^2 = .266, F(2, 158) = 28.68***	

Note: * = p<.05; ** = p<.01; *** = p<.001; M=Mediator Variable; IV=Independent Variable; DV=Dependent Variable

Table 9. *Continued.*

CHAPTER 3: Simple Mediation Models Coefficients and Model Summaries

Model 3	Outcome Variables			
	M: Intentions		DV: Current Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: PBC	.393***	.062	36.71**	12.79
M: Intentions			82.09***	14.66
Constant	2.71***	.355	-331.8***	76.82
	R^2 = .203, *F*(1, 160) = 40.75***		R^2 = .299, *F*(2, 159) = 33.94***	

Note: * = *p*<.05; ** = p<.01; *** = *p*<.001; PBC = Perceived Behavioural Control; M=Mediator Variable; IV=Independent Variable; DV=Dependent Variable

Table 11). This suggests that the relationship between intentions and physical activity behaviour significantly varied according to levels of past behaviour, self-efficacy, family support and positive affect (see *Figure 3*).

Simple slopes analyses showed that the relationship between intentions and current physical activity behaviour only differed significantly when levels of past physical activity behaviour were high, *B*= 118.05, *t*(157) = 6.07, *p*= .000; whereas participants with low levels of past behaviour did not significantly differ, *B*= 7.66, *t*(157) = .515, *p*= .607. This suggests that previous behaviour strongly drives the likelihood of physical activity participation, with those with low levels of physical

Table 10

CHAPTER 3: Direct and Indirect Effect Coefficients for Intentions Mediating the Relationship between Attitudes (Model 1), Subjective Norms (Model 2), Perceived Behavioural Control (Model 3) and Current Physical Activity

	Unstandardised Effects				Standardised Effects			
	Direct Effects							
	Coeff.	*SE*	*Boot LLCI*	*Boot ULCI*	*Coeff.*	*SE*	*Boot LLCI*	*Boot ULCI*
Model 1	20.42	18.64	-16.40	57.23	.103	.094	-.083	.290
Model 2	12.13	15.29	-18.06	42.32	.063	.079	-.094	.219
Model 3	36.71*	12.79	11.46	61.97	.216*	.075	.067	.364
	Indirect Effects							
Model 1	60.54*	12.97	38.55	89.78	.307*	.066	.191	.447
Model 2	46.01*	10.14	28.97	68.22	.238*	.052	.151	.352
Model 3	32.27*	8.62	18.36	52.30	.190*	.050	.111	.309

Note: * = a significant effect based on 95% confidence intervals (i.e. <*p*.05), using 5000 bootstrap samples

activity in the past being less active, regardless of their intentions, and those highly active in the past more likely to be active in the future. A similar pattern emerged for the interaction effects of intentions and self-efficacy in the prediction of physical

Table 11

CHAPTER 3: Coefficients for Moderation Analyses of the Intention-behaviour Gap

Moderation 1	*Coefficient*	*t(df)*
Past Physical Activity	.388***	6.77(157)
Intentions	62.86***	5.21(157)
Interaction Term (Past Physical Activity by Intentions)	.158***	4.44(157)
Model Summary	R-square Change = .053***, F Change(1/157)= 19.75	
Moderation 2	*Coefficient*	*t(df)*
Self-efficacy	28.99***	5.53(157)
Intentions	82.95***	6.03(157)
Interaction Term (Self-efficacy by Intentions)	13.69***	5.23(157)
	R-square Change = .095***, F Change(1/157)= 27.39	
Moderation 3	*Coefficient*	*t(df)*
Friend Support	4.85	12.63(157)
Intentions	95.95***	6.94(157)
Interaction Term (Friend Support by Intentions)	.475	.284(157)
Model Summary	R-square Change = .000, F Change(1/157)= .081	

Note: * = *p*<.05; ** = *p*<.01; *** = *p*<.001

Table 11 *Continued.*

CHAPTER 3: Coefficients for Moderation Analyses of the Intention-behaviour Gap

Moderation 4	*Coefficient*	*t(df)*
Family Support	5.65*	2.41(155)
Intentions	97.13***	7.04(155)
Interaction Term (Family Support by Intentions)	4.79**	3.49(155)
Model Summary	R-square Change = .051**, F Change(1/155)= 12.15	
Moderation 5	*Coefficient*	*t(df)*
Positive Affect	8.13**	3.27(155)
Intentions	90.52***	6.81(155)
Interaction Term (Positive Affect by Intentions)	4.91**	3.55(155)
Model Summary	R-square Change = .052**, F Change(1/155)= 12.62	

Note: * = p<.05; ** = p<.01; *** = p<.001.

activity behaviour, with only participants with high levels of self-efficacy showing significant variation in physical activity, B= 137.28, t(157) = 7.36, p= .000. The relationship between intentions and physical activity behaviour did not vary significantly for participants with low levels of self-efficacy B= 28.61, t(157) = 1.82, p= .070. This result suggests that self-efficacy can function as both a barrier to

Figure 3. CHAPTER 3: Moderating Effects of Past Physical Activity, Self-efficacy, Family Support and Positive Affect on the Relationship between Intentions and Current Physical Activity

following through with intentions (when self-efficacy is low), or a facilitator for putting intentions into action (when self-efficacy is high).

The relationship between intentions and physical activity significantly differed at both low B=53.36, $t(155)$ = 3.21, p=.002, and high B=140.91, $t(155)$ = 6.87, p=.000 levels of family support. This suggests that at low levels of family support, intentions still play a significant role in determining physical activity levels; however, high levels of family support have a much stronger impact. Lastly, the interaction effect of intentions and positive affect in the prediction of physical activity behaviour similarly significantly differed at both low B=49.68, $t(155)$ = 2.88, p=.005, and high B=131.36, $t(155)$ = 7.34, p=.000 levels of positive affect. This result indicated that high levels of positive affect can boost one's physical activity behaviour when in conjunction with positive intentions; however, low levels of positive affect do not prevent physical activity participation, with intentions playing the stronger role in determining physical activity levels.

3.4 Discussion

The aim of the present study was to examine, in the first instance, the model fit of the theory of planned behaviour in the prediction of physical activity behaviour in a cohort of young adult university student. Importantly, however, the study aimed to extend the theory of planned behaviour by exploring the contribution of past behaviour, self-efficacy, social support (from friends and family) and positive affect on the intention-behaviour gap in current physical activity participation. The main findings indicated that the central tenets of the theory of planned behaviour model were supported, with intentions fully accounting for the relationship between attitudes and physical activity, as well as between subjective norms and physical activity. Perceived behavioural control influenced physical activity behaviour both directly and indirectly through its effects on intentions. In addition, past behaviour, self-efficacy, family support and positive affect were identified as moderators of the relationship between intentions to be active and extent of participation in physical activity.

Self-reports indicated that on average the majority of participants were meeting or exceeding physical activity guidelines at the time of the study and during the previous 12 months. This contrasts with previous research indicating that physical activity levels are typically insufficient (i.e. not meeting guidelines) during adolescence and young adulthood (Bray & Born, 2004; Butler et al., 2004; Huang et al., 2003; Jung et al., 2008; Leslie et al., 1999). However, reductions in weekly physical activity rates were found, with current physical activity participation reducing by around two and a half hours compared to past behaviour, which is consistent with the declines repeatedly reported during early adulthood (Bray & Born, 2004; Butler et al., 2004; Huang et al., 2003; Jung et al., 2008; Leslie et al., 1999; Wing Kwan et al., 2009). The fact that this sample of young adult university students was found to be sufficiently active on average could be supported by research conducted by Irwin (2004), who reported that although internationally young adults were typically not sufficiently active, Australian participants were shown to have the highest adherence to physical activity guidelines, at 60%. This may suggest that culturally, Australians may be more inclined to live active lifestyles.

This cohort of young adult university students was found to have clear positive attitudes, supportive perceptions of subjective norms, good perceived behavioural control and strong intentions to engage in regular physical activity. This indicated a clear positive inclination towards an active lifestyle, which is consistent with previous reports on other young adult samples (Wing Kwan et al., 2009). Additionally, participants reported moderate levels of self-efficacy to exercise and positive mood states, as well as low to moderate levels of social support for physical activity from both friends and family. Similar levels of these constructs have been reported in previous research, and as such this sample does not differ from other young adult samples (Charles, Reynolds, & Gatz, 2001; Molloy, Dixon, Hamer, & Sniehotta, 2010; Röcke, Li, & Smith, 2009; Steptoe, Wardle, Pollard, Canaan, & Davies, 1996; Treiber et al., 1991; Wing Kwan et al., 2009).

The predictions based on the theory of planned behaviour model were confirmed by this study. Specifically, attitudes and subjective norms functioned indirectly via intentions to influence physical activity behaviour and perceived behavioural control influenced physical activity both directly and indirectly through intentions (Ajzen, 1991). Therefore, this study provided additional support for the value of this theoretical model in the prediction of intentions and behaviour in the physical activity domain and was consistent with previous research in this regard (Godin & Kok, 1996; McEachan et al., 2011). Furthermore, in addition to the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions) correlations in the appropriate direction were also evidenced between current physical activity and past behaviour, self-efficacy, social support and positive affect. This highlights the important relationship that each of these factors has with physical activity participation, and confirms the findings evidenced in previous research (Godin & Kok, 1996; McEachan et al., 2011; Dishman, Saunders, Motl, Dowda, & Pate, 2009; Ekkekakis et al., 2013; Hagger et al., 2001; Okun et al., 2003; Wing Kwan et al., 2009).

Past behaviour, self-efficacy, family support and positive affect were found to moderate the intention-behaviour gap. The contribution from past behaviour and self-efficacy demonstrates that the relationship between intentions and physical activity differed significantly only for participants with higher scores on these variables. This suggests that individuals with high levels of past physical activity and self-efficacy are more likely to succeed in turning intention into physical activity behaviour, while individuals with low levels of past physical activity and self-efficacy are less active, regardless of their intentions. A potential mechanism behind the moderation effect of past behaviour may be that past enactment of physical activity behaviour may provide a positive feedback loop maintaining positive attitudes, self-efficacy, perceived behavioural control and intentions, thus providing temporal stability in both social-cognitive factors and behaviour engagement itself. Additionally, some of the effect of past behaviour may be attributed to common method variance issues between past and current behaviour, particularly notable given the cross-sectional design and self-report nature of the data (Ajzen, 2002; Conner, Warren, Close, & Sparks, 1999; Norman & Conner, 2006; Sheeran, 2002). However, previous research has indicated that common method variance between past and future behaviour only accounts for some but not all of the effect of the relationship between past and furture behaviour (Ajzen, 2002; Conner et al, 1999; Norman & Conner, 2006; Sheeran, 2002). As for the mechanism driving the moderating effect of self-efficacy, higher levels of self-efficacy are likely to result in increased confidence in an individual's ability to engage in physical activity, providing greater motivation towards forming intentions to act. The implication of these results is that simply improving intention to act may not be sufficient for everyone and that a particularly targeted approach may be required for those with poorer self-efficacy for physical activity and lower levels of past participation. Interventions that address these barriers in addition to improving intention should improve actual behaviour.

A different pattern emerged for the contributions from family support and positive affect to the intention-behaviour gap, with the relationship between intentions and physical activity behaviour significantly differing at both low and high levels of family support and positive affect. This indicates that high levels of family support or positive affect can boost physical activity behaviour, in conjunction with positive intentions. However, at low levels of family support or positive affect, intentions play a stronger role in determining behaviour, and physical activity levels will increase, albeit to a lesser extent, when individuals hold positive intentions, even if they are lacking support or are experiencing less positive mood states. This suggests that social support from family members and positive affect can greatly assist in the translation of intentions to action; however, unlike past behaviour and self-efficacy, family support and positive affect do not function as barriers towards becoming active when they are lacking. This finding may be a function of the different motivations individuals may have to be active. For example, some people may engage in physical activity to help overcome negative mood states, therefore the motivation behind one's behaviour may play an important role in explaining this finding. The potential mechanisms explaining the moderating effects for high levels of social support and positive affect could be that the provision of support and assistance from family members, and feelings of positive mood, may further increase students' confidence in their capacity to be physical active, increasing the likelihood of forming positive intentions, and assisting in overcoming barriers to be active.

Previous research has also found that affective states can explain and facilitate the translation of intent into action (Kwan & Bryan, 2010; Mohiyeddini et al., 2009). However, these studies examined affective responses to either one's intention or behaviour as moderating or mediating the intention-behaviour relationship; whereas, our study focused on generalised positive mood states. Therefore, while our findings further support the moderating role of positive affective states in the intention- physical activity behaviour gap presented elsewhere

(Kwan & Bryan, 2010; Mohiyeddini et al., 2009), our study provides a novel finding suggesting a role for general positive mood in the translation of intentions. Additionally, the present results empirically confirm the previous proposition that social support may contribute to the intention-behaviour gap (Rhodes et al., 2008). Specifically, this result provides a novel inclusion to the understanding of the mechanisms involved in translating intentions into behaviour by highlighting the role of social support from family in this process.

Unlike family support, friend support was not a moderator of the intention-behaviour gap and did not correlate with perceived behavioural control. Previous research investigating social support for physical activity in young adults has also reported differences in the roles of friends and family, with some reports indicating a stronger influence from family, and others reporting a stronger influence from friends (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000). However, in the current sample of young adult university students, family support was more influential than friend support. This finding could be explained by this study being completed at the beginning of students' first semester at university, and therefore many students may not have established their friendship network in the university environment, and as such, more influenced by their family at the time. Interventions that target the involvement of family members in the physical activity of young adults may facilitate the conversion of intent to action, within first-year university students in Australia.

It is important to note, however, that as previous research has identified friend support as also having an important role in physical activity in young adults, the role of friendships in physical activity interventions should still be considered. Future research may benefit from further examining the different influences from friends and family. For example, determining what factors govern which source of support is most influential towards physical activity behaviour. This information could provide important insights into which source of social support would be most beneficial for physical activity participation of particular individuals and for particular activities. It may also be fruitful to discriminate between young adult students that live at home with their parents and those who do not, as this may be a moderating factor driving which source of social support is most influential to young adult university student cohorts.

The findings of this study indicate that interventions that target physical activity in young adults studying at university could choose several pathways to improve participation in physical activity. For example, interventions that aim to increase self-efficacy, facilitate family involvement, or induce positive affect are all likely to assist young adults at university in following through with intentions to be active. Furthermore, the significant role of past behaviour highlights the importance of instilling physical activity habits early in life, such as in childhood or adolescence, as behaviour during these periods will have flow on effects during young adulthood and beyond. The current results, however, do need to be interpreted with consideration of the limitations of this study, specifically noting the self-selected sample, cross-sectional design, and self-report measures. Each of these factors can limit the interpretive value of the results. Future research could usefully aim to examine these factors using random sampling techniques, more objective measures, and a prospective design.

The results of this study suggest that while the central tenets of the theory of planned behaviour do indeed provide a crucial backbone in the understanding of physical activity behaviour, other factors also provide important contributions, and should be included in the theoretical model. This reflects the recent controversy surrounding the theory of planned behaviour, which questions whether the components of this theory adequately explain actual engagement in behaviour (Sniehotta et al., 2014). Specifically, that intentions alone are not sufficient to produce behavioural outcomes, and that the theoretical model does not have a complete understanding of the processes that occur between the formation of intention and behavioural engagement. This study supports the propositions by other researchers, that the extension of the theoretical model to include additional constructs, particularly those factors that function between intentions and behaviour could have important implications for future intervention (Armitage, 2015; Conner, 2015; Schwarzer, 2015). The results of the present study, in particular, suggest the inclusion of past behaviour, self-efficacy, family support and positive affect as moderators of the intention-behaviour relationship.

In conclusion, the present study adds to the body of knowledge examining potential moderators of the intention-behaviour gap in physical activity behaviour, specifically within a young adult university student sample. Additionally, the study provided further support for the use of the theory of planned behaviour in predicting physical activity, by establishing intentions as the mediating factor that translates attitudes, subjective norms and perceived behavioural control into behaviour. However, this study demonstrated the importance of also including past behaviour, self-efficacy, social support (particularly family support) and positive affect when predicting physical activity behaviour, as each variable moderated the intention-behaviour gap, working to facilitate intentions into action. The identification of family support as a moderator of this relationship provides a novel contribution to the understanding of the intention-behaviour relationship. The results of this study have important implications for targeted interventions by highlighting several modifiable factors which assist in the translation of intentions into behaviour, and thus influence physical activity behaviour and health into adulthood.

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CHAPTER 4: Predicting Young Adult Physical Activity Behaviour with an Augmented Theory of Planned Behaviour Model: Examining the Role of Past Behaviour, Self-efficacy, and Social Support

4.1 Introduction

The previous chapters have highlighted the importance of examining physical activity behaviour in young adults, on the basis of the establishment of new habits that typically occurs during this period, which have the potential to determine the adoption of long term health behaviours. In addition these chapters have noted the numerous health and well-being benefits associated with regular physical activity, which have the potential to improve future health outcomes. Additionally, previous chapters have further discussed the importance of exploring potential determinants of motivational factors such as intentions in addition to physical activity behaviour in order to better guide the development of physical activity interventions. While social cognitive theories, such as the theory of planned behaviour, have outlined important determinants which play a key role in predicting both intentions and physical activity behaviour, researchers have stressed the need to extend these cognitive models to further explain variance which is currently not accounted for (Conner, 2015; Godin & Kok, 1996; McEachan, Conner, Taylor, & Lawton, 2011; Sniehotta, Presseau, & Araújo-Soares, 2014). The previous chapter outlined the moderating effects of past behaviour, self-efficacy, social support from friends and family, and positive affect on the intention-physical activity behaviour gap in a young adult sample. Following on from this, the current chapter discusses the respective role of past behaviour, self-efficacy, social support from friends and family in the prediction of both intentions and physical activity behaviour, whilst controlling for theory of planned behaviour constructs.

The last chapter discussed the role of past behaviour, self-efficacy, social support in the prediction of physical activity behaviour, and as such the role of these factors in the prediction of intentions will now be briefly discussed. Past behaviour has been shown to be a significant predictor of intentions, with the potential to attenuate the role of social-cognitive variables (Hagger, Chatzisarantis, & Biddle, 2001). However, previous research has shown that the inclusion of past behaviour in regression models predicting intentions does not always completely extinguish the influence of social-cognitive variables, with attitudes, perceived behavioural control and self-efficacy often found to still significantly predict behaviour (Hagger et al., 2001). A possible explanation of the mechanism behind the attenuation of social-cognitive variables within the prediction of intentions, is that past behaviour provides information regarding the ease or difficulty of a behaviour, and controls for decision making processes which have led to intention formation and behaviour in the past (Hagger et al., 2001). Thus past behaviour increases the likelihood of forming intentions to engage in that target behaviour again in the future, without as much cognitive effort (Hagger et al., 2001). However, as some of the influence of social-cognitive factors on intentions remains after controlling for past behaviour, this indicates that behavioural intentions are influenced by situation-specific cognitions regarding the behaviour, in addition to the information provided by past behaviour (Hagger et al., 2001).

Self-efficacy has also been found to influence intentions as well as physical activity behaviour, and provides unique variance in addition to that explained by perceived behavioural control (Bandura, 2004; Duncan & McAuley, 1993; McAuley & Blissmer, 2000; Schwarzer & Fuchs, 1996; Sniehotta, Scholz, & Schwarzer, 2005). Additionally, social support has also been shown to predict intentions, with some research reporting that social support better predicts intentions than the theory of planned behaviour construct subjective norm (Courneya & McAuley, 1995; Okun et al., 2003). However, given that subjective norms and social support provide distinct information relating to one's social environment, it is important to consider the contribution of both constructs (Courneya & McAuley, 1995; Okun et al., 2003).

Therefore, in this chapter the cross-sectional time one data from the longitudinal study described in Chapter 2 was further assessed. Specifically, this chapter aimed to examine the respective predictive strength of past behaviour, self-efficacy, and social support on both intentions and physical activity, while controlling for theory of planned behaviour determinants. For a description of the sample, methodological approach and descriptive statistics see the previous chapter.

4.2 Results

4.2.1 Regression Models

Two hierarchical regression analyses were conducted to determine the predictive weight of past behaviour, self-efficacy, and social support, on both intentions to engage in physical activity and physical activity behaviour at the beginning of first year university, while controlling for the theory of planned behaviour variables. A measure of effect size (*r*) was calculated for each individual predictor to ascertain the strength of each predictor, using the formula outlined by Durlak (2009). For the first analysis, in step one, attitudes, subjective norms, and perceived behavioural control were regressed onto intentions, to determine the predictive weight of the theory of planned behaviour model. In the second step, self-efficacy and social support variables were added to the model to determine their respective contributions, and in the last step past behaviour was included, as it was hypothesized to be the most influential correlate.

4.2.1.1 Predicting intentions. The results (see Table 12) showed that in the first step, the theory of planned behaviour variables explained 52% of the variance in

Table 12

CHAPTER 4: Hierarchical Regression Models Predicting Intentions from the Theory of Planned Behaviour Determinants and Additional Correlates

Step 1	*B*	*t*	*df*	*Effect Size*
Attitudes	.548***	7.71	150	.529
Subjective Norms	.148*	2.23	150	.177
PBC	.147**	2.77	150	.218
Model Summary	R^2 =.520***, *F* (3/150) = 54.08			
Step 2	*B*	*t*	*df*	*Effect Size*
Attitudes	.507***	7.27	147	.507
Subjective Norms	.082	1.24	147	.099
PBC	.076	1.42	147	.114
Self-efficacy	.085**	3.40	147	.265
Family Support	.022*	2.12	147	.064
Friend Support	-.009	-.794	147	.169
Model Summary	R^2 *Change* =.057***, *F Change* (3/147) = 6.56			
Step 3	*B*	*t*	*df*	*Effect Size*
Attitudes	.483***	6.89	146	.501
Subjective Norms	.079	1.21	146	.095
PBC	.087	1.62	146	.092
Self-efficacy	.017**	2.49	146	.215
Family Support	.065	1.67	146	.071
Friend Support	-.006	-.515	146	.132
Past Physical Activity	.001*	2.50	146	.189
Model Summary	R^2 *Change* =.016*, *F Change* (1/146) = 5.69			

Note: * p <.05; ** p<.01; *** p<.001; PBC = Perceived Behavioural Control intentions, and this model was found to be significant. Within this model, all three theory of planned behaviour constructs were significant, with small to moderate effect sizes; attitudes shown to be the most important predictor. The results for the second step indicated that the addition of the correlates (i.e. self-efficacy, friend and family support), resulted in a significant improvement to the model, and the total variance explained increased to 57.6%. After the addition of these variables, attitudes remained a significant predictor, but subjective norms and perceived behavioural control were no longer significant. Of the additional correlates, self-efficacy and family support emerged as significant predictors of intentions with small effect sizes; however, friend support was not significant. The final step, including the addition of past behaviour, also resulted in a significant improvement to the model with a small effect size, and the total variance explained for intentions increased to 59.2%. With all the variables in the model, attitudes, self-efficacy and past behaviour remained as significant predictors of intentions, and attitudes emerged as the most important predictor. These results suggest that attitudes, self-efficacy and past behaviour are the most influential determinants of intentions, and likely account for the contributions of the other correlates.

4.2.1.2 Predicting Physical Activity Behaviour. The second analysis, repeated the above hierarchical steps, however, predicting physical activity behaviour, and intentions were included in step one with the other theory of planned behaviour variables. The results (see Table 13) showed that in the first step, the three theory of planned behaviour variables explained 30.2% of the variance in physical activity behaviour, and this model was found to be significant. Consistent with the theory of planned behaviour model, intentions and perceived behavioural control were shown to be significant predictors of physical activity, showing small effect sizes; however, attitudes and norms were not significant predictors in this model. The

Table 13

CHAPTER 4: Hierarchical Regression Models Predicting Physical Activity from the Theory of Planned Behaviour Determinants and Additional Correlates

Step 1	*B*	*t*	*df*	*Effect Size*
Attitudes	10.62	.510	149	.041
Subjective Norms	1.21	.072	149	.006
PBC	36.16**	2.68	149	.212
Intentions	79.51***	3.93	149	.303
Model Summary	R^2 =.302***, *F* (4/149) = 16.12			
Step 2	*B*	*t*	*df*	*Effect Size*
Attitudes	15.49	.772	146	.062
Subjective Norms	-12.84	-.781	146	.063
PBC	23.54	1.78	146	.143
Intentions	48.55*	2.38	146	.189
Self-efficacy	21.25**	3.30	146	.258
Family Support	5.42*	2.07	146	.165
Friend Support	.565	.198	146	.016
Model Summary	R^2 *Change* =.087***, *F Change* (3/146) = 6.91			
Step 3	*B*	*t*	*df*	*Effect Size*
Attitudes	18.90	1.12	145	.091
Subjective Norms	-13.91	-1.01	145	.081
PBC	14.81	1.33	145	.107
Intentions	21.68	1.25	145	.100
Self-efficacy	12.23*	2.23	145	.177
Family Support	2.57	1.16	145	.093
Friend Support	-.311	-.130	145	.011
Past Physical Activity	.469***	8.00	145	.543
Model Summary	R^2 *Change* =.187***, *F Change* (1/145) = 63.94			

Note: * p <.05; ** p<.01; *** p<.001; PBC = Perceived Behavioural Control results for the second step indicated that the addition of the covariates (self-efficacy and social support from friend and family), resulted in a significant improvement to the model, and the total variance explained increased to 38.9%. After the addition of these variables, intentions remained significant, and was the most important predictor of physical activity, but perceived behavioural control was no longer significant in this model. Of the additional correlates, self-efficacy and family support emerged as significant predictors of physical activity, with small effect sizes; however, friend support was not significant. The final step, including the addition of past behaviour, also resulted in a significant improvement to the model and the total variance explained for physical activity behaviour increased to 57.6%. Past behaviour accounted for 18.7% of the variance in physical activity and was a significant predictor with a moderate effect size. Self-efficacy remained a significant predictor of physical activity behaviour after including past behaviour; however, intentions and family support no longer significantly predicted physical activity behaviour. These results suggest that past behaviour and self-efficacy provide greater importance in the prediction of physical activity behaviour in young adults, over and above that of the theory of planned behaviour model constructs. While perceived behavioural control did account for physical activity in step one, the addition of self-efficacy and social support variables, resulted in perceived behavioural control becoming non-significant, with these factors likely accounting for its contribution. Furthermore, the addition of past behaviour resulted in intentions no longer significantly predicting physical activity, indicating that the role of past behaviour likely accounts for the contribution of intentions, in addition to self-efficacy.

4.3 Discussion

Within this chapter, the respective predictive strength of past behaviour, self-efficacy, social support from friends and family on intentions to be active and physical activity behaviour was examined, focusing on a sample of young adults at the beginning of their first year at university. The results indicated that the theory of planned behaviour constructs, attitudes, perceived behavioural control and subjective norms contributed 52% of the variance in intentions, and all three were significant predictors, consistent with the theoretical model. Unique variance was explained after the addition of self-efficacy, and social support to the model, with self-efficacy and family support emerging as significant predictors, and attenuating the role of subjective norms and perceived behavioural control, leaving them non-significant. The addition of past behaviour contributed unique variance, and was also a significant predictor of intentions. In this final model, approximately 59% of the variance in intentions to be active was explained; with attitudes, self-efficacy and past behaviour remaining as the primary significant predictors.

In the prediction of physical activity behaviour, the theory of planned behaviour variables contributed approximately 30% of variance, and consistent with the theory, with only intentions and perceived behavioural control significantly predicting physical activity behaviour. Unique variance was provided with the addition of self-efficacy, family support, and friend support; however, only self-efficacy and family support significantly predicted physical activity. Moreover, this addition resulted in the full attenuation of perceived behavioural control. Lastly, the final model accounted for approximately 58% of the variance in physical activity behaviour, with the addition of past behaviour providing unique variance to the model. In this final model, only past behaviour and self-efficacy emerged as the key predictors of physical activity behaviour, superseding the theory of planned behaviour constructs, and social support variables.

The initial model predicting intentions, was consistent with the theory of planned behaviour, and previous research, indicating that attitudes, subjective norms and perceived behavioural control are significant predictors of intentions, with attitudes emerging as the most important predictor (Godin & Kok, 1996; McEachan et al., 2011). The finding that self-efficacy and social support from family were significant predictors is consistent with previous reports (Hagger et al., 2001; Plotnikoff, Costigan, Karunamuni, & Lubans, 2013). Additionally, the attenuation of perceived behavioural control and subjective norms after the addition of self-efficacy and social support has also been reported elsewhere (Hagger et al., 2001; Okun et al., 2003). Consistent with previous research, past behaviour was found to be an important predictor of intentions (Hagger et al., 2001). Additionally, given that attitudes remained significant after the addition of self-efficacy, social support, and past behaviour supports the notion suggested by previous research that in addition to the information provided by an individuals' past behaviour (such as previous controllability of behaviour, ease or difficulty of behaviour, previous performance), situation-specific evaluations, in the form of attitudes are still an important component in the formation of intentions in young adults at university (Hagger et al., 2001). The result that attitudes remained as the only theory of planned behaviour construct in the final model is consistent with research indicating that attitudes were the strongest predictor of intentions (Godin & Kok, 1996; McEachan et al., 2011). Further to this, the attenuation of perceived behavioural control relationship with intentions is consistent with previous research indicating that self-efficacy often emerges as the stronger correlate of intention and behaviour. Additionally, this is consistent with predictions based on the new extension of the theory of planned behaviour model, known as the reasoned action approach (Fishbein & Ajzen, 2011). Within this approach, self-efficacy is considered the control factor which affects behaviour both directly and indirectly via intention, whereas the effects of perceived behavioural control are independent of intentions (McEachan et al., 2016).

The finding that the theory of planned behaviour constructs in the prediction of physical activity behaviour resulted in only intentions and perceived behavioural control as significant predictors, is consistent with the theory, as well as previous research (Ajzen, 1991; Godin & Kok, 1996; McEachan et al., 2011). Self-efficacy and social support have both been identified in previous research as being important predictors of physical activity behaviour, and have provided unique variance over the theory of planned behaviour constructs, and as such the results of this study are consistent with this previous research (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; McAuley & Blissmer, 2000; Okun et al., 2003; Reuter et al., 2010; Treiber et al., 1991). The results of this study are also consistent with previous research reporting the importance of past behaviour, over and above that of theory of planned behaviour constructs on the prediction of physical activity behaviour (Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger et al., 2001; Hamilton & White, 2008; Norman & Smith, 1995; Wallace, Buckworth, Kirby, & Sherman, 2000). Given that past-behaviour and self-efficacy remained as the key predictors of physical activity, superseding the theory of planned behaviour constructs and social support, this highlights the importance of including these factors in prediction models.

Additionally the differential influences provided by social support from friends and family in the prediction of intentions and behaviour has been reported previously, with some reports demonstrating a stronger influence from family, and others reporting a stronger influence from friends (Leslie et al., 1999; Treiber et al., 1991; Wallace et al., 2000). Within this sample, it seems that family support was more influential than friend support. This may be a function of the fact that many young adults still remain within the family home when they begin university, and as a result family members provide a greater role in the formation of intentions to be active and physical activity behaviour. The role of friends may also be reduced during this period due to the changes to young adults' social environments, such as starting university, employment, or new recreational activities, which may destabilize pre-existing support, which had previously influenced intentions and behaviour.

The unique contribution of this research highlights the importance of self-efficacy and past behaviour over and above that of the theory of planned behaviour constructs and social support, in predicting both intentions and physical activity behaviour. This suggests that while the theory of planned behaviour constructs and social support provide important variance in the prediction of intentions and behaviour, within this sample self-efficacy and past behaviour largely accounted for their influence. As such, the use of an augmented theory of planned behaviour model, which accounts for social support, self-efficacy, and past behaviour in the prediction of both intentions and physical activity is strongly encouraged. This finding also suggests that within this sample the theory of planned behaviour model is not the best fit, given that the primary predictors of the theory of planned behaviour model were rendered non-significant or trivial after the addition of self-efficacy and past behaviour. However, it may indicate that Bandura's social cognitive theory (1986, 1989, 1997, 1998, 2004), which highlights the importance of self-efficacy in behavioural engagement, may better predict the physical activity-based intentions and behaviour of this sample of first year university students.

The implications of the current results for intervention highlights the importance of attitudes and self-efficacy for developing intentions, and self-efficacy for participation in physical activity. Thus interventions that target intentions may wish to focus on attitudinal change to influence intention formation, whereas interventions designed to increase physical activity may seek to increase perceptions of self-efficacy. Previous interventions for manipulating attitudes and self-efficacy perceptions have been shown to be successful (Ajzen & Fishbein, 2000; McAuley & Blissmer, 2000). For example, self-efficacy can be successfully increased through shaping the environment (e.g. through a socially enriched group environment), and providing positive performance feedback (McAuley & Blissmer, 2000; McAuley, Talbot, & Martinez, 1999; Turner, Rejeski, & Brawley, 1997). Moreover, there are a number of approaches to attitudinal change, such as conditioning tasks, affective priming and persuasive communication methods, all of which have shown success in changing attitudes at either implicit and/or explicit levels (Gawronski & Bodenhausen, 2006). Therefore, utilizing methods such as these could be successful in increasing both intentions and physical activity behaviour. Furthermore, the significant role of past behaviour for both intention formation and physical activity behaviour highlights the importance of targeting physical activity habits early in life, such as in childhood or adolescence, as behaviour during these periods will have flow on effects during young adulthood and beyond.

The results of this study need to be interpreted with consideration of the limitations of the study methods. Namely, the use of a self-selected sample, self-reports, and a cross-sectional design could have inflated the behavioural reports, thereby limiting the interpretative value of the results.. Future use ofrandom sampling, more objective measures and a prospective design could produce more robust results.

The present study increases the knowledge of the role of important determinants of intentions and behaviour in relation to physical activity in young adults, including the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, intentions) past behaviour, self-efficacy, and social support. Specifically, this study has highlighted the importance of including past behaviour and self-efficacy in social-cognitive models. Furthermore, the results have significant implications for intervention. In particular, interventions to increase positive attitudes towards physical activity and improving self-efficacy are likely to improve both intentions to be active and physical activity rates. Moreover the study emphasized the importance of establishing regular physical activity patterns earlier in life as they have a strong relation to future participation rates.

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CHAPTER 5: Attitudes, Intentions, Self-efficacy and Social Support: Relationships and Influential Pathways relating to Physical Activity in Young Adults

Objectives: This study aimed to examine the relationships between attitudes, intentions, self-efficacy and social support, exploring the potential pathways and interaction effects predicting physical activity participation in young adults. **Methods:** Students (*N*=206; 156 female, 50 male; aged 17-25 years)* completed a short questionnaire measuring attitudes and intentions towards regular physical activity, self-efficacy and social support to engage in regular physical activity, and physical activity behaviour. **Results:** Intentions fully mediated the relationships between attitudes, self-efficacy and social support with physical activity behaviour, consistent with the theory of planned behaviour. Additionally, self-efficacy moderated the relationship between social support variables and intentions, with intentions significantly varying at low levels of self-efficacy, suggesting that social support counteracts the deficits associated with low levels of self-efficacy. **Conclusions:** This study adds to the body of knowledge examining the role of attitudes, intentions, self-efficacy, and social support as important determinants of physical activity, within a young adult sample. The results provide support for social-cognitive theory and theory of planned behaviour concepts, as well as valuable insights for targeted interventions.

5.1 Introduction

Engaging in regular physical activity has long been shown to provide numerous physical and psychological benefits (e.g. protection from chronic disease, healthy weight management, mood improvement), and is considered an important contributor to good health (Gómez-López, Gallegos, & Extremera, 2010; Gómez-Pinilla, 2008; Scarmeas et al., 2009; Zunft et al., 1999). Investigating the determinants of physical activity can help identify which factors contribute to the prediction of physical activity behaviour, which can then be used to inform interventions that aim to increase engagement in regular physical activity.

It has been shown that physical activity participation can decline in young adulthood and this can lead to deterioration of health later in life (Bray & Born, 2004; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003; Irwin, 2004; Jung, Bray, & Ginis, 2008; Leslie et al., 1999; Wallace, Buckworth, Kirby, & Sherman, 2000). Emerging adulthood is a critical period where independence is established and long-term health behaviour patterns are adopted, and therefore this cohort is an important group in which to address the establishment of long-term health behaviour (Bray & Born, 2004; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008).

Attitudes and intentions have been well documented as valuable predictors of physical activity behaviour, and are included in the theory of planned behaviour model, which has been successfully applied to physical activity behaviour (Ajzen, 1991; Calitri, Lowe, Eves, & Bennett, 2009; Godin & Kok, 1996; McDermott et al., 2015; McEachan, Conner, Taylor, & Lawton, 2011; Plotnikoff, Costigan, Karunamuni, & Lubans, 2013; Plotnikoff, Lubans, Trinh, & Craig, 2012; Sniehotta, Scholz, & Schwarzer, 2005). In particular, the theory of planned behaviour model stipulates that intentions are the proximal predictor of behaviour, and act as a mediator between other factors, such as attitudes, and behaviour (Ajzen, 1991).

Meta-analyses reviewing the theory of planned behaviour within health behaviours, repeatedly report that intentions are the strongest predictor of health behaviour, including physical activity, and that intentions are strongly guided by attitudes as the most important predictor (Godin & Kok, 1996; McEachan et al., 2011). Therefore, it was hypothesised that intentions would function as a mediator between attitudes and behaviour.

Self-efficacy has also been identified as an important factor for the participation in physical activity. Research consistently demonstrates that individuals with high levels of self-efficacy are more likely to be physically active (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Kavussanu & Roberts, 1996; McAuley & Blissmer, 2000). Self-efficacy is defined as an individual's belief in their capability to carry out a specific behaviour, particularly in the face of situational obstacles (Bandura, 1998; Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005; Williams & French, 2011). Self-efficacy influences which behaviours people engage in, how much effort they exert on these activities, and the extent of persistence they show in the event of failure or situational barriers (Dishman et al., 2005; McAuley & Blissmer, 2000; Sniehotta et al., 2005). Previous research has shown that self-efficacy is most predictive of behaviour within situations that have obstacles, compared to those that are under habitual control (McAuley & Blissmer, 2000). Self-efficacy is a particularly important factor to investigate during young adulthood, due to the changes (such as new educational, occupational, social, and living environments) and developing independence which occurs during this period, which provides new challenges relating to the establishment of new behaviours.

Self-efficacy is the primary variable of interest within social cognitive theory, however, within this framework, the contribution of self-efficacy in predicting behaviour, such as physical activity, is evaluated along with other personal and social variables, such as attitudes, intentions and support from family and friends (Bandura, 2004; Leslie et al., 1999; McAuley & Blissmer, 2000). Previous researchers have also suggested that the factors in social cognitive theory should be viewed within the context of other theoretical frameworks, such as the theory of planned behaviour, which may provide a more complete understanding of behaviour, and better guide behavioural intervention (Bandura, 1998; McAuley & Blissmer, 2000).

Within the social cognitive theory, factors which may influence physical activity behaviour are attitudinal constructs (e.g. enjoyment and activity preference), cognitive factors (e.g. self-efficacy and intentions), and the social support provided within the environment (McAuley & Blissmer, 2000). Previous research has found that self-efficacy positively influences cognitive (including attitudes and intentions), affective and social factors (Bandura, 2004; Duncan & McAuley, 1993; McAuley & Blissmer, 2000; Schwarzer & Fuchs, 1996; Sniehotta et al., 2005). It was hypothesised that the effect of self-efficacy on physical activity behaviour would also be mediated by intentions, as per the theory of planned behaviour.

The contextual environment also affects self-efficacy, for example, socially supportive environments may have a greater effect on self-efficacy and as a result more strongly affect intentions and behaviour compared to environments lacking in social support (McAuley & Blissmer, 2000). Social support has been found to predict health behaviours, including physical activity, and is defined as any action that an individual makes which assists another individual in achieving their desired goals (Treiber et al., 1991). Research consistently shows that those receiving higher levels of support for an active lifestyle from friends and/or family typically engage in higher rates of physical activity (Booth et al., 2000; Okun et al., 2003; Treiber et al., 1991). Therefore, in line with the theory of planned behaviour, it was also hypothesised that intentions would mediate the relationship between social support and physical activity behaviour.

Social support has also been shown to influence perceptions of self-efficacy by functioning as a coping resource (Bandura, 1998; Duncan & McAuley, 1993; Gruber, 2008; Okun et al., 2003). In this case social support influences available external coping resources, whereas self-efficacy is concerned with one's own personal coping resources (Duncan & McAuley, 1993). Bandura theorized that social support exerts its influence on physical activity through self-efficacy, and this has been supported by previous research (Anderson, Winett, & Wojcik, 2007; Bandura, 1997; Courneya & McAuley, 1995; Duncan & McAuley, 1993; Gruber, 2008; Okun et al., 2003). However, Bandura (1998) also indicated that the effects of self-efficacy and social support on physical activity may strengthen each other bi-directionally, and previous research has indeed found that the relationship between self-efficacy and physical activity also functioned indirectly through social support (Dishman, Saunders, Motl, Dowda, & Pate, 2009).

While most research has focused on the mediating role of self-efficacy within the relationship between social support and physical activity, social-cognitive theory implies that self-efficacy may function as a moderator of this relationship (Bandura, 2004; Dishman et al., 2009). In support, Dishman et al. (2009) tracked physical activity, self-efficacy and social support in adolescent girls longitudinally, and determined that self-efficacy operated as a moderator of the relationship between perceived social support and physical activity participation, with higher levels of self-efficacy predicting reduced declines in physical activity levels.

Here we propose an alternative perspective on the relationship between self-efficacy and social support in relation to physical activity intentions and participation. Although social support and self-efficacy can be viewed as separate forms of resources, these constructs may in fact interact. For example, deficits in self-efficacy could potentially be counteracted by the coping resources provided by social support. In contrast, individuals with high levels of self-efficacy may be less influenced by social support as their perception of their personal resources are deemed sufficient to overcome potential behavioural obstacles. Therefore, we hypothesized that self-efficacy would moderate the relationship between social support measures and intentions to be active. Furthermore, we expected that the indirect effect of social support on physical activity, via intentions, would significantly differ according to levels of self-efficacy. Specifically, we expected that the relationship between social support and intentions would be significantly stronger when self-efficacy was low versus when self-efficacy was high.

Furthermore, research indicates that both friend and family support are important predictors of physical activity participation in young adults, with friend support typically exerting a stronger influence on behaviour than family support (Gruber, 2008; Leslie et al., 1999; Okun et al., 2003; Wallace et al., 2000). Wallace et al. (2000) found that family support was more influential for women and friend support was more important for men, although Leslie et al. (1999) found that friend and family support were of equal importance across genders. Treiber et al. (1991) found that among young adult men, both friends and family influenced sport participation, but only friend support related to leisure time physical activity. Because this research suggests that the source of social support can influence people differentially, it is important to investigate both sources of social support when examining physical activity in young adults.

Thus the present study aimed to examine the relationships between attitudes, intentions, self-efficacy, and social support, in the prediction of physical activity participation in young adults, with predictions based on the theory of planned behaviour and social cognitive theory. In line with the theory of planned behaviour, we first aimed to determine whether the contribution of a) attitudes, b) self-efficacy, and social support from c) friends and d) family to physical activity are mediated by intentions to be active. Second, we examined whether social support and self-efficacy interact to predict intentions to be active, which subsequently predict physical activity behaviour.

5.2 Method

5.2.1 Participants

Two hundred and six young adult first year students from Flinders University (156 female, 50 male, mean age = 19.5 years, age range: 17-25 years) were recruited through the first year psychology participant pool and with flyers around campus. One hundred and seventeen first year psychology student volunteers participated for course credit, while the remaining 89 participants received a $10 honorarium.

5.2.2 Measures

5.2.2.1 Attitudes. Attitudes towards physical activity were measured using two questions, with responses rated on 7 point scales. These items were similar to those used in previous research (Ajzen, 2001; Courneya & McAuley, 1995; Hamilton & White, 2008; Jackson, Smith, & Conner, 2003; Rhodes & Blanchard, 2008). Participants were asked (1) whether they like to engage in regular physical activity (i.e. exercising at least three times a week), with 1 ‘Definitely do not like to do this’ and 7 ‘Definitely do like to do this’, and (2) whether they enjoy doing regular physical activity with 1 ‘Not enjoyable’ and 7 ‘Enjoyable’. Responses to these two items were averaged to create a composite attitudes score, with higher scores indicating more positive attitudes. The resulting Cronbach’s a was .76.

5.2.2.2 Intentions. Participants were questioned on their intentions and plans to engage in regular physical activity (i.e. exercising at least three times per week) within the following month, on two 7 point Likert scales, as used in previous research (Ajzen & Sheikh, 2013; Hamilton & White, 2008; Hobbs, Dixon, Johnston, & Howie, 2013; Jackson et al., 2003; Kuijer & Boyce, 2014; Plotnikoff et al., 2012). Participants were asked (1) whether they intended to engage in regular physical activity within the next month, with 1 'Definitely do not intend to do this' and 7 'Definitely intend to do this', and (2) how often they planned to engage in regular physical activity, with 1 'Never', and 7 'Everyday'. Responses were averaged to create a composite intentions score, with higher scores suggesting stronger intentions. The resulting Cronbach's a was .82.

5.2.2.3 Self-efficacy. Self-efficacy for physical activity was recorded using Schwarzer and Renner's (2009) Exercise Self-efficacy Scale. The measure asks participants to rate their certainty of carrying out their physical activity intentions across five potential barriers (having worries and problems, feeling depressed, feeling tense, feeling tired, and being busy), on four point scales ranging from 1 'Very uncertain' to 4 'Very certain'. 'Not applicable' was also offered as a response and scored as zero. A total self-efficacy score was calculated by summing each item, with possible scores ranging from 0 to 20, and larger scores indicating higher levels of self-efficacy. This scale has been found to be both a valid (construct validity demonstrated by correlations to exercise behaviour and intentions) and reliable (internal consistency: Cronbach's a = .88) tool for assessing physical activity self-efficacy (Schwarzer & Renner, 2009). Within this sample, the Cronbach's a for this scale was .83.

5.2.2.4 Social Support. Social support for physical activity was measured using the Social Support Survey for Exercise Behaviour (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). The survey asks participants to rate how often their family and friends engage in ten various exercise related interactions with them (e.g.

'exercised with me', 'discussed exercise with me', 'helped plan activities around my exercise') using five point scales ranging from 1 'Never' to 5 'Very often'. 'Not applicable', scored as zero, was also offered as a response. A total social support score for family and friends respectively, was calculated by summing allocated items, with possible scores ranging from 0 to 50, and larger scores indicating higher levels of social support. This scale has previously been shown to demonstrate both criterion-related and construct validity, and good reliability (internal consistency: Cronbach's a = 0.61-0.91; test-retest reliability: r = 0.55-0.79). Within this sample the Cronbach's a for the friend support scale was .90, and for the family support scale was .91.

5.2.2.5 Physical Activity Behaviour. Participants were asked to list their current physical activity behaviour, including the type of activity they participate in, the frequency with which they engaged in each activity, and the average duration of the activity on each occasion. A total physical activity score was calculated by multiplying the frequency and duration data for each physical activity listed, and then these scores were summed. Total physical activity was reported in minutes, with higher scores reflecting greater participation in physical activity.

5.2.3 Procedure

Participants were tested in small groups in a quiet room in the Applied Cognitive Psychology laboratory at Flinders University, South Australia. After giving informed consent, participants completed the questionnaire, which took approximately 20 minutes. Demographic information was also collected from participants.

5.2.4 Statistical Analyses.

Pearson correlations were run to determine the strength, direction and significance of the relationships between each of the variables. All other analyses were conducted using the SPSS macro PROCESS (Hayes, 2012). The mediation analyses, investigating the mediating effects of intentions on the relationships between attitudes, self-efficacy and social support with physical activity behaviour, used PROCESS model 4, and assessed both direct and indirect effects. Indirect effects were based on bias-corrected bootstrap 95% confidence intervals, using 5000 bootstrap samples, and significant effects were deemed present when confidence intervals did not straddle zero. The moderation analyses, examining the interaction effects between social support and self-efficacy on the prediction of intentions, were run using PROCESS model 1, and significant effects were defined when a significant interaction was present. In addition, moderated mediation analyses were run to determine whether the indirect effect of social support on physical activity behaviour, via intentions, significantly varied according to levels of self-efficacy. These analyses were run using PROCESS model 7, with significance determined by the presence of both a mediated effect (i.e. a significant indirect effect), and a significant interaction term, resulting in a significant moderated mediation index, where the bias-corrected bootstrapped 95% confidence intervals (based on 5000 boostrap samples) do not straddle zero. Variables were mean centered before conducting all moderation based analyses.

5.3 Results

5.3.1 Descriptive Statistics and Relationships

Descriptive data for attitudes, intentions, self-efficacy, social support from friends and family and physical activity behaviour can be found in Table 14. Participants indicated positive attitudes towards being regularly physically active, and also reported having strong intentions to engage in regular physical activity within the next month.

Table 14

CHAPTER 5: Descriptive Data and Correlations for Attitudes, Intentions, Self-efficacy, Social Support from Friends and Family, and Physical Activity

	M (SD) Range	Self-efficacy	Friend Support	Family Support	Attitudes	Intentions
Physical Activity	365 (322) 0 to 1770	.239**	.208**	.073	.321***	.449***
Self-efficacy	13.6 (3.9) 0 to 20		.227**	.070	.342***	.412***
Friend Support	25.8 (9.2) 8 to 46			.368***	.266***	.293***
Family Support	23.3 (9.6) 0 to 48				.110	.151*
Attitudes	6.1 (1.2) 2 to 7					.669***
Intentions	5.2 (1.5) 1 to 7					

Note: * p <.05; ** p<.01; *** p<.001

Students' reports of their self-efficacy for physical activity indicated that on average they have moderate levels of self-efficacy to engage in regular physical activity. Mean social support scores for both friends and family members, indicated that participants had fairly low levels of social support from both their friends and their family. While social support levels from friends and family were similar, participants rated friends as providing slightly higher levels of support for physical activity.

Participants reported that on average they spent approximately six hours per week engaging in physical activities, with only 8.3% of the sample indicating that they were not purposefully active. Thus on average, students appeared not only to be meeting the recommended amount of purposeful physical activity, but seemed to be exceeding the Australian physical activity guidelines, which recommend between 150 minutes (2.5 hours) to 300 minutes (5 hours) of purposeful physical activity per week (Brown, Bauman, Bull, & Burton, 2012), similar to those used internationally (World Health Organization, 2011).

Correlational data can be found in Table 14. All variables were found to be significantly positively inter-correlated, except for family support which only significantly correlated with friend support and intentions.

5.3.2 Mediating effect of intentions

A series of mediation analyses were run to test the hypotheses that intentions to engage in regular physical activity mediated the relationships between attitudes (Model 1), self-efficacy (Model 2), friend (Model 3) and family (Model 4) support, with physical activity behaviour (coefficients are displayed in Table 15).

The results indicated that each of the independent variables (i.e. attitudes, self-efficacy, friend support and family support) significantly positively predicted intentions and these variables accounted for approximately 45%, 17%, 9% and 2% of the variance in intentions respectively. Furthermore, in each of the models, intentions were shown to significantly predict physical activity behaviour, indicating that those with positive intentions participated in higher levels of physical activity. The variance explained in physical activity behaviour for each of these models ranged from 19.6% to 20.5%. The direct and indirect effects are shown in Table 16, and indicate that there was no direct effect between each of the independent variables and physical activity behaviour, when controlling for intentions. Significant indirect

Table 15

CHAPTER 5: Coefficients for Simple Mediation Analyses

Model 1	Consequents			
	M: Intentions		DV: Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Attitudes	.810***	.063	9.32	22.07
M: Intentions			92.17***	18.22
Constant	.319	.390	-172.31	101.47
Model Summaries	R2 = .447***		R2 = .204***	
	F(1, 203) = 164.39		*F*(2, 202) = 25.91	
Model 2	**Consequents**			
	M: Intentions		DV: Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Self-efficacy	.159***	.025	5.47	5.71
M: Intentions			90.49***	14.74
Constant	3.04***	.350	-180.70*	86.18
Model Summaries	R2 = .169***		R2 = .205***	
	F(1, 204) = 41.59		*F*(2, 203) = 26.17	
Model 3	**Consequents**			
	M: Intentions		DV: Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Friend Support	.048***	.011	3.01	2.33
M: Intentions			89.74***	14.17
Constant	3.98***	.303	-179.39*	83.00
Model Summaries	R2 = .086***		R2 = .203***	
	F(1, 201) = 18.83		*F*(2, 200) = 25.46	

Note: * p <.05; ** p<.01; *** p<.001

Table 15. *Continued.*

CHAPTER 5: Coefficients for Simple Mediation Analyses

Model 4	Consequents			
	M: Intentions		DV: Physical Activity	
Antecedent	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Family Support	.024*	.011	.228	2.16
M: Intentions			95.12***	13.80
Constant	4.68***	.275	-133.99	84.07
Model Summaries	R2 = .023*		R2 = .196***	
	F(1, 201) = 4.67		*F*(2, 200) = 24.44	

Note: * p <.05; ** p<.01; *** p<.001

effects, however, were found for each of the models. This suggests that intentions fully accounted for the relationships between each of the independent variables (i.e. attitudes, self-efficacy, friend support and family support) and physical activity.

5.3.3 Moderating effects of self-efficacy

Additionally, two moderation analyses were run to determine whether self-efficacy moderates the relationship between friend support and intentions, and the relationship between family support and intentions. In both models, self-efficacy and social support (either from friends or family) were significant predictors of intentions, as was the interaction term between friend/family support and self-efficacy (see Table 17). Furthermore, the addition of the interaction terms resulted in a significant increase in variance explained. These results indicated that the relationships between friend support and intentions, and family support and intentions, both significantly varied according to levels of self-efficacy (see *Figure 4*). Simple slopes analyses highlighted that the relationship between family support and intentions significantly differed only for participants with low levels of self-

Table 16

CHAPTER 5: Direct and Indirect Effect Coefficients for Intentions Mediating the Relationship between Attitudes (Model 1), Self-efficacy (Model 2), Friend Support (Model 3), and Family Support (Model 4)

		Direct Effects		
	Coeff.	*SE*	*Boot LLCI*	*Boot ULCI*
Model 1	9.32	22.07	-34.19	52.83
Model 2	5.47	5.71	-5.79	16.73
Model 3	3.01	2.33	-1.57	7.59
Model 4	.228	2.16	-4.03	4.49
		Indirect Effects		
Model 1	74.68*	20.81	32.06	114.33
Model 2	14.43*	3.58	8.48	22.72
Model 3	4.31*	1.15	2.23	6.81
Model 4	2.24*	1.04	.290	4.35

Note: * = Significant effect; 95% Bias Corrected Bootstrapped Confidence Intervals, using 5000 Bootstrap Samples

efficacy, B= .043, t(199) = 3.00, p= .003; those with high levels of self-efficacy were not shown to significantly differ, B= -.003, t(199) = -.232, p= .826. The same pattern emerged for the relationship between friend support and intentions, with only participants with low levels of self-efficacy showing significant variation, B= .076, t(199) = 4.79, p= .000, but not those with high levels of self-efficacy B= .003, t(199) = .232, p= .816. Specifically, participants with low levels of self-efficacy showed greater intentions to be active when either friend or family support was high. In comparison, students with high levels of self-efficacy did not differ in intentions regardless of the level of friend or family support. This suggests that increased levels of social support, either from friends or family, could counteract low levels of self-efficacy in the formation of intentions, and likewise low levels of social support, either from friends or family, may be overcome with high levels of self-efficacy.

Table 17

CHAPTER 5: Coefficients for Moderation Analyses

	Predicting Intentions		
Moderation 1	*Coefficient*	*t*	*df*
Family Support	.020*	2.01	199
Self-efficacy	.145***	5.85	199
Interaction	.006*	-2.30	199
Model Summary	R^2 *change* = .021*, *F change* (1, 199) = 5.30		
Moderation 2	*Coefficient*	*t*	*df*
Friend Support	.039***	3.79	199
Self-efficacy	.117***	4.67	199
Interaction	-.009*	-3.44	199
Model Summary	R^2 *change* = .044**, *F change* (1, 199) = 11.86		

Note: * p <.05; ** p<.01; *** p<.001

5.3.4 Moderated Mediation Analyses

Furthermore, two moderated mediation analyses were run to confirm whether the indirect effect of social support from both family (Moderated Mediation Model 1) and friends (Moderated Mediation Model 2) on physical activity behaviour, via intentions, significantly differed according to levels of self-efficacy. Specifically, the analyses examined whether self-efficacy moderated the mediation pathway between friend support and intentions.

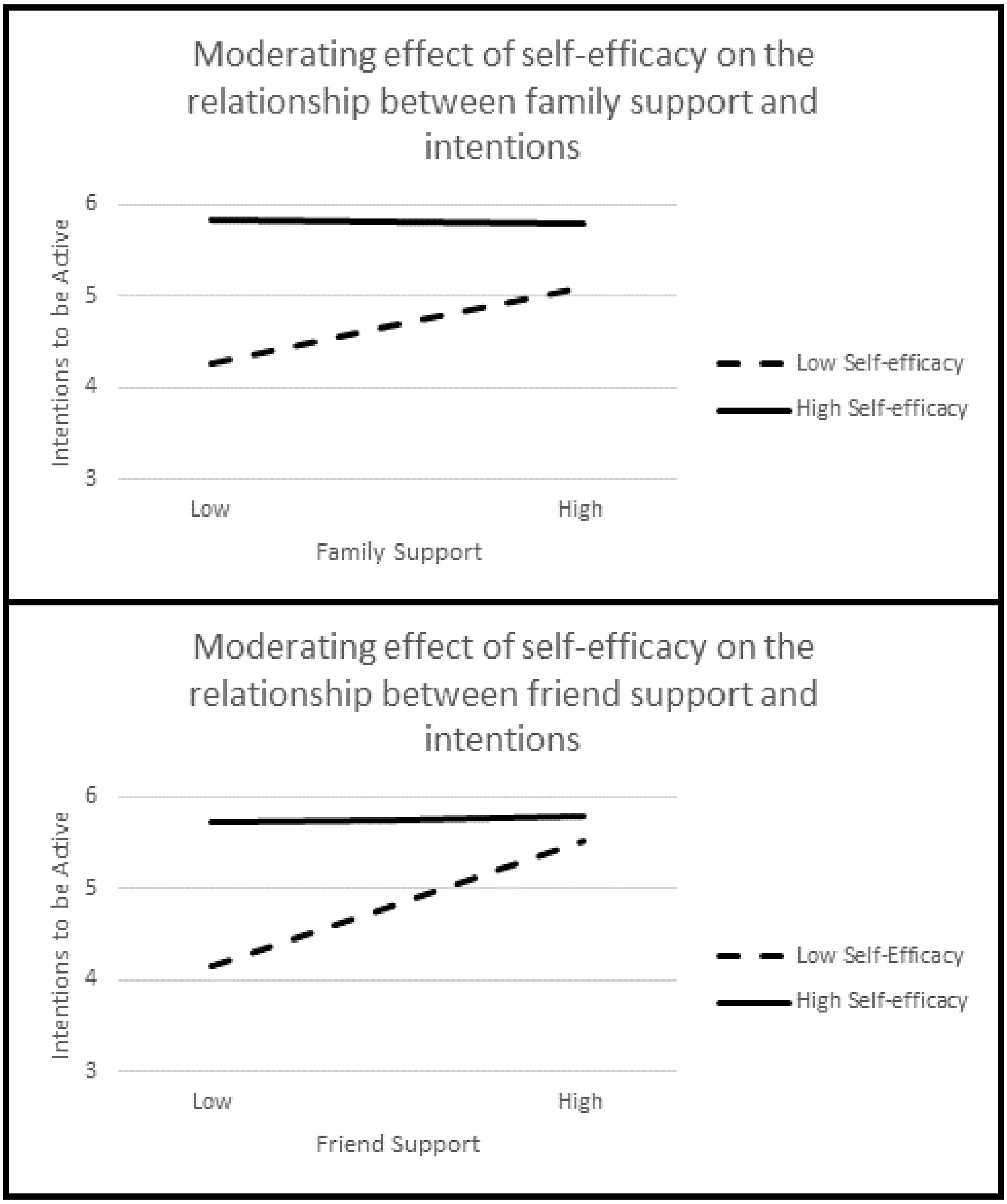

Figure 4. CHAPTER 5: Moderating Effects of Self-efficacy on the Relationship between Social Support and Intentions

In the first step for both moderated mediation models, social support from family or friends, self-efficacy and the interaction term (i.e. product of social support and self-efficacy) was regressed onto intentions. The following regression model was estimated with physical activity as the outcome variable, and included intentions and social support from family or friends (see Table 18 for the family support model, and Table 19 for the friend support model). The results indicated that in both models, social support, self-efficacy and the interaction term each significantly predicted intentions. Additionally, in step two of each model, intentions significantly predicted physical activity; however, social support did not, suggesting a non-significant direct effect between social support and physical activity.

Table 18

CHAPTER 5: Moderated Mediation Model 1 – Indirect effect of family support on physical activity via intentions, moderated by self-efficacy

Step 1: Predicting Intentions	Coefficient	SE	*t*
Constant	5.25***	.095	55.41
Family Support	.020*	.010	2.01
Self-efficacy	.145***	.025	5.85
Interaction (Family Support x Self-efficacy)	-.006*	.003	-2.30
Model Summary	R^2 =.208***, F (3, 199) = 17.41		
Step 2: Predicting Physical Activity	Coefficient	SE	*t*
Constant	-128.66	75.00	-1.72
Intentions	95.12***	13.80	6.90
Family Support	.222	2.16	.106
Model Summary	R^2 =.196***, F (2, 200) = 24.44		

Note: * p <.05; ** p<.01; *** p<.001

Table 19

CHAPTER 5: Moderated Mediation Model 2 – Indirect effect of friend support on physical activity via intentions, moderated by self-efficacy

Step 1: Predicting Intentions	Coefficient	SE	*t*
Constant	5.29***	.094	56.16
Friend Support	.039***	.010	3.79
Self-efficacy	.117***	.025	4.67
Interaction (Friend Support x Self-efficacy)	-.009**	.003	-.015
Model Summary	R^2 =.256***, *F (3, 199)* = 22.85		
Step 2: Predicting Physical Activity	Coefficient	SE	*t*
Constant	-101.60	76.68	-1.33
Intentions	89.74***	14.17	6.33
Friend Support	3.01	2.33	1.30
Model Summary	R^2 =.203***, *F (2, 200)* = 25.46		

Note: * p <.05; ** p<.01; *** p<.001

Furthermore, the conditional indirect effects of social support, from both family and friends, on physical activity via intentions, consistent with the moderation analyses above, was shown to be significant only at low levels of self-efficacy, but not at high levels of self-efficacy (see Table 20 for the direct, and conditional indirect effects for both models). Additionally, a significant index of moderated mediation was found for both family support (*Index* = -.561, *SE* = .267, *BootLLCI* = -1.12, *BootULCI* = -.069), and friend support (*Index* = -.834, *SE* = .273, *BootLLCI* = -1.41, *BootULCI*

= -.335). These results therefore provide support for the proposed moderated mediation models, whereby the indirect effect of social support from family and friends on physical activity, via intentions, was significant, and differed significantly at low levels of self-efficacy.

Table 20

CHAPTER 5: Direct and conditional indirect effects for moderated mediation models 1 and 2

	Direct Effects			
	Coeff.	*SE*	*Boot LLCI*	*Boot ULCI*
Moderated Mediation Model 1 (Family Support)	.228	2.16	-4.028	4.89
Moderated Mediation Model 2 (Friend Support)	3.01	2.33	-1.57	7.59
	Conditional Indirect Effects			
Model 1: Low Levels of Self-efficacy	4.08*	1.58	1.32	7.67
Model 1: High Levels of Self-efficacy	-.290	1.14	-2.74	1.78
Model 2: Low Levels of Self-efficacy	6.79*	1.91	3.35	10.85
Model 2: High Levels of Self-efficacy	.286	.978	-1.65	2.22

Note: * = Significant effect; 95% Bias Corrected Bootstrapped Confidence Intervals, using 5000 Bootstrap Samples.

5.4 Discussion

The aim of this study was to determine the nature of the relationships between attitudes, intentions, self-efficacy, and social support from friends and family, and explore the potential influencing pathways towards physical activity participation in young adults. The results indicated that participants have clear positive attitudes and intentions towards being active and were on average engaging in more physical activity than the recommended guidelines. However, participants reported only moderate levels of self-efficacy, and low levels of social support from both their friends and family. Attitudes, intentions, self-efficacy, friend support, and physical activity were all positively inter-correlated; however, family support only correlated with friend support and intentions. The relationships between the social-cognitive variables (i.e. attitudes, self-efficacy, friend support, and family support) and physical activity were all shown to be fully mediated by intentions. Additionally, the relationship between support from both friends and family with intentions significantly varied for participants with low levels of self-efficacy, indicating that social support from friends or family can counteract low levels of self-efficacy in the formation of intentions. These results also suggest that for those with high levels of self-efficacy, the role of social support in intentions to be active may be less influential as there was no significant difference in intentions for participants with high levels of self-efficacy, irrespective of perceived social support. This same interaction effect between social support and self-efficacy was further supported as a mechanism guiding the prediction of intentions, and subsequent behaviour with the observation of a significant moderated mediation. Specifically, the indirect effect of social support from both friends and family on physical activity, via intentions, significantly varied at low but not high levels of self-efficacy. This suggests that social support plays a predominant role in strengthening intentions when self-efficacy is lacking, but has little influence when self-efficacy is high.

The current findings are consistent with previous research that has also found that young adults have positive attitudes and intentions towards being active (Wing Kwan, Bray, & Martin Ginis, 2009). Other studies have also found that young adults, on average, report moderate levels of self-efficacy, and receive only low levels of support from their friends and/or family to be active (Molloy, Dixon, Hamer, & Sniehotta, 2010; Steptoe, Wardle, Pollard, Canaan, & Davies, 1996; Treiber et al., 1991; Wing Kwan et al., 2009). However, the finding here that students were sufficiently active, and in fact exceeded the recommended guidelines for physical activity, is inconsistent with previous research from both Australia and overseas, which has shown that physical activity levels decline in early adulthood (Bray & Born, 2004; Butler et al., 2004; Huang et al., 2003; Jung et al., 2008; Leslie et al., 1999). However, research by Irwin (2004) indicated that while young adults internationally were typically insufficiently active, including Australians, the Australian participants had the highest rate of adherence to physical activity guidelines at 60%. This suggests that culturally Australians may be more inclined to live active lifestyles.

The positive inter-correlations between attitudes, intentions, self-efficacy, social support, and physical activity have all been reported in previous research (Anderson, Wojcik, Winett, & Williams, 2006; Beets, Pitetti, & Forlaw, 2007; Conner & Armitage, 1998; Duncan & McAuley, 1993; Hagger, Chatzisarantis, & Biddle, 2001; McEachan et al., 2011; Molloy et al., 2010; Rhodes & Dickau, 2013). The differential predictive weight of support from friends versus family has also been reported previously, with results often indicating that friend support is more influential than support provided by family in the participation and adherence to physical activity (Gruber, 2008; Okun et al., 2003). The result that each social-cognitive variable (i.e. attitudes, self-efficacy, and social support) influenced physical activity through its effects on intentions, is also supported by previous research, and is consistent with the theory of planned behaviour and our hypotheses

(Ajzen, 1991; Godin & Kok, 1996; McEachan et al., 2011; Plotnikoff et al., 2013; Plotnikoff et al., 2012).

The moderating effect of self-efficacy in the relationship between friend and family support with intentions is consistent with the implication by Bandura (2004) that self-efficacy may operate as a moderator within this relationship. This result, along with the significant moderated mediation analysis, also supports our novel hypothesis that social support and self-efficacy interact by each counteracting the resource deficits of the other, aiding the formation of intentions, which subsequently affects physical activity behaviour. This finding provides a new perspective on the respective roles of internal and external coping mechanisms such as self-efficacy and social support when predicting intentions to be physically active, which ultimately affect physical activity behaviour.

Previous studies have typically focused on self-efficacy as a mediator between social support and physical activity behaviour. By contrast, research that has examined the moderating role of self-efficacy in the relationship between social support and intentions/physical activity is scarce. In the only previous study to investigate the moderating role of self-efficacy in the relationship between social support and physical activity, Dishman et al. (2009) examined these variables in adolescent girls longitudinally across their secondary education. Although they found that self-efficacy functioned as a moderator of this relationship, the nature of this interaction differed from our own results. Specifically, they found that only adolescents with high self-efficacy who maintained high levels of perceived support had reduced declines in physical activity throughout their secondary education. By contrast, high self-efficacy levels at baseline did not mitigate the effects of decreases in perceived support on physical activity. Physical activity in adolescents with low self-efficacy remained at low levels regardless of any changes in perceived social support.

The Dishman et al. (2009) study differed from the current study in methodology (longitudinal method), outcomes measured (physical activity change as opposed to intentions to be active) and subjects studied (adolescent females compared to male and female young adults). These methodological differences may account for the differences in results. In addition, there could be other constructs unaccounted for which influenced the interaction between social support and self-efficacy. Further research is required to determine the nature of the moderation effect of self-efficacy on the relationship between social support and intentions/physical activity, and the environments in which this counteractive effect between self-efficacy and social support emerges.

Previous research which has manipulated self-efficacy has been fruitful in providing information on how interventions can increase self-efficacy (McAuley & Blissmer, 2000). Given the current results, interventions aimed at increasing self-efficacy are likely to have follow-on effects towards other social cognitive factors (i.e. attitudes, intentions, and social support), as well as behavioural outcomes. The current findings also imply that if interventions focus on facilitating supportive friendships as well as self-efficacy, then both these factors will function to mitigate the deficits in the other and will subsequently favourably impact attitudes, and intentions, resulting in improvements in physical activity. Previous research has identified that interventions that focused on building, strengthening and maintaining social networks within community settings have also been successful in increasing supportive relationships and increasing the frequency and duration of physical activity participation (Kahn et al., 2002; McNeill, Kreuter, & Subramanian, 2006; Task Force on Community Preventive Services, 2002). These interventions typically involved setting up ‘buddy’ systems, making ‘contracts’, or organizing physical activity groups, working within pre-existing social networks or creating new ones (Kahn et al., 2002; McNeill et al., 2006; Task Force on Community Preventive Services, 2002). Improving interventions to increase physical activity behaviour in young adults has the potential to increase physical activity participation throughout adulthood, and as such could have a significant impact on adult health outcomes.

The theory of planned behaviour, while demonstrating success in predicting intentions and behaviour across a range of behavioural domains, including physical activity, has recently come under some scrutiny, with particular focus on the unexplained variance in the intention-behaviour gap (Sniehotta, Presseau, & Araújo-Soares, 2014; Sniehotta et al., 2005). Researchers have highlighted the need to extend this model to address this gap, and several developments have been made, with factors such as past behaviour and planning showing clear involvement in this process (Ajzen, 2015; Amireault, Godin, Vohl, & Pérusse, 2008; Conner, 2015; Conner & Armitage, 1998; Rhodes & de Bruijn, 2013; Rhodes & Dickau, 2013; Sniehotta et al., 2005). Self-efficacy has also shown potential to have a role in this mechanism (Conner & Armitage, 1998; Rhodes & Dickau, 2013), and given the interaction between self-efficacy and social support predicting intentions demonstrated in the current study, further research could determine whether this interaction also functions within the intention-behaviour gap.

The findings of the current study do need to be evaluated with consideration of the methodological limitations of this study’s design, particularly with regard to the cross-sectional, self-selected sample, and the use of self-reported nature of the data. Thus, future research could usefully employ a prospective design, random sampling and more objective measures of social-cognitive factors and behaviour.

The present study adds to the growing body of knowledge examining the role of self-efficacy and social support as important determinants of physical activity, specifically within a young adult university student sample. It provides further support for components of social cognitive theory and the theory of planned behaviour. The results identified intentions as the mediating variable for the relationships between each social-cognitive variable and physical activity behaviour, consistent with the theory of planned behaviour. Furthermore, this study also empirically demonstrated for the first time that social support and self-efficacy act in concert to influence intentions, which then go on to affect physical activity behaviour.

The results of this study can inform future physical activity intervention research, by identifying several variables which will support young adults at university to overcome barriers to engage in regular physical activity. Additional research is needed to further examine the role of the interaction between self-efficacy and social support in predicting intentions and physical activity behaviour, as this interaction may have important implications for targeted interventions.

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CHAPTER 6: Implicit and Explicit Attitudes towards Physical Activity in First Year University Students

Objectives: This study investigated implicit and explicit attitudes towards physical activity in first year university students, and assessed their relative predictive value towards intentions and behaviour. **Methods:** Students (*N*=101; 76 women, 25 men; aged 17-25 years) completed a computerised IAT, which measured implicit attitudes towards physical activity, and a self-report questionnaire, which measured explicit attitudes and intentions towards physical activity, as well as physical activity behaviour. **Results:** Students held positive implicit and explicit attitudes towards active lifestyles, and had clear intentions to engage in regular physical activity. Implicit and explicit attitudes were positively correlated, and explicit attitudes, intentions and behaviour were inter-correlated, with intentions mediating the relationship between attitudes and behaviour, consistent with the theory of planned behaviour. Additionally, there was an indirect pathway between implicit attitudes and physical activity behaviour, through both explicit attitudes and intentions in a causal chain. **Conclusions:** This research adds to the body of knowledge regarding the role of attitudes in predicting physical activity, and could be used to guide the development of behavioural interventions targeting active lifestyles in young adult university students.

6.1 Introduction

Engaging in a healthy lifestyle involving regular physical activity has been shown to provide numerous benefits (e.g. protection from chronic disease, healthy weight management) and is an essential foundation to good health (Gómez-Pinilla, 2008; Scarmeas et al., 2009; Zunft et al., 1999). Attitudes are a fundamental component toward understanding health-related behaviour, including physical activity, and are key to the maintenance of healthy lifestyles (Calitri, Lowe, Eves, & Bennett, 2009). The transition into first year university is characterised by profound change and adjustment, and lifestyle behaviour is one area that may be influenced by the disruption of established behaviour patterns that occurs during this period (Bray & Born, 2004). The majority of first year university students are emerging adults, a critical period when independence is established and long-term health behaviour patterns are adopted. As a result, this cohort is an important group in which to address the establishment of long-term health behaviour (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008).

Previous research on attitudes toward physical activity in university samples is limited; however, existing research suggests that university students have positive attitudes towards the importance of a healthy lifestyle (Berry, 2016; Leslie et al., 1999; Wing Kwan, Bray, & Martin Ginis, 2009). For example, studies examining attitudes towards physical activity in Australian and Canadian samples have indicated that most university students report positive attitudes towards regular exercise, particularly noting that students view exercise as enjoyable and important for health (Berry, 2016; Leslie et al., 1999).

How people behave can be predicted not only by self-reported, conscious thoughts and feelings (i.e. explicit attitudes), but also by automatic associations, known as implicit attitudes (Gawronski & Bodenhausen, 2006; Greenwald & Nosek, 2001; Karpinski & Hilton, 2001; Maison, Greenwald, & Bruin, 2001; Smith & Nosek, 2010). Explicit attitudes, typically measured by self-reports, can highlight introspective evaluations of a given topic; however, their expression can be influenced by response bias and social desirability (Brunel, Tietje, & Greenwald, 2004; Craeynest et al., 2005; Karpinski & Hilton, 2001; Schwartz, Vartanian, Nosek, & Brownell, 2006). One benefit of measuring implicit attitudes is that they are resistant to self-presentation strategies, and therefore can provide additional information regarding an individual's preferences, and thus assist in the prediction of behaviour (Greenwald, McGhee, & Schwartz, 1998; Karpinski & Hilton, 2001; Maison et al., 2001; Schwartz et al., 2006).

Due to the automatic nature of implicit attitudes, implicit measures are based on performance on reaction time tasks, where the attitudinal construct is implied from the speed or accuracy of the response to specific stimuli (Craeynest et al., 2005; De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Karpinski & Hilton, 2001). One such implicit measure is the Implicit Association Task (IAT) (Greenwald et al., 1998). The IAT is designed to measure implicit attitudes by examining the automatic associations between target categories and evaluative attributes (Greenwald et al., 1998; Karpinski & Hilton, 2001). The faster the response to target and attribute pairings, the stronger the association, and thus one's implicit preference (Greenwald et al., 1998; Karpinski & Hilton, 2001). The IAT is a psychometrically robust and flexible tool, which has been widely used and adapted to measure a variety of constructs, including those surrounding physical activity (Berry, Spence, & Clark, 2011; Conroy, Hyde, Doerksen, & Ribeiro, 2010; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Maison et al., 2001; Maison, Greenwald, & Bruin, 2004).

Implicit attitudes have been shown to be related to explicit measures, and can often reveal the same underlying preference as explicit reports; however, the literature suggests that implicit and explicit attitudes are distinct constructs (Brunel et al., 2004; Hofmann et al., 2005; Karpinski & Hilton, 2001; Nosek & Smyth, 2007). This distinction is thought to allow implicit and explicit measures to predict behaviour in a complementary manner (Brunel et al., 2004). Dual-systems models provide an explanation for the distinction between the pathways by which implicit and explicit processes affect health-related behaviours. That is, explicit measures function through a deliberative, reflective system, whereas implicit measures reflect an impulsive system (Conner, Perugini, O'Gorman, Ayres, & Prestwich, 2007; Keatley, Clarke, & Hagger, 2012; Keatley, Clarke, & Hagger, 2013a, 2013b; Strack & Deutsch, 2004). Within this framework, implicit atttitudes may have a greater influence on spontaneous behaviours, whereas explicit attitudes are likely to have a greater effect on deliberate, planned behaviours (Conner et al., 2007; Keatley et al., 2012; Keatley et al., 2013a, 2013b; Strack & Deutsch, 2004).

While research examining both implicit and explicit measures regarding physical activity is limited, research suggests that implicit attitudes contribute a worthwhile dimension to understanding physical activity behaviour (Berry et al., 2011; Calitri et al., 2009; Conroy et al., 2010; Forrest, Smith, Fussner, Dodd, & Clerkin, 2016; Goldstein et al., 2014; Keatley et al., 2012; Keatley et al., 2013a, 2013b; Maison et al., 2001; Markland, Hall, Duncan, & Simatovic, 2015). For example, Conroy et al. (2010) investigated implicit and explicit attitudes regarding physical activity and found that implicit attitudes predicted objective physical activity behaviour, when controlling for explicit motivational processes regulating intentional activity. Additionally, Berry et al. (2011) showed that individuals who reported doing higher levels of physical activity exhibited biases toward ‘exercisers’ over ‘couch potatoes’ in an IAT, whereas individuals who reported low levels of physical activity showed little such bias. Research by Keatley, Clark and Hagger (2012) also found that physical activity behaviour was predicted by both implicit and explicit motivational-based attitudes.

Attitudes alone are an important factor in the prediction of behaviour; however, social-cognitive models, such as the theory of planned behaviour (Ajzen, 1991) speculate that attitudes towards a specific behaviour influence that behaviour through their impact on one’s intention to engage in the target behaviour. Intentions are defined as an individual’s motivation and conscious plan to engage in a particular behaviour, and are guided by attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). The theory of planned behaviour has shown to successfully predict both intentions and behaviour, explaining between 40-49% of the variance in intentions, and 26-36% of the variance in behaviour (McEachan, Conner, Taylor, & Lawton, 2011).

Previous research into the application of the theory of planned behaviour on health behaviours, including physical activity, supports this model and has highlighted its success in predicting health behaviour (Plotnikoff, Lubans, Trinh, & Craig, 2012; Riebl et al., 2015). In particular, several meta-analyses repeatedly reported that intentions are the strongest predictor of health behaviour, and that intentions are strongly guided by attitudes as the most important predictor (Godin & Kok, 1996; McDermott et al., 2015; McEachan et al., 2011; Riebl et al., 2015). Furthermore, these meta-analyses have reported that physical activity behaviour is particularly well predicted by the theory of planned behaviour model, with attitudes predicting 39.9% of the variance for physical activity, and intentions predicting 42.0% of the variance in physical activity (McEachan et al., 2011). The attitudes measured in these studies, however, were explicit in nature, and the role of implicit attitudes within this process is largely unexplored, and therefore requires investigation.

Research on implicit and explicit attitudes towards physical activity is still in its infancy. The aim of the current study was to examine the relationships between implicit and explicit attitudes, intentions and physical activity behaviour, specifically in a first year university student sample. Increased knowledge of the relationships between attitudes, intentions and behaviour, particularly in this population, may assist in the development of improved health promotion interventions, targeting those at risk for developing unhealthy lifestyle habits, which could proliferate into established patterns of behaviour into adulthood, leading to detrimental health.

There were two components to this study: a computer based IAT designed to measure implicit attitudes towards physical activity and a self-report questionnaire designed to measure explicit attitudes, intentions, and physical activity behaviour. These measures were used to determine the direction of implicit and explicit attitudes towards physical activity, the nature of the relationship between these two forms of attitude and their relative predictive value for intentions to be active, as well as the engagement in physical activity itself. Specifically, based on the theory of planned behaviour, it was predicted that intentions would mediate the relationship between explicit attitudes and behaviour. In addition, as implicit attitudes have been shown to provide independent prediction of physical activity behaviour (Conroy et al., 2010), we further sought to determine the role of implicit attitudes within this predictive model. We therefore aimed to assess whether implicit attitudes had direct and/or indirect effects on physical activity behaviour, and whether explicit attitudes and intentions potentially affected this relationship.

6.2 Method

6.2.1 Participants

One hundred and one first year students from Flinders University (76 female, 25 male; mean age = 19.36 years, age range: 17-25 years) were recruited through the first year psychology participant pool and by posting flyers on campus notice boards. Sixty first year psychology student volunteers participated for course credit, while the remaining 41 participants received a $10 honorarium.

6.2.2 Measures

6.2.2.1 Implicit attitudes. Implicit attitudes towards physical activity were measured using a five block IAT (Greenwald et al., 1998), programmed using Neurobehavioural Systems Presentation® software (Versions 16.0 - 18.0, Neurobehavioral Systems, Inc., Berkeley, CA, www.neurobs.com). In each block, participants were shown a series of words displayed one by one in the center of the screen. The task was to categorise the word stimuli, as quickly and accurately as possible, according to the relevant category labels displayed on the top left and right hand corners of the screen, by pressing keys labelled ‘L’ for the left category and ‘R’ for the right category.

In block 1, participants were introduced to the target categories only (i.e. active and inactive) and asked to sort the associated word stimuli into their respective categories. In block 2, participants were required to categorise a different set of words, falling into positive and negative evaluative categories (i.e. I like and I dislike). Blocks 1 and 2 were considered learning trials in which participants familiarised themselves with the categorisation task, and the target and evaluative categories. In Block 3, the two previously learned categorisations were combined, consisting of all the words presented in the previous two blocks. Participants sorted the words into their corresponding category labels, which were grouped together in either compatible (i.e. active and I like; inactive and I dislike) or incompatible (i.e. active and I dislike; inactive and I like) pairings. For block 4, participants again categorised the target concepts as in Block 1; however, the category labels were reversed. For example, if one category was on the left for Block 1, it would now be on the right for Block 4, and vice versa. Finally, Block 5 repeated the task from Block 3; however, the category labels were reversed. For example if the compatible pairing was shown in Block 3, then the incompatible pairing would be displayed in Block 5 and vice versa.

The target concepts for the IAT included activity based words (i.e. 'active' and 'inactive' activities; such as walking, sport, and training; or sitting, rest, and television). The positive and negative evaluative categories were labelled 'I like' and 'I dislike', respectively, with word stimuli including positive and negative-based words (e.g. holiday, rainbow, gift; and death, fear, war). Word stimuli for target and evaluative categories were based on those used in previous research (Craeynest et al., 2005; Maison et al., 2001).

The use of personalised labels such as 'I like' and 'I dislike' instead of the traditionally used 'pleasant' and 'unpleasant' evaluative labels has recently been adopted by researchers due to the concern that implicit responses are affected by cultural norms and environmental exposure, and can therefore measure irrelevant attitudes which may not reflect an individual's personal preference (Craeynest, Crombez, Haerens, & De Bourdeaudhuij, 2007; Houben & Wiers, 2007; Karpinski & Hilton, 2001; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010; Olson & Fazio, 2004). This could potentially diminish their predictive value on behaviour (Houben & Wiers, 2007; Karpinski & Hilton, 2001; Olson & Fazio, 2004). Previous research has demonstrated that personalised labels better reflect personal evaluations and reduce the contamination of extra-personal or environmental associations of target stimuli, and consequently provide more focus on individually based attitudes (Craeynest et al., 2007; Houben & Wiers, 2007; Karpinski & Hilton, 2001; Nederkoorn et al., 2010; Olson & Fazio, 2004).

Blocks 1, 2 and 4 consisted of 40 trials, with the 20 target or evaluative concepts (Target Concepts: 10 'active' words and 10 'inactive' words; Evaluative Concepts: 10 'I like' and 10 'I dislike' words) repeated twice, in a randomised order. Blocks 3 and 5 consisted of 80 trials, including all of the word stimuli, repeated twice. All blocks adhered to the following constraints: a) the same word was not repeated on consecutive trials, and b) the same correct response (e.g. left or right key press) occurred on no more than three consecutive trials. To control for potential differences in the order and location that the stimuli were presented to participants, the assignment of category label location (i.e. left or right hand side of the screen) and order of target and evaluative pairings (i.e. compatible versus incompatible pairings) were counterbalanced so that there were four versions of the task, each administered to a quarter of the sample.

Each block was preceded by a set of instructions, including the list of words belonging to each relevant category and the applicable key responses for the category label location. The target stimuli remained on the screen until the participant responded and there was a 400ms interval between the response and presentation of the next word stimulus. Accuracy and response times were recorded.

6.2.2.2 Explicit attitudes. A questionnaire was created to measure explicit attitudes towards physical activity, with items similar to those used in previous research (Ajzen, 2001; Courneya & McAuley, 1995; Hamilton & White, 2008; Jackson, Smith, & Conner, 2003; Rhodes & Blanchard, 2008). Participants were asked (1) whether they like to engage in regular physical activity (i.e. exercising at least three times a week), with 1 'Definitely do not like to do this' and 7 'Definitely do like to do this', and (2) whether they consider doing regular physical activity to be enjoyable, with 1 'Not enjoyable' and 7 'Enjoyable'. An explicit attitudes score was calculated by averaging the liking and enjoyment scores with higher scores indicating more positive attitudes. The resulting Cronbach's a score was .72.

6.2.2.3 Intentions. As part of the questionnaire, participants were questioned on their intentions and plans to engage in regular physical activity (i.e. at least three times per week) within the following month. Specifically, participants were asked (1) whether they intended to engage in regular physical activity with 1 'Definitely do not intend to do this' and 7 'Definitely intend to do this', and (2) how often they planned to engage in regular physical activity, with 1 'Never', and 7 'Everyday'. These items were based on those used in previous research (Ajzen & Sheikh, 2013; Hamilton & White, 2008; Hobbs, Dixon, Johnston, & Howie, 2013; Jackson et al., 2003; Kuijer & Boyce, 2014; Plotnikoff, Lubans, Trinh, & Craig, 2012). An intentions score was calculated by averaging the intent and plans scores with higher scores indicating stronger intentions. The resulting Cronbach's a score was .81.

6.2.2.4 Physical activity behaviour. The final part of the questionnaire focused on physical activity behaviour. Participants were asked to list their average physical activity behaviour, including the type of activities they participate in, the frequency with which they engage in these activities, and the duration of these activities on each occasion. Total physical activity was calculated by multiplying the duration by the frequency of participants' reports of purposeful physical activities and summing the totals for each type of activity reported. Total purposeful physical activity was reported in minutes per week, with higher scores indicating greater participation in physical activity.

6.2.3 Procedure

Participants were tested in small groups in a quiet room in the Applied Cognitive Psychology laboratory at Flinders University, South Australia. The session took approximately 25 minutes. Participants were seated at individual computer workstations, and after giving informed consent, participants completed the IAT, followed by the questionnaire. Demographic information was also collected from participants.

6.3 Results

6.3.1 Data Preparation

Only IAT Blocks 3 and 5 were included in the analyses to assess the mixed categorisation phases: compatible ('active' + 'I like' and 'inactive + 'I dislike') and incompatible ('active' + 'I dislike' and 'inactive' + 'I like') pairings. Greenwald, Nosek, and Banaji's (2003) D600 algorithm protocol was used to prepare the data, whereby penalty scores replaced incorrect responses, defined as the compatible/incompatible block mean plus 600ms. The percentage of incorrectly categorised stimuli during these blocks was 6% of trials. Additionally, response times of more than 10000ms were removed as outliers; less than 0.001% of trials were identified as outliers and removed. Furthermore, the protocol stipulates that cases with more than 10% of trials with response times less than 300ms be removed; however, no such cases existed. An IAT D score was calculated by subtracting the compatible mean response time from the incompatible mean response time and dividing it by the pooled standard deviation. Thus a positive score indicates an implicit preference towards being physically active.

6.3.2 Descriptive Statistics

Descriptive data for implicit and explicit attitudes, intentions, and behaviour, can be found in Table 21. A one sample t-test indicated strong implicit preferences toward being active t(100) = 15.12, p=<.001, as demonstrated by positive IAT scores, which were significantly different from zero. Participants indicated positive explicit attitudes towards doing physical activity at least three times a week. This was highlighted by students' mean ratings (5.94), indicating a very clear positive inclination towards physical activity behaviour. Students further reported that on average, they had positive intentions to do physical activity within in the next month. Students rated well above the mid-point of this seven point scale, demonstrating very clear positive intentions to engage in regular physical activity.

Table 21

CHAPTER 6: Descriptive Data and Correlations for Implicit and Explicit Attitudes, Intentions, and Physical Activity Behaviour

	M (SD)	Range	Correlation with Explicit Attitudes	Correlation with Intentions	Correlation with Physical Activity
Implicit Attitudes	.526 (.350)	-.46 to 1.37	.203*	.158	.047
Explicit Attitudes	5.94 (1.38)	1 to 7		.645***	.291**
Intentions	5.07 (1.42)	1.5 to 7			.395***
Physical Activity	285.64 (251.89)	0 to 1510			

Note: * p <.05; ** p<.01; *** p<.001

In addition, participants reported that on average they spent five hours per week engaging in purposeful physical activities, with only 11% of the sample indicating that they were not purposefully active. Based on the Australian physical activity guidelines to engage in physical activities between 150 minutes (2.5 hours) to 300 minutes (5 hours) per week (Brown, Bauman, Bull, & Burton, 2012), this indicated that on average students were meeting the recommended amount of physical activity, and in fact were at the upper end of the guidelines. The Australian guidelines are similar to those used internationally (World Health Organization, 2011).

6.3.3 Relationships between Implicit and Explicit Attitudes, Intentions and Behaviour

Correlational data can be found in Table 21. Implicit attitudes significantly positively correlated with explicit attitudes; however, implicit attitudes did not correlate with intentions or physical activity behaviour. By contrast, explicit attitudes were significantly positively correlated with both intentions and physical activity behaviour. Furthermore, intentions to engage in regular physical activity was also significantly positively correlated with physical activity behaviour.

To test the theory of planned behaviour model foundations, a mediation analysis (Model 1) focusing on examining the direct and indirect effects of explicit attitudes on behaviour via intentions was run using the SPSS macro PROCESS (Hayes, 2012). The results indicated that explicit attitudes significantly positively influenced intentions, accounting for approximately 42% of the variance. Coefficients are displayed in Table 22. Furthermore, only intentions were shown to be a significant predictor of behaviour, indicating that those with stronger intentions engaged in greater levels of physical activity, with the models including both explicit attitudes and intentions accounting for approximately 16% in physical activity behaviour. Direct and indirect effects are shown in Table 24. There was no direct effect between explicit attitudes and behaviour when controlling for intentions,

Table 22

CHAPTER 6: Mediation Analysis Coefficients for Model 1

Model 1	Consequents			
	Mediator: Intentions		DV: Physical Activity	
Antecedents	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Explicit Attitudes	.666***	.080	12.02	22.38
Mediator: Intentions			62.05**	21.66
Constant	1.12*	.486	-99.15	107.09
Model Summaries	*F*(1,98) =69.66***	*R Sq* = .415	*F*(2,97) = 8.97***	*R Sq* = .156

Note: Significance values: * p <.05; ** p<.01; *** p<.001; *Model 1 Description:* Effects of explicit attitudes towards regular physical activity on physical activity behaviour via intentions to engage in regular physical activity.

suggesting a mediated effect. Furthermore, the indirect effects, for the pathway of explicit attitudes to behaviour via intentions was significant. These results suggest that intentions fully accounted for the relationship between explicit attitudes and physical activity behaviour.

The correlational results for physical activity suggested that implicit attitudes may influence explicit attitudes. Thus a mediation analysis examining the indirect effects of implicit attitudes on behaviour via explicit attitudes (Model 2) was run using the SPSS macro PROCESS (Hayes, 2012). The results indicated that implicit attitudes significantly positively influenced explicit attitudes and accounted for approximately 4% of the variance. Coefficients are displayed in Table 23.

Table 23

CHAPTER 6: Simple Mediation Analysis Coefficients for Model 2

Model 2	Consequents			
	Mediator: Explicit Attitudes		DV: Physical Activity	
Antecedents	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Implicit Attitudes	.795*	.388	-9.39	71.30
Mediator: Explicit Attitudes			53.83**	18.19
Constant	5.52***	.245	-27.38	109.72
Model Summaries	*F*(1,98) =4.21*	*R Sq* = .041	*F*(2,97) = 4.49*	*R Sq* = .085

Note: Significance values: * p <.05; ** p<.01; *** p<.001; *Model 2 Description:* Effects of implicit attitudes towards being active on physical activity behaviour via explicit attitudes towards regular physical activity.

Furthermore, only explicit attitudes were shown to significantly predict behaviour, indicating that those with positive explicit attitudes participated in higher levels of physical activity, and the model containing both implicit and explicit attitudes accounted for approximately 9% of the variance. Direct and indirect effects are shown in Table 24. There was no direct effect between implicit attitudes and behaviour when controlling for explicit attitudes, suggesting a mediated effect, and the indirect effect, for the pathway of implicit attitudes to behaviour via explicit attitudes was significant. These results suggest that explicit attitudes fully accounted for the relationship between implicit attitudes and behaviour, for physical activity.

Table 24

CHAPTER 6: Direct and Indirect effects for Simple (Models 1 and 2) and Serial Mediation Models

	Direct Effects			
	Coeff.	*SE*	*Boot LLCI*	*Boot ULCI*
Model 1	12.02	22.38	32.39	56.43
Model 2	-9.39	71.30	150.90	132.13
Serial Model	-16.38	68.85	153.05	120.28
	Indirect Effects			
Model 1	41.33	14.00	15.01	70.61
Model 2	42.80	27.26	1.92	113.40
Serial Model	32.67	23.50	1.24	100.54

Note: These models are based on bias-corrected 95% confidence intervals, using 5000 bootstrap samples. Confidence intervals indicate significant effects when lower and upper limits do not straddle zero.

Model Descriptions: Model 1: Effects of explicit attitudes towards regular physical activity on physical activity behaviour via intentions to engage in regular physical activity; Model 2: Effects of implicit attitudes towards being active on physical activity behaviour via explicit attitudes towards regular physical activity; Serial Model: Effects of implicit attitudes towards being active on physical activity behaviour via both explicit attitudes towards regular physical activity and intentions to engage in regular physical activity.

While there was no correlation between implicit attitudes and physical activity behaviour, Hayes (2013) highlights that modern mediation analyses no longer impose the precondition of an association between X and Y in order to examine indirect effects. Therefore, as the previous simple mediation results suggested that implicit attitudes influence physical activity by affecting explicit attitudes, and explicit attitudes were shown to influence physical activity behaviour through intentions, a serial mediation analysis was run using the SPSS macro PROCESS (Hayes, 2012) to examine the indirect effects of implicit attitudes on physical activity behaviour through both explicit attitudes and intentions in a causal pathway. Serial mediation is a form of multiple mediation, which removes the assumption that no mediators causally influence another, and assesses how a series of mediators affects another within a predetermined causal sequence (Hayes, 2013). Coefficients are displayed in Table 25.

Results indicated that implicit attitudes significantly predicted explicit attitudes, exerting a positive influence, and explaining approximately 4% of the variance. Explicit attitudes significantly predicted intentions, while implicit attitudes did not, and the combined model explained approximately 42% of the variance in intentions. The positive coefficients indicated that those with positive attitudes had stronger intentions. Furthermore, only intentions were found to significantly predict behaviour, indicating that those with stronger intentions engaged in higher rates of physical activity. The model, including implicit attitudes, explicit attitudes and intentions, accounted for approximately 16% of the variance in physical activity behaviour. Direct and indirect effects are shown in Table 24. As expected, based on the correlational and previous simple mediation results, there was no direct effect of implicit attitudes on behaviour. However, the indirect pathway from implicit attitudes to behaviour through both explicit attitudes and intentions was significant.

Table 25

CHAPTER 6: Serial Mediation Analysis Results for Effects of Implicit Attitudes towards being Active on Physical Activity Behaviour via both Explicit Attitudes and Intentions to Engage in Regular Physical Activity

	Consequents					
	Mediator 1: Explicit Attitudes		Mediator 2: Intentions		DV: Physical Activity	
Antecedents	*Coeff.*	*SE*	*Coeff.*	*SE*	*Coeff.*	*SE*
IV: Implicit Attitudes	.795*	.388	.112	.321	-16.38	68.85
Mediator 1: Explicit Attitudes			.660***	.082	12.74	22.69
Mediator 2: Intentions					62.23**	21.78
Constant	5.52***	.245	1.10*	.494	-95.78	108.55
Model Summary	*F*(1,98)= 4.21*	*R Sq*= .041	*F*(2,97)= 34.58***	*R Sq*= .416	*F*(3,96)= 5.94**	*R Sq*= .157

Note: * p <.05; ** p<.01; *** p<.001

These results suggest that implicit attitudes towards physical activity exert a positive effect on explicit attitudes; this in turn increases intentions to engage in physical activity, and consequently results in increased participation in physical activity.

6.4 Discussion

This research aimed to investigate implicit and explicit attitudes towards physical activity in first year university students, and to assess their relationships with students' intentions toward regular physical activity, as well as the students' actual physical activity behaviour.

The results indicated that first year university students had both positive implicit and explicit attitudes towards an active lifestyle, and indicated clear intentions to engage in regular physical activity. Students were typically engaging in active lifestyles, with the sample, on average, meeting the recommended guidelines for physical activity participation.

Explicit attitudes, intentions, and behaviour were inter-correlated; however, implicit attitudes correlated only with explicit attitudes. In line with the theory of planned behaviour, intentions emerged as a mediator accounting for the relationship between explicit attitudes and physical activity behaviour. Additionally, explicit attitudes mediated and explained the relationship between implicit attitudes and physical activity behaviour. Furthermore, a significant indirect effect was found for the causal pathway whereby implicit attitudes positively influenced explicit attitudes, which subsequently positively influenced intentions, and intentions consequently had a positive effect on physical activity behaviour.

The finding that students had both positive implicit and explicit attitudes towards physical activity is consistent with previous research showing that university students hold positive attitudes towards engaging in physical activity behaviour (Berry, 2016; Leslie et al., 1999; Wing Kwan et al., 2009). This result is also consistent with previous research showing that both implicit and explicit attitudes often reveal the same underlying preference (Brunel et al., 2004; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Karpinski & Hilton, 2001; Nosek &

Smyth, 2007). In line with previous research (Wing Kwan et al., 2009), students also reported clear intentions to engage in physical activity behaviour.

This study's finding that students are meeting the guidelines for physical activity is inconsistent with previous research from overseas which indicates reduced physical activity for university students (Bray & Born, 2004; Butler et al., 2004; Huang et al., 2003; Jung et al., 2008). Previous Australian data has also indicated that a significant proportion of university students are insufficiently active (Leslie et al., 1999). However, an international meta-analysis of sufficiently active university students indicated that while large proportions of university students are not sufficiently active, including Australian students, Australians appeared to have the highest rate of sufficient activity at 60% (Irwin, 2004). This suggests that culturally, Australian students may be more inclined to engage in active lifestyles.

While implicit and explicit attitudes towards physical activity were both positive and significantly correlated, implicit and explicit attitudes exhibited different effects towards intentions and behaviour. These differential effects are consistent with the notion that implicit and explicit attitudes are related but likely unique constructs, a consideration which has been supported by previous research (Brunel et al., 2004; Hofmann et al., 2005; Karpinski & Hilton, 2001; Nosek & Smyth, 2007). Furthermore, the correlation between the implicit and explicit attitudes has been reported in previous research (Maison et al., 2001).

Implicit attitudes, in this study, did not correlate with, or directly influence the adoption of physical activity behaviour. This finding is inconsistent with some previous reports where implicit attitudes have been found to correlate with, and directly predict physical activity behaviour (Conroy et al., 2010; Keatley et al., 2012). As a result further investigation into the role of implicit attitudes in physical activity behaviour is warranted. The lack of a direct effect between implicit attitudes and physical activity behaviour may be due to physical activity behaviour largely being a deliberate, often planned activity, which would therefore most likely be more readily influenced by explicit attitudes and intentions, based on dual-systems theory and the theory of planned behaviour (Ajzen, 1991; Conner et al., 2007; Keatley et al., 2012; Keatley et al., 2013a; 2013b). Implicit attitudes may therefore play less of a role in influencing physical activity behaviour, except in cases when physical activity is enacted spontaneously as a result of physical activity habits and routines.

Although there was no direct effect between implicit attitudes and behaviour, there was an indirect effect between implicit attitudes and physical activity behaviour. Specifically, implicit attitudes influenced explicit attitudes; these in turn affected intentions, and consequently physical activity behaviour. The result that implicit attitudes may influence explicit attitudes is consistent with the associative-propositional evaluation model (Gawronski & Bodenhausen, 2006, 2007; Gawronski, Hofmann, & Wilbur, 2006), in which implicit attitudes can form the basis of an explicit attitude if an individual's propositional reasoning determines it to be consistent with other information considered during the formation of the explicit attitude. Additionally, the result that explicit attitudes exert their influence on physical activity behaviour through their effect on intentions is consistent with the theory of planned behaviour model and our hypothesis (Ajzen, 1991).

Explicit attitudes emerged as an important predictor of intentions to engage in regular physical activity, which subsequently predicted physical activity behaviour. The observed inter-correlations between explicit attitudes, intentions, and behaviour have been reported in previous research, and are consistent with the theory of planned behaviour (Godin & Kok, 1996; McDermott et al., 2015; McEachan et al., 2011; Riebl et al., 2015). In line with this theory, intentions were found to be an influential predictor of physical activity behaviour, and fully mediated the relationship between explicit attitudes and behaviour. This fits with previous research showing that intentions are a proximal predictor of physical activity behaviour, and that intentions are guided by attitudes (Ajzen, 1991; Godin & Kok, 1996; McDermott et al., 2015; McEachan et al., 2011; Riebl et al., 2015). The results of the present study further support the idea that the theory of planned behaviour model provides a useful basis for predicting health behaviours such as physical activity (McEachan et al., 2011). In particular, this study shows that explicit attitudes strongly drive the prediction of intentions and subsequent behaviour.

Nevertheless, recent controversy surrounding the theory of planned behaviour has raised concerns about its exclusive focus on rational reasoning to predict behaviour without considering unconscious influences, as well as the unexplained variance in the intention-behaviour gap (Sniehotta, Presseau, & Araújo-Soares, 2014). This highlights the need for future research to extend the model to include other potential determinants to better predict behaviour (Ajzen, 2015; Armitage, 2015; Conner, 2015; Gollwitzer & Oettingen, 2015; Hagger, 2015; Rhodes, 2015; Schwarzer, 2015). One such extension, identified here, might be the inclusion of implicit attitudes to the attitudes – intentions – behaviour pathway, thereby addressing the potential role for unconscious processes.

It is important to interpret the results of this study in relation to its limitations, namely the self-sampling techniques and self-reported measures used. The concern regarding self-sampling techniques relates to the potential for only students with an interest in health and physical activity to choose to be involved in the research. This outcome could result in higher average reports of physical activity, which may not be reflective of the larger university student and general young adult population, and could explain the higher rates of physical activity reported within this study. Additionally, the use of self-reported measures is known to be subject to social desirability bias and self-presentational strategies, and as such could result in exaggerated reports and inflated means. However, these methods are commonly used within research in this field, and thus the findings should be comparable to similar such research.

The results of this study provide a greater understanding of the inter-relationships between implicit and explicit attitudes, intentions and behaviour, and could be utilised to guide interventions that aim to improve the adoption of physical activity behaviour in a young adult population. Specifically, the results suggest that interventions targeting regular physical activity in first year university students should focus on influencing explicit attitudes and intentions, either independently or in conjunction, as it is these elements which largely drive the adoption of physical activity behaviour in this cohort. Furthermore, interventions for physical activity engagement may also benefit from targeting implicit attitudes due to their potential effects on explicit attitudes, which subsequently affect intentions and in turn behaviour. These could include evaluative conditioning, affective priming or modified IATs, which have demonstrated success in changing implicit attitudes in other domains, such as alcohol consumption (Houben, Havermans, & Wiers, 2010; Houben, Schoenmakers, & Wiers, 2010) and eating behaviour (Haynes, Kemps, & Moffitt, 2015a, 2015b).

Applying these principles to a first year university cohort may be particularly fruitful in improving the engagement in physical activity behaviour, for several reasons. First, previous research has highlighted that first year university students, as emerging adults, are establishing their independence, and often begin to adopt long-term health behaviours during this period (Nelson et al., 2008). Second, this research, along with previous research based on the theory of planned behaviour, has found explicit attitudes and intentions to be particularly important in predicting lifestyle behaviour (Godin & Kok, 1996; McDermott et al., 2015; McEachan et al., 2011; Riebl et al., 2015). Finally, Plotnikoff et al. (2012) showed that the theory of planned behaviour can be used successfully to predict future behaviour. Therefore, interventions that apply the theory of planned behaviour in first year university students, may assist in improving not only current lifestyle behaviour, but also future behaviour and health.

This study adds to a growing body of knowledge regarding the role of attitudes in predicting intentions and physical activity behaviour, in a first year university population. Results highlighted the importance of explicit attitudes and intentions for predicting behaviour in this group, and provided further support for the theory of planned behaviour. Importantly, this study has also demonstrated a role for implicit attitudes in physical activity behaviour, in particular through their influence on explicit attitudes, which affects intentions and subsequently behaviour. Together, the findings provide support for directing the focus of behavioural interventions for physical activity on attitudes and intentions as the primary drivers of behaviour.

6.5 References

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CHAPTER 7: General Discussion

7.1 Introduction

Physical activity behaviour provides an excellent foundation towards good physical and psychological health, with the benefits of engaging in regular physical activity well established (Brown, Bauman, Bull, & Burton, 2012; Leslie et al., 1999; Scarmeas et al., 2009; Zunft et al., 1999). Nevertheless, the participation in physical activity is often insufficient, with detrimental implications for health outcomes (Bray & Born, 2004; Brown et al., 2012; Leslie et al., 1999). Young adulthood has been highlighted as an important period where declines in physical activity behaviour appear particularly prominent. Often these declines endure into adulthood and therefore affect health outcomes later in life (Bray & Born, 2004; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). As a consequence, young adults are an important cohort in which to study the determinants of physical activity behaviour – particularly with respect to establishing, structuring and guiding behavioural change programs, which have the potential to improve physical activity rates both during young adulthood and beyond. Therefore, the aim of this thesis was to examine physical activity behaviour and its potential predictors in young adults within the context of two well-established theoretical models: the theory of planned behaviour (Ajzen, 1991) and social-cognitive theory (Bandura, 2004).

Chapter 1 introduced the topic of physical activity behaviour specifically in relation to young adulthood, guided by two commonly applied theoretical models, (1) the theory of planned behaviour, and (2) social-cognitive theory. These theories propose multiple constructs which are important to consider in the prediction of physical activity behaviour, including attitudes, subjective norms, perceived behavioural control, intentions, past behaviour, self-efficacy, social support and mood state. This first chapter provided the background for the subsequent empirical studies. These studies evaluated physical activity behaviour in young adults and its relationships with the aforementioned predictors, in various combinations. Together these studies contribute to the further understanding of the prediction of physical activity behaviour, specifically within a young adult cohort, providing insight into theoretical approaches for targeted interventions. Namely, these studies indicated that Australian young adults are in fact meeting the recommended guidelines for physical activity behaviour, and this behaviour further appeared to be stable across an academic year. This research also highlighted the roles of the predictors mentioned above and provided insight into how these constructs inter-relate, as well as the mechanisms and pathways by which they contribute to physical activity behaviour.

The remainder of this chapter will summarise and integrate the main findings of Chapters 2 to 6, discuss their theoretical contributions, and address methodological issues as they relate to the content raised throughout the chapter. Specifically, this chapter will first highlight the unique observations of physical activity behaviour within the cohorts examined, addressing explanations for the discrepancies between our observations and those reported elsewhere. Following this, the main contributions of each important correlate (i.e. past behaviour, self-efficacy, social support, affect and implicit attitudes) in the prediction of physical activity behaviour in young adults will be outlined, and interpretations for their significance and utility will be proposed. A discussion of the application of the theory of planned behaviour model within this thesis, and the respective roles and integration of the aforementioned correlates and social-cognitive theory within this theoretical framework will also be addressed. A brief overview of the limitations of the research presented in this thesis will also be discussed. This will be followed by a discussion of the theoretical and practical implications of the results as well as potential directions for future theoretical and applied research.

7.2 Summary of Findings and Theoretical Contributions

7.2.1 Physical Activity Behaviour in Young Adults

Chapter 1 of this thesis outlined previous research that indicated that physical activity participation in young adults is typically insufficient, and declines in physical activity during this period of life are frequently reported (Bray & Born, 2004; Nelson et al., 2008). Chapters 2 to 6 each examined physical activity behaviour in young adults, with Chapters 3 to 6 observing physical activity at a single time point, and Chapter 2 longitudinally tracking this behaviour across three time points during a university academic year. The results showed that our Australian based cohorts of young adults were on average meeting, or even exceeding (Chapter 5) the recommended guidelines for physical activity of 2.5 to 5 hours per week (Brown et al., 2012). The average physical activity participation rates ranged from just over four hours to six hours per week, with between 77% and 92% of participants reporting being purposefully active. Chapter 2 also showed that physical activity behaviour remained stable across the three time points measured across a university academic year.

Chapters 2 to 4 also measured past physical activity behaviour. The findings showed that on average participants had engaged in approximately six and a half hours of physical activity in the year prior to university; with approximately 89% reporting that they were purposefully active during that year. This showed that participants' current physical activity behaviour had in fact reduced from previous levels; comparisons indicated that this reduction was statistically significant. The reductions observed from students' past behaviour to their current physical activity participation during first-year university were consistent with the declines in physical activity typically reported in young adulthood. However, our findings contrasted with previous reports that have shown that young adults are insufficiently active, and that physical activity declines during first year university (Bray & Born, 2004; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003; Jung, Bray, & Ginis, 2008; Wallace, Buckworth, Kirby, & Sherman, 2000). In particular, across three samples, we found that the physical activity patterns of young adults at university were consistent with meeting physical activity guidelines. Furthermore, examining physical activity rates longitudinally in Chapter 2 highlighted that physical activity participation was also stable and did not decline over time.

There are several potential explanations for this inconsistency. It is possible that declines in physical activity rates do occur within Australian young adults, but that these declines do not occur within first-year university. Perhaps longer tracking of behaviour, beyond a single academic year may have highlighted the declines that are typically reported in this age group. By contrast, declines in physical activity across first-year university students have been reported in US cohorts (Bray & Born, 2004; Jung et al., 2008). It is possible that the transition to university within Australia does not produce the same barriers to be physically active that occurs within other countries – suggesting potential cultural differences. While previous research has typically reported insufficient physical activity participation in young adults, Irwin (2004) reported that Australian young adults had the highest adherence rates of physical activity guidelines compared to other international samples. This suggests that Australians may be uniquely more inclined to engage in active lifestyles than other cohorts, on the basis of cultural or environmental differences, such as better climate conditions.

In support for the role of culture, our Australian young adult samples, compared to similar samples in other countries such as North America and Europe, participated in higher rates of physical activity (Haase, Steptoe, Sallis, & Wardle, 2004; Huang et al., 2003; Steptoe et al., 1997; Wallace et al., 2000). According to a report by the Australian Bureau of Statistics (2011), sport and physical recreation play a major part in the lives of many Australians, with 64% of Australians over 15 years of age participating in such activities over a 12 month period, and almost half doing so regularly (i.e. more than twice a week). Further to this, sport is an important feature of Australian lifestyle and society which is widely encouraged within school systems, governmental policy and Australian media (Australian Bureau of Statistics, 1995, 2011; Kirk, 2000).

Moreover, Australian census data indicate that across the Australian population, adults aged 18 to 24 report the highest levels of physical activity, with approximately 73% participating in physical activities, and 53% classified as 'sufficiently active', based on the Australian Physical Activity Guidelines (Brown et al., 2012) (Australian Bureau of Statistics, 2007, 2013a). Young adults in Australia also had the lowest rates of physical inactivity across the lifespan, at just over 20% (Australian Bureau of Statistics, 2003). Collectively, this suggests that our findings of physical activity participation in young adults are comparable to Australian population estimates, and likely accurate depictions of physical activity participation within this cohort.

Another explanation for the high rates of physical activity participation reported in our samples is related to the nature of self-selected sampling techniques. It is possible that only students with an interest in health and physical activity chose to participate in the studies, which could result in higher average reports of physical activity participation, and may not be as reflective of physical activity participation within the general young adult population. That being said, self-selected sampling techniques are regularly used in other research, and many of the studies cited within this thesis used self-selected samples (Bray & Born, 2004; Butler et al., 2004; Haase et al., 2004; Macdonald & Palfai, 2008; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008; Steptoe et al., 1997; Wallace et al., 2000). Therefore, the comparison between our findings and reports based on other self-selected samples in other countries indicate that Australian young adults may indeed be more active than international counterparts.

Further to this point, the studies reported within this thesis relied on self-report measures of physical activity behaviour, which have been known to raise the potential for social desirability bias and self-presentational strategies (Bray & Born, 2004; Sallis & Saelens, 2000; Troiano et al., 2008). Such strategies could result in exaggerated reports of physical activity participation, which could, therefore, inflate participation means. However, self-reported physical activity measures have been considered to provide a reasonably accurate picture of physical activity behaviour in previous research, including retrospective recounts up to 12 months (Bray & Born, 2004). Nevertheless, the potential for distortion and memory decay should still be considered when interpreting any self-reported data (Bray & Born, 2004). Furthermore, self-reported physical activity measures are frequently used within the literature, including the majority of the studies referred to within this thesis (Bray & Born, 2004; Butler et al., 2004; Haase et al., 2004; Macdonald & Palfai, 2008; Racette et al., 2008; Steptoe et al., 1997; Wallace et al., 2000). As a result, the self-reported measurement used within this thesis does not differ from other studies in this regard. Therefore, our observations of Australian young adults as being more active than their international counterparts may be an accurate trend.

Another point regarding the measurement of physical activity within this thesis relates to the intensity of physical activities not being taking into account. While previous research has used similar forms of physical activity measurement (i.e. only taking into account the type, frequency and duration of physical activity participation) (Bray & Born, 2004; Macdonald & Palfai, 2008; Wallace et al., 2000), including intensity ratings in surveys, can provide another dimension of information, which more comprehensively measures physical activity patterns. The inclusion of rating intensity allows for the classification of physical activity participation into low, moderate and vigorous categories. These categories can then be assigned energy expenditure ratings, or metabolic equivalents (METS), which can more accurately classify individuals as being sufficiently, or insufficiently active in relation to physical activity guidelines (Bauman et al., 2009; Leslie et al., 1999). This, in addition to objective measures of physical activity, such as accelerometry, can provide an even more accurate and informative measure of physical activity participation, compared to the relatively simpler forms of self-reported data utilised in this thesis (Troiano et al., 2008).

Examining physical activity data using METS algorithms and accelerometry may provide further insight into potential differences between participants on the basis of the intensity of the activities they typically engage in. Further, subgroup analysis regarding differences between individuals classified as ‘sufficiently’ versus ‘insufficiently’ active, may shed light on important distinctions between these groups. Distinctions identified by subgroup analysis could help recognise and target individuals who are at risk of inactivity. Therefore, future work, specifically relating to applied research, such as intervention design and evaluation, should consider the use of METS algorithms and accelerometry to enable greater accuracy of results (Troiano et al., 2008).

The following section will address the prediction of physical activity behaviour in young adults. First, the results of each empirical chapter in relation to the specific roles and contributions of each main correlate examined will be summarised. Second, the application of the central theoretical models (i.e. the theory of planned behaviour, and social-cognitive theory) and the involvement of the additional correlates examined within these theoretical contexts will be highlighted, with a specific emphasis on the potential extension and integration of these theoretical models. The relationship between our findings and previous research will also be discussed throughout.

7.2.2 Predicting Physical Activity

7.2.2.1 Past Behaviour. The importance of past behaviour in the prediction of future behaviour, specifically in the domain of physical activity, has been reported elsewhere (Amireault, Godin, Vohl, & Pérusse, 2008; Chatzisarantis & Hagger, 2007; Conner & Armitage, 1998; Hagger, Chatzisarantis, & Biddle, 2001; Hamilton & White, 2008; McEachan, Conner, Taylor, & Lawton, 2011; Norman & Smith, 1995; Plotnikoff, Lubans, Trinh, & Craig, 2012; Sheeran & Abraham, 2003; Wallace et al., 2000). This thesis further supports the role of past behaviour in prediction models, for understanding both intentions to be active and physical activity behaviour in young adults. The specific contributions of past behaviour as a predictor within this thesis are based on the results reported in Chapters 2, 3 and 4. In Chapter 2, past behaviour was found to be highly correlated with physical activity behaviour in first-year university students, and positively predicted differences in physical activity between individuals across an academic year. This suggests that those who were highly active in the year preceding university commencement were also likely to be active throughout their first year. Furthermore, past behaviour emerged as an important factor after controlling for the effects of the theory of planned behaviour constructs and self-efficacy over time, demonstrating the consistent additive effects of past behaviour in understanding physical activity behaviour across an academic year.

Despite past behaviour strongly and significantly predicting differences in behaviour between individuals, students with high levels of past behaviour were only participating in approximately 30 seconds more physical activity throughout the academic year compared to students with low levels of past behaviour. The likely reason for this small difference is due to a large proportion of students reporting being purposefully active in the past (89%) and average past physical activity participation exceeding the recommended guidelines. This perhaps resulted in the difference between those with high and low levels of past physical activity actually being small, as the majority of the sample was highly active in the preceding year, and those with lower levels may still have been meeting guidelines in the previous year. Therefore, the differences between individuals' current behaviour during university, while being significantly lower than their previous behaviour, may similarly have had only small variation between individuals, with the majority (76%) of the sample being sufficiently active.

In the literature, two contrasting reports of moderating effects in relation to past physical activity behaviour and the intention-behaviour gap have been reported. One reports that high levels of past behaviour strengthen the intention-behaviour relationship, and the other suggests that high levels weaken it (Amireault et al., 2008; Sheeran & Abraham, 2003).The explanation for high levels of past behaviour weakening the intention-behaviour relationship is suggestive of behaviour being habitual and thus controlled less by cognitive processes such as intentions (Amireault et al., 2008), whereas the explanation for high past behaviour strengthening the intention-behaviour relationship relates to past behaviour's ability to produce strong intentions, which results in the stronger likelihood of successful action (Sheeran & Abraham, 2003). These contradictory results warranted further examination of the role of past behaviour on the intention-behaviour relationship, particularly in relation to young adult cohorts.

The results of Chapter 3 provided additional support for the latter explanation mentioned above, as the relationship between intentions and physical activity behaviour significantly differed for individuals with high levels of past behaviour. This suggests that individuals with high levels of past behaviour were more likely to translate their intentions into action, thus the intention-behaviour relationship was strengthened. Individuals with low levels of past behaviour, however, participated in lower levels of physical activity, regardless of their intention. The significance of this finding suggests that not only can past behaviour strongly drive the likelihood of continued participation in physical activity behaviour but also that low levels of past physical activity can function as a barrier to future participation. One reason for why the former explanation (i.e. relating to habitual behaviour) may be less likely in young adult cohorts is due to the many potential changes that occur during young adulthood, such as changes to their educational, social, occupational or living environments (Nelson et al., 2008) – any of which may act to prevent the establishment of habitual physical activity behaviour during this period of life. Given this consideration, physical activity behaviour within this cohort may, therefore, remain under cognitive control, strongly driven by intentions, which are also strongly guided by past behaviour.

Following from this, Chapter 4 outlined that the addition of past behaviour provided a significant improvement to the understanding of intentions in a model which controlled for the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control), as well as social support and self-efficacy. After the addition of past behaviour, only self-efficacy and attitudes remained, along with past behaviour as the primary significant predictors of intentions. This suggests that physical activity in the past can strongly influence the likelihood of forming intentions to engage in further physical activity. The finding that attitudes and self-efficacy also remained significant predictors of intentions after the inclusion of past behaviour suggests that (a) attitudes towards physical activity, specific to an individual's current circumstances, remain important in intention formation, and (b) being confident in one's ability to be physically active is also essential when creating an intention to engage in physical activity. The role of past behaviour in the prediction of intentions also provides additional support to the notion that past behaviour moderates the relationship between intention and physical activity behaviour. This is through its ability to shape the creation of positive intentions, increasing the likelihood of behavioural enactment, as discussed above.

Chapter 4 also assessed the role of past behaviour in the prediction of physical activity behaviour. The results highlighted that the addition of past behaviour significantly improved prediction (i.e. explaining a further 19% of variance) after the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), social support and self-efficacy had been controlled for. Prior to the addition of past behaviour, attitudes and subjective norms had already been mediated by intentions, and perceived behavioural control was attenuated by the addition of self-efficacy and social support. After the addition of past behaviour; however, only self-efficacy and past behaviour itself remained as the most significant predictors of physical activity behaviour. This result provides further support for the role of past behaviour as one of the most important predictors of physical activity behaviour, consistent with previous findings (McEachan et al., 2011). Additionally, the attenuation of intentions by past behaviour further supports the previous moderation results (Chapter 3), highlighting that past behaviour plays a more proximal role in guiding behaviour than intentions, and likely accounts for the effects of intentions on physical activity behaviour.

The significant role of past behaviour highlighted within this thesis emphasises the importance of encouraging physical activity participation early in life. The practical implications for the significance of past behaviour will be addressed in section 7.4. This section also acknowledges the importance of self-efficacy, given that self-efficacy remained alongside past behaviour as a primary predictor of both intentions and physical activity behaviour, after accounting for all other social-cognitive factors. Therefore, the following section will continue by discussing the specific contributions of self-efficacy to physical activity participation in young adults.

7.2.2.2 Self-efficacy. Self-efficacy played a significant role in Chapters 2 to 5 of this thesis given its centrality to social-cognitive theory and its additive role within the theory of planned behaviour model. Self-efficacy has been established in previous research as having a crucial role within the physical activity domain (Bandura, 2004; Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Duncan & McAuley, 1993; McAuley & Blissmer, 2000; Reuter et al., 2010; Rhodes & Dickau, 2013; Rhodes, Plotnikoff, & Courneya, 2008; Schwarzer & Fuchs, 1996; Sniehotta, Scholz, & Schwarzer, 2005). This thesis strongly supported this evidence and highlighted the many roles and functions that self-efficacy plays in guiding intentions and physical activity in young adults. The specific contributions of self-efficacy within this thesis will now be outlined.

In Chapter 2, self-efficacy was shown to have consistent, strong correlations with physical activity behaviour, and further positively predicted differences in participation levels between individuals across an academic year. Specifically, young adults with high levels of self-efficacy were reported to participate in approximately half an hour more physical activity than those with low levels of self-efficacy. Additionally, self-efficacy provided additive effects in the prediction of physical activity behaviour across an academic year while controlling for the theory of planned behaviour constructs. Furthermore, the addition of self-efficacy (rather than perceived behavioural control) remained significant alongside intentions when predicting physical activity, and its inclusion attenuated the effects of subjective norms and perceived behavioural control. Lastly, self-efficacy also remained significant, alongside intentions and past behaviour when controlling for the theory of planned behaviour constructs, highlighting the robust predictive effects of self-efficacy on physical activity engagement over time.

The results of Chapter 3 demonstrated that high levels of self-efficacy significantly strengthened the relationship between intentions and physical activity behaviour, indicating that young adults with high levels of self-efficacy were more successful in translating their intentions into behaviour, consistent with previous research (Rhodes et al., 2008). Moreover, individuals with low levels of self-efficacy were less active, irrespective of their intentions. This suggests that self-efficacy can strongly support participation in physical activity behaviour but at low levels can actually prevent the participation in physical activity.

Self-efficacy was evaluated in Chapter 4 as an additional predictor (alongside social support) of both intentions and physical activity behaviour, after controlling for the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions). Self-efficacy and social support variables added increased variance and resulted in the full attenuation of subjective norms and perceived behavioural control. This suggests that (a) self-efficacy and social support are important additions to the foundation model, and (b) these factors are stronger predictors of intentions than the original theory of planned behaviour constructs - subjective norms and perceived behavioural control (see the following section for further discussion of the role of social support). Furthermore, similar results were found in the prediction of physical activity behaviour, where perceived behavioural control was attenuated by the addition of self-efficacy and social support. Furthermore, self-efficacy remained a significant predictor of physical activity behaviour after the addition of past behaviour, highlighting its essential role.

The attenuation of perceived behavioural control reported above could be interpreted in a couple of ways. First, self-efficacy may simply account for the role of perceived behavioural control in the prediction of intentions and physical activity behaviour. Second, perhaps an individual’s confidence in their abilities is more important to intention formation and physical activity engagement, than perceived controllability over behaviour. The attenuation of perceived behavioural control by self-efficacy has been reported previously, and this study provided further evidence for the strength of this effect (Bandura, 2004; Sniehotta et al., 2005).

The important roles that self-efficacy played in the prediction of both intentions and physical activity reported above, provided further evidence for effects that have been reported in previous research. Chapter 5, however, presented a unique way in which self-efficacy can contribute to intention and behaviour in the physical activity domain. This novel finding, relates to Bandura’s (2004) prediction, based on social-cognitive theory, that self-efficacy may interact with social support when influencing behaviour. This prediction was integrated with the theory of planned behaviour where intentions are the proximal predictor of behaviour, with the hypothesis tested being whether self-efficacy moderates the relationship between social-support and intentions. This prediction was supported, with the relationship between social support (from both friends and family) and intentions being significantly different for individuals with low levels of self-efficacy. This finding was then extended by examining whether the indirect effects of social support on physical activity behaviour, via intentions, significantly differed according to levels of self-efficacy.This moderated mediation analysis was also significant,.implying that social support and self-efficacy work together to counteract the deficits present in the other, in order to create intentions to engage in physical activity, and thus influence actual engagement in physical activity behaviour. This finding presents a new perspective on the individual roles of internal and external resources (i.e. self-efficacy providing internal resources and social support providing external resources) within the prediction of intentions to be physically active, which then predict physical activity behaviour. The significance of this effect is that it presents pathways to strengthen intention formation, in relation to specific resource deficits that individuals may face. Specifically, individuals lacking access to a socially supportive network may benefit from strategies which increase perceptions of self-efficacy. Likewise, individuals who struggle with low self-efficacy may benefit from the provision of social support. Specific discussion of how to modify perceptions of self-efficacy and increase social support are presented in section 7.4.

The specific moderating effect of self-efficacy on the relationship between social support and intentions has, to the author's knowledge, not been investigated before. One study by Dishman et al. (2009), however, similarly investigated the moderating effects of self-efficacy between social support and physical activity change in adolescent girls across secondary school. Their results, however, differed from those reported in this thesis in that they found that high levels of self-efficacy did not mitigate the effects of decreases in perceived social support. Additionally, physical activity remained low for adolescents with low levels of self-efficacy, regardless of perceived social support levels. However, there are many differences between the Dishman et al. (2009) study and the studies reported within this thesis, any of which could explain the differences between the results. These include differences in methodology (longitudinal versus cross-sectional method), outcomes measured (physical activity change versus intentions to be active), and population (adolescent females compared to young adult males and females).

It is clear from previous research, and the additional research presented within this thesis, that self-efficacy plays a prominent role in both intention formation and physical activity behaviour within young adults. Therefore, self-efficacy should be considered for both theoretical and practical applications related to physical activity participation, and suggestions for these will be discussed in section 7.4. This section also highlighted a significant role for social support, and therefore the following section addresses the contributions of social support for the participation of physical activity behaviour in young adults.

7.2.2.3 Social Support. Like self-efficacy and past behaviour, social support has also been identified in previous research as having an important role in the prediction of physical activity behaviour (Booth et al., 2000; Okun et al., 2003; Treiber et al., 1991). Within this thesis, the role of social support, provided by both friends and family, was examined in Chapters 2 to 5. In these chapters, social support from both friends and family were identified as significant predictors of young adult physical activity behaviour. Both sources of support had consistent, moderate to strong correlations with physical activity behaviour in Chapter 2, and each positively predicted differences in physical activity behaviour across the academic year.

Family support was found to moderate the relationship between intentions and physical activity behaviour (Chapter 3). In particular, high levels of family support can strongly encourage the translation of intentions into physical activity behaviour, in conjunction with positive intentions. However, when family support is low, intentions play a crucial role in determining behaviour, so that physical activity will still increase when intentions are positive, even when family support is lacking. Rhodes et al. (2008) proposed that social support may function as a moderator of the intention-behaviour relationship; however, to the best of our knowledge this interaction has not been formally established previously, and therefore, this study appears to be the first to investigate social supports role as a moderator of the intention-behaviour relationship for physical activity. While family support was found to moderate the relationship between intentions and physical activity, friend support, however, did not demonstrate such an effect. The differentiation between the roles of friend and family support was particularly noted across this thesis, and explanations for these differences will be discussed at the end of this section.

As reported in the previous section, social support from both friends and family was evaluated, alongside self-efficacy, as an additional predictor of both intentions and physical activity behaviour, controlling for the theory of planned behaviour constructs (Chapter 4). This addition significantly increased the variance explained in both intentions and behaviour; however, only family support, not friend support, emerged as a significant predictor in each model, further highlighting the differential effects between sources mentioned above. Social support and self-efficacy were shown to be stronger predictors of intentions than the original theory of planned behaviour constructs of subjective norms and perceived behavioural control. This could be interpreted as social support better accounting for the role of subjective norms in the prediction of intentions. Or alternatively, that actual support (e.g. encouragement and company) simply may be more important than perceived social pressure in forming intentions. The distinction between subjective norms and social support, and the attenuation of subjective norms by social support has been noted in previous research, and therefore, this thesis supports the separation of these constructs, as well as confirming that social support is the stronger predictive factor (Hamilton & White, 2008; Okun et al., 2003; Treiber et al., 1991).

Furthermore, after the addition of past behaviour, the role of family support in the prediction of both intentions and physical activity behaviour became attenuated. This suggests that past behaviour provides a stronger effect on intentions and behaviour than family support. This suggestion is also supported by the moderation findings reported above. Whilst family support did strengthen the relationship between intention and behaviour, its absence did not have an effect. However, past behaviour, both facilitated and prevented participation in physical activity – depending on whether previous participation was high or low. These results provide support for the addition of social support within prediction models for intentions and physical activity behaviour, as it adds unique variance to the foundation theory of planned behaviour model. However, it seems that social support is secondary to more prominent features such as past behaviour and self-efficacy.

As discussed in the previous section, Chapter 5 presented a unique finding based on social-cognitive theory, which also included social support constructs. This included the interaction effects between social support and self-efficacy when predicting intentions. Specifically, there were significant moderating effects of self-efficacy on the relationship between social support and intentions for both friend and family-based social support. The significance of these findings was discussed in the section above, and therefore, will not be repeated.

This thesis highlighted that evaluating the source of social support is an important consideration as friend and family support each emerged as having separate influential pathways for predicting intentions and behaviour. Previous research has also indicated that the source of social support can have different effects for different people, and types of activities (Leslie et al., 1999; Treiber et al., 1991;

Wallace et al., 2000). The differences may reflect that the individual support systems which are important to a person may differ in relation to the environmental social structures which are unique to the individual, their personal circumstances, and across a given time period.

For instance, specifically in relation to young adults, and the transitions that occur during this phase of life, the roles of different sources of support may vary, and be dependent on the context and time frame in which they occur. For example, in Chapters 3 to 4, family support emerged as the stronger predictor of intention and behaviour, and friend support did not reach significance. This may reflect that these studies reported data collected at the beginning of students' first year at university, and as such, many students may not have established their social network within the university system. Furthermore, students may have become disconnected from the social connections associated with their previous schooling environment. These factors, therefore, may have resulted in the influence of friend support being weak during this period. In addition, many of these students were likely remaining within their family home (Australian Bureau of Statistics, 2013b), and, as a result, family support played a larger role in contributing to intention formation and facilitating behavioural engagement – as they were functioning as the primary source of social support at this time. This argument is further supported by Chapter 5, in which friend support emerged as the stronger source of support. This is likely a result of these data sets being collected further into the academic year, when students had established themselves socially, and therefore, friends became the more influential source of social support during this time frame. In Chapter 2, both sources of social support significantly predicted physical activity behaviour across young adults' first year at university. This further reflected that between people, and at different times throughout the year, both sources of social support had an effect on physical activity behaviour. Due to at least one source of support emerging as important in relation to physical activity participation across each chapter, it highlights that social support, in general, is an important factor which can improve behavioural engagement. Therefore, the provision of social support, from either source, when support is lacking, is likely to be beneficial. Practical applications relating to social support provision will be discussed in section 7.4.

7.2.2.4 Affect. The role of affective factors, specifically mood state, was examined in Chapters 2 and 3. The consideration of affective variables within social cognitive theories is fairly new (Ekkekakis, Hargreaves, & Parfitt, 2013), but an important avenue for understanding behaviour. This is due to affective states taking into account automatic or emotional reactions which may not be driven by cognitive, rational forces already addressed, and nonetheless also affect behavioural outcomes.

The role of affect in predicting physical activity behaviour within this thesis was confirmed in Chapter 2. Positive affect emerged as a consistent correlate of physical activity participation and was a significant predictor of differences in physical activity behaviour between individuals, across an academic year. Negative affect which was also included in Chapter 2, however, was not found to be correlated with, or predict differences, in physical activity behaviour – and as such was not further examined. The emergence of positive affect, over negative affect, is consistent with current research suggesting that pleasure and positive mood states are particularly important for physical activity behaviour (Bryan, Hutchison, Seals, & Allen, 2007; Ekkekakis et al., 2013; Ekkekakis, Lind, & Vazou, 2010; Focht, 2009; Guérin & Fortier, 2012; Kwan & Bryan, 2010; Mohiyeddini, Pauli, & Bauer, 2009).

Chapter 3 highlighted that the relationship between intentions and physical activity behaviour significantly differed depending on the level of positive affect. Specifically, differences were observed for both individuals with high and those with low levels of positive affect. This suggests that positive affect can facilitate the translation of intentions into physical activity behaviour, in conjunction with positive intentions. However, even in the absence of positive mood states (i.e. low levels of positive affect), physical activity participation will still occur when an individual possesses positive intentions (i.e. the lack of positive affect does not prevent or act as a barrier to physical activity participation). As this is a new area of research, only two studies were found suggesting the involvement of affective variables in post-intentional processes, reporting mediating and moderating functions (Kwan & Bryan, 2010; Mohiyeddini et al., 2009). However, the affective variables used within each of these studies were related to specific affective responses to either intentions to be active or partaking in physical activity, whereas our study focused on generalised positive affect. This indicates that general positive mood states also play a role in post-intentional processes, by strengthening the relationship between intentions and behaviour – presenting a unique finding not previously examined.

While affective states only played a very small role within this thesis, the role of positive affect identified may provide unique utility in practical interventions that aim to improve the engagement in physical activity behaviour. This is due to positive affect being a modifiable construct, which has been successfully manipulated in previous research (Ekkekakis et al., 2013; Johnson, Gooding, Wood, Fair, & Tarrier, 2013; Lench, Flores, & Bench, 2011). As such, the use of positive mood induction techniques may be successful in the facilitation of increased physical activity participation. This finding presents an opportunity for future research, which could have significant utility in improving physical activity participation rates.

7.2.2.5 Implicit Associations. The majority of this thesis, much like the research in the prediction of health behaviour (such as physical activity), has predominantly focussed on factors which are within one's conscious awareness. However, recently research has shifted its focus and highlighted the importance of implicit or automatic associations in this process (Conroy, Hyde, Doerksen, & Ribeiro, 2010; Gawronski & Bodenhausen, 2006, 2007, 2011; Gawronski, Hofmann, & Wilbur, 2006; Hagger & Chatzisarantis, 2014). Chapter 6 of this thesis presented evidence that implicit attitudes, in addition to explicit attitudes, have the potential to influence physical activity behaviour. Differences were found between implicit and explicit attitudes, with only explicit attitudes predicting intentions; however, implicit attitudes were found to indirectly predict physical activity, via both explicit attitudes and intentions in a causal chain. These results support both the theory of planned behaviour model (to be further discussed in the following section) and the associative-propositional evaluation model (Ajzen, 1991; Gawronski & Bodenhausen, 2006, 2007, 2011; Gawronski et al., 2006). The associative-propositional model proposes that implicit attitudes can form the basis of an explicit attitude if an individual's propositional reasoning determines it to be consistent with other information which is considered at the time when the explicit attitude is formed (Gawronski & Bodenhausen, 2006, 2007, 2011; Gawronski et al., 2006).

Chapter 6 provided a unique extension to the theory of planned behaviour model by demonstrating a role for implicit attitudes in physical activity behaviour. Specifically, the influence of attitudes on physical activity behaviour can result from both implicit and explicitly formed attitudes. In this thesis, implicit attitudes were not found to predict behaviour directly, which was likely due to the often deliberate, planned nature of physical activity behaviour, which is more aligned with explicit influences. However, the unique finding was that implicit attitudes affected explicit attitudes, explicit attitudes predicted intentions, and intentions predicted subsequent behaviour in a causal chain. Interventions, therefore, may benefit from targeting implicit attitudes, in addition to explicit attitudes – as both are likely to influence physical activity behaviour indirectly. Interventions for implicit attitudes could include evaluative conditioning, affective priming or modified IATs. These methods have shown success in changing implicit attitudes in other health-related domains (Haynes, Kemps, & Moffitt, 2015a, 2015b; Houben, Havermans, & Wiers, 2010; Houben, Schoenmakers, & Wiers, 2010); and as such, research may benefit from testing these methods in relation to physical activity behaviour.

7.2.3 Theoretical Frameworks

7.2.3.1 Theory of Planned Behaviour Model. The theory of planned behaviour model was the primary theory underpinning this thesis, with each empirical chapter (i.e. Chapters 2 to 6) incorporating elements of the theoretical model into the prediction of physical activity behaviour in young adults. Specifically, Chapter 2 focused on physical activity participation, the theory of planned behaviour constructs (i.e. attitudes, subjective norms, perceived behavioural control, and intentions), and other important constructs, longitudinally tracking young adults in their first academic year at university. Chapters 3 and 4 both examined the full theoretical model, whilst also extending it through the addition of other variables, which were identified as significant in Chapter 2. These extensions included a) the examination of the role of past behaviour, self-efficacy, social support and positive affect as moderators of the intention-behaviour relationship, and b) whether past behaviour, self-efficacy and social support contributed uniquely to the prediction of both intentions and physical activity, after controlling for the theory of planned behaviour constructs.

Chapters 5 and 6 focussed only on the attitudes-intentions-behaviour component of the theoretical model and did not consider subjective norms and perceived behavioural control. Specifically, Chapter 5 tested predictions based on social-cognitive theory and integrated these along with the role of intentions from the theory of planned behaviour model. This included testing the moderating effect of self-efficacy on the relationship between social support and intentions. Lastly, Chapter 6 examined implicit and explicit attitudes and their respective relationships with intentions and physical activity behaviour. Across these five chapters, the components of the theory of planned behaviour were consistently found to be important in the prediction of physical activity within the young adult samples investigated. Furthermore, the central tenets of the model were well supported. The specific results pertaining to the theory of planned behaviour model will now be briefly discussed.

In Chapter 2, the results highlighted that each of the theory of planned behaviour constructs significantly predicted differences in rates of physical activity participation between individuals across the first year of university. While these factors were not found to predict rates of change in physical activity, this result was likely reflective of physical activity behaviour remaining stable over time, and thus, there was no change for these variables to predict. As physical activity behaviour remained stable in Chapter 2, the remaining chapters focussed on the prediction of physical activity behaviour within a single time frame.

Predictions based on the theory of planned behaviour were also tested longitudinally in Chapter 2. The results showedthat attitudes, subjective norms, and perceived behavioural control each significantly predicted physical activity behaviour, and consistent with the theory, the addition of intentions appeared to mediate these relationships, reducing effect sizes and rendering attitudes non-significant. The remaining direct effect of perceived behavioural control on physical activity behaviour is consistent with the theory of planned behaviour; however, the remaining direct effect of subjective norms deviates from the theory. This latter effect can, however, be explained by subjective norm ratings significantly increasing over time, which may have increased the influence of this variable within this sample. Despite these findings largely being consistent with the theory of planned behaviour, additive effects were found for the inclusion of self-efficacy, and then past behaviour, each of which remained significant alongside intentions while controlling for the other theory of planned behaviour contructs. These findings do provide support for the predictions of the model longitudinally, particularly the mediation effects of intentions, and intentions demonstrating a proximal role in predicting behaviour. However, they also question the sufficiency of the base theory of planned behaviour model in that the addition of self-efficacy and past behaviour each remained significant factors alongside intentions, thus providing additive effects. This concern about the sufficiency of the theory of planned behaviour aligns with the Sniehotta et al. (2014) critique of the theory of planned behaviour, indicating that the base model alone does not sufficiently predict behaviour as other factors have been found to provide additive effects.

Supporting the primary tenets of the theory of planned behaviour model, in Chapter 3, intentions were found to fully mediate the relationships between attitudes and physical activity, and subjective norms and physical activity. Furthermore, perceived behavioural control was found to predict physical activity behaviour both directly, and indirectly, through its effects on intentions - as proposed by the theory of planned behaviour. The central proponents of the theory of planned behaviour were also supported in Chapter 4. Attitudes, subjective norms, and perceived behavioural control each significantly contributed to the prediction of intentions, whereas only intentions and perceived behavioural control significantly contributed to the prediction of physical activity behaviour, attenuating the roles of attitudes and subjective norms. The central mediating role of intentions in the prediction of behaviour was also supported in Chapter 5, with attitudes, self-efficacy, and social support (from both friends and family) each influencing physical activity indirectly, through their effects on intentions. Additionally, in Chapter 6, implicit attitudes indirectly predicted physical activity, via both explicit attitudes and intentions in a causal chain. This provides support for the important role of attitudes in the theory of planned behaviour, as well as supporting the mediating effect of intentions.

Additionally, justification was found for extending the theory of planned behaviour model. Specifically, in Chapter 3, past behaviour, self-efficacy, family support, and positive affect were all found to significantly moderate the intention-behaviour relationship (as discussed previously). Moreover, in Chapter 4 self-efficacy, social support, and past behaviour, each significantly improved the understanding of both intention formation and physical activity - after controlling for the theory of planned behaviour constructs. In the prediction of intentions, attitudes, self-efficacy, and past behaviour emerged as the strongest and most significant predictors of intentions. This maintained the important role of attitudes in the prediction of intentions, but also highlighted the important additions of past behaviour and self-efficacy. In the prediction of physical activity behaviour, only self-efficacy and past behaviour emerged as the primary significant predictors, superseding the theory of planned behaviour constructs. This left intentions, the proposed proximal antecedent of behaviour within the theory of planned behaviour model, no longer significant. These findings further justified the extension of the theory of planned behaviour model to include self-efficacy and past behaviour, due to their respective significance in both predicting intentions and physical activity participation. Additionally, the attenuation of intentions in the prediction of physical activity further emphasised the importance of examining moderating factors in the intention-behaviour relationship – with past behaviour and self-efficacy clearly having a strong impact, thus explaining the attenuation of intentions.

It is apparent from the results of this thesis that the theory of planned behaviour model does indeed provide a useful basis for predicting both intentions and behaviour, particularly in relation to the physical activity behaviour of young adults. This is supported by the results from each chapter consistently validating the primary tenets of the theoretical model. A greater focus was made on attitudes and intentions within this thesis, with the purpose of highlighting the importance and centrality that these particular factors have on the prediction of physical activity. This thesis adds to the plethora of research which has found the theory of planned behaviour to be useful in the prediction of behaviour, especially in the prediction of physical activity behaviour, and in student samples (Godin & Kok, 1996; McEachan et al., 2011). However, it is clear that while the theory of planned behaviour model does provide a strong foundation for the prediction of intentions and physical activity behaviour, the integration of additional factors, namely past behaviour and self-efficacy, but also social support, positive affect, and implicit attitudes, greatly improves the understanding of intention formation and behaviour. The theoretical implications for the integration of these additional factors to the theory of planned behaviour will be discussed in section 7.4.

Despite this thesis providing many examples where the predictions of the theory of planned behaviour were supported, the predictive validity of the theory was questioned in Chapter 4. This question came from the attenuation of intentions in the prediction of physical activity behaviour by the addition of past behaviour, and only past behaviour and self-efficacy remaining as predictors of behaviour after controlling for the theory of planned behaviour constructs. This lack of predictive validity aligns with the criticisms of the model provided by Sniehotta et al. (2014).

Namely, due to past behaviour, and self-efficacy – which are not explicitly part of the theory of planned behaviour – predicting physical activity over and above that of intentions, which is arguably the cornerstone construct within the theory. However, while this does provide a more critical review of the model's validity and utility, the theory should not be discounted and invalidated based upon one failed test, but the cummulative evidence is important to consider when proposing alternative models of behaviour in the future. Although, it did appear in this Chapter that the theory of planned behaviour model was not the best fit in predicting physical activity behaviour, and that social-cognitive theory may have had better explanatory power within this sample due to the importance of self-efficacy highlighted in the results. The following section therefore will review the results pertaining to social-cognitive theory.

7.2.3.2 Social-Cognitive Theory. Social-cognitive theory was predominantly utilised to guide the hypotheses outlined in Chapter 5. However, as self-efficacy is the central construct within this theoretical model, one could also argue that social-cognitive theory played a much larger role in shaping the predictions of this thesis, given the significant focus on the role of self-efficacy in each chapter. The specific predictions based on social-cognitive theory related to self-efficacy's potential to moderate the effects of social support on behaviour, through intentions (as per the theory of planned behaviour), which was supported. However, as the respective results and interpretations have already been discussed in the sections above - specifically in relation to the roles of self-efficacy and social support, no further interpretation of those findings will occur here. Nevertheless, the integration of these concepts based on social-cognitive theory along with the theory of planned behaviour model is noteworthy. This is due to highlighting the pathways and mechanisms in which self-efficacy, social support, and attitudes drive intentions and subsequent behaviour. The greater understanding of these pathways and mechanisms improves the utility of prediction from these models, which, therefore, has important implications for theoretical and practical applications. The following section will now discuss the methodological limitations of this thesis.

7.3 Limitations

It is important to consider the results of the research presented in this thesis in context of the methodological limitations of the studies. Specifically, these limitations include the use of cross-sectional designs for four of the five studies reported, the use of self-sampling techniques to recruit participants in each study, as well as the reliance on self-report measures in each study. Each of these factors can limit the interpretative value of the findings. Cross-sectional designs are known to be problematic in examining cause and effect factors, and as such using this design in examining the prediction of behaviour has its limits. Methodological improvements suggested for future research include the use of prospective designs to examine the predictive validity of the theoretical models, mechanisms and pathways examined in this thesis.

The use of self-sampling techniques has the potential to bias the results, potentially resulting in only students with an interest in health or physical activity choosing to take part, which could increase the homogeneity of the sample, and thus reduce generalisability. This is of particular concern given that young adult university students are already a fairly homogenous group. The samples were also biased towards female participants, which may in part be due to the self-selected sampling techniques used. As a result the pattern of findings of this research may be more predictive of female young adult university students, and may not fully reflect the pattern behaviour in male university students. Future research may want to counter the self-sampling techniques utilized in this research by using random sampling techniques, which will increase the generalisability of the findings.

This thesis also relied heavily on self-report measures, which are subject to social desirability biases, self-presentational strategies and memory decay. The use of these types of measures may have resulted in biased or skewed responses, and therefore, future research could use more objective measures, particularly in relation to behaviour, in order to reduce these potential biases.

However, it is important to note that these techniques are all commonly used within similar research (Bray & Born, 2004; Butler et al., 2004; Haase et al., 2004; Macdonald & Palfai, 2008; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008; Steptoe et al., 1997; Wallace et al., 2000) and as a result the findings of this thesis would be comparable to some previous research findings. The following section will now discuss the theoretical and practical applications of this thesis, and address future directions for theoretical and applied research.

7.4 Research Implications and Future Directions

7.4.1 Theoretical Implications

The theoretical implications and underlining information presented in this thesis add further support for the value of the major premises of the theory of planned behaviour model, particularly in relation to the prediction of physical activity behaviour in young adults at university. A number of prominent researchers in the field, however, have argued for the extension of the theory of planned behaviour model (Ajzen, 2015; Conner, 2015; Conner & Armitage, 1998; Hagger, 2015; Schwarzer, 2015). This thesis provides further support for this argument. Firstly, limits to the predictive validity of the model were observed within this thesis, suggesting that the base theory of planned behaviour model lacks sufficiency in and of itself. Secondly, the additive effects of other factors (such as past behaviour, self-efficacy, social support, and affect) to the prediction of physical activity, sometimes over and above that of the theory of planned behaviour constructs, further supports the argument for extending the theory of planned behaviour to include these other influential factors. Therefore, this thesis supports that the theory of planned behaviour model be used as the foundation for predicting physical activity; however, the addition and extension of the model provides greater utility for prediction of both intentions and behaviour, as well as further informing intervention methods for future research. This thesis has presented several avenues for possible extension of the theory of planned behaviour model, and the findings reported support their inclusion into a larger model.

Extensions to the model can be separated into two main phases, (a) the motivational processes (i.e. the antecedents, processes and pathways to the development of intentions), and (b) the volitional or post-intentional processes (i.e. mechanisms guiding the translation of intent into action). On the basis of this thesis, the most notable extensions to the motivational phase include the addition of past behaviour, self-efficacy, social support from both friends and family, and implicit attitudes. Each of these factors was important, as each uniquely contributed to the prediction of intentions, and highlighted pathways for which intentions could be influenced. Additionally, the inclusion of past behaviour, self-efficacy, family support and positive affect, each increased the understanding of post-intentional processes, which, in turn, assisted in the translation of intentions into physical activity behaviour. The results of this thesis provide further evidence and support for their inclusion in an extended theory of planned behaviour model, as facilitators of action.

One caveat of the theoretical implications reported above is that the application of the theory of planned behaviour model is behaviour specific, and in this case specific to regular physical activity participation. To simplify, all social cognitive constructs within this thesis (i.e. attitudes, subjective norms, perceived behavioural control, intentions, self-efficacy, and social support) were measured specifically in relation to the participation in regular physical activity. Therefore, in the prediction of an alternative behaviour (e.g. fruit and vegetable consumption), the roles of the aforementioned social-cognitive predictors may, or may not, emerge as important. Furthermore, these factors may not function in the same way as they were reported in this thesis about physical activity behaviour. That said, the factors and mechanisms which have been shown to be important for physical activity within this thesis may be similarly important for other health-related behaviours. Therefore, the results of this thesis may be used to guide further research examining the utility of the pathways and mechanisms identified and reported here – for example, to predict behaviour in other health domains, such as eating habits.

Another theoretical implication pertaining to this thesis relates to the integration of concepts from social-cognitive theory (i.e. the interaction effects between social support and self-efficacy in predicting intentions) into the framework of the theory of planned behaviour (i.e. the importance of attitudes, and the mediating role of intentions in predicting behaviour). The results highlighted that these concepts were well integrated into the framework of the theory of planned behaviour. They also provided a unique understanding into the pathways and mechanisms which guide intention formation, which, as such, has implications for behaviour change.

Recent developments related to integrating theoretical frameworks include Hagger and Chatzisarantis's (2014) formulation of the integrated behaviour-change model. The integrated behaviour-change model sought to synthesise pathways highlighted by several different theoretical models which predict physical activity, and integrate them into a single comprehensive model of behaviour change. The theory incorporated elements of Deci and Ryan’s (2000) self-determinism theory, Heckhausen and Gollwitzer’s (1987) action-control model, and Strack and Deutsch’s (2004) reflective-impulsive model. The theory of planned behaviour served as the foundation of the integrated behaviour-change model, with intentions highlighted as the primary mediator between social-cognitive predictors and behaviour (Hagger & Chatzisarantis, 2014). The integration then extended outwards, to take into account additional phases of behaviour development and change. These include: a) the antecedents of attitudes, subjective norms and perceived behavioural control, b) the volitional phase after intention formation, developing action plans and intention implementation strategies to facilitate behavioural enactment, and c) recognition of alternative implicit pathways to behaviour change, functioning alongside the conscious cognitive factors.

The integrated behaviour-change model mirrors some of the conclusions made in this thesis. Specifically, a) that the theory of planned behaviour is a workable foundation, b) importance of separating motivational versus volitional phases of behaviour development, and c) the potential for implicit or automatic pathways to influence behaviour, in addition to the conscious predictors. However, this thesis focussed predominantly on social-cognitive factors, such as self-efficacy and social support, and identified several pathways and mechanisms for how they utilise the motivational and volitional phases to produce physical activity behaviour. The additional factor that this thesis presents is the role of affective constructs, namely positive affect, to also be involved in behaviour change. According to this thesis, positive moods can function as a facilitator of one's intentions, assisting in their translation into physical activity behaviour. Further work examining and testing the integration of the routes and factors identified within this thesis, into a larger framework, such as that proposed by the integrated behaviour-change model, is an important theoretical step. This is an important direction which has potential practical applications for the development of physical activity behaviour change interventions, which will be discussed in the following section.

Another model which should be raised for theoretical comparison is that of the reasoned action approach (Fishbein, 2008; Fishbein & Ajzen, 2011; McEachan et al., 2016). This approach is an extension of the theory of planned behaviour in which the three determinants of intentions (i.e. attitudes, subjective norms, and perceived behavioural control) are represented by pairs of related, but distinct subcomponents, each of which may have differing effects towards both intentions and behaviour. Attitudes are thought to consist of both experiential and instrumental attitudes, which reflect affective-based and cognitive-based attitudes, respectively. Research has suggested that affective/experiential attitudes are more strongly linked to intentions and behaviour than those of cognitive/instrumental attitudes (McEachan et al., 2016). Additionally, research has also hypothesised that intrumental attitudes may affect behaviour through a reflective path via intentions; however, experiential attitudes may operate via intention, but also through an impulsive, direct route to behaviour, mirroring dual-systems models (McEachan et al., 2016; Strack & Deutsch, 2004).

Subjective norms are theorised to comprise of injunctive and descriptive norms. Injunctive norms, which are considered to be those aligned with the subjective norms typically included within the theory of planned behaviour, are related to the perceived social approval of others. Descriptive norms, however, are considered to be perceptions of what others do. Research has indicated that injunctive norms are often a stronger correlate of intentions, whereas as descriptive norms are a stronger correlate of behaviour (McEachan et al., 2016). The proposed pathways highlight injunctive norms as influencing behaviour only indirectly via intentions; however, descriptive norms may influence behaviour both indirectly via intention, and directly as a result of social modelling processes (McEachan et al., 2016).

The perceived behavioural control subcomponents include capacity, which is synonymous with self-efficacy, and autonomy, which is synonymous with perceived control. Research has reported that capacity (i.e. self-efficacy) was a stronger correlate of intention and behaviour compared to autonomy (i.e. perceived behavioural control) (McEachan et al., 2016). Additionally, it is hypothesised that capacity influences behaviour both directly and indirectly via intention, whereas autonomy only directly influences behaviour (McEachan et al., 2016).

The reasoned action approach is an alternative model which relates to and has some overlap with the research presented in this thesis. Specifically, it notes the consideration of affective variables in the form of experiential attitudes, which may exert influence along an impulsive or implicit pathway, thus highlighting the potential for affective and implicit factors in the prediction of behaviour, which are also a focus of this thesis. The inclusion of both perceived behavioural control and self-efficacy within the reasoned action approach model was also emphasised in this thesis, and the separation of these constructs was further supported by the results presented. Additionally,the finding that self-efficacy typically demonstrates stronger predictive effects than perceived behavioural control when predicting behaviour is consistent with the predictions outlined within the reasoned action approach.

7.4.2 Practical Implications

At the beginning of this chapter, it was outlined that declines in physical activity behaviour are typically reported during young adulthood life (Bray & Born, 2004; Nelson et al., 2008). Furthermore, young adults are on average reported to be insufficiently active to receive the numerous physical and psychological health benefits, as recommended by physical activity guidelines (Bray & Born, 2004; Brown et al., 2012; Leslie et al., 1999). However, contrasting with previous reports, the research reported in this thesis found that the majority of young adult participants, within these Australian samples, were, in fact, meeting physical activity guidelines, and that their participation in physical activity was shown to be stable over time. At face value, it would appear that a large proportion of the Australian young adults sampled do not require intervention to participate in regular physical activity, as they already are doing so. However, as noted in section 7.2.1, further subgroup analysis comparing differences between individuals classified as sufficiently versus insufficiently active, may highlight important distinctions between these groups. Importantly, distinctions identified through a subgroup analysis could help identify individuals who are at risk of inactivity, and help target intervention efforts towards those young adults who are most at risk in terms of health outcomes. Therefore, future research should focus on first distinguishing at risk individuals, within this population, prior to undertaking applied research, such as intervention design and evaluation.

Other future directions for research highlighted in section 7.2.1 relate to tracking physical activity behaviour across a longer period of time. This would help ascertain whether or not the declines that have been reported in similar samples in previous generations, apply within the current generation and cultural climate. Furthermore, assessment of young adults' physical activity behaviour outside of university settings is also important, as these individuals may be at greater risk for inactivity and subsequent poor health. This subset of the population may face additional barriers, such as lower socioeconomic status, financial adversity, and lack of access to education, all of which may affect physical activity participation. Section 7.2.1 also recommended that future applied research, such as intervention design and evaluation studies, may wish to use more comprehensive measurement techniques - such as the use of METS algorithms and accelerometry (Troiano et al., 2008). These techniques, in addition to self-reported data, may provide a more complete and accurate overview of physical activity participation, resulting in the development of more practical intervention strategies.

One practical strategy is the potential for using the internet and social media platforms (e.g. Facebook, Instagram, and Twitter) to proliferate health information, and to help initiate behavioural change in young adults. Commensurate with this, research has noted a rise in the use of the internet and social networking sites – with large proportions of the young adult and adolescent population regularly using the internet and connecting through social media (Lenhart et al., 2010; Polsgrove & Frimming, 2013). Furthermore, research has highlighted that many young adults reportedly use the internet and social media platforms to seek health information and discuss health related topics, including information relating to physical activity and fitness. Interest in keeping fit has progressed rapidly across the last two decades, with the trends towards general fitness and gym culture becoming popularised. Social media platforms, such as Facebook, Instagram and Twitter contribute to this popularisation of health and fitness culture (Andreasson & Johansson, 2014; Sassatelli, 2006). In light of this popularisationthese online services may already be used to improve the health and lifestyles of adolescents and young adults (Lenhart et al. 2010; Teodoro & Naaman, 2013).

However, these platforms may have greater utility for large-scale health promotion efforts, as well as targeted interventions. Research has indicated that that the use of social networking is a useful and effective platform for the spread of behaviour (Centola, 2010). Additionally, young adult students reported that they believed the long-term use of health specific social media sites benefited their fitness regimes (Frimming et al., 2011). Furthermore, research has shown that social networking environments provide a naturally occurring, socially supportive community for individuals engaging in health activities, providing accountability for users' intentions and behaviour, as well as helping and encouraging the participation in health behaviours (Teodoro & Naaman, 2013). These factors highlight that these communities could serve as an alternative source of social support, which may be important for individuals who do not have access to socially supportive family or friends. Additionally, research indicated that the involvement within these online communities provide information on subjective norms, as well as positive feedback and role modelling, which are known antecedents of self-efficacy (Bandura, 2004; Teodoro & Naaman, 2013). The above-mentioned studies highlighted that social media platforms have the potential to influence many of the important factors noted within this thesis, including intentions, subjective norms, social support, self-efficacy, and health-specific behaviour. Therefore, the use of social-media platforms should be a focus of applied research in the future, as the use of social networking communities may have significant success for the engagement in, and maintenance of, regular physical activity. (Centola, 2010; Frimming et al., 2011; Lenhart et al., 2010; Polsgrove & Frimming, 2013; Teodoro & Naaman, 2013).

Past behaviour was highlighted within this thesis as having a significant role in shaping physical activity participation in young adults. This emphasises the importance of encouraging physical activity participation early in life and targeting interventions towards increasing physical activity participation in children and adolescents. The use of the internet and social media platforms discussed above may also be useful for developing healthy lifestyles in younger generations. However, care would need to be taken, especially for younger children, to develop child-friendly applications. It is important that these platforms do not promote long hours of seated screen time, as increased screen time has been linked to sedentariness (Melkevik, Torsheim, Iannotti, & Wold, 2010; Pearson & Biddle, 2011), which could potentially counteract the benefits associated with increased health knowledge and physical activity participation. However, research has determined that activity-promoting screen-based activities (such as physically interactive video games, like dance or sports games) can successfully increase energy expenditure in children (Lanningham-Foster et al., 2006), which provides some efficacy for using technology platforms to increase physical activity in youth. As current generations are increasingly active on the internet and social media, and physical activity is strongly driven by past behaviour, the development of online-based social media intervention approaches in youth is a direction of interest. This approach may not only appeal to this age group but could also be successful in improving future health outcomes across the lifespan of the individual.

Another practical application of the research reported in this thesis is the identification of many different modifiable determinants of intentions and physical activity behaviour, including self-efficacy, social support, positive affect and attitudes (both implicit and explicit). As a result, experimental work manipulating influential predictors and evaluating their relative effects on intentions and behaviour is a necessary step for the development of successful intervention programs. Each of the above-mentioned predictors has shown to be successfully manipulated in previous research, and therefore integrating these approaches in future experimental research may have significant implications for intervention approaches and physical activity engagement. A brief overview of these approaches will now follow.

Successful approaches for increasing self-efficacy include shaping the environment (e.g. through a socially enriched group environment, such as one of the ‘positive’ online communities outlined above), and by providing positive performance feedback (also highlighted as occurring in online communities above) (McAuley & Blissmer, 2000; McAuley, Talbot, & Martinez, 1999; Teodoro & Naaman, 2013; Turner, Rejeski, & Brawley, 1997). Facilitating socially supportive networks, either through friends or family – or potentially online communities, is also important. Previous research has identified that focusing on building, strengthening and maintaining social networks within community settings can successfully increase supportive relationships and increase the frequency and duration of physical activity participation (Kahn et al., 2002; McNeill, Kreuter, & Subramanian, 2006; Task Force on Community Preventive Services, 2002). Successful approaches typically involved setting up 'buddy' systems, making 'contracts', or organising physical activity groups. Working within pre-existing social networks or creating new ones are both effective approaches for increasing social support (Kahn et al., 2002; McNeill et al., 2006; Task Force on Community Preventive Services, 2002).

Positive affect has also been successfully manipulated. Positive mood induction has been demonstrated in laboratory and clinical settings using therapeutic techniques, such as listening to pleasant music or recalling past positive memories (Ekkekakis et al., 2013; Johnson et al., 2013; Robinson, Grillon, & Sahakian, 2012). There are also a number of approaches to attitudinal change. These include evaluative conditioning tasks, affective priming and persuasive communication methods, all of which have shown success in changing attitudes at either implicit and/or explicit levels, in other health behaviour domains (Gawronski & Bodenhausen, 2006; Haynes et al., 2015a, 2015b; Houben, Havermans, et al., 2010; Houben, Schoenmakers, et al., 2010). Therefore, experimental work should focus on determining whether the use of the techniques mentioned above can a) induce and/or promote self-efficacy, social support, positive mood and attitudes, and b) whether these changes correspond with improvements to physical activity behaviour.

The final practical consideration based on the findings of this thesis relates to the complementary effects of social support and self-efficacy, and the reciprocal effects for social support, self-efficacy, and attitudes. These findings imply that a) self-efficacy can counteract deficits in social support, and vice versa, and b) that changes in one or more predictors are likely to reciprocally affect the others. Therefore, creating targeted approaches aimed at identifying what resource deficits may be lacking on an individual basis (e.g. lack of self-efficacy or socially supportive networks) and tailoring interventions to suit the specific needs of an at-risk individual, may be particularly effective. For example, individuals lacking access to social support may benefit from strategies which increase perceptions of self-efficacy. Similarly, individuals who struggle with low self-efficacy may benefit from the provision of social support. However, while tailored approaches may be important on an individual level, large-scale health promotion efforts targeting any of the abovementioned predictors, may have more widespread implications for the greater community, particularly with respect to physical activity participation and health outcomes.

7.5 Conclusion

This thesis was based on previous research which had identified young adulthood as an at-risk group for inactivity and poor health outcomes, as well as the likelihood that physical activity behaviour – or lack thereof, established during this period of life, would extend into later adulthood. Contrary to previous research, the young adults sampled across the five empirical studies presented in this thesis (i.e. Chapters 2 to 6), were found to be meeting physical activity guidelines and their behaviour was stable over time (i.e. did not decline). This would imply that the majority of an educated group of young adults typically may not require physical activity intervention efforts. However, further identification of at-risk subgroups in young adult cohorts is clearly necessary to address the potential for negative health outcomes within this group and beyond.

The theoretical models which underpinned the predictions investigated within this thesis (i.e. the theory of planned behaviour model and social-cognitive theory) were shown to be supported by the results presented. However, several additional factors were identified that uniquely contributed to the prediction of both intentions and physical activity behaviour. These included past behaviour, self-efficacy, social support, positive affect and implicit attitudes. These social-cognitive and affective predictors were shown to influence intention formation and physical activity participation through a variety of pathways and interactive mechanisms. This, therefore, highlighted that an integrated theoretical conceptualisation, involving each of these factors in addition to the theory of planned behaviour is an important direction. A direction such as this would improve the utility of the theoretical framework in the prediction of intentions and behaviour, and thus better guide the development of successful behaviour change strategies.

Many practical applications were suggested relating to the work outlined in this thesis. These utilised the unique involvement of each of the important social-cognitive and affective predictors identified in the current work. Specifically, the suggestions raised were designed to take advantage of the routes each study identified, in which influential correlates were shown to affect physical activity participation. One suggestion which may be particularly useful was the use of online, social networking platforms to help proliferate health knowledge, and encourage health behaviour change. The use of these platforms has implications not only for individual behaviour change but also for the spread of large-scale health promotion – with the potential to reach a broader population, beyond that of young adults.

Young adults, while not being identified within this thesis as requiring attention, may still be a useful target to improve health outcomes later in adulthood. Interventions could target physical activity participation in young adults through the manipulation of the important predictors highlighted in the present work, each of which has the potential to bring about behaviour change. However, findings relating to the significant role of past behaviour suggest that targeting younger age groups may be more beneficial to the improvement of physical activity participation and health outcomes across the lifespan. Specifically, it seems that encouragement of physical activity behaviour from a young age, promoting confidence in physical abilities, having access to socially supportive networks, as well as inducing positive mood states and attitudes, are likely to facilitate a population who intend to, and actually do participate in regular physical activities, thus improving the overall health of the nation.

7.6 References

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