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Relationships Among Self-Efficacy, Implicit Associations, Motives and Exercise Behaviour

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ABSTRACT

The general purpose of this dissertation was to examine how self-efficacy, explicit exercise motives, and implicit automatic associations with exercise influence exercise behaviour of sedentary adults. This dissertation is divided into three manuscripts. The first manuscript examined how self-selection influences the decision to enrol in an exercise program as well as in self-efficacy, explicit motives, and implicit associations. Additionally, manuscript one sought to understand the role of self-selection bias in the adoption and maintenance of exercise over six months. A total of 290 inactive adults aged 35-65 completed the Multidimensional Self-Efficacy for Exercise Scale (MSES; Rodgers, Wilson, Hall, Fraser, & Murray, 2008), two Go/No Go Association Tasks (GNATs; Nosek & Banaji, 2001) to measure automatically activated associations of exercise, and the Exercise Motivations Inventory-2 (EMI-2; Markland & Ingledew, 1997) at baseline, three months and six months of an exercise program. Analysis of variance was used to test study hypotheses. At baseline, participants were grouped into three self-selection profiles: self-selection (n = 126), self-selection with previous knowledge of the exercise program (n = 111), and those who did not enrol in the exercise program (n = 53). Those in the self-selection groups had higher task, coping and scheduling SE, as well positive health exercise motives. No differences in implicit automatic associations with exercise were found. The influence of self-selection bias did not influence adherence or drop outs at three and six months across the three dependent variables.

Manuscript two investigated the role that self-efficacy, explicit motives and implicit automatic associations with exercise influence the intention behaviour gap. Those participants who enrolled in the exercise program and had no previous knowledge
of the exercise program were included in this study resulting in a total of 141 participants (107 inclined actors and 35 inclined abstainers) aged 35-65. Analysis of variance, logistic regression, and moderation models were used to examine hypotheses. SE beliefs, explicit motives or implicit automatic associations with exercise did not differentiate inclined actors and abstainers. Coping SE was a significant predictor of being an inclined actor. Explicit weight management and appearance motives moderated the relationship between SE and becoming an inclined actor.

The purpose of Manuscript 3 was to examine how self-efficacy, explicit exercise motives and implicit automatic associations change over the course of a six-month exercise program as a function of exercise type (weight training or aerobic training). A total of 141 (aged 35-65) began the exercise program and were included in this manuscript. Repeated measures analysis of variance was used to assess change over time. Implicit associations did not change over time. Explicit motives, except weight management motives significantly decreased from baseline to six months and from three months to six months. The change in appearance motives was stronger for those in the strength-training group. Task, coping and scheduling SE increased from baseline and remained stable except for task SE, which, decreased from three to six months.

*Keywords: Exercise, Implicit, motives, self-efficacy, intention-behaviour gap, exercise initiation, exercise adherence*
CO-AUTHORSHIP STATEMENT

This dissertation is my own work. However, I would like to acknowledge my co-authors on this research project. I would like to acknowledge my supervisor Dr. Craig Hall for his contribution to all three of my studies and Dr. Tanya Berry and Dr. Wendy Rodgers from the University of Alberta for their contributions.
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INTRODUCTION

Extensive empirical research has demonstrated that regular exercise is beneficial for health, physical and psychological wellbeing (Warburton, Nicol, & Bredin, 2006). However, despite these known benefits of physical activity and exercise the majority of adults are not sufficiently active (Colley et al., 2011). Exercise behaviour entails multiple phases. First, people need to hold positive exercise intentions. Once intentions are established, people then have to act on these intentions. After exercise behaviour has been initiated people strive to maintain the newly formed exercise behaviour. Each of these phases provides challenges to the successful continuation of exercise participation. The present research investigates these phases while considering some variables known to influence exercise behaviour.

**Intention-Behaviour Gap**

Intentions are explicit decisions to perform a particular action and represent an individual’s motivation to engage in exercise behaviour (Sheeran, 2002). However, of the 87% of Canadian adults that intend to exercise, only 43% successfully fulfil their exercise intentions (Canadian Fitness and Lifestyle Research Institute, 2003). This finding highlights the discordance between exercise intentions and behaviour. This discrepancy has important implications for health research as most health models (e.g., Ajzen, 1991; Fishbein & Ajzen, 1975; Rogers, 1983) include a measure of intentions that directly or indirectly predicts behaviour. However, intentions explain
only 23% of the variance in exercise behaviour (Webb & Sheeran, 2006). Although statistically significant, 77% of the variance in exercise behaviour is not explained by intentions. This discrepancy between intentions and action has been labelled the intention-behaviour gap (Sheeran, 2002) and has been the source of much recent research (e.g., Rhodes & Dickau, 2012; Rhodes, Plotnikoff, & Courneya, 2008; Sheeran & Abraham, 2003; Sniehotta, Scholz, & Schwarzer, 2005). Indeed, a large portion of people that hold positive intentions fail to act (Orbell & Sheeran, 1998; Rhodes & Bruijn, 2013). To understand the intention behaviour relationship Sheeran (2002) conceptualized the relationship across intentions (positive vs. negative) and action (acted or did not act). As a result, intention and behaviour relations can be conceptualized into four categories. Inclined actors are people who hold positive intentions and subsequently act and fulfill their intentions. Inclined abstainers are people who hold positive intentions but fail to enact behaviour. Disinclined actors, are those who do not intend to engage in behaviour, but subsequently engage in that behaviour. Lastly, disinclined abstainers are people who have no intentions to act and do not act. Research has demonstrated that across multiple health behaviours, the intention-behaviour gap is the responsibility of the inclined abstainers (Rhodes & Bruijn, 2013; Sheeran, 2002). Although inconsistent with their intentions, disinclined actors do not contribute greatly to the intention-behaviour discordance, as people rarely act when they hold no intention to do so.

Several researchers have found evidence for both intention formation and intention translation phases of engaging in behaviour (Baumeister, Heatheron, &
Tice, 1994; Gollwitzer & Sheeran, 2006; Rhodes, Courneya, & Jones, 2003; Schwarzer, 1992), suggesting that self-regulatory processes such as self-efficacy and exercise motivation may impact successful fulfillment of positive intentions. Indeed, subsequent research has found that self-efficacy is a consistent predictor of intention-behaviour profiles (Rhodes et al., 2008). Although intentions are thought to capture motivational components of engaging in a behaviour (Ajzen, 1991), additional motivational factors beyond the formation of intentions may be necessary to successfully act on intentions. People’s motivations are important determinants of initiating behaviour and may prove useful in bridging the intention-behaviour gap for many behaviours including exercise.

Self-Efficacy

Social Cognitive Theory (SCT; Bandura, 1977, 1986) provides a theoretical foundation that has driven a considerable body of literature focused on the determinants of health behaviours, including exercise. The central tenet in SCT is self-efficacy (SE) beliefs, which are beliefs regarding people’s capabilities to successfully complete a behaviour (Bandura, 1977). Efficacy beliefs are behaviour specific and include beliefs about the subsets of skills required to act. As such successful adoption of a complex behaviour such as exercise requires people to be efficacious in all required subsets of skills needed to complete the behaviour (Bandura, 1997). Furthermore, efficacy beliefs influence people’s choice in activity, and their coping efforts. That is, the more self-efficacious people are, the more effort they will expend, and they will persist longer in the face of obstacles or difficulty.
(Bandura, 1997). Given that exercise is a complex and sometimes difficult behaviour, its clear that choice, effort and persistence are related to the successful adoption and maintenance of exercise behaviour. Thus, SE appears to be a natural correlate of exercise behaviour, and indeed has been one of the most consistent determinants of exercise behaviour (McAuley & Blissmer, 2000).

In line with SCT’s conceptualization that people engage in behaviour when they hold efficacy beliefs in the required subsets of skills (Bandura, 1997), SE in exercise has been operationalized as multidimensional (Rodgers, Wilson, Hall, Fraser, & Murray, 2008). Specifically, exercise SE comprises three types of efficacy beliefs: a) task SE, which refers to the confidence to complete the exercise skills and movements; (b) coping SE, which refers to being able to exercise in the face of challenges, such as lacking energy and; (c) scheduling SE, which refers to the confidence to regularly schedule exercise sessions (Rodgers et al., 2008). SE has been shown to be an important and consistent predictor of exercise behaviour (McAuley & Blissmer, 2000; Rhodes et al., 2008). The role of SE in exercise appears to be consistent across age groups (De Dourdeaudhuij & Sallis, 2002). Task SE may be influential at the beginning of exercise adoption as research has found that task SE influences exercise intentions (Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002) and adoption of exercise behaviour (Rodgers, Murray, Courneya, Bell, & Harber, 2009). However, after the initiation of exercise, task SE seems less important and does not differentiate regular exercisers from non-exercisers (Rodgers et al., 2008). Instead, coping and scheduling SE were shown to differentiate
regular exercisers and non-exercisers, regardless of exercise intentions (Rodgers et al., 2008).

There is also extensive evidence for the role of SE in the maintenance of exercise behaviour (Fraser & Rodgers, 2010; McAuley & Blissmer, 2000; McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003; McAuley et al., 2007; Rodgers & Sullivan, 2001). Specifically, coping and scheduling SE differentiates high frequency exercisers from less frequent exercisers (Rodgers & Sullivan, 2001), and predicts longer-term exercise adherence better than task SE (Fraser & Rodgers, 2010).

Research supports the contention that specific SE beliefs may be more important at different stages of behaviour engagement (Biddle & Mutrie, 2007; Rodgers et al., 2009; Rodgers, Murray, Selzler, & Norman, 2013; Rodgers et al., 2008) and that the relationship between SE and behaviour is reciprocal (Bandura, 1977; Fraser & Rodgers, 2010). That is, SE provides an important basis for engagement in behaviour, but SE is also influenced by behavioural successes or failures. As such, SE is necessary for the initiation of exercise behaviour and through engagement in repeated exercise SE beliefs are influenced. Research has demonstrated that SE does change over the course of an exercise program. Rodgers and colleagues (2009) examined how the SE beliefs of middle aged adults changed over a six-month exercise program as a function of two types of exercise. The two exercise programs consisted of an at home walking program requiring participants to walk every day, whereas the traditional fitness group completed aerobic exercise (e.g., elliptical, bike, rower, treadmill) at a gym facility three times per week. The
fitness programs were equated for intensity and overall exertion. Overall, task and coping SE was higher for the walking group. Specific to those in the walking group, coping SE decreased from baseline to the midpoint of the exercise program, but increased at the end point, whereas task and scheduling SE remained consistent across the six month program. This drop in coping SE for the participants in the walking activity may have been a result of the coping demands of having to incorporate exercise into their daily lives (Rodgers et al., 2009).

The traditional fitness group increased task, coping and scheduling SE from baseline to midpoint; however, a decrease in all three types of SE occurred from midpoint to six months. The progressive nature of the exercise program may not have allowed for sufficient time for participants to get accustomed to the program prior to further increases in intensity or duration (Rodgers et al., 2009). This research provides unique findings into the specificity of SE across exercise behaviour (Rodgers et al., 2009). The contextual (i.e., home or fitness centre) and scheduling demands of the two exercise programs differed; however, both exercise programs focused on aerobic training. Strength training may result in a different pattern of SE change, as strength training requires different knowledge and skills to perform correctly. Additionally, sedentary adults are less likely to have as much previous experience with strength training as with walking behaviour, as most people walk to some degree throughout the day, even if its not in a structured manner. Differences in how SE beliefs change over the course of exercise, compared across aerobic and weight-training modalities have not yet been assessed.
Explicit Motives

An important component of SCT is that SE beliefs on their own are not necessarily sufficient for action (Bandura, 1986). To engage in behaviour both SE beliefs and incentives or motives are required. As such, people may be self-efficacious in their ability to exercise, but if they lack sufficient motivation to do so, they are unlikely to exercise. Indeed, the reasons why people exercise is a central determinant of exercise participation (Markland & Hardy, 1993; Ingledew & Markland, 1998). These incentives can be conceptualized as participatory motives which reflect the contents of people’s goals that they wish to attain or avoid through engaging in exercise behaviour (Ingledew & Markland, 2008). Research into participatory motives has identified an extensive range of exercise motives including affiliation, appearance, challenge, competition, enjoyment, ill health avoidance, health pressures, nimbleness, positive health, revitalization, social recognition, strength and endurance, stress management, and weight control motives (Ingledew & Markland, 2008; Ingledew, Markland, & Ferguson, 2009; Markland & Ingledew, 1997). Research has demonstrated that exercise motives are associated with exercise initiation, and continued exercise participation (Ingledew & Markland, 2008; Ingledew et al., 2009; Ingledew, Markland, & Medley, 1998; Markland & Ingledew, 1997). The most frequently cited reasons for exercise across age groups are health and appearance related motives (Markland & Ingledew, 1997). At the beginning of exercise adoption people tend to endorse appearance and weight management motives
more so than health and fitness motives (Ingledew et al., 1998). However, health and fitness motives are associated with greater exercise participation, whereas appearance and weight management motives are associated with less continued exercise behaviour (Ingledew et al., 1998). Although research has demonstrated that there are differences among people at different stages of exercise behaviour, it has yet to be examined how exercise motives change in individuals as they progress through the adoption and maintenance of exercise behaviour. Exercise motives tend to explain small portions of exercise variance (De Bourdeaudhuij & Sallis, 2002). One reason may be the reliance on measures that treat exercise motives as rational and deliberative processes (Connor & Norman, 2005). For instance, measures of exercise motives through the use of questionnaires reflect these rational processes. Additionally, explicit measures may be relatively inconsistent with people’s actual exercise behaviour. The recent interest in implicit automatic associations, therefore, is understandable.

**Implicit Cognition**

Theoretical advances in dual process approaches to cognition highlight the importance of assessing the influences of automatic processes. The associative-propositional evaluation model (APE; Gawronski & Bodenhausen, 2006; Gawronski & Bodenhausen, 2011) is one dual process model that postulates that attitudes can be represented explicitly as overt expression of attitudes and implicitly as automatically activated associations in memory.
Explicit processes as measured by self-reports tend to be slower and rational, whereas an implicit automatic association occurs quickly, often without awareness, and cannot be assessed using self-report. An implicit automatic association is the result of pre-existing associations stored in memory (Gawronski & Bodenhausen, 2011). These associations are created over time through learning and through motivational states (e.g., wanting to improve appearance). An individual can hold multiple associations for the same attitude object or behaviour. Which association is activated is influenced by the external contextual cues available (Gawronski & Bodenhausen, 2006, 2011). For instance, exercising in the free weight section of the gym setting may be associated with anxiety; therefore in the context of a gym facility, implicit associations with exercise may be negative. However, if the exercise context is outside or at home, implicit associations with exercise may be positive. An important distinction between explicit evaluations and implicit automatic associations is the assignment of truth. Implicit associations are the automatically activated responses to an attitude object or behaviour and do not contain an assessment of truth. That is, automatically activated responses can occur regardless of whether people believe these associations are accurate or not (Gawronski & Bodenhausen, 2007).

Within dual process research it is generally accepted that explicit and implicit processes affect behaviour differentially (Conroy, Hyde, Doerksen, & Ribeiro, 2010). Research has indicated that implicit associations are related to both exercise intentions and behaviour. Berry, Jones, McLeod, and Spence (2011) have demonstrated that, believing appearance related exercise messages on an implicit
level is negatively related to exercise intentions, regardless of whether the message is believed explicitly. It has been proposed that implicit motivation towards exercise may have a direct effect on exercise behaviour (Hagger & Chatzisarantis, 2014). Indeed, implicit motives associated with health, fitness and enjoyment have direct unique effects on physical activity behaviour (Levesque & Pelltier, 2003). Additionally, exercisers hold more positive implicit associations with exercise, which in turn predict exercise duration and frequency (Bluemke, Brand, Schweizer, & Kahlert, 2010).

Research on implicit automatic associations and exercise behaviour is still in its infancy. To date, little research has assessed how implicit automatic associations influence multiple components of exercise behaviour, such as the decision to enrol in an exercise program, following through on those intentions, and maintaining exercise over time. Additionally, how implicit automatic associations change over the course of an exercise program is not yet known.

**Change in Explicit Processes and Implicit Associations**

Whether an individual maintains newly adopted exercise behaviour over time may result from evaluations of the behavioural experiences that occur through exercise. In line with the APE model, both explicit processes and implicit automatic associations are amendable to change (Gawronski & Bodenhausen, 2006). Explicit processes change due to revaluation of known information or the consideration of new information (Gawronski & Bodenhausen, 2006). For instance, engaging in exercise behaviour may provide new information about the outcomes of exercise.
This new information may result in a change in explicit exercise motives. For example, participating in weight training may result in outcomes associated with feeling stronger, healthier and having more energy. Therefore the exercise experience may result in stronger motives associated with health and fitness, with other motives, such as weight loss remaining stable or diminishing. Indeed research has found that at the initiation of exercise behaviour appearance and weight management motives are prominent; however, motives associated with positive health are related to continued exercise behaviour (Ingledew & Markland, 2008; Ingledew et al., 2009; Ingledew et al., 1998). This suggests that over the course of exercise engagement exercise motives may change as a result of the exercise experience.

Changes in implicit automatic associations occur as the result of changes in the associative structure, such as learning a new evaluation or through changes in the activation of existing patterns (Smith, 1996). The latter implies that multiple evaluations of the attitude object are previously stored in memory. Changes in contextual cues may result in a different pattern of activation, and therefore, a change in implicit automatic associations (Gawronski & Bodenhausen, 2006). A change in implicit automatic associations is most likely the result of repeated exercise participation strengthening evaluative patterns stored in memory (Calitri, Lowe, Eves, & Bennett, 2009). That is, over the course of an exercise program particular associations with exercise, such as appearance or health may be more salient as these associations become more automatic from repeated engagement in exercise. This change in implicit associations may in turn, influence continued exercise.
participation. However, to date research has not examined how continuing exercise behaviour influences changes in implicit automatic associations.

**Self-Selection Bias**

An important concern for researchers is the effects of self-selection bias on research outcomes. Self-selection bias refers to situations, in which individuals select themselves into a study or group. This can impact both causal and non-causal findings as those who self-select may not represent the target population. Within exercise behaviour, self-selection influences correlates of exercise (e.g., Body Mass Index), nutrition habits (Racette, Deusinge, Strube, & Highstein, 2010), and levels of moderate and vigorous physical activity (De Souto, Ferrandez, & Saliba-Serre, 2013). As such, it is possible that self-selection bias may influence the process of exercise adoption and maintenance over time, but also correlates of exercise behaviour such as SE, explicit motives and implicit automatic associations with exercise.

**Overview of the Present Research**

The overall purpose of this dissertation was to examine the roles that SE, explicit motives, and implicit automatic associations play in the process of exercise adoption and maintenance. To this end, two studies were conducted and some of the findings are outlined in three manuscripts comprising this thesis. Manuscript 1 served two purposes, the first of which was to assess how SE, explicit motives, and implicit automatic associations with exercise influenced enrolment in an exercise program. The second purpose was to assess if self-selection bias impacted exercise enrolment
and exercise adherence over six months as a function of SE, explicit motives, and implicit automatic associations.

Manuscript 2 examined how SE, explicit motives, and implicit automatic associations are related to the intention-behaviour gap. Specifically, this manuscript looks at the profiles of inclined actors and inclined abstainers across the dependent variables. Additionally, whether SE, explicit motives and implicit automatic associations could predict if people become an inclined actor was also examined. Furthermore, based on the tenets of SCT (Bandura, 1986) the interaction between SE and motives, both explicit and implicit, on the intention-behaviour gap was tested.

The purpose of Manuscript 3 was to assess how SE, explicit motives, and implicit automatic associations change over a six-month exercise program. It also assessed if participation in different exercise modalities (i.e., aerobic or weight training) resulted in unique patterns of change across the three dependent variables. Additionally, exercise type (i.e., aerobic versus weight training) was assessed.

The three manuscripts in this dissertation are presented using integrated-article format. Each is written as a standalone document and focuses on a specific research question. Given the integrated-article format, redundancy is evident in the information presented in the general introduction and the manuscripts.

In addition, the research presented in this dissertation is part of a larger research project that encompasses a year-long exercise program. However, for purpose of this dissertation, data up to and including six months of the exercise program are included. Further, measurements were taken as part of the larger research
project, such as fitness tests (e.g., sub maximal VO2, predicted strength test, and body composition DEXA scans) that are not included in the analyses within the manuscripts.
References


The Influence of Self-Selection Bias on Exercise Behaviour

Self-Selection Bias

Self-selection bias is important to consider in exercise research. Self-selection bias occurs in a situation in which individuals select themselves into a group, causing a biased sample with nonprobability sampling (Mujere, 2016); this means that those who self-select for a study may not represent the target population or that particular findings may be exaggerated. This is important, as both causal and non-causal findings can be impacted. Limited research has examined the influence of self-selection bias on correlates of exercise, and exercise behaviour itself. For instance, body mass index (BMI) differed between university students who decided to attend a 3-month follow-up assessment of body composition and nutrition habits compared to those who did not (Racette et al., 2010). Additionally, when older adults were invited to enrol in an exercise program at the end of an initial study, there were significant differences between those who enrolled, compared to those who refused, and those who enrolled but withdrew prior to the exercise program starting (De Souto et al., 2013). Specifically, those who enrolled in the exercise study were healthier and engaged in more moderate and vigorous physical activity (De Souto et al., 2013). As such, it is possible that self-selection bias may influence decisions to enrol in an exercise program. The effects of self-selection bias have not been systematically examined in the decision to enrol in an exercise program in middle-aged adults or on
the determinants of exercise behaviour. Additionally, it has yet to be determined if self-selection bias persists through adoption and adherence to an exercise program.

An additional consideration with self-selection bias is how long a person has to consider enrolling in an exercise program. Those who possess previous knowledge about such a program may be different than those who do not because they have had time to consider the reasons for engaging in exercise behaviour and their capabilities to do so. Unique to the current study is the opportunity to not only assesses self-selection bias on enrolling in an exercise program but also the effects of possessing previous knowledge of the exercise program prior to the invitation to enrol.

The process of adopting and maintaining exercise behaviour occurs through multiple phases, even prior to the initiation of exercise. Distinct differences exist between people who have no intention to exercise, who are thinking about exercise, and who are intending to exercise. Research has demonstrated these differences consistently across self-efficacy (SE) beliefs (Marcus, Selby, Niaura, & Rossi, 1992; Simonavice & Wiggins, 2008; Wallace, Buckworth, Kirbey, & Sherman, 2000) and motivation (Ingledew et al., 1998). As such, given that people who self-select into an exercise program hold positive exercise intentions, they likely have different SE beliefs and motivation from those who do not enrol. That is, those who self-select into an exercise program are likely to be more self-efficacious and more motivated to exercise than those who do not self-select.
Self-efficacy

A consistent determinant of exercise behaviour is SE, which is the belief that you have the skills and capabilities to engage in exercise behaviour (Bandura, 1997). Within exercise, SE is a multidimensional construct comprised of the confidence in one’s ability to complete exercise skills and techniques (task SE), to overcome barriers such as lacking energy (coping SE), and to regularly schedule exercise sessions (scheduling SE; Rodgers, Wilson, Hall, & Murrary, 2008). There is considerable evidence that SE predicts exercise intentions (Garcia & Mann, 2003; Rhodes & Plotnikoff, 2006; Rhodes et al., 2008; Rodgers et al., 2008; Sniehotta et al., 2005) and is a powerful determinant of exercise behaviour (Biddle & Mutrie, 2007). Specially, task SE is more important for exercise intentions and during the early stages of exercise adoption (Biddle & Mutrie, 2007; McAuley & Blissmer, 2000; Rodgers et al., 2009; Rodgers et al., 2008). Coping and scheduling SE distinguishes exercisers from non-exercisers, regardless of whether the non-exercisers hold exercise intentions. Additionally, coping and scheduling SE are associated with greater exercise adherence (Fraser & Rodgers, 2010; Rodgers et al., 2002) and distinguish frequent exercisers from less frequent exercisers, whereas task SE does not (Rodgers & Sullivan, 2001). Furthermore, SE distinguishes those who have varying degrees of intentions to exercise. Specifically, those who intend to exercise in the foreseeable future have higher SE beliefs than those thinking about being active and those who are not considering engaging in exercise behaviour (Marcus et al., 1992; Simonavice & Wiggins, 2008; Wallace et al., 2000). This suggests that those who self-select may
be intending to exercise, and therefore, may be more self-efficacious than those who do not self-select.

**Explicit Motives**

Participatory exercise motives reflect what people want to gain or avoid through exercise participation (Markland & Ingledew, 1997) and are related to exercise intentions and participation. For instance, health and fitness motives are associated with continued exercise participation (Ingledew & Markland, 2008), whereas appearance and weight management motives appear to be important at the initiation or adoption of exercise behaviour (Ingledew et al., 1998). Additionally, health motives are strongly endorsed for both sexes, however, weight related and appearance motives are higher for females than they are for males (Egli, Bland, Melton, & Czech, 2011; Johansen, Hoigaard, & Haugen, 2005). Appearance and weight management motives dominate in early phases of exercise adoption (Ingledew et al., 1998). More specifically, appearance and weight management motives increase as people become closer to engaging in exercise behaviour. Those who self-select into an exercise program likely intend to exercise, and are thus expected to have stronger exercise motives, in particular appearance and weight management motives, than those who do not self-select.

**Implicit Processes**

The reliance on explicit measures (i.e., self-report questionnaires) of the correlates of exercise behaviour may have contributed to the relatively ineffective interventions aimed at producing sustained exercise behaviour change (Rhodes &
Dickau, 2012; Webb & Sheeran, 2006). Theoretical advances highlight the importance of assessing both implicit automatic associations and explicit processes (Carlston, 2010). These advances have arisen from dual process models, such as the Associative Propositional Evaluative (APE) model (Gawronski & Bodenhausen, 2006; 2011). This model posits that individuals have both explicitly driven attitudes based on propositions about an object or behaviour, as well as automatic affective associations with an object or behaviour (Gawronski & Bodenhausen, 2006). Implicit automatic associations are a reflection of pre-existing structures in memory and specific contextual stimuli (Gawronski & Bodenhausen, 2006). These pre-existing structures occur as a result of learning through past experiences, as well as through motivational states such as the desire to lose weight.

A limited number of studies have examined links between exercise and implicit automatic associations. Some researchers have found implicit automatic associations explain variance in exercise behaviour over and above explicit motives (Conroy, Hyde, Doerksen, Riberio, 2010). Furthermore, implicit processes have differentiated exercisers from non-exercisers (Bluemke, Brand, Schwazer, & Kahlat, 2010). Specifically, exercisers held positive automatic associations with exercise and these positive associations predicted exercise frequency and duration. Also, automatic associations with exercise and appearance have been shown to inversely relate to exercise intentions (Berry, Jones, Mcleod, & Spence, 2011).

The APE model proposes that an individual can have multiple associations with a single attitude object or behaviour. Which pattern of automatic associations is
activated for a given object or behaviour is influenced by the contextual information available. This contextual information essentially acts as a prime for behaviour (Gawronski & Bodenhausen, 2006). Given that automatic associations may be related to exercise intentions (Berry et al., 2011) and exercise behaviour (Bluemke et al., 2010; Conroy et al., 2010), self-selection may influence implicit automatic associations with exercise by acting as a prime.

**Present Study**

Self-selection has been shown to be related to correlates of physical activity, such as BMI (Racette et al., 2010) and levels of moderate and vigorous physical activity (De Souto et al., 2013), suggesting that important determinants of exercise behaviour may differ between self-selection groups. As such, the purpose of this study was two-fold: (1) to examine the relationships of self-selection to an exercise program with SE, implicit automatic associations and explicit exercise motives; and (2) to assess whether effects of self-selection bias and previous knowledge persist throughout an exercise program, with respect to exercise adherence at three months and six months and across all three dependent variables. Participants who had previous knowledge of the exercise program (e.g., from a friend, family member, or co-worker) were considered separately from those who did not know about the program. As such, for the first purpose participants could be grouped into three groups: self-select, self-select with previous knowledge, and refused to enrol in the exercise program. Three hypothesis were tested: First, those who self-selected would have higher task, coping and scheduling SE compared to those that did not self-select,
and those who self-selected with previous knowledge would be higher on these variables than those who self-selected but did not have previous knowledge. Second, it was hypothesized that appearance and weight management motives would be higher in those who self-selected, and highest for those with previous knowledge. Based on findings that indicated that health motives are more prominent as exercise behaviour continues (Ingledew et al., 1998), no differences between groups for positive health motives at the time of enrolment were hypothesized. Third, in line with the APE model propositions (Gawronski & Bodenhausen, 2006), it was hypothesized that those who self-selected, especially those with previous knowledge, would have stronger implicit associations with exercise and appearance/body shape.

For the second purpose, those who enrolled in the exercise program were included and grouped according to whether or not they had previous knowledge of the exercise program. Hypotheses regarding how the effects self-selection bias and previous knowledge on exercise adherence and measures of self-efficacy, explicit motives and impact associations over six months of an exercise program were not forwarded given the lack of research on how self-selection may influence SE, implicit automatic associations, and explicit motives over continued exercise participation.

**Method**

**Participants**

Inactive adults aged 35 to 65 years of age ($M_{age} = 48.32, SD = 8.67$) were recruited through advertisements in local newspapers, posters and through word of mouth to participate in a study investigating thoughts about exercise. Participants
were considered inactive if they exercised one or less times per week. Those who exercised more frequently were excluded from this study. At the end of the study, participants were asked if they wanted to join a year-long exercise program. Participants were also asked if they knew about the offer of the exercise program before participating in the study. Those who previously knew about the exercise program and decided to enrol were deemed to have self-selected with previous knowledge. The study sample included 290 participants (68.51% female) of whom 111 previously knew about the exercise program and 179 who did not.

Materials

Demographic information. Participants were asked to self-report their sex, age, and ethnicity, as well as their yearly family income, their education, and self-reported weight and height, which was used to calculate body mass index (BMI).

Self-efficacy. Participants completed the Multi-Dimensional Self-Efficacy for Exercise Scale (MSES; Rodgers et al., 2008). The MSES consists of nine items that measure task SE (3 items; e.g., “complete exercise using proper technique”), coping SE (3 items; e.g., “exercise when you lack energy”) and scheduling SE (3 items; e.g., “arrange your schedule to include regular exercise”) on a 100% confidence scale ranging from 0 = “no confidence” to 100 = “completely confident.” The MSES has demonstrated strong factorial validity through EFA and CFA (Rodgers et al., 2008). Cronbach alphas in the current study ranged from .83–.85.

Implicit automatic associations. Implicit outcome expectations were measured using two Go/No Go Association Tasks (GNAT; Nosek & Banaji, 2001). The GNATs are a
computer task comprised of a target category of exercise (e.g., workout, run) and two ends of an evaluative attribute dimension (i.e., desirable-undesirable). The distracter category consists of generic words (e.g., table, flannel). The tasks consisted of four blocks of trials, each with practice trials followed by experiment trials. One task assessed health associations (e.g., healthy-unhealthy) and the second task assessed appearance and body shape associations (e.g., attractive-unattractive). Participants were given a target category and an evaluative attribute to which they were instructed to respond (go) by hitting the space bar if the word that appeared in the middle of the screen matched the target or attribute category. Participants were also instructed to ignore those words (no go) that did not fit into the target categories. The response deadline was 850msec for categorizing words as this response deadline has been determined to be appropriate to detect sensitivity between categories and avoid error ceiling effects (Nosek & Banaji, 2001). The GNAT task has demonstrated convergent and predictive validity across a variety of domains (e.g., Cunningham, Preacher, & Banaji, 2001; Nosek & Banaji, 2001; Teachman, 2006). Given that a first and second half splits approach to reliability are influenced by practice effects (Williams & Kaufman, 2010), odd/even experimental trials were used to calculate reliability. Response time differences between desirable and undesirable associations were used as the within subjects variables for implicit health and appearance/body shape associations. Faster response times equated to a positive association between exercise and health or appearance/body shape. Reliability was demonstrated with health related GNAT at baseline three months and six months with interclass correlations.
ranging from 77 -.89 for desirable and .61 -.76 for undesirable. Similarly, for appearance/body shape associations, reliability was demonstrated for baseline, three months, and six months with correlations ranging from .87 -.90 for desirable and from .76 -.79 for undesirable evaluative attributions.

*Explicit motives.* Explicit autonomous and controlled outcome expectations were assessed with the Exercise Motives Inventory-2 (EMI-2; Markland & Ingledew, 1997). The EMI-2 consists of 14 subscales, however, three subscales were used: 1) positive health (2 items, e.g., “to be healthy”); 2) weight management (2 items; e.g., “I exercise to burn calories”); 3) Appearance (2 items; e.g., “to have a good body”). The items are scored on a 5-point Likert scale ranging from 0 (not at all true for me) to 5 (very true for me). Spearman-Brown coefficient is more appropriate assessment of reliability for two item measures than Cronbach alpha (Eisinga, Grotenhuis, Pelzer, 2013), therefore reliability was demonstrated across the three times points with Spearman-Brown coefficients ranging from .73 -.80.

**Procedure**

All procedures were approved by a University health ethics review board. Participants completed the two GNAT tasks followed by the questionnaire package consisting of the demographics, the EMI-2 and the MSES. Following completion of the questionnaires, participants were given a written invitation to enrol in a study entailing a yearlong exercise program. The invitation included details about the program which consisted of both cardiovascular and strength training exercises and required participants to exercise at a private lab three times per week for a year.
Additionally, participants were informed that the study included fitness assessments, at the beginning of the program and every 3 months following. Also, at these assessment points, participants would be asked to complete the GNAT computer tasks and questionnaires again. Interested participants checked a box indicating that they wanted to participate in the program and provided us with contact information. Following the invitation to the exercise program, people were asked if they previously knew about the exercise program. They were informed that it did not affect their ability to participate and it was simply for our records.

**Results**

The three groups were examined at baseline: self-select (n = 126), self-selectors with previous knowledge (n = 111), and those who did not enrol (n = 53). Demographic information by group is presented in Table 1. Missing data occurred for ethnicity (n = 21), BMI (n = 2), and education (n = 1). Participants’ average age was 47.85 (SD = 8.68) and the average BMI was 30.12 (SD = 2.16). For ethnicity categories, the “other” category included those who reported “mixed” ethnicity. Differences in demographic variables were not significant across all three groups. Effect sizes are reported as Cohen’s d as this statistic is more appropriate when comparing unequal groups (Cohen, 1998).

**Self-Selection bias in enrolment**

Self-selection bias was assessed using two separate one way (Self-selection: self-select with previous knowledge, self-select, did not enrol) MANOVAs with the baseline scores for the three SE constructs as dependent variables for the first
MANOVA and three exercise motives as dependent variables for the second MANOVA. For implicit automatic associations a one way (Self-select) Repeated

### Table 1

**Demographic information by enrollment status**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Self-select with knowledge</th>
<th>Self-select</th>
<th>Did not enrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (% female)</td>
<td>118 (65.25%)</td>
<td>135 (65.93%)</td>
<td>53 (77.35%)</td>
</tr>
<tr>
<td>Age</td>
<td>50.74 (8.57)</td>
<td>46.06 (8.09)</td>
<td>46.32 (8.93)</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>30.81 (8.51)</td>
<td>29.43 (6.78)</td>
<td>30.44 (8.73)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School or college</td>
<td>60 (51.72%)</td>
<td>72 (53.33%)</td>
<td>21 (39.62%)</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>29 (25.00%)</td>
<td>36 (26.67%)</td>
<td>20 (37.73%)</td>
</tr>
<tr>
<td>Graduate or professional</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>degree</td>
<td>23 (19.83%)</td>
<td>22 (16.29%)</td>
<td>10 (18.87%)</td>
</tr>
<tr>
<td>Yearly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35,000</td>
<td>11 (9.32%)</td>
<td>27 (20.00%)</td>
<td>19 (35.84%)</td>
</tr>
<tr>
<td>35,000-75,000</td>
<td>28 (23.72%)</td>
<td>44 (32.59%)</td>
<td>20 (37.73%)</td>
</tr>
<tr>
<td>&gt;75,000</td>
<td>74 (62.71%)</td>
<td>53 (39.26%)</td>
<td>11 (20.75%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>88 (82.24%)</td>
<td>94 (73.44%)</td>
<td>35 (70.00%)</td>
</tr>
<tr>
<td>Asian</td>
<td>7 (6.54%)</td>
<td>20 (15.63%)</td>
<td>3 (6.00%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2 (1.87%)</td>
<td>5 (3.90%)</td>
<td>3 (6.00%)</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>4 (3.73%)</td>
<td>2 (1.56%)</td>
<td>2 (4.00%)</td>
</tr>
<tr>
<td>African</td>
<td>0 (0.00%)</td>
<td>2 (1.56%)</td>
<td>2 (4.00%)</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>5 (4.67%)</td>
<td>2 (1.56%)</td>
<td>4 (8.00%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.93%)</td>
<td>1 (0.78%)</td>
<td>0 (0.00%)</td>
</tr>
</tbody>
</table>
Measures (RM) MANOVA was conducted with mean reaction times as the within
subjects dependent variables.

**Self-efficacy.** The multivariate examination of SE indicated a significant multivariate
effect for self-selection group ($F_{(6, 572)} = 9.091 \ p < .001, \ \eta^2 = .087$) that was
significant for task ($F_{(2, 287)} = 3.441, p = .033, \ \eta^2 = .023, \ d = .307$), coping ($F_{(2, 287)} =
20.885, p < .001, \ \eta^2 = .13, \ d = .765$) and scheduling SE ($F_{(2, 287)} = 21.633, p < .001,
\eta^2 = .131, \ d = .776$). Post hoc analysis indicated that those who self-selected with
previous knowledge had significantly higher task SE than those who did not enrol.
The self-selected with previous knowledge group also had higher coping and
scheduling SE than the other two groups. Additionally, for scheduling SE the self-
select group had higher SE than the did not enrol group. Means and standard
deviations (SD) are shown in Table 2.

**Explicit motives.** Multivariate effects were significant for self-selection group ($F_{(6, 570)} = 1.770 \ p = .1303, \ \eta^2 = .18, \ d = 710$) for positive health motives ($F_{(6, 286)} = 3.37
p = .036, \ \eta^2 = .23, \ d = .845$). Post hoc analysis revealed that those who self-selected
with previous knowledge have significantly higher positive health motives than those
who did not have previous knowledge and did not enrol. Means and standard
deviations (SD) are shown in Table 2.

**Implicit automatic associations.** Implicit automatic associations were assessed with a
RM ANOVA. Means and standard deviations (SD) of the difference scores are shown
in Table 2. There were no significant multivariate effects for implicit automatic
associations and self-selection group ($F_{(6, 572)} = .512, p = .799, \ \eta^2 = .005$). However,
there was significant within subject’s effect for implicit automatic associations \(F_{(1, 287)} = 164.660, p < .001, \eta^2 = .365, d = .965\). Specifically, there were strong, positive associations of exercise as desirable with health/fitness and appearance/body shape.

Table 2

*Means and standard errors for self-efficacy, implicit automatic associations, and explicit exercise motives by self-selection/enrollment groups.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Self-select with knowledge (n = 118)</th>
<th>Self-select enrollment (n = 135)</th>
<th>Did not enrol (n = 53)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task self-efficacy</td>
<td>79.92 (16.15)</td>
<td>74.88 (21.19)</td>
<td>71.60 (23.80)</td>
</tr>
<tr>
<td>Coping self-efficacy</td>
<td>61.47 (19.78)</td>
<td>45.63 (24.03)</td>
<td>39.01 (24.32)</td>
</tr>
<tr>
<td>Scheduling self-efficacy</td>
<td>67.52 (19.87)</td>
<td>54.23 (25.58)</td>
<td>42.21 (26.08)</td>
</tr>
<tr>
<td>Implicit automatic associations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>51.80 (54.42)</td>
<td>56.78 (50.28)</td>
<td>54.00 (57.04)</td>
</tr>
<tr>
<td>Appearance / body Shape</td>
<td>45.16 (51.16)</td>
<td>38.36 (43.21)</td>
<td>42.97 (52.52)</td>
</tr>
<tr>
<td>Explicit exercise motives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>3.86 (1.00)</td>
<td>4.08 (1.05)</td>
<td>3.77 (1.26)</td>
</tr>
<tr>
<td>Weight management</td>
<td>4.08 (1.04)</td>
<td>4.16 (1.20)</td>
<td>3.94 (1.35)</td>
</tr>
<tr>
<td>Positive health</td>
<td>4.65 (0.52)</td>
<td>4.57 (0.69)</td>
<td>4.35 (0.97)</td>
</tr>
</tbody>
</table>

Note: Implicit automatic association scores are the difference scores between desirable and undesirable evaluations of exercise. Positive values refer to automatic associations with desirable associations of exercise with appearance/ body shape and/or health. SE is scored on a 100% confidence scale and explicit motives are scored on a 5-point Likert scale.
Exercise status at three months

Participants who enrolled in the exercise program ($N = 221$, 81.45\% female) were used for this analysis. Sixty-one participants dropped out before three months and 160 adhered to the exercise program. Given that those who dropped out did not have three-month data, baseline scores for the dependent variables were used. The impact of self-selection on exercise adherence at three months was assessed with a 2 (Self-selected: with previous knowledge / without previous knowledge) x 2 (Adherence: dropped out/adhered) MANOVA for SE and explicit motives. A 2 (Self-selected) x 2 (Adherence: dropped out / adhered) RM ANOVA was conducted to assess the impact of previous knowledge and exercise status with respect to implicit automatic associations. Due to small cell sizes sex differences in exercise adherence were assessed separately using a 2 (Sex: female, male) x 2 (Adherence: dropped out/adhered) MANOVA for SE and explicit motives and a RM ANOVA for implicit associations.

Self-efficacy. A 2 (Self-selected) x 2 (Adherence) MANOVA was employed to examine SE. Means and SD are presented in Table 3. Multivariate effects were not significant for adherence ($F_{(3, 143)} = .372, p = .773, \eta^2 = .008$), or for self-selection ($F_{(3, 143)} = .452, p = .716, \eta^2 = .009$). There was no significant interaction between self-selection and adherence ($F_{(3, 143)} = 1.062, p = .367, \eta^2 = .022$).

Sex differences. A 2 (Sex) x 2 (Adherence) RM MANOVA was conducted. Multivariate effects were not significant for sex ($F_{(3, 178)} = 2.057, p = .108, \eta^2 = .034$)
or adherence ($F_{(3,148)} = .685, p = .562, \eta^2 = .011$), and there was not a significant interaction between the two variables ($F_{(3,178)} = .338 p = .798, \eta^2 = .006$).

**Implicit automatic associations.** Difference scores are presented in Table 3. Multivariate effects for self-selection ($F_{(1,204)} = .004, p = .947, \eta^2 = .006$) and adherence ($F_{(1,204)} = 1.052, p = .306, \eta^2 = .010$) were not significant. Additionally, there was no interaction between self-selection and adherence for implicit associations ($F_{(1,204)} = .452, p = .502, \eta^2 = .007$).

**Sex differences.** A $2 \times 2$ (Sex x Adherence) RM MANOVA was employed to examine implicit automatic associations of exercise. Multivariate effects for adherence ($F_{(1,247)} = 2.02, p = .111, \eta^2 = .022$) were not significant, but were significant for sex ($F_{(1,246)} = 4.558, p = .034, \eta^2 = .008$) and there was no interaction ($F_{(3,271)} = .652, p = .583, \eta^2 = .007$). The multivariate effects for sex indicated that females had stronger associations with appearance/body shape and exercise than males.

**Explicit motives.** A $2 \times 2$ (Self-selected x Adherence) MANOVA was used to assess differences in exercise status and outcome expectations. Means and SD are presented in Table 3. No significant multivariate effects were found for self-selection ($F_{(3,215)} = 1.847, p = .135, \eta^2 = .025$) or adherence ($F_{(3,215)} = .897, p = .444, \eta^2 = .012$), and there was no interaction ($F_{(3,143)} = .202, p = .895, \eta^2 = .004$).

**Sex differences.** A $2 \times 2$ (Sex x Adherence) MANOVA was employed. Multivariate effects were not significant for sex ($F_{(3,178)} = 1.845, p = .141, \eta^2 = .030$) or adherence ($F_{(3,178)} = .878, p = .454, \eta^2 = .015$). There was no significant
interaction between sex and adherence for explicit motives ($F_{(3, 178)} = 1.635, p = .183, \eta^2 = .027$).

**Exercise status at six months.**

The analyses for exercise status at three months were repeated at six months. Dropouts in this analysis included those who dropped out between three and six months into the exercise program. Participants for the six-month analysis included 184 adults of which 65% were females and 31.3% were males. Fifty-six participants dropped out between three and six months and 126 were still exercising. The impact of self-selection on exercise adherence at six months was assessed with a 2 (Self-selected: with previous knowledge/without previous knowledge) x 2 (Adherence: dropped out/adhered) MANOVA for SE and explicit motives. A 2 (Self-selected: with previous knowledge/without previous knowledge) x 2 (Adherence: dropped out/ adhered) RM ANOVA was conducted to assess the impact of previous knowledge and exercise status with respect to implicit automatic associations. Due to small cell sizes sex differences in exercise adherence were assessed separately using a 2 (Sex: female, male) x 2 (Adherence: dropped out/adhered).

**Self-efficacy.** Multivariate effects were not significant for self-selection ($F_{(3, 143)} = .452, p = .716, \eta^2 = .009$) or for adherence ($F_{(3, 143)} = .372, p = .773, \eta^2 = .008$). The interaction between self-selection and adherence also was not significant ($F_{(3, 143)} = 1.062, p = .367, \eta^2 = .022$). Means and SD are presented in Table 3.

**Sex differences.** Multivariate effects were not significant for adherence ($F_{(3, 178)} = .685, p = .562, \eta^2 = .011$) and sex ($F_{(3, 178)} = 2.057, p = .108, \eta^2 = .034$). The
interaction between sex and adherence was not significant \( (F_{(3, 178)} = .338, p = .798, \eta^2 = .006)\).

**Implicit automatic associations.** Multivariate effects were not significant for implicit automatic associations with self-selection \( (F_{(1, 109)} = .020, p = .888, \eta^2 = .000)\) and adherence \( (F_{(1, 109)} = .016, p = .900, \eta^2 = .000)\). The interaction between self-selection and adherence was not significant \( (F_{(1, 109)} = .335, p = .564, \eta^2 = .003)\). Difference scores are presented in Table 3.

**Sex differences.** No significant multivariate effects were found for implicit associations and for adherence \( (F_{(1, 135)} = 1.107, p = .295, \eta^2 = .008)\) or for sex \( (F_{(1, 135)} = .883, p = .349, \eta^2 = .006)\). The interaction between adherence and sex was not significant \( (F_{(1, 135)} = 2.897, p = .091, \eta^2 = .021)\).

**Explicit motives.** Multivariate effects were not significant for self-selection \( (F_{(3, 143)} = .254 p = .858, \eta^2 = .005)\) or for adherence \( (F_{(3, 143)} = .088, p = .967, \eta^2 = .002)\). The interaction between sex and adherence was not significant \( (F_{(3, 143)} = .202, p = .895, \eta^2 = .004)\). Means and SD are presented in Table 3.

**Sex differences.** Multivariate effects were not significant for sex \( (F_{(3, 178)} = 1.845, p = .141, \eta^2 = .030)\) or adherence \( (F_{(3, 178)} = .878, p = .454, \eta^2 = .015)\) The interaction between sex and adherence also was not significant \( (F_{(3, 178)} = 1.635, p = .183, \eta^2 = .027)\).

**Discussion**

The current study aimed to assess the influence of self-selection bias on enrolling in an exercise program and adherence to that exercise program across three
and six months. The first purpose examined how self-selection bias impacts enrolment in a yearlong exercise program as a function of SE, implicit automatic associations, and explicit motives. For SE beliefs it was hypothesized that those who self-selected would be more self-efficacious in the domains of coping and scheduling. This hypothesis was partially supported as results indicated that self-selection bias was present at the enrolment level with respect to scheduling SE. The results suggest that both self-selection and exercise enrolment are associated with greater SE. This finding is in line with previous self-selection research indicating that correlates of physical activity are influenced by self-selection (De Souto et al., 2013). It was also hypothesized that self-selection with previous knowledge would be higher on all three types of SE than self-selection with no previous knowledge of the exercise program. This hypothesis was supported. Specifically, those who self-selected with previous knowledge had significantly more task SE than those who did not enrol, and higher coping and scheduling SE than both those who self-selected and those who did not enrol. These findings suggest that self-selectors with previous knowledge likely chose to participate in the exercise program because they felt confident that they could commit to exercising, possessed the necessary skills to cope with barriers that might arise, and were able to regularly schedule exercise into their daily routine. This idea is in line with SCT indicating that behaviour occurs when people are self-efficacious in the necessary domains (Bandura, 1997). Moreover, self-selectors with previous knowledge would have ample time between when they found out about the exercise program and the time of enrolment to consider how to schedule exercise into their
Table 3
Means and standard errors for self-efficacy, implicit automatic associations, and explicit exercise motives by self-selection with and without previous knowledge and adherers and drop outs at three and six months

<table>
<thead>
<tr>
<th>Variables</th>
<th>Three Months</th>
<th>Six Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With Previous Knowledge</td>
<td>Without Previous Knowledge</td>
</tr>
<tr>
<td></td>
<td>Adherers (n = 100)</td>
<td>Drop Outs (n = 61)</td>
</tr>
<tr>
<td></td>
<td>(M \ (SE))</td>
<td>(M \ (SE))</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>80.71 (16.35)</td>
<td>82.11 (13.43)</td>
</tr>
<tr>
<td>Coping</td>
<td>62.17 (20.83)</td>
<td>64.17 (20.83)</td>
</tr>
<tr>
<td>Scheduling</td>
<td>68.51 (19.98)</td>
<td>67.58 (18.39)</td>
</tr>
<tr>
<td>Implicit Automatic Associations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>67.13 (5.23)</td>
<td>42.39 (9.57)</td>
</tr>
<tr>
<td>Appearance</td>
<td>55.37 (5.20)</td>
<td>26.92 (9.50)</td>
</tr>
<tr>
<td>Explicit Exercise Motives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>4.09 (0.95)</td>
<td>4.09 (0.96)</td>
</tr>
<tr>
<td>Weight Management</td>
<td>4.13 (0.98)</td>
<td>4.26 (0.80)</td>
</tr>
<tr>
<td>Health</td>
<td>6.70 (0.43)</td>
<td>4.78 (0.41)</td>
</tr>
</tbody>
</table>

Note: Implicit automatic association scores are the difference scores between desirable and undesirable evaluations of exercise. Positive values refer to an automatic association with desirable associations of exercise with appearance/body shape and/or health. SE is scored on a 100% confidence scale and explicit motives are scored on a 5-point Likert scale.
lives and to cope with barriers. The current findings are consistent with previous work (Biddle & Mutrie, 2007; Fraser & Rodgers, 2010; McAuley & Blissmer, 2000) indicating that task SE may be most important in the formation of exercise intentions. However, the current findings are novel and highlight that coping and scheduling SE are important much earlier in the exercise adoption process than originally thought.

With respect to explicit motives, it was hypothesized that those who self-selected and those who self-selected with previous knowledge would endorse appearance and weight management motives more so than those who did not enrol in the exercise program. However, the opposite was found: self-selectors with previous knowledge had greater positive health motives than those who did not have previous knowledge and did not enrol. For some participants the exercise related components of health, fitness and appearance might be related (Waldon & Dieser, 2010), such that losing weight may actually be considered a healthy reason for engaging in exercise. Although self-selectors with previous knowledge had higher positive health motives than those who did not enrol and had no previous knowledge, the difference is small (.3). In addition, appearance and weight management motives are unlikely to be influenced by self-selection bias, which is reassuring for researchers pursing further understanding of exercise motivation.

The hypothesis that self-selectors would have stronger implicit automatic associations with appearance/body shape was not supported, as findings indicated that there were no differences between self-selection groups for this variable. Additionally, self-selectors with previous knowledge did not differ on implicit
associations compared to self-selectors. Contextual factors may have influenced implicit automatic associations (Gawronski & Bodenhausen, 2006). Previous knowledge of the exercise program prior to completing the first data collection session may have served as a prime for these participants. However, completing a study entitled “thoughts on exercise” and being in a room in a physical activity lab, consisting of exercise equipment, may have also served as a prime for those who did not know about the exercise program. These contextual effects may have cancelled out the effect of self-selection bias on implicit automatic associations.

The second purpose of this study was to examine the longitudinal influence of self-selection on adherence to an exercise program over three and six months. Automatic associations with exercise did not differentiate adherers and drops outs at three months or six months. Potentially, implicit automatic associations are more important as exercise behaviour continues and becomes more automatic or habitual. Self-efficacy and exercise motives did not differentiate adherers and drop outs at three or six months regardless of self-selection bias or previous knowledge. Although not assessed in the current study, motives might influence exercise behaviour as the result of satisfaction or dissatisfaction with appearance related changes. Research examining the effects of subjective gains and participatory motives found that exercise behaviour is reduced when people perceive that they have not achieved the gains expected (Ingledew, Markland, & Strömmer, 2014). For instance, if an individual exercises for appearance reasons, but achieves unsatisfactory changes in appearance, they are less likely to continue to participate in exercise. However, the
opposite occurs if subjective gains are high. When individuals motivated for appearance reasons achieve satisfactory changes in appearance, exercise participation is likely to continue (Ingledew et al., 2012). Future research may want to assess how satisfaction with subjective gains in outcomes of exercise effects endorsement of motives, and in turn adherence to an exercise program.

SE beliefs did not differentiate dropouts and adherers at three or six months, irrespective of self-selection bias or self-selection with previous knowledge. This is consistent with research indicating that the changes in SE are quadratic in nature. That is, task, coping and scheduling SE tends to increase over the first portion of exercise, but then tend to level off or decrease (Rodgers, 2009). Although SE beliefs increase with exercise experiences (Rodgers et al., 2009), the finding that SE does not differentiate adherers and drop outs at three or six months suggests that SE beliefs is a stronger determinant of exercise intentions and important for early stages of exercise adoption.

**Strengths and Limitations**

The longitudinal assessment of the effects of self-selection bias on the process of adopting and maintain exercise behaviour, as well as the large sample size are relative strengths of this study. Additionally, the inclusion of a variant of self-selection bias, that of previous knowledge of an exercise program provides unique insight into the effects of self-selection bias. However, limitations need to be recognized. Enrolling in a yearlong exercise program was taken to be a strong indicator of intention strength. However, research has shown that intention stability is
an important index of intention strength. Indeed, research has shown that the more stable the intentions, the stronger the intention-behaviour relationship (Cooke & Sheeran, 2004). The current study did not include a measure of intention stability, which may have influenced whether an individual enrolled in the exercise program. Intention strength and stability is an important consideration for future research.

An additional limitation is the narrow assessment of exercise motives. Most commonly reported motives are appearance and health related, however, there are multiple reasons why an individual engages in exercise behaviour. For instance, the EMI-2 measures 14 types of explicit motives, however, only the explicit motives of appearance, weight management and positive health were chosen to ensure comparability with implicit automatic associations. Given the nature of measuring implicit automatic associations, assessing numerous associations may result in participant burden. Nevertheless, further research may want to examine more types of exercise motives.

Conclusions

The current research study provides insight into the adoption and maintenance of an exercise program. Specifically, the current study supports the literature regarding the effects of task SE and appearance explicit motives on exercise intentions. Additionally, the current study provides novel information about the effects of self-selection bias with exercise interventions. Furthermore, a unique variant of self-selection bias was assessed, namely, previous knowledge of an upcoming exercise program. This is informative as self-selection bias is a concern for
researchers; simply note the limitations offered in research papers (e.g., Biddle & Mutrie, 2007; Ingledew et al., 1998) to see its pervasiveness. It appears that with respect to exercise initiation, self-selection and self-selection with previous knowledge influences SE, a robust predictor of exercise initiation and behaviour. In real world settings, individuals who choose to start exercising are essentially self-selecting to participate in an exercise program. Therefore, the self-selectors in the present study may be similar in intentions to exercise, and possibly in SE beliefs to individuals choosing to start an exercise program outside of the research setting. Although, self-selection influenced SE at the intention level, the effects of self-selection bias were fleeting. This provides assurance to researchers that the effects of self-selection bias are unlikely to influence exercise intervention research.
References


The Role of Self-Efficacy, Implicit Associations, and Explicit Motives in Bridging the Intention-Behaviour Gap in Initiating Exercise Behaviour

The Intention-Behaviour Gap

Intentions are explicit decisions to perform a particular action and represent an individual’s motivation to engage in exercise behaviour (Sheeran, 2002). However, of the 87% of Canadian adults who intend to exercise, only 43% successfully fulfill their exercise intentions (Canadian Fitness and Lifestyle Research Institute, 2003). This finding highlights the discrepancy between exercise intentions and actual behaviour. To understand the source of this discrepancy, Sheeran (2002) conceptualized intention-behaviour consistency across intentions (positive or negative) and action (acted or did not act). As a result, intention and behaviour consistency can be viewed across four categories. Those who hold positive intentions and subsequently act and fulfill their intentions are referred to as inclined actors. Inclined abstainers are people who hold positive intentions but fail to enact behaviour. Disinclined actors, are those who do not intend (negative intentions) to engage in behaviour, but subsequently engage in that behaviour. Lastly, disinclined abstainers are people who have no intentions to act and do not act. The intention behaviour gap is most often seen in inclined abstainers, as there are generally very few non-intenders who subsequently engage in a behaviour (Sheeran, 2002).

The intention-behaviour gap has important implications for health research as most popular theories on human behaviour indicate that intentions are the most proximal
and therefore most important predictor of behaviours such as exercise. Meta-analyses examining the effect of intentions on behaviour have found a moderate effect size ($r = .48$) explaining 23% of the variance in exercise behaviour (Armitage & Conner, 2001). Nevertheless, 77% of the variance in exercise behaviour remains unexplained. This discordance between intention and behaviour is even more noteworthy when we examine interventions that have targeted intentions to enact exercise behaviour change (Webb & Sheeran, 2006). Indeed, such interventions often result in a significant increase in intentions but no subsequent change in exercise behaviour (McEachan, Conner, Taylor, & Lawton, 2011). Taken together the abovementioned findings on the effectiveness of intentions to predict behaviour suggest that intentions may be necessary but not sufficient to ensure exercise behaviour (Rhodes & Dickau, 2012; Webb & Sheeran, 2006). In order to create effective exercise interventions it is necessary to understand what differentiates inclined actors from inclined abstainers (Norman, Conner, & Bell, 2000; Rhodes et al., 2008).

**Differentiating Inclined Actors/ Abstainers**

Limited research has examined the profiles of inclined actors and inclined abstainers from positive exercise intentions measured at time one. Of this research two findings are consistent. First, outcome expectancies did not distinguish inclined actors from abstainers, but did influence intentions (Godin, Shephard, & Colanronio, 1986; Rhodes et al., 2003; Rhodes & Plotnikoff, 2006; Rhodes et al., 2008) and second, SE, as measured by the confidence in overcoming barriers to exercise is a consistent predictor of inclined actors (Rhodes et al., 2003; Rhodes & Plotnikoff, 2006, Rhodes et al., 2008).
Limitations of the above research include the use of mainly undergraduate samples (Rhodes & Plotnikoff, 2006), which limits the generalizability to other age cohorts. Exercise behaviour not only decreases with age while the risk of health implications increases (Canadian Fitness and Lifestyle Research Institute, 2004), but determinants of exercise behaviour, such as exercise motives also change over the lifespan. These differences between young adults and middle-aged adults suggest that the factors that influence successful enactment of exercise intentions may be different. In fact, research has demonstrated that the discordance between intentions and physical activity is larger among middle-aged adults when compared to younger adults (Nigg, Lippke, & Maddock, 2009).

Rhodes and colleagues (2008) included middle-aged adults when examining the successful adoption of exercise from positive intentions. Findings replicated previous research indicating that SE is an important predictor of exercise adoption from positive intentions (Rhodes et al., 2003; Rhodes et al., 2008; Sneiotta, Scholz, & Schwarzer, 2005); however, the conceptualization of SE has been limited to SE beliefs about overcoming barriers to exercise. Multiple SE constructs differentially predict exercise intentions and behaviour (Rodgers, Wilson, Hall, Fraser, & Murray, 2008) and may be useful in further understanding the intention-behaviour gap (Rhodes et al., 2008). Additionally, researchers have provided evidence that there may be additional self-regulatory constructs, such as social-cognitive and motivational factors, that influence consistency between intentions and behaviour (Rhodes et al., 2003; Rhodes et al., 2008). Furthermore, behaviour change models indicate that the likelihood that people will
initiate a behaviour change is a function of both confidence in their ability to exercise (e.g., SE) and the belief that exercising will provide benefits that will improve their lives (Rothma & Salovey, 2007). Therefore, examining how SE and exercise motives influence the intention-behaviour gap in middle-aged exercise initiates is worthwhile.

**Self-Efficacy**

Successful adoption of a complex behaviour such as exercise requires people to be efficacious in all required subsets of skills needed to complete the behaviour (Bandura, 1997). Within the exercise context, SE has been examined as a multidimensional construct, comprising three types: (a) task SE, the confidence to complete the basic exercise skills and movements; (b) coping SE, being able to exercise in the face of challenges, such as lacking energy and; (c) scheduling SE, the confidence to regularly schedule exercise sessions (Rodgers et al., 2008). SE is a robust predictor of exercise behaviour. Extensive evidence demonstrates that the types of SE differentially predict exercise behaviour. Specifically, task SE is important in the formation of exercise intentions (Rodgers, Blanchard, Hall, McAuley, & Munroe, 2002) and in the early phases of exercise adoption (Rodgers et al., 2002). However, beyond the initiation of exercise, coping and scheduling SE are related to long term exercise behaviour (Rodgers, Murray, Courneya, Bell, & Haber, 2009). The differential effects of multiple SE constructs on intention and behaviour suggests that SE beliefs, beyond coping may have important implications for understanding the discordance between exercise intentions and behaviour. Indeed, Rhodes and colleagues (2008) have argued that assessing the role of
multiple efficacy constructs should prove useful in understanding complex behaviours such as the initiation of exercise, which requires effort, time, energy and skills.

**Exercise Motives**

In line with tenets of social cognitive theory, SE leads to behaviour when necessary motives are present (Bandura, 1997). As such, assessing exercise motives along with SE may provide unique insight into intention-behaviour consistency. Although previous research has found that motivational constructs are related to intentions but not fulfillment of these intentions (e.g., Rhodes et al., 2003; Rhodes & Plontikoff, 2006), the measurement of motivational constructs has been limited to outcome expectations measured as pros and cons to exercise (Rhodes et al., 2003; Rhodes & Plotnikoff, 2006), as well as motivation to comply to exercise instructions (Godin et al., 1986). However, research has not examined participatory exercise motives which reflect the contents of people’s goals for exercise behaviour and what people aim to attain or avoid through exercise participation (Markland & Ingledew, 1997). At the initiation of exercise behaviour, appearance and weight management motives tend be more salient than positive health motives which may not be as apparent to exercise initiates (Markland & Ingledew, 1997). In contrast, health and fitness motives are more important for continued exercise participation (Ingledew et al., 1998). As such, weight management and appearance motives may have a stronger relationship with intention-behaviour consistency than health related motives.

The majority of research concerning motives has used self-report methods, often questionnaires; however, theoretical advances in dual process approaches highlight the
importance of assessing the influence of automatic processes on behaviour. One such dual processes approach is outlined in the Associative and Propositional Evaluation (APE) Model (Gawronski & Bodenhausen, 2011). The APE model includes automatic processes that occur from the interaction of the activation of available mental representations in memory and contextual stimuli. Implicit associations are effortless, and cannot be assessed with self-report measures (Gawronski & Bodenhausen, 2006). In contrast, explicit attitudes reflect the process of validation or truthfulness of the information that is activated by the automatic associations (Gawronski & Bodenhausen, 2006). Explicit processes are effortful, rational, accessible to awareness, and can be assessed using self-report, through questionnaires. For example, a commercial gym might automatically activate associations of exercise with appearance, but a person might reject that association after thinking about it and reflect on other reasons to go to the gym, such as health. Implicit and explicit processes have been found to affect behaviour differentially and implicit processes can explain variance in physical activity behaviour over and above that explained by explicit attitudes (Dimmock & Banting, 2009). Furthermore, implicit processes have been shown to differentiate exercisers from non-exercisers (Conroy, Hyde, Doerksen, & Riberio, 2010). Exercisers hold positive automatic associations with exercise and these positive associations predict exercise frequency and duration, whereas non-exercisers hold negative associations with exercise (Bluemke et al., 2010). Based on above mentioned research indicating that implicit automatic associations are differentially related to exercise behaviour (Conroy et al., 2010) and cognitions (Bluemke et al., 2010), it is possible that both explicit exercise
motives and implicit automatic associations can influence the consistency between intentions and behaviour.

The current research aimed to expand on previous research by addressing sample (e.g., undergraduate) and construct (e.g., SE, explicit motives) limitations. As such, it seemed prudent to examine the intention behaviour gap in a middle-aged sample of inactive adults and to extend previous findings by assessing multiple SE constructs. It was also worthy to include further self-regulatory variables beyond what has previously been tested. Accordingly, the overall aim of the current research was to assess how multiple SE beliefs, explicit motives and implicit automatic associations are related to consistency between intentions and behaviour. To achieve this, three main purposes were considered: 1) to examine if SE, implicit automatic associations of exercise and explicit motives differentiated between inclined actors and inclined abstainers, 2) to assess the predictive utility of SE, implicit automatic associations and explicit motives on whether people became inclined actors or abstainers, and 3) to assess the moderating influence of implicit associations and explicit motives on the relationship between SE and whether people are inclined actors or abstainers.

To address the first purpose, the following hypotheses were offered:

H1: It was hypothesized that inclined actors would have higher coping and scheduling SE but not task SE. This hypothesis is based on findings that task SE is related to exercise intentions (Rodgers et al., 2002), whereas coping and scheduling SE are related to exercise behaviour and adherence (Rodgers et al., 2008; Rodgers & Sullivan, 2001).
H2: Although health motives are associated with more exercise behaviour (Ingledew & Markland, 2008; Ingledew et al., 2009), appearance and weight management motives are stronger at the initiation of exercise behaviour. Therefore it was hypothesized that explicit weight management and appearance motives would differentiate inclined actors from abstainers, and explicit health motives would not differentiate inclined actors and abstainers.

H3: Hypotheses for implicit automatic associations were exploratory, as very little previous research has looked at implicit cognitions. It was hypothesized that inclined actors would have stronger appearance and body shape associations than inclined abstainers, and that implicit automatic associations with exercise and health would not differentiate between those who were inclined actors versus abstainers.

To address the second purpose the following hypothesis was offered:

H4: It was hypothesized that coping and scheduling SE, as well as explicit appearance and weight management motives and implicit appearance and body shape associations would be significant predictors of people who become inclined actors.

To address the third purpose, the following hypothesis was made:

H5: Based on the tenets of SE theory, specifically, that SE results in action when there are necessary motives (Bandura, 1997), it was hypothesized that appearance and weight related implicit automatic associations and explicit motives would moderate the relationship between SE and inclined actors.
Method

Participants

A total of 465 participants completed initial baseline data collection consisting of measures of SE, explicit motives and implicit automatic associations. Following the data collection, participants were offered a year-long exercise program. Some participants were recruited through word of mouth (e.g., friends, family, co-workers); as such they had previous knowledge of the exercise program. Those who knew about the exercise program were removed from this study. Therefore 141 participants who enrolled in the exercise program were included in this analysis.

Materials

Demographic information. Participants were asked to self-report their sex, age, race, and yearly family income (on a nine increment scale, from less than $5000 to greater than $100,000), their education, the number of children they had, and their marital status. They also self-reported their weight and height, which was used to calculate body mass index (BMI).

Self-efficacy. Participants completed the Multi-Dimensional Self-Efficacy for Exercise Scale (MSES; Rodgers et al., 2008). The MSES consists of nine items and is scored on a 100% confidence scale ranging from 0 = “no confidence” to 100 = “completely confident”. Following the stem: “How confident are you that you can exercise when…” participants responded to three items for each of task SE (3 items; e.g., “complete exercise using proper technique”), coping SE (3 items; e.g., “exercise when you lack energy”) and scheduling SE (3 items; e.g., “arrange your schedule to include regular
exercise”). The MSES has demonstrated strong factorial validity through EFA and CFA (Rodgers et al., 2008). The current study demonstrated reliability with Cronbach alphas ranging from .83 - .85.

**Implicit associations.** Automatically activated exercise-related associations were measured using two Go/No Go Association Tasks (GNATs; Nosek & Banaji, 2001). The GNATs comprise a target category of exercise (e.g., workout, run) and two poles of an evaluative attribute dimension (i.e., desirable-undesirable). There is also a distracter category that consists of generic words (e.g., table, flannel). The two tasks consisted of four blocks of trials, including practice trials followed by experimental trials. One GNAT task measured health-related associations (e.g., healthy-unhealthy, fit-unfit) and the other measured appearance and body shape associations (e.g., attractive-unattractive, fat-thin). Participants were given a target category and an evaluative attribute to which they were instructed to respond (go) by hitting the space bar if the word matched the target or attribute category. For example, for the target of exercise, participants would hit the space bar if the word ‘run’ appeared. Participants were also instructed to ignore those words (no go) that did not fit into the target categories. The response deadline was 850 msec for categorizing words as this response deadline has been determined to be appropriate to detect sensitivity between categories and avoid error ceiling effects (Nosek & Banaji, 2001). The GNAT task has demonstrated convergent and predictive validity across a variety of domains (e.g., Cunningham et al., 2001; Nosek & Banaji, 2001; Teachman, 2006). Given that a first and second half splits approach to reliability are influenced by practice effects (Nosek & Banaji, 2001) odd/even experimental trials were used to
calculate reliability. Response time differences between associations of exercise as desirable or undesirable were used as the within subjects variables for implicit health and appearance/body shape associations. Faster response times equate to a positive association between exercise and health or appearance/body shape as desirable. The health related GNAT demonstrated reliability correlations for exercise and desirable = .89 and undesirable = .76. Similarly the appearance/body shape GNAT had interclass correlations of .89 for exercise and desirable and .76 for exercise and undesirable.

**Explicit motives.** Explicit motives were assessed with the Exercise Motives Inventory-2 (EMI-2; Markland & Ingledew, 1997). The EMI-2 consists of 14 subscales; however, only three subscales were used for this study: 1) positive health (2 items, e.g., “to be healthy”); 2) weight management (2 items; e.g., “I exercise to burn calories”); and 3) Appearance (2 items; e.g., “to have a good body”). The items are scored on 5-point Likert scales ranging from 0 (not at all true for me) to 5 (very true for me). Reliability was demonstrated with Spearman-Brown coefficients ranging from .73-.80.

**Design and Procedure**

All procedures were approved by a University health ethics review board. This study was designed to examine positive intentions at time one, and fulfillment of intentions at time two. Differences among key variables were assessed between intentions and action. To achieve this, inactive adults (aged 35-65) were recruited via newspaper advertisements and posters to complete a study entitled “thoughts on exercise.” A number of participants were also recruited via word of mouth (e.g., through friends, family, co-workers). Participants were considered inactive if they exercised one or less times per
week. Those who exercised more frequently were excluded from this study. The initial “thoughts on exercise” data collection session included demographic questions, the two GNAT tasks followed by measures of SE and exercise motives. At the end of data collection an invitation to enrol in a yearlong exercise program was presented. The invitation described details about the program that included both cardiovascular and strength training exercises and required attendance at a private training facility three times per week for a full calendar year. The exercise program also included a fitness assessment and DEXA body composition scan at the beginning of the program and every 3 months thereafter, at which time they would also be asked to complete the computer tasks and questionnaires again. Those who were interested checked a box indicating that they wanted to participate in the program and provided contact information. Participants were then asked if they knew about the exercise program prior to attending the data collection session. Those who had heard about the study through word of mouth had prior knowledge that they were going to be offered an exercise program. There is the potential that those who had previous knowledge of the exercise program prior to completing the data session may have had different motives and SE beliefs because they may have completed the “thoughts on exercise” study in order to receive the exercise program. As such, those who had previous knowledge of the exercise program were removed from the analysis.

Those who enrolled were considered to have positive exercise intentions and were included in the present research. At time point two, participants completed baseline fitness tests (e.g., predicted Vo2 max walking test, predicted 1 repetition max strength
tests and DEXA body scan) to start the exercise program. The fitness tests occurred during the participants first cardio and first strength session of the program. Following the fitness tests participants were classified into either inclined actors or inclined abstainers. Those who completed baseline fitness tests at time point two were classified as inclined actors, whereas those who did not complete baseline fitness testing were classified as inclined abstainers. Once participants were classified into inclined actors or inclined abstainers, the baseline data was analyzed to assess differences in the constructs of interest between the two groups.

**Results**

A total of 141 (107 inclined actors and 35 inclined abstainers) male and female (63.7%) participants enrolled in the exercise program. The average age of participants was 46.12 (SD = 8.17) years old. The majority of participants were Caucasian (67.53%), had high school or college education (49.05%), an average household income above $75,000 (41.73%) and were overweight with a mean BMI of 29.48 (SD = 6.74). Demographic information by group is presented in Table 1. Assessment of inclined actors and inclined abstainers revealed no differences between groups on all demographic variables (p > 05). Missing data were found to be 2.7% (n = 27) missing completely at random (Chi-square = 53.422, DF = 42, p = .111) and deletion of missing cases occurred during the analysis. Effect sizes are reported as Cohen’s d as this statistic is more appropriate when comparing unequal groups (Cohen, 1998).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Inclined Actors</th>
<th>Inclined Abstainers</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (% female)</td>
<td>107 (66.9%)</td>
<td>35 (69.9%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>46.39 (7.93)</td>
<td>45.41 (9.02)</td>
</tr>
<tr>
<td>BMI (SD)</td>
<td>29.44 (6.81)</td>
<td>29.64 (6.62)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School or college</td>
<td>53 (49.5%)</td>
<td>21 (60.0%)</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>28 (26.1%)</td>
<td>8 (22.8%)</td>
</tr>
<tr>
<td>Graduate or professional degree</td>
<td>20 (18.7%)</td>
<td>4 (11.4%)</td>
</tr>
<tr>
<td>Yearly Household Income ($)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35,000</td>
<td>20 (18.7%)</td>
<td>12 (34.2%)</td>
</tr>
<tr>
<td>35,000-75,000</td>
<td>44 (41.1%)</td>
<td>11 (31.4%)</td>
</tr>
<tr>
<td>&gt;75,000</td>
<td>143 (47.8%)</td>
<td>12 (34.2%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>77 (72.0%)</td>
<td>20 (57.1%)</td>
</tr>
<tr>
<td>Asian</td>
<td>15 (8.5%)</td>
<td>5 (14.3%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6 (3.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>0 (2.2%)</td>
<td>2 (5.7%)</td>
</tr>
<tr>
<td>African</td>
<td>1 (1.3%)</td>
<td>1 (2.8%)</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>0 (2.9%)</td>
<td>1 (2.8%)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.6%)</td>
<td>2 (5.7%)</td>
</tr>
</tbody>
</table>
Differentiating inclined actors from abstainers

To address the first purpose and related hypothesis, inclined actors and abstainers were compared on their SE beliefs, explicit motives and implicit automatic associations. This was achieved by using Multivariate Analysis of Variance (MANOVA) for SE and explicit motives, and by Repeated Measures (RM) ANOVA for implicit associations.

Table 2

Means (SD) for by group for self-efficacy, explicit motives, and implicit automatic associations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Inclined Actors (n = 271)</th>
<th>Inclined Abstainers (n = 70)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self-Efficacy</td>
<td></td>
</tr>
<tr>
<td>Task self-efficacy</td>
<td>75.55 (19.16)</td>
<td>73.48 (24.46)</td>
</tr>
<tr>
<td>Coping self-efficacy</td>
<td>48.82 (23.54)</td>
<td>39.31 (25.47)</td>
</tr>
<tr>
<td>Scheduling self-efficacy</td>
<td>54.91 (24.66)</td>
<td>52.63 (27.52)</td>
</tr>
<tr>
<td></td>
<td>Explicit Motives</td>
<td></td>
</tr>
<tr>
<td>Weight Management</td>
<td>4.17 (1.12)</td>
<td>4.26 (1.29)</td>
</tr>
<tr>
<td>Appearance</td>
<td>4.02 (1.00)</td>
<td>4.30 (1.08)</td>
</tr>
<tr>
<td>Positive Health</td>
<td>4.55 (0.71)</td>
<td>4.59 (0.56)</td>
</tr>
<tr>
<td></td>
<td>Implicit Automatic Associations*</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>54.13 (5.13)</td>
<td>58.78 (4.89)</td>
</tr>
<tr>
<td>Appearance/ Body Shape</td>
<td>39.28 (4.26)</td>
<td>38.29 (5.55)</td>
</tr>
</tbody>
</table>

Note: * For implicit automatic associations differences scores were calculated by subtracting mean desirable RT from undesirable mean RT. Self-efficacy is scored on a 0-100% confidence scale, explicit motives are scored on a 5 point Likert Scale.
Self-efficacy. A one way (Group: inclined actors /abstainers) MANOVA was used to assess difference in SE between inclined actors and abstainers, with task, coping and scheduling SE as the dependent variables (DVs Means and standard deviations (SD) for the SE variables are shown in Table 2). The multivariate effect for group was not significant, \( F_{(3, 137)} = 2.050, p = .110, \eta^2 = .043 \).

Explicit motives. A one way (Group) MANOVA with explicit health, appearance and weight motives as DVs was utilized to assess difference in explicit motives. Multivariate effects for group were not significant \( F_{(1, 138)} = .691, p = .015, \eta^2 = .015 \). Means and SDs for explicit motives are shown in Table 2.

Implicit associations. A one way (Group) RM MANOVA using the mean reaction times for desirable and undesirable evaluations of appearance /body shape and health associations was used to assess differences in implicit associations. Mean reaction times for categorizing desirable compared to undesirable health and appearance/body shape associations with exercise are not independent and were the within subject variables in the RM MANOVA. Implicit associations (difference scores) are shown in Table 2. Multivariate within subject’s effects were not significant \( F_{(3, 125)} = .088, p = .967, \eta^2 = .002 \).

Prediction of inclined actors

The second purpose was to examine if SE, explicit motives and implicit automatic associations predicted inclined actors from abstainers. Multivariate logistic regression was used. The dependent variable was whether the individual was an inclined actor or abstainer and the independent variables included SE, implicit associations and explicit
motives. The logistic regression model (Table 3) demonstrated good fit ($X^2 (8) = 6.05, p = .605$), explaining 9.0% of the variance (Nagelkeke $R^2$) between actors and abstainers, and correctly classified 73.6% of cases. Coping SE was the only significant predictor. For each percent increase in coping SE, the odds of being an inclined actor rose 1.032.

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Nagelkerke $R^2$</th>
<th>Exp (B)</th>
<th>S.E</th>
<th>Sig</th>
<th>95 % CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task self-efficacy</td>
<td>1.00</td>
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<td>.864</td>
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<td></td>
</tr>
<tr>
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<td>.01</td>
<td>.024</td>
<td>1.01 - .104</td>
<td></td>
</tr>
<tr>
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<td>.01</td>
<td>.185</td>
<td>.98 - 1.02</td>
<td></td>
</tr>
<tr>
<td>Explicit weight management motives</td>
<td>1.07</td>
<td>.20</td>
<td>.674</td>
<td>.79 - 1.45</td>
<td></td>
</tr>
<tr>
<td>Explicit appearance motives</td>
<td>.86</td>
<td>.19</td>
<td>.428</td>
<td>.60 - 1.58</td>
<td></td>
</tr>
<tr>
<td>Explicit positive health motives</td>
<td>.87</td>
<td>31</td>
<td>641</td>
<td>.48 - 1.58</td>
<td></td>
</tr>
<tr>
<td>Implicit association with health</td>
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<td>.00</td>
<td>.395</td>
<td>.99 - 1.01</td>
<td></td>
</tr>
<tr>
<td>Implicit association with appearance</td>
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<td>.01</td>
<td>.876</td>
<td>.99 - 1.01</td>
<td></td>
</tr>
</tbody>
</table>

**Moderation of the effect of SE on inclined actors**

The third purpose of this study was to examine if the interaction between SE and motivations was related to whether people were successful or unsuccessful intenders. Moderation effects were tested using a Hayes’ PROCESS macro (model 1), which runs a
bootstrapped maximum likelihood logistic regression with dichotomous outcome variables (Hayes, 2012). The independent variables were task, coping, and scheduling SE. Each independent variable was analyzed with an individual moderator. The moderators were implicit health and appearance/body shape associations and explicit motives of weight management, appearance, and positive health. The results indicated that there were statistically significant interactions between coping SE and explicit motives for weight management ($B = -0.026, p = .031$), and appearance motives ($B = -0.03, p = .010$), and between scheduling SE and explicit motives for appearance ($B = -0.24, p = .012$). Additionally, there was a significant interaction between task SE and explicit appearance motives ($B = -0.0195, p = .03$). The findings suggest that the effects of coping SE on inclined actors and abstainers is moderated by weight and appearance motives, and that the effects of task and scheduling SE on inclined actors and abstainers is moderated by appearance related motives (Tables 4, 5, 6, and 7). The explicit positive health motives and health or appearance/body shape automatic associations did not significantly moderate the relationship between SE and acting or abstaining. The effects of the moderation were probed by estimating conditional effects at three values of explicit weight management motives: low, one standard deviation below the mean (i.e., 3.048), moderate, the mean (i.e., 4.130), and high, one standard deviation above the mean (i.e., 5.211). As noted in Table 4 for coping SE and weight management all but one (i.e., “high” level) of the conditional effects were significant for any value of explicit weight management for coping SE. This indicates that endorsing low to moderate levels of explicit weight managing motives (below 4.19 for coping) strengthened the relationship
between SE and being an inclined actor. However, this is not the case when people endorsed high weight management motives. Additionally, for task, coping and scheduling

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<td>-1.708</td>
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<td>-7.363</td>
<td>.5049</td>
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<tr>
<td>Weight Management</td>
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<td>.018</td>
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<tr>
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<td>.012</td>
<td>-2.152</td>
<td>.031</td>
<td>-.051</td>
<td>-.002</td>
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</table>

Conditional effects at levels of explicit weight management motives

<table>
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<th>Weight Management</th>
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<td>.015</td>
<td>.123</td>
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<tr>
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<td>.006</td>
<td>4.381</td>
<td>.000</td>
<td>.016</td>
<td>.041</td>
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<tr>
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<td>.008</td>
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<td>.023</td>
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Conditional effect range for values of explicit weight management motives

<table>
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<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
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<td>2.598</td>
<td>.0094</td>
<td>.0160</td>
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<td>.015</td>
<td>.097</td>
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<td>.017</td>
<td>2.700</td>
<td>.007</td>
<td>.013</td>
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<td>.010</td>
<td>.064</td>
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<td>.036</td>
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<td>.000</td>
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<td>.009</td>
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<td>.027</td>
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<tr>
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<td>.012</td>
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<td>.997</td>
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<td>.022</td>
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Note: Conditional effect at range values of explicit weight management motives have been truncated because of space limitations.
Table 5

*Conditional effects of Coping SE in relation to inclined actors or abstainers through explicit appearance motives.*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE</th>
<th>z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moderator variable model</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
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<td>-1.631</td>
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</tr>
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<td>Appearance Motives</td>
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<td>.444</td>
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<td>.078</td>
<td>-.088</td>
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<tr>
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<td>.0612</td>
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<td>.005</td>
<td>.0510</td>
<td>.291</td>
</tr>
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<td>.0131</td>
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<td>.009</td>
<td>-.060</td>
<td>-.008</td>
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<table>
<thead>
<tr>
<th>Appearance</th>
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<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
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<td>.110</td>
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<td>0.10</td>
<td>.054</td>
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<td>.001</td>
<td>.010</td>
<td>.112</td>
<td>.911</td>
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<td>.021</td>
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</table>

**Conditional effect range for values of explicit appearance motives**

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.250</td>
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<td>2.804</td>
<td>.050</td>
<td>.049</td>
<td>.276</td>
</tr>
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<td>.146</td>
<td>.052</td>
<td>2.83</td>
<td>.005</td>
<td>.045</td>
<td>.246</td>
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<tr>
<td>1.500</td>
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<td>.0418</td>
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<td>.004</td>
<td>.038</td>
<td>.202</td>
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<td>2.983</td>
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<td>.027</td>
<td>.129</td>
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<td>.020</td>
<td>3.016</td>
<td>.003</td>
<td>.024</td>
<td>.1140</td>
</tr>
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<td>.014</td>
<td>3.013</td>
<td>.002</td>
<td>.016</td>
<td>.072</td>
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<td>.007</td>
<td>.046</td>
</tr>
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<td>.009</td>
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<td>.050</td>
<td>.000</td>
<td>.034</td>
</tr>
<tr>
<td>4.750</td>
<td>.010</td>
<td>.009</td>
<td>1.086</td>
<td>.278</td>
<td>-.008</td>
<td>.027</td>
</tr>
</tbody>
</table>

*Note: Conditional effect at range values of explicit appearance motives have been truncated because of space limitations*
SE (Tables 5, 6, and 7) only one (i.e., “low” level) of the conditional effects was coping,

**Table 6**

*Conditional effects of Scheduling SE in relation to inclined actors or abstainers through appearance motives*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1.816</td>
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<td>-1.071</td>
<td>.2840</td>
<td>-5.138</td>
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<tr>
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<td>1.540</td>
<td>.127</td>
<td>-.168</td>
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<td>.043</td>
<td>2.553</td>
<td>.011</td>
<td>.025</td>
<td>.193</td>
</tr>
<tr>
<td>Interaction</td>
<td>-.024</td>
<td>.009</td>
<td>-2.520</td>
<td>.012</td>
<td>-.042</td>
<td>-.005</td>
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</table>

Conditional effects at levels of explicit appearance motives

<table>
<thead>
<tr>
<th>Appearance</th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.09</td>
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<td>.015</td>
<td>2.345</td>
<td>.019</td>
<td>.006</td>
<td>.066</td>
</tr>
<tr>
<td>4.106</td>
<td>.012</td>
<td>.009</td>
<td>1.326</td>
<td>.188</td>
<td>-.006</td>
<td>.029</td>
</tr>
<tr>
<td>5.000</td>
<td>-.010</td>
<td>.010</td>
<td>-.980</td>
<td>.327</td>
<td>-.029</td>
<td>.010</td>
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</table>

Conditional effect range for values of explicit appearance motives

<table>
<thead>
<tr>
<th>Appearance</th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.500</td>
<td>.050</td>
<td>.020</td>
<td>2.470</td>
<td>.014</td>
<td>.010</td>
<td>.090</td>
</tr>
<tr>
<td>2.750</td>
<td>.044</td>
<td>.018</td>
<td>2.432</td>
<td>.015</td>
<td>.009</td>
<td>.079</td>
</tr>
<tr>
<td>3.000</td>
<td>.038</td>
<td>.016</td>
<td>2.374</td>
<td>.018</td>
<td>.007</td>
<td>.069</td>
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<tr>
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<td>.014</td>
<td>2.237</td>
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<td>.039</td>
</tr>
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<tr>
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<tr>
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<td>.011</td>
<td>1.960</td>
<td>.050</td>
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<tr>
<td>3.750</td>
<td>.020</td>
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<td>1.529</td>
<td>.126</td>
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<td>.033</td>
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</tbody>
</table>

*Note: Conditional effect at range values of explicit appearance motives have been truncated because of space limitations*

significant indicating that endorsing low levels of appearance motives (below 4.09 for
3.70 for scheduling SE, and 3.07 for task SE) strengthened the relationship between SE and being an inclined actor.

Table 7

*Conditional effects of Task SE in relation to inclined actors or abstainers through appearance motives*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-.037</td>
<td>-.002</td>
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</tbody>
</table>

Conditional effects at levels of explicit weight management outcomes

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<thead>
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<th>Appearance</th>
<th>B</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
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<td>.041</td>
<td>.001</td>
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<td>.010</td>
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<td>.029</td>
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<td>-.031</td>
<td>.015</td>
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Conditional effect range for values of explicit controlling outcomes

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<th>SE</th>
<th>Z</th>
<th>P</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
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<td>2.259</td>
<td>.024</td>
<td>.007</td>
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<tr>
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<td>.025</td>
<td>.008</td>
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<td>.021</td>
<td>2.227</td>
<td>.023</td>
<td>.005</td>
<td>.086</td>
</tr>
<tr>
<td>2.500</td>
<td>.041</td>
<td>.019</td>
<td>2.196</td>
<td>.028</td>
<td>.004</td>
<td>.078</td>
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<tr>
<td>2.750</td>
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<td>.017</td>
<td>2.149</td>
<td>.032</td>
<td>.003</td>
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<tr>
<td>3.000</td>
<td>.031</td>
<td>.015</td>
<td>2.075</td>
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<td>.002</td>
<td>.061</td>
</tr>
<tr>
<td>3.250</td>
<td>.026</td>
<td>.013</td>
<td>1.960</td>
<td>.050</td>
<td>.000</td>
<td>.052</td>
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<td>.075</td>
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*Note: Conditional effect at range values of explicit appearance motives have been truncated because of space limitations*
In addition, the Johnson and Nyman (1936) technique was used to detect the value(s) of explicit weight management motives for which conditional effects were statistically significant at $\alpha = 0.05$. As shown in Figures 1, 2 and 3, moderation effects were significant for any value of explicit weight management motives below 4.59 (out of 5) for coping SE (Figure 1). Moderation effects were significant for any value of explicit appearance motives between 0.25 - 4.53 (out of 5) for coping SE (Figure 2), below 3.70 for scheduling SE (Figure 3) and below 3.07 for task SE (Figure 4).

*Figure 1.* Conditional effect of coping SE in inclined actors or absainters through weight management motives
**Figure 2.** The conditional effects of coping SE in inclined actors or abstainers through explicit appearance motives.

**Figure 3.** The conditional effects of scheduling SE in inclined actors or abstainers through explicit appearance motives.
Discussion

The aim of the current research was to evaluate the influence of SE, explicit exercise motives and implicit automatic associations with exercise on exercise intentions and behaviour. The findings of the study replicate prior work on profiles of intention and behaviour, while extending past findings through the inclusion of multiple SE constructs, explicit participatory motives, and implicit associations in a middle-aged adult sample.

The first purpose of this study was to examine variables that differentiated inclined actors from inclined abstainers. It was hypothesized that inclined actors would have higher levels of coping and scheduling SE than inclined abstainers. This hypothesis was not supported as no multivariate differences were found between inclined actors and
abstainers. The current findings as well as past work (Rhodes et al., 2008) suggests that the influence of SE may not occur on a multivariate level, rather on an univariate level as coping SE has been found to be a consistent predictor of inclined actors (Rhodes et al., 2008; Rhodes et al., 2012).

It was hypothesized that explicit weight management and appearance motives would be endorsed more by inclined actors than abstainers. This hypothesis was not supported. There was no difference in explicit weight management, appearance, or health motives between inclined actors and abstainers. Previous research has viewed motivation as a component of the formation of exercise intentions (Ajzen, 1991). Additionally, given the time between indicating exercise intentions and acting allows people adequate time to consider their exercise motives. Not only does this time allow for additional motives to be considered that could influence successful fulfillment of exercise intentions, but also an assessment of attainability of motives. People are more likely to commit to a behaviour if they believe that the desired outcomes are attainable. An avenue of future research that seems worthwhile is examining if attainability influences the effect of motives to facilitate behaviour from positive intentions.

Lastly, for implicit automatic associations, it was hypothesized that inclined actors would have stronger associations with appearance/body shape motives than inclined abstainers. There were no significant differences in implicit automatic associations between inclined actors and abstainers. These findings suggest that implicit automatic associations with exercise may not be as salient in the initiation of exercise behaviour. Implicit associations have been found to predict incidental physical activity
(i.e., step counts) over and above explicit measures (Conroy et al., 2010). However, the intentional exercise program assessed in the current study may be more complex than incidental physical activity and explicit processes may be more salient. However, implicit automatic associations may play a greater role in exercise behaviour when people have engaged in continued exercise participation over time.

The second purpose of the current research examined if SE beliefs, explicit motives and implicit automatic associations could predict if people became an inclined actor. The hypothesis that inclined actors would be predicted by coping and scheduling SE, as well as implicit automatic associations with health was only partially supported. Coping SE was the only significant predictor, explaining 9% of the variance in inclined actors. A unique finding to this study is that coping SE is related to the enactment of exercise intentions. Although previous work (Rodgers et al., 2009) has found that coping SE is related to continued exercise participation, the current findings suggests that a prerequisite amount of coping SE may be necessary at the early stages of behavioural enactment.

No other research in the intention-behaviour literature has examined the interaction between SE and motives. As such, in line with SCT, the third purpose of the present research assessed the effect of motives (explicit motives and implicit automatic associations of exercise) on the relationship between SE and fulfillment of intentions. The current findings indicate that when people endorsed low to moderate levels of explicit weight management motives and low levels of appearance motives, the relationship between SE and being an inclined actor was enhanced. This supports the
importance of fostering benefits of exercise beyond weight control and appearance as the lower the endorsement the stronger the relationship between exercise SE and being an inclined actor. Additionally, research has demonstrated that health and appearance motives are related (Waldron & Dieser, 2010), as such, it’s possible that specific motives may have multiple meanings to people, such that exercising to lose weight is not solely about changes in appearance but may also be considered healthy for those who are overweight. This is an important finding as often researchers look at SCT constructs, such as SE and motives, in isolation, in contrast to Bandura’s (1997) contention that they should be examined together.

The lack of prediction or moderation by implicit automatic associations on the relationship between SE and fulfillment of intentions suggests that at the initiation of exercise, explicit motives may be more salient to the decision to enact on exercise intentions. Another possible explanation for the implicit motives not moderating the relationship between SE and inclined actors is that explicitly measured SE may be related to explicit measure of motives more so that implicit associations. There is some support for this explanation in the occupational domain; implicit associations and perceived abilities have been found to be unrelated but explicit motives and abilities are related (Kehr, 2004). As such, it is possible that explicitly measured SE is more likely to be related to explicit measures of motives as opposed to implicit automatic associations. This may occur as the time between enrolling in the exercise program and coming back for fitness testing afforded people time to consider why they want to participate, as well as their capabilities in doing so. As such, judgments about both SE beliefs and motives for
participating are considered based on propositional information that occurs during explicit processes. As people think about the decision to exercise, it's possible that more propositional information was considered (Gawronski & Bodenhausen, 2006) and, therefore, is more salient than implicit automatic associations. Therefore, it is possible that explicit motives are more salient in the decision to act on positive exercise intentions.

The prospective analysis employed in the present study provided information about what differentiates those who go on to fulfill their intentions and those who do not. The theoretically driven constructs and analysis, and the large sample size of inactive middle-aged adults are certainly strengths of this study. A limitation of this current research is the context in which the study was conducted. The data collection occurred in a lab that included an exercise facility. Implicit associations are subject to priming effects, such that contextual factors change the activation pattern of implicit representations (Wilson et al., 2000). As such, being in an exercise facility may have primed participant’s implicit responses to exercise, as exercise related associations might be more accessible at the time of participation (Wilson et al., 2000). There is a need for future research to assess context effects on implicit assessments (Lowe & Norman, 2013).

The current research adds to the literature examining the intention-behaviour gap in inactive middle-aged adults by demonstrating that the interaction between SE beliefs and explicit motives influence the enactment of positive exercise intentions. This may lead to refinements in thinking about exercise interventions among middle-aged inactive adults. For those not yet exercising, interventions may highlight a range of possible motives, however down playing weight and appearance related motives. This may
improve intention-behaviour consistency, particularly when sufficient SE beliefs are present. Intervention studies that target changing SE, as well as implicit automatic associations, and explicit motives to narrow the intention behaviour gap are warranted. It may be that different implicit and explicit motives may influence intentions-behaviour consistency for males compared to females. Due to small cell sizes, sex differences were not assessed in the current study; however, this may be an important avenue for future research. Although the findings add a unique contribution to the literature, there is still a need for longitudinal studies to assess changes in SE, implicit automatic associations, and explicit motives over an extended exercise program (e.g., a one year program). The current study also suggests that coping intervention studies are needed to determine if influencing SE, especially coping and scheduling SE, and explicit motives would narrow the intention-behaviour gap for exercise and to determine the role of implicit automatic associations as exercise behaviour progresses.

The results of this study are important because they suggest that the role played by task, coping, and scheduling SE occurs earlier in the behaviour adoption phase than previously thought. As such, inactive adults intending to exercise need to have sufficient beliefs in their ability to regularly schedule exercise and cope with the demands of engaging in exercise behaviour. Furthermore, this study provides unique findings with respect to the interaction between SE and exercise motives, in particular weight management motives. This interaction is often overlooked in exercise research and has not been examined previously with respect to the intention-behaviour gap. Taken together, the findings suggest that focusing on abilities to overcome obstacles to exercise,
and moderate amounts of appearance and weight management motives are more likely to promote successful enactment of exercise behaviour from positive intentions.
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MANUSCRIPT 3

Changes in Self-Efficacy, Implicit Associations, and Explicit Motives Over the Course of a Progressive Exercise Program

The high prevalence of inactivity and the associated health risks (Warburton et al., 2006) highlight the need to understand processes underlying exercise behaviour. However, interventions designed to address this issue of inactivity have been relatively unsuccessful. This may be due to the majority of the associated research treating exercise related cognitions as deliberate and rational processes (Connor & Norman, 2005). For instance, measures of exercise motives through the use of questionnaires reflect these rational processes. However, motives may also be relatively automatic. Recently, researchers have begun to understand the importance of examining implicit processes in conjunction with explicit processes and their influence on health behaviours (Sheeran, Gollwitzer, & Bargh, 2013). A model of this dual process approach, the associative-propositional evaluation model (Gawronski & Bodenhausen, 2006) suggests that attitudes can be represented explicitly as expressions of attitudes and implicitly as automatically activated associations stored in memory (Gawronski & Bodenhausen, 2006, 2011). An implicit automatic association is the result of pre-existing associations interacting with external contextual cues. For instance, exercising in a traditional gym setting may be associated with anxiety; therefore, in the context of a gym facility, implicit associations with exercise may be negative. However, if the exercise context is outside or at home, implicit associations with exercise may be positive. These associations are created over
time through learning, such as through exercise experiences (Gawronski & Bodenhausen, 2006; 2011).

Decisions regarding continued exercise behaviour rest on evaluations of the behavioural experiences that occur as a result of engagement in exercise behaviour. In general, it is believed that explicit and implicit processes influence behaviour differentially (Bohner & Dickle, 2011). Explicit processes are important when people start a new exercise behaviour (Ingledew et al., 1998). However, implicit processes may influence spontaneous decisions (Dimmock & Banting, 2009), and therefore, may effect exercise behaviour as it becomes more habitual or automatic. Thus, an examination of both explicit exercise motives and implicit automatic associations with exercise may be more revealing than assessing either in isolation.

Explicit exercise motives reflect what people aim to attain or avoid through exercise participation (Markland & Ingledew, 1997). At the initiation of exercise behaviour appearance and weight management motives tend be more salient than positive health motives which may not be as apparent to exercise initiates (Ingledew et al., 1998). Research examining how motives differed among people at different levels of exercise behaviour, from non exercisers only contemplating exercise to those who have been exercising for six months or more found that at the beginning of an exercise program appearance and weight management motives are more prominent, whereas other motives including positive health motives are necessary for continued exercise participation (Ingledew & Markland, 2008; Ingledew et al., 2009). Additionally, appearance and weight management motives do not differ between high and low adherers (Ryan,
Exercise modality may influence exercise motives. For instance, resistance training is associated with increases in lean body mass; however, aerobic activity is associated with greater reductions in body fat and overall body mass (Willis et al., 2012). As such, exercise motives may change with exercise experience as a function of the type of exercise (i.e., aerobic versus weight training). Although researchers have demonstrated that there are differences among people at different stages of exercise behaviour, they have yet to examine how exercise motives change in individuals as they progress through the adoption and maintenance of exercise behaviour.

In line with the Associative Propositional Evaluation (APE) model, implicit and explicit processes have been found to affect behaviour differentially and implicit processes can explain variance in physical activity behaviour over and above that explained by explicit processes (Conroy et al., 2010). Additionally, implicit processes have been shown to differentiate exercisers from non-exercisers (Bluemke et al., 2010). Specifically, exercisers hold positive automatic associations with exercise and these positive associations predict exercise frequency and duration. Research has also demonstrated that implicit motivation influences behaviour. Sheeran (2011) found that using a goal-priming task that required participants to read words related to effort and persistence prior to exercising increased time spent working out. An important question is to what extent does implicit automatic associations motivate exercise participation and how implicit associations change with exercise experience. However, little research has assessed the relationships between implicit motivation and exercise behaviour.
Maintenance of exercise behaviour may go beyond explicit processes and be a result of the behaviour becoming more automatic. That is, associative associations in memory between exercise and contextual cues (e.g., time of day) may become more established (Gawronski & Bodenhausen, 2006). Repeated exercise behaviour may result in reduced reliance on explicit processes in favour of a greater influence by implicit associations on exercise behaviour. Changes in implicit automatic associations occur as the result of changes in the associative structure, such as learning a new evaluation or through changes in the activation of existing patterns (Smith, 1996). This suggests that different evaluations (patterns) of the attitude object are already represented in memory and that contextual cues are enough to stimulate attitude change. With respect to changes in associative structure research has demonstrated that pairing of an attitude object with an evaluative attribute does result in changes in implicit associations. Within the exercise context a change in implicit automatic associations is most likely the result of repeated exercise strengthening evaluative patterns stored in memory (Calitri et al., 2009).

Exercise behaviour may result in stronger representations in memory resulting in an increase in implicit associations that may in turn, influence further exercise behaviour. That is, over the course of an exercise program particular associations with outcomes of exercise behaviour, such as appearance or health, may be more salient as these associations become more automatic from repeated engagement in exercise.

Research assessing how both explicit participatory motives and implicit automatic associations change over the course of engagement in exercise behaviour is limited. As such the current study adds to the literature by examining how repeated exercise
behaviour influences exercise motives through both explicit and implicit processes as this this may have implications for understanding and promoting exercise maintenance.

In conjunction with motives for exercise, social cognitive theory posits that self-efficacy (SE) beliefs are necessary to engage in behaviour (Bandura, 1986). SE is defined as one’s confidence for organizing and executing behaviours to achieve a desired outcome (Bandura, 1986). Indeed, the more self-efficacious people are the more likely they are to persist, overcome barriers and achieve their desired outcomes (Bandura, 1986; 1997). Furthermore, Bandura (1997) indicates that SE is behaviour specific and may behaviour may require multifaceted efficacy beliefs as one moves from a mastery stage to ongoing regulation of the behaviour. This appears important for complex behaviours such as exercise. For instance, engaging in exercise behaviour requires knowledge and ability about the physical exercises, the ability to repeatedly engage in exercise in the face of changing contextual circumstances. Within the exercise context SE is comprised of three dimensions. Specifically, these are the belief in one’s ability to complete exercise techniques properly and perform skills (task SE), to overcome barriers such as lacking energy or not feeling well (coping SE), and to arrange exercise sessions into one’s daily scheduling (scheduling SE, Rodgers et al., 2008).

There is robust evidence about the role that SE plays in exercise behaviour (Biddle & Mutrie, 2007; Fraser & Rodgers, 2010; Rodgers et al., 2002; Rodgers et al., 2009). Specifically, regular exercisers have stronger coping and scheduling SE than those who do not exercise (Rodgers et al., 2008). Among exercisers, coping and scheduling SE is associated with greater exercise adherence than task SE (Fraser & Rodgers, 2010;
Rodgers et al., 2002) and distinguishes the high frequency exercise from low frequency exercisers (Rodgers & Sullivan, 2001).

Research supports the contention that specific SE beliefs may be more important at different stages of behaviour engagement. Across a progressive six month exercise program conducted with middle aged adults, task, coping, and scheduling SE changed differentially across time and by exercise type (Rodgers et al., 2009). In general, task and coping SE was higher for the walking activity (completed at home) over traditional fitness (e.g., elliptical, bikes, rowers, treadmills). For the walking group, coping SE decreased from baseline to midpoint but increased at the endpoint, whereas task and scheduling SE remained relatively stable across the three time points. The traditional fitness centre group increased task, coping, and scheduling SE from baseline to the midpoint and then decreased at the endpoint. This research provides unique findings into the specificity of SE across exercise behaviour (Rodgers et al., 2009). Although two different tasks were assessed, the traditional fitness group and the walking lifestyle activity differed in scheduling commitments as the walking lifestyle group was conducted at “home” everyday and the other required people to attend a fitness centre three times per week, the exercise modality is essentially the same as both used aerobic activity. Weight training requires different skills (e.g., exercise technique and form) than aerobic (walking) based activity. Additionally, people have extensive experience with walking whether they have walked as part of structured exercise or not, whereas in comparison people tend to have less experience with weight training. As such the pattern of SE change may be different across weight training compared to aerobic training.
The purpose of the present study was to examine how implicit automatic associations, explicit motives and SE, change over a six month exercise program across aerobic and weight training groups. For implicit automatic associations it was hypothesized that appearance/ body shape associations would be higher at the initiation of exercise, with increases in associations with health across time. Further, it was hypothesized that implicit associations with health would increase more for the weight-training group than for the aerobic group. In line with findings by Ingledew et al. (1998), it also was hypothesized that explicit positive health motives would increase over six months of exercise behaviour, where there would be no change in appearance and weight management motives overall. Given that weight loss is generally associated with aerobic exercise (Willis et al., 2012), it was hypothesized that explicit health motives would increase for the weight-training group to a greater extent than for the aerobic group, and appearance and weight management motives would decrease more for the weight training group than the aerobic group. Based on findings by Rodgers et al. (2009), it was hypothesized that task, coping and scheduling SE would increase over the first three months of exercise, with greater increases seen in the cardio group than the weight training group. No further increase in SE was expected between three and six months.

Methods

Participants

A total of 141 inactive adults who completed six months of the exercise program were included in this analysis. Inactive was defined as exercising once or less per week, those who exercise more frequently were excluded from this study. Participants were
randomized into either an aerobic training group (n = 73; 68% female) or a weight-training group (n = 68; 67% female). Randomization was completed by a third party using a random number generator and sealing the exercise group into numbered envelopes.

**Measures**

**Demographics.** Participants self-reported their age, sex, ethnicity, education level, early household income, height and weight. Demographic data are presented in Table 1.

**Implicit automatic associations.** Automatically activated associations with exercise were measured using two Go/No Go Association Tasks (Nosek & Banaji, 2001). The GNATSs comprises a target category and two pole of an evaluative attribute. To assess exercise-related associations the target category was exercise (e.g., workout, run) and the evaluative attribution assessed desirability. Each GNAT task consisted of four blocks of trails, beginning with practice trials followed by the experimental trials. One GNAT task assessed appearance and body shape associations (e.g., attractive-unattractive, fat-thin), and the other assessed health related associations (e.g., health-unhealthy, fit-unfit). Participants are given both a target category and an evaluative attribute. If the word matches the target category or the attribute, participants are instructed to hit the space bar (go). If the word did not match the target or attribute categories participants were instructed to ignore those word (no go). The response deadline for categorizing words was 850msec as this response deadline has been determined to be appropriate to detect sensitivity between categories and avoid error ceiling effects (Nosek & Banaji, 2001). The GNAT task has demonstrated convergent and predictive validity across a variety of
domains (e.g., Cunningham et al., 2001; Nosek & Banaji, 2001; Teachman, 2006). Reliability was calculated using odd/even experimental trials. Difference scores between desirable and undesirable reactions times were calculated. Positive scores indicated greater associations with desirable evaluations. Reliability was demonstrated with health related GNAT at baseline three months and six months with interclass correlations ranging from .77 -.89 for desirable and .61 -.76 for undesirable. Similarity for appearance/body shape associations, reliability was demonstrated for baseline, three months, and six months with interclass correlations ranging from .87 -.90 for desirable and from .76 -.79 for undesirable evaluations.

**Explicit Motives.** Exercise motives were measured using the Exercise Motivations Inventory -2 (EMI-2; Markland & Ingledew, 1997). Only the Appearance (e.g., “to have a good body”), Weight management (e.g., “to burn calories”) and Positive Health (e.g., “to be healthy”) scales were used in the current analysis. Each scale consists of two items and is scored on a 5-point Likert scale ranging from 0 (not at all true for me) to 5 (very true for me). Reliability was demonstrated with Spearman-Brown coefficients ranging from .79 -. 86.

**Self-Efficacy.** Participants completed the Multi-Dimensional Self-Efficacy for Exercise Scale which possesses reasonable psychometric properties (Rodgers et al., 2008). The MSES assesses three dimensions of exercise SE: 1) task SE (3 items, e.g., complete exercise using proper technique”); 2) coping SE (3 items; e.g., exercise when you lack energy”), and scheduling SE (3 items; e.g., “arrange your schedule to include regular exercise”). Participants respond on a 100% confidence scale ranging from 0 (no
confidence) to 100 (complete confidence). The MSES demonstrated adequate reliability in the present study with Cronbach alphas ranging from .60 - .82.

**Procedures**

All procedures were approved by a University health ethics review board. Participants completed the two GNAT tasks and questionnaires in a single data collection session as part a separate study. At the end of the data collection session participants were invited to join a free year long exercise program. Participants who enrolled in the exercise program completed baseline testing, which included a predicted 1 repetition maximum strength test, a submaximal predictive VO2 treadmill walking test, a body composition DEXA scan, as well as anthropometric measurements. Following the baseline fitness assessment, participants were randomized into either the weight-training group or aerobic training group. Randomization was done by a third party using a random number generator with the exercise group sealed in a number envelope. Participants came into a private lab to exercise three times per week. Both exercise groups completed aerobic and strength training, however, there was a 3:1 ratio of exercise depending on which group they were randomized into. For example, the strength group completed three days of strength training, followed by one day of aerobic training, whereas the aerobic group completed three days of aerobic training and one day of strength training. This training cycle was maintained for the duration of the study. Following an introductory two weeks, the intensity and duration was increased. The progressive exercise program started at low intensity (50-55% of HHR for aerobic and 50-60% of predicted 1 RM) and increased at regular intervals throughout the study (see Table 2). Assessments, including
the GNATs, the EMI-2, the predicted 1rep maximum strength test and aerobic tests
where completed at three months. The same assessments where completed at six months
with the addition of a body composition DEXA scan.

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**Resistance Prescription**

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**Aerobic Prescription**

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Results

A total of 141 participants aged between 35-65 (\(M_{age} = 49.97\), \(SD = 8.447\)) completed six months of the exercise program. The majority of participants were Caucasian (67.53%), had high school or college education (51.45%), an average
household income above $75,000 (61.2%) and were overweight with a mean BMI of 29.65 ($SD = 6.12$). Assessment of exercise modality revealed no differences between groups on all demographic variables ($p > .05$). Demographic information by group is presented in Table 2. Changes in implicit automatic associations, explicit motives and SE from exercise initiation through six months of exercise behaviour were examined. Means and standard deviations for these variables are presented in Table 3.

**Implicit associations.** Automatic associations were assessed with a 2 (Exercise Group: aerobic training, weight training) x 3 (Time: baseline, 3 months, 6 months) Repeated Measure (RM) ANOVA. Subtracting undesirable from desirable reaction times for appearance/body shape and health associations produced difference scores. The differences scores were used as the dependent variables. Means and SD are presented in Table 3.

**Appearance/body shape associations.** No significant changes were found over time for implicit associations for appearance/body shape ($F_{(2, 139)} = .870, p = .421, \eta^2 = .012$, Figure 1). The main effect for exercise group also was not significant ($F_{(1, 90)} = .142, p = .007, \eta^2 = .002$). Additionally, there was no significant interaction between group and time for appearance/body associations ($F_{(2, 139)} = .870, p = .421, \eta^2 = .012$).

**Health associations.** No significant changes over time were found for implicit associations with exercise for health ($F_{(2, 139)} = .870, p = .421, \eta^2 = .012$, Figure 2), and the main effect for exercise group was not significant ($F_{(1, 98)} = .338, p = .562, \eta^2 = .003$). Additionally, there was no significant interaction between group and time for implicit health associations ($F_{(2, 139)} = .756, p = .532, \eta^2 = .011$).
Figure 1. The change in overall implicit automatic associations with exercise and appearance/body shape. As well as, change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

Figure 2. The change in overall implicit automatic associations with exercise and health. As well as, change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

**Explicit Motives.** Change in explicit motives was tested with 2 (Exercise Group: aerobic training, weight training) x 3 (Time: baseline, 3 months, 6 months) RM ANOVAs with appearance, weight management, and positive health as dependent variables. Means and SD are presented in table 3.
**Appearance Motives.** For appearance motives, there was a significant change over time ($F(2,138) = 3.093, p = .049, \eta^2 = .043$, Figure 3) but no main effect for exercise group ($F(1,139) = 666, p = .416, \eta^2 = .005$). No change in appearance motives occurred from baseline to three months ($F(1,139) = 2.827, p = .095, \eta^2 = .020$). However, there was a significant decrease in appearance motives from three months to six months ($F(1,139) = 5.684, p = .018, \eta^2 = .039, d = .403$). The change from baseline to six months ($F(1,139) = .859, p = .356, \eta^2 = .006$) was not significant. Additionally, there was a significant interaction between exercise group and time for appearance motives ($F(2,138) = 3.149, p = .046, \eta^2 = .044$). For the group by time interaction there was a significant decrease in appearance motives between baseline and six months ($F(1,139) = 5.631, p = .019, \eta^2 = .039, d = .403$). This decrease in appearance motives was larger for those in the strength group than in the aerobic group. There was no difference in the change in appearance motives across exercise groups between baseline and three months ($F(1,139) = 3.220, p = .075, \eta^2 = .023$) or between three and six months ($F(1,139) = .762, p = .403, \eta^2 = .006$).

![Figure 3](image-url) **Figure 3.** The change in overall explicit appearance motives and change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.
**Weight Management Motives.** There were no significant differences for weight management motives over time \((F(2, 139) = .870, p = .421, \eta^2 = .012, \text{ Figure 4})\), no main effect for exercise group \((F(1, 140) = 2.678, p = .104, \eta^2 = .019)\), and no significant interaction between group and time \((F(2, 139) = .226, p = .764, \eta^2 = .004)\).

![Change Over Time for Explicit Weight Management Motives](image)

**Figure 4.** The change in overall explicit weight management motives and change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

**Positive Health Motives.** A significant change over time occurred for positive health motives \((F(2, 136) = 33.081, p < .001, \eta^2 = .327, \text{ Figure 5})\). There was no significant change between baseline and three months \((F(1, 137) = .786, p = .337, \eta^2 = .006, d = .155)\). However there was a significant decrease from baseline to six months as well as three months to six months of exercise \((F(1, 137) = .65.960, p < .001, \eta^2 = .325, d = .965)\). Additionally, there was a significant decrease in positive health motives between baseline and six months \((F(1, 137) = 45.943, p < .001, \eta^2 = .251, d = .943)\). There was no main effect for exercise group \((F(1, 137) = .803, p = .372, \eta^2 = .006)\), and no interaction between group and time for positive health motives \((F(2, 136) = 1.652, p = .195, \eta^2 = .024)\).
Figure 5. The change in overall explicit positive health motives and change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

**Self-efficacy.** Changes in SE were also examined with 2 (Exercise Group: aerobic training, weight training) x 3 (Time: baseline, 3 months, 6 months) RM ANOVAs with task, coping and scheduling SE as dependent variables. Means and standard errors for SE are displayed in Table 3.

**Task SE.** A significant main effect for time occurred for task SE ($F_{(2,137)} = 29.364$, $p < .001$, $\eta^2 = .300$, Figure 6). From baseline to 3 months task SE significantly increased ($F_{(1,138)} = 58.773$, $p < .001$, $\eta^2 = .200$, $d = .812$). From three months to six months there was a significant decrease in task SE ($F_{(1,138)} = 6.334$, $p = .013$, $\eta^2 = .040$, $d = .408$). Although task SE decreased in the second half of the exercise program, task SE at six months was significantly greater than at baseline ($F_{(1,138)} = 29.364$, $p < .001$, $\eta^2 = .300$, $d = .924$). There was no main effect for exercise group ($F_{(1,138)} = 1.570$, $p = .212$, $\eta^2 = .011$) and no interaction between group and time for task SE ($F_{(1,138)} = 39.068$, $p = 000$, $\eta^2 = .221$).
Figure 6. The change in overall task SE and change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

Coping SE. A significant change over time occurred for coping SE ($F_{(2, 139)} = 26.201, p < .001, \eta^2 = .274$, Figure 7). Coping SE significantly increased from baseline to three months ($F_{(1, 140)} = 52.155, p < .001, \eta^2 = .271, d = .956$), followed by a slight non-significant decrease between three and six months ($F_{(1, 140)} = 2.886, p = .092, \eta^2 = .020$). Coping SE was significantly higher at six months compared to baseline ($F_{(1, 140)} = 37.228, p < .001, \eta^2 = .210, d = .912$). There was no main effect for exercise group ($F_{(1, 140)} = .008, p = .930, \eta^2 = .000$) and no interaction between group and time for coping SE ($F_{(2, 139)} = .186, p = .851, \eta^2 = .003$).
Figure 7. The change in overall coping SE and change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

Scheduling SE. A significant change over time occurred for scheduling SE ($F_{(2,139)} = 10.980, p < .001, \eta^2 = .136$, Figure 8). Following a similar pattern as coping SE, scheduling SE increased from baseline to three months ($F_{(1,140)} = 21.881, p < .001, \eta^2 = .135, d = .790$), with a slight non-significant decrease in scheduling SE from three months to six months ($F_{(1,140)} = 2.063, p = .153, \eta^2 = .015, d = .247$). Scheduling SE was significantly greater after six months of exercise compared to baseline ($F_{(1,140)} = 11.863, p < .001, \eta^2 = .078, d = .582$). There was no main effect for exercise group ($F_{(1,140)} = .104, p = .747, \eta^2 = .001$) and no exercise group by time interaction ($F_{(2,139)} = .003, p = .987, \eta^2 = .136$).

Figure 8. The change in overall scheduling SE and change by exercise group (aerobic and resistance) across baseline, three months and six months of exercise.

Discussion

The purpose of this study was to assess how explicit exercise motives, implicit automatic associations with exercise and SE change over the course of an exercise
program across two exercise modalities, aerobic training and weight training. In terms of implicit automatic associations with exercise it was hypothesized that with exercise experience implicit automatic associations for exercise and health would increase. This hypothesis was not supported. Implicit automatic associations for exercise and health or appearance/body did not change with continued exercise participation. From an APE model perspective, the experience of exercise either reflected previously held associations, therefore this association strengthened and did not change, or the different pattern of activation was not activated frequently enough to result in a change of implicit association. Additionally, given the contextual dependence of implicit associations (Lowe & Norman, 2013), completing baseline assessments of implicit associations with exercise within a private exercise facility, may have elicited particular patterns of activation. Engaging in exercise behaviour in the same context may have resulted in the same pattern of activation, serving to strengthen the initial implicit association. Assessing implicit automatic associations with exercise in a neutral context may have resulted in a different pattern of activation, which may have resulted in a change in implicit associations after repeated exercise experience. With respect to explicit exercise motives it was expected that appearance and weight management motives would decrease and that health motives would increase with repeated exercise behaviour, especially in the weight-training group. However, this hypothesis was only partially supported. Appearance motives did indeed decrease from baseline to six months of exercise behaviour. This decrease was larger for the weight-training group. However, no change in weight management motives occurred over time. Although positive health motives we expected
<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Three Months</th>
<th>Six Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aerobic Training</td>
<td>Strength Training</td>
<td>Aerobic Training</td>
</tr>
<tr>
<td>Task SE</td>
<td>77.11 (19.74)</td>
<td>82.27 (13.32)</td>
<td>90.88 (6.91)</td>
</tr>
<tr>
<td>Coping SE</td>
<td>56.26 (23.05)</td>
<td>57.56 (21.40)</td>
<td>71.33 (16.87)</td>
</tr>
<tr>
<td>Scheduling SE</td>
<td>62.29 (23.29)</td>
<td>63.27 (21.67)</td>
<td>62.77 (22.45)</td>
</tr>
<tr>
<td>Explicit Motives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>4.00 (.85)</td>
<td>4.09 (.88)</td>
<td>4.22 (.86)</td>
</tr>
<tr>
<td>Weight Management</td>
<td>4.18 (.90)</td>
<td>3.96 (1.13)</td>
<td>4.27 (.95)</td>
</tr>
<tr>
<td>Positive Health</td>
<td>4.61 (.51)</td>
<td>4.63 (.52)</td>
<td>4.65 (.445)</td>
</tr>
<tr>
<td>Implicit automatic associations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance/body shape</td>
<td>56.41 (47.75)</td>
<td>42.52 (51.13)</td>
<td>43.66 (44.39)</td>
</tr>
<tr>
<td>Health</td>
<td>60.11 (47.03)</td>
<td>60.51 (50.48)</td>
<td>67.05 (48.24)</td>
</tr>
</tbody>
</table>
to increase over the course of the exercise program, this was not the case, as the results indicated a decrease in positive health motives from three months to six months. The lack of change in positive health motives in the present study may be due to near ceiling scores for the majority of participants at most time points. People exercise for multiple reasons, and potentially other exercise motives may be more likely to change with continued exercise participation. For instance previous research found that enjoyment, revitalization (Ingledew et al., 1998), fitness, health and skill development motives (Gillison, Standage, & Skevington, 2006; Sebire, Standage, & Vansteenkiste, 2008) were related for maintenance of physical activity. Furthermore, participant preferences for type of exercise may impact ongoing exercise motives. For instance, those who get their first choice of exercise type (e.g., aerobic training) have greater adherence, more positive affect and lower perceived exertion (Parfitt & Gledhill, 2004). Given that participants did not have a choice to participate in their preferred exercise modalities (aerobic or weight training), this lack of choice may have impacted how their exercise motives changed.

The present research compliments other research in supporting the important of assessing SE over time (Rodgers et al., 2009). It was expected that task, coping and scheduling SE would increase from baseline to three months and then decrease or remain stable from three to six months. It was also expected that SE, particularly task SE would increase more for the weight-training group. This hypothesis was partially supported. For task SE, there was a significant increase from baseline to three months, and a significant decrease from three months to six months though it remained above baseline levels.
However, there was no difference between exercise modality and changes in task SE. This finding is similar to that of Rodgers and colleagues (2009). Given the progressive nature of the exercise program, it is possible that after three months participants did not have enough time to establish task SE at each incremental stage. For coping and scheduling SE, both increased from baseline to three months and then remained stable till six months. Again, this is consistent with previous research that found the same pattern in exercise SE (Rodgers et al., 2009).

The longitudinal design of this study, and the inclusion of both explicit and implicit automatic associations based on the APE model are certainly strengths of this study. A potential limitation is the narrow assessment of explicit exercise motives. Appearance, weight management and positive health motives are only a few of the possible reasons why people exercise. This narrow approach was taken in order to match explicit and implicit automatic associations, and measuring further automatic associations would have been difficult. However, future research may want to include a wider range of exercise motives, such as enjoyment, revitalization and social affiliation. Another limitation, which is certainly a consideration for future research, is the context in which the initial data collection session occurred. Implicit automatic associations are influenced by contextual inputs (Lowe & Norman, 2013); as such the initial implicit associations may have been influenced by completing the task in a testing room within a private exercise lab. Contextual influences on implicit automatic associations with exercise and the effect on exercise behaviour is an avenue for future research.
In conclusion, a distinct contribution of the present study was not only to incorporate both implicit automatic associations with exercise and explicit motives, but also to assess how they change over time with exercise experience. This adds to the extant literature by providing insight into how exercise experience influences explicit and implicit associations in previously sedentary adults. The limited influence of exercise behaviour to change implicit automatic associations in the current research serves to highlight important considerations when assessing implicit automatic associations within exercise interventions, such as the influence of contextual cues. Potentially, implicit associations with exercise outcome goals may not be impacted by exercise experiences, whereas, implicit affective responses may be impacted to a greater extent. This contention is certainly in line with the APE model, which highlights the affective component inherent in implicit automatic associations (Gawronski & Bodenhausen, 2006). Repeated exercise experience may influence affective responses, which in turn may elicit changes in implicit automatic associations with exercise. This is an important avenue of future research.
References


doi:10.1348/014466601164939


SUMMARY, STRENGTHS AND IMPLICATIONS, FUTURE DIRECTIONS AND FINAL THOUGHTS

The purpose of this dissertation was to assess the influence of self-efficacy (SE), explicit exercise motives, and implicit automatic associations with exercise across multiple phases of exercise behaviour. Specifically, the manuscripts included in this dissertation assess the influence of the above-mentioned variables on exercise intentions, the fulfillment of positive exercise intentions, and adherence to an exercise program over six months. Furthermore, how SE, explicit motives and implicit associations change with repeated engagement in exercise behaviour was examined.

Manuscript 1 aimed to examine how SE, motives and implicit associations influenced exercise intentions, by assessing their influence on people’s decisions whether or not to sign up for an exercise program. Additionally, self-selection bias was examined from enrolment in the program to exercise maintenance over six months. Those who self-selected had higher task, coping and scheduling SE than those who did not enrol in the exercise program. Those who self-selected had higher positive health motives than those who did not enrol. Maintenance of exercise behaviour at three months and six months was not associated with SE, implicit automatic associations, or explicit motives. The results indicated that exercise intentions, measured as enrolling in an exercise program, is influenced by self-selection bias across SE beliefs and explicit health motives; however, the effects of self-selection bias do not persist beyond enrolling in an exercise program. These findings prompted further evaluation of these variables in the progression of exercise behaviour adoption.
Manuscript 2 investigated if SE beliefs, explicit motives and implicit automatic associations are related to the intention-behaviour gap. This relationship was examined three ways: 1) examining how the variables differentiate inclined actors from abstainers; 2) assessing if the variables predict whether one becomes an inclined actor or an abstainer, and 3) if the interaction between SE and motives (both explicit and implicit automatic associations) influences whether one becomes an inclined actor. Inclined actors and inclined abstainers were not differentiated by SE beliefs, explicit motives or implicit automatic associations with exercise. Coping SE was the only significant predictor of people becoming inclined actors. Additionally, explicit weight management motives and appearance motives moderated the relationship between both SE beliefs and becoming an inclined actor. That is, having low to moderate levels of weight management motives strengthened the relationship between coping SE and becoming an inclined actor. Additionally, low levels of appearance motives strengthened the relationship between coping, scheduling, and task SE and becoming an inclined actor.

The purpose of Manuscript 3 was to examine how SE, explicit exercise motives and implicit automatic associations with exercise change with engagement in exercise behaviour over six months. Implicit automatic associations with exercise and appearance/body shape and health did not change between baseline, three months and six months. Explicit positive health motives decreased from baseline to six months, and from three months to six months, however, weight management motives did not change over the six months. Appearance motives decreased from three months to six months, with the decrease stronger for those in the strength-training group than those in the aerobic training group. With respect to SE beliefs, task SE increased from baseline to three months but
decreased again at six months. Coping and scheduling SE increased from baseline to three months, and then remained stable till six months. In sum, these findings support previous literature in regards to changes in SE beliefs, and provides unique findings into how implicit associations and exercise motives change with continued exercise participation.

**Strengths and Implications**

There are several strengths of this dissertation that can be highlighted. First, the research questions and hypothesis were theoretically and conceptually driven. In line with advances in theory and grounded in the APE model, the effects of both implicit automatic associations and explicit motives on exercise intentions, adoption and maintenance were assessed. Additionally, in line with Social Cognitive Theory (SCT; Bandura, 1986), SE beliefs were not assessed independently; in fact, the interaction between SE beliefs and motives was examined. This supports the Bandura’s (1998) contention that multiple components of social cognitive theory should be examined simultaneously. This is important as the interaction between SE and motives influenced the intention behaviour gap differently than each independently. Furthermore, the progressive analysis presented throughout the three manuscripts is a positive strength of this dissertation.

Second, the assessment of influence of self-selection bias on exercise behaviour is another strength. Self-selection bias is a commonly cited limitation and concern for researchers. The present results indicated that self-selection into a study that offers and an exercise program influences both the measured constructs and actual behaviour. Self-selection is associated with higher self-efficacy beliefs and enrolment in an exercise program. Furthermore, the results provided insight into whether self-selection persists after the beginning of the exercise program. Although self-selection bias is present at the
beginning of an exercise program and influences the participant scores on key determinants of exercise, these effects do not persist throughout an exercise intervention. Researchers should still be cognizant of the effects of self-selection bias in their recruitment of participants, but the effects appear to be fleeting with respect to continuing participation in an exercise program.

Viewed from a different perspective, real-world application may also be informed by the self-selection results. It seems possible to draw parallels between previously inactive adults who decide to engage in an exercise program and those who self-select for exercise research studies. Given this, the current findings inform health promotion practitioners as to what may be some of the most important variables (i.e., task, coping and scheduling SE, and positive health motives) to consider at exercise initiation. As such, understanding how exercise is affected by self-selection provides insight into how the exercise adoption process operates outside the research domain.

The results of this dissertation represent several noteworthy contributions to the extant literature. First, there appears to be a certain level of coping and scheduling SE that is required in the formation of exercise intentions and in the successful fulfillment of these intentions, particularly when sufficient incentives are in place. Whereas, previous research proposed that task SE is important at the beginning of exercise, with coping and scheduling SE becoming more prominent as exercise engagement continues (Rodgers et al., 2009; Rodgers et al., 2008), the current findings suggest that although task SE is important, coping and scheduling SE are important much earlier in the exercise adoption process than previously thought. That is, people may be more likely to adopt a new exercise program when they feel efficacious in their ability to deal with barriers to exercise and to routinely
schedule exercise into their daily or weekly lives. The role of coping and scheduling SE in successful fulfillment of exercise intentions provides important and novel information to the literature and informs interventions aimed at increasing exercise behaviour. Perhaps more focus should be given to building exercise into one’s daily, weekly schedules and strategies to cope with barriers prior to the initiation of exercise behaviour.

With respect to the distinction between intentions and action, the present results support previous theorizing (Ajzen & Fishbein, 2000) that exercise motivation is associated with intention formation. However, the current findings indicate that explicit exercise motives, particularly weight management and appearance motives, are important beyond the formation of intentions and influence the fulfillment of exercise intentions. Additionally, the results provide insight into how appearance, weight management, and positive health motives change over six months of exercise behaviour in middle aged adults. Although it was anticipated that positive health motives would increase with exercise behaviour, the results indicated that they actually decreased. This suggests that exercise motives may not necessarily change in response to exercise behaviour as expected, or that other factors (e.g., gains, affect) associated with the exercise experience influence how motives change.

Although implicit automatic associations with exercise and appearance/body shape and health were not significant, the results suggest that the role that implicit automatic associations have on exercise behaviour may be quite complex. It is possible that at the beginning stages of exercise adoption, implicit automatic associations are less salient than explicit exercise motives. Researchers suggest that implicit automatic associations become increasingly important as behaviour becomes more automatic (Dimmock & Banting,
2009). Although initially believed to take six months for people to achieve a maintenance state of exercise behaviour, where exercise is more routine and habitual, it may actually take longer to achieve this state. As such, implicit automatic associations may be more important to the long-term (e.g., a year or more) maintenance of exercise behaviour, once it becomes more habitual.

Additionally, changes in implicit associations are thought to occur over time as exercise experience provides either the strengthening of pre-existing associations in memory, or a change in the associative structure as the exercise experience provides new information resulting in a new implicit associations with exercise (Gawronski & Bodenhausen, 2006, 2011). It is the latter that is thought to be a result of exercise behaviour (Calitri et al., 2009; Lowe & Norman, 2013). Appearance and health related outcomes as a result of exercise behaviour are relatively distal in nature and take time to achieve. As such, it is possible that within the first six months of exercise adoption, changes in appearance and health were not sufficient to produce changes in implicit automatic associations. However, potentially with continued exercise participation beyond six months, motives for exercise may be satisfactorily achieved and result in changes in implicit automatic associations.

**Future Directions and Final Thoughts**

Although the results from this dissertation add unique findings to the literature, the results highlight the need for further research in a number of avenues. First, the results indicated that SE beliefs, in particular coping and scheduling SE are associated with successful of exercise intentions. Sheeran (2002) called for further investigation into the factors that moderate intention behaviour relations. Therefore, assessing whether
interventions that increase SE beliefs result in increased engagement in exercise behaviour from positive intentions would be worthwhile.

Second, although appearance and health related motives are the most commonly reported reasons for exercise, people exercise for multiple reasons. Indeed, preventing poor health, enjoyment, challenge and revitalization are important outcomes of exercise behaviour (Markland & Ingledew, 1997). Therefore, assessing a broader range of exercise motives, beyond or in conjunction with health and appearance motives, may provide further insight into how motives influence exercise intentions and subsequent exercise behaviour. Additionally, the mechanisms, which influence how exercise motives change appears to be worthy of further study. For instance, satisfaction with progress or achievement of participatory motives may influence not only how motives change, but also exercise. Some initial research has found that perceived gains influence motivation and subsequent exercise behaviour. For instance, appearance motives are associated with greater exercise participation when perceived gain is high but not when it is low (Ingledew et al., 2014). Furthermore, assessing more proximal motives may influence exercise behaviour. Indeed, research has indicated that proximal motives are associated with greater exercise participation (Evans, Cooke, Murray & Wilson, 2014).

A third avenue for future research is examining the content of implicit automatic associations with exercise. The current research assessed the motivational contents of implicit associations, however, given the inherent affective nature of implicit automatic associations, assessing implicit associations with affective constructs may provide unique insight into the relationship between implicit associations and the phases of exercise adoption. Affective constructs such as enjoyment and pleasure are related to exercise
behaviour such that positive exercise affect is associated with greater exercise participation (Williams et al., 2008). Therefore, future researchers may want to consider assessing implicit affect associations with exercise, as this may have important implications as to whether people chose to adopt and maintain exercise.

This dissertation provides insight into the effects of self-selection across the process of exercise adoption and maintenance. Additionally, it provides unique findings on how engagement in exercise affects exercise motives, in particular explicit exercise motives. Perhaps more importantly, the results add to the understanding of the factors that influence the intention-behaviour gap in the exercise domain.
Gender: ___________________________
Age: ________
Race: _____________________________

Weight: _______ (kg)
Height: _______ (cm)

Please state your combined family income over the past 12 months:
- less than $5,000
- $5,000 – 11,999
- $12,000 – 15,999
- $16,000 – 24,999
- $25,000 – 34,999
- $35,000 – 49,999
- $50,000 – 74,999
- $75,000 – 99,999
- $100,000+
- Don’t know
- No response

Education:
- High school diploma
- College diploma
- Bachelor’s degree
- Master’s degree
- Doctorate degree
- Professional (MD, LLB etc)
- Other: ______________________________
- None of the above

Occupation: ______________________________

Marital Status:
- Single
- Separated
- Married
- Common Law
- Divorced
- Widowed
- No response

Do you have children? No
☐ Yes ➔ Please indicate ages (separated by comma)

_____________________________________________
APPENDIX B

MULTIDIMENSIONAL SELF-EFFICACY FOR EXERCISE SCALE – STUDIES 1, 2, 3

Please indicate HOW CONFIDENT YOU ARE THAT YOU CAN PERFORM each of the exercise related tasks below. Remember, exercise means being active 30 minutes, 3 days a week at a moderate intensity level.

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No confidence</td>
<td>Complete Confidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How confident are you that you can . . .

- Complete your exercise using proper technique %
- Follow directions to complete your exercise %
- Perform all of the movements required for your exercise %
- Exercise when you feel discomfort from the activity %
- Exercise when you lack energy %
- Include exercise in your daily routine %
- Consistently exercise every day of the week %
- Exercise when you don’t feel well %
- Arrange your schedule to include regular exercise %
APPENDIX C

EXERCISE MOTIVATIONS INVEOTRY – 2 – STUDIES 1, 2, 3

The following is a list of a number of statements concerning the reasons people often give when asked why they exercise. Whether you currently exercise regularly or not, please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement is true for you personally, or would be true personally if you did exercise.

Remember, we want to know why you personally choose to exercise or might choose to exercise, not whether you think the statements are good reasons for anybody to exercise.

<table>
<thead>
<tr>
<th>Personally, I exercise (or might exercise) . . .</th>
<th>Not at all true for me</th>
<th>Very true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To avoid ill-health.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>2. To show my worth to others.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>3. To have a healthy body.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>4. To build up my strength.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>5. Because I enjoy the feeling of exerting myself.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>6. To spend time with friends.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>7. Because I like trying to win in physical activities.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>8. To stay/become more agile.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>9. To give me goals to work towards.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>10. To prevent health problems.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>11. Because I find exercise invigorating.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>12. To have a good body.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>13. Because it helps to reduce tension.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>14. To increase my endurance.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>15. To enjoy the social aspects of exercising.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>16. To help prevent an illness that runs in my family.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>17. To give me personal challenges to face.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>18. To help control my weight.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>19. To recharge my batteries.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>20. To improve my appearance.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>21. To gain recognition for my accomplishments.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>22. To help manage stress.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>23. To feel more healthy.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>24. For enjoyment of the experience of exercising.</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>25. To help recover from an illness/injury</td>
<td>0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>26. Because I enjoy physical competition.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>27. To stay/become flexible.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>28. Because exercise helps me to burn calories.</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
APPENDIX D

IMPLICIT AUTOMATIC ASSOCIATION CATEGORIES AND WORDS

Desirable and Undesirable words for Health and Appearance / Body Shape Associations,

<table>
<thead>
<tr>
<th>Health</th>
<th>Appearance / Body Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desirable</td>
<td>Undesirable</td>
</tr>
<tr>
<td>Healthy</td>
<td>Unhealthy</td>
</tr>
<tr>
<td>Good mood</td>
<td>Bad mood</td>
</tr>
<tr>
<td>Relaxed</td>
<td>Stressed</td>
</tr>
<tr>
<td>Fit</td>
<td>Unfit</td>
</tr>
<tr>
<td>Strong</td>
<td>Weak</td>
</tr>
<tr>
<td>Fun</td>
<td>Boring</td>
</tr>
<tr>
<td>Energetic</td>
<td>Tired</td>
</tr>
<tr>
<td>Health</td>
<td>Desirable</td>
</tr>
<tr>
<td>Healthy</td>
<td>Attractive</td>
</tr>
<tr>
<td>Good mood</td>
<td>Look good</td>
</tr>
<tr>
<td>Relaxed</td>
<td>Lose weight</td>
</tr>
<tr>
<td>Fit</td>
<td>Thin</td>
</tr>
<tr>
<td>Strong</td>
<td>Win</td>
</tr>
<tr>
<td>Fun</td>
<td>Popular</td>
</tr>
<tr>
<td>Energetic</td>
<td>Toned</td>
</tr>
<tr>
<td>Health</td>
<td>Undesirable</td>
</tr>
<tr>
<td>Healthy</td>
<td>Unattractive</td>
</tr>
<tr>
<td>Good mood</td>
<td>Look bad</td>
</tr>
<tr>
<td>Relaxed</td>
<td>Gain weight</td>
</tr>
<tr>
<td>Fit</td>
<td>Fat</td>
</tr>
<tr>
<td>Strong</td>
<td>Lose</td>
</tr>
<tr>
<td>Fun</td>
<td>Unpopular</td>
</tr>
<tr>
<td>Energetic</td>
<td>Flabby</td>
</tr>
</tbody>
</table>

Target / Distractor Category words

<table>
<thead>
<tr>
<th>Target Category</th>
<th>Distraction Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>Generic</td>
</tr>
<tr>
<td>Exertion</td>
<td>Retailer</td>
</tr>
<tr>
<td>Workout</td>
<td>Flannel</td>
</tr>
<tr>
<td>Run</td>
<td>Ink</td>
</tr>
<tr>
<td>Active</td>
<td>Carpet</td>
</tr>
<tr>
<td>Gym</td>
<td>Mug</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Bookshelf</td>
</tr>
<tr>
<td>Sports</td>
<td>Rental</td>
</tr>
</tbody>
</table>
APPENDIX E

STUDY 2 – PROTOCOLS AND EXERCISE PROGRAMS

Participants sign up for study two and attend an Information session
- given information sheet
- complete PAR-Q
- scheduled for Baseline assessment

Baseline

Baseline assessment – fitness test and DEXA

Randomize to exercise program

3 months of fitness program (up to 3 times per week)

3 month assessment – GNATs, questionnaires, fitness test

3 months of fitness program (up to 3 times per week)

6 month assessment – GNATs, questionnaires, fitness test, DEXA

3 months of fitness program (up to 4 times per week)

9 month assessment – GNATs, questionnaires

3 months of fitness program (up to 4 times per week)

12 month assessment – GNATs, questionnaires, fitness test, DEXA

Study Completion
## Resistance Program (3-resistance/ 1- Aerobic)

<table>
<thead>
<tr>
<th>Resistant Training Phases</th>
<th>0-2 weeks Lead-in Training</th>
<th>3-12 weeks (i.e. end of 3 mo.)</th>
<th>4-6 Months</th>
<th>7-9 Months</th>
<th>10 – 12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency (sessions per 4 weeks)</strong></td>
<td>3 d/wk during wk1 2 d/wk during week 2</td>
<td>3 d/wk-week 1 &amp; 2 d/wk weeks 2,3&amp;4 ea. mo. (9session/mo)</td>
<td>3 d/wk-week 1 &amp; 2 d/wk weeks 2,3&amp;4 ea. mo. (9session/mo)</td>
<td>3 d/wk-week 1 &amp; 2 d/wk weeks 2,3&amp;4 ea. mo. (9session/mo)</td>
<td>3 d/wk-week 1 &amp; 2 d/wk weeks 2,3&amp;4 ea. mo. (9session/mo)</td>
</tr>
<tr>
<td><strong>Duration (min)</strong></td>
<td>~20-25 min</td>
<td>~30-35 min</td>
<td>~40-45 min</td>
<td>~45-50 min</td>
<td>~50-55 min</td>
</tr>
<tr>
<td><strong>Intensity (% of p1RM)</strong></td>
<td>50-60%</td>
<td>55-65%</td>
<td>60-70%</td>
<td>65-75%</td>
<td>65-80%</td>
</tr>
<tr>
<td><strong>Number of Sets</strong></td>
<td>2</td>
<td>2-3</td>
<td>2-3</td>
<td>3</td>
<td>3-4</td>
</tr>
<tr>
<td><strong>Number of Reps</strong></td>
<td>10-12</td>
<td>8-12</td>
<td>8-12</td>
<td>6-12</td>
<td>6-10</td>
</tr>
<tr>
<td><strong>Rest between sets</strong></td>
<td>2 min</td>
<td>2 min</td>
<td>2 min</td>
<td>2 min</td>
<td>2 min</td>
</tr>
<tr>
<td><strong>Number of Exercises</strong></td>
<td>2 upper body + 2 lower body exercises</td>
<td>3 upper body + 2 lower body exercises</td>
<td>3 upper body + 3 lower body exercises</td>
<td>3 upper body + 3 lower body exercises</td>
<td>3 upper body + 3 lower body exercises</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>+Aerobic Training Phases</th>
<th>1 d/wk during week 2</th>
<th>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</th>
<th>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</th>
<th>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</th>
<th>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration (min)</strong></td>
<td>20-25 min</td>
<td>30-35 min</td>
<td>40-45 min</td>
<td>45-50 min</td>
<td>50-55 min</td>
</tr>
<tr>
<td><strong>Intensity (% HRR)</strong></td>
<td>50-55</td>
<td>55-60</td>
<td>60-65</td>
<td>65-70</td>
<td>70-75</td>
</tr>
<tr>
<td><strong>Ratio of the Frequency of Resistance to Aerobic Training Sessions</strong></td>
<td>3:1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total duration per week</strong></td>
<td>~60-75 min</td>
<td>90-105 min</td>
<td>120-135 min</td>
<td>135-150 min</td>
<td>150-165 min</td>
</tr>
</tbody>
</table>
## Aerobic Program (3-Aerobic / 1 –resistance)

<table>
<thead>
<tr>
<th>Aerobic</th>
<th>0-2 weeks Lead-in Training</th>
<th>3-12 weeks (i.e. end of 3 mo.)</th>
<th>4-6 Months</th>
<th>7-9 Months</th>
<th>10 – 12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (session per 4 weeks)</td>
<td>3 d/wk during wk 1 2 d/wk during week 2</td>
<td>3 d/wk-week 1 &amp; 2 d/wk weeks 2,3&amp;4 ea. mo. (9session/mo)</td>
<td>3 d/wk-week 1 &amp; 2 d/wk weeks 2,3&amp;4 ea. mo. (9session/mo)</td>
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<td>Duration (min)</td>
<td>20-25 min</td>
<td>30-35 min</td>
<td>40-45 min</td>
<td>45-50 min</td>
<td>50-55 min</td>
</tr>
<tr>
<td>Intensity (%HRR)</td>
<td>50-55</td>
<td>55-60</td>
<td>60-65</td>
<td>65-70</td>
<td>70-75</td>
</tr>
<tr>
<td>Frequency (d/wk)</td>
<td>1 d/wk during week 2</td>
<td>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</td>
<td>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</td>
<td>1 d/wk-weeks 2,3&amp;4 ea. mo. (3sessions/mo)</td>
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</tr>
<tr>
<td>Duration (min)</td>
<td>20-25 min</td>
<td>30-35 min</td>
<td>40-45 min</td>
<td>45-50 min</td>
<td>50-55 min</td>
</tr>
<tr>
<td>Intensity (% 1RM)</td>
<td>50-60%</td>
<td>55-65%</td>
<td>60-70%</td>
<td>65-75%</td>
<td>65-80%</td>
</tr>
<tr>
<td>Number of Sets</td>
<td>2</td>
<td>2-3</td>
<td>2-3</td>
<td>3</td>
<td>3-4</td>
</tr>
<tr>
<td>Number of Sets</td>
<td>10-12</td>
<td>8-12</td>
<td>8-12</td>
<td>6-12</td>
<td>6-10</td>
</tr>
<tr>
<td>Rest between sets</td>
<td>2 min</td>
<td>2 min</td>
<td>2 min</td>
<td>2 min</td>
<td>2 min</td>
</tr>
<tr>
<td>Number of Exercises</td>
<td>2 upper body + 2 lower body exercises</td>
<td>3 upper body + 2 lower body exercises</td>
<td>3 upper body + 3 lower body exercises</td>
<td>3 upper body + 3 lower body exercises</td>
<td>3 upper body + 3 lower body exercises</td>
</tr>
<tr>
<td>Ratio of the Frequency of Aerobic to Resistance Training Sessions</td>
<td>3:1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total duration per week*</td>
<td>~60-75 min</td>
<td>90-105 min</td>
<td>120-135 min</td>
<td>135-150 min</td>
<td>150-165 min</td>
</tr>
</tbody>
</table>
APPENDIX F

LETTER OF INFORMATION – STUDY 1

Letter of Information

Study Title: Health and psychological outcomes of physical activity

You are invited to participate in a research study if you are a healthy male or female between the ages of 35 to 65 and do not currently engage in exercise. The purpose of this project is to examine people’s views about health and psychological outcomes of participating in exercise. You will be asked to complete 2 computer tasks and a questionnaire package. The total time it will take for you to participate is about 1 hour. You will receive a $20 gift card for Loblaws as compensation for your participation.

The purpose of this letter is to provide you with the information you require to make an informed decision on participating in this research. This letter contains information to help you decide whether or not to participate in this research study. It is important for you to know why the study is being conducted and what it will involve. Please take the time to read this carefully and feel free to ask questions if anything is unclear or there are words you do not understand.

There are no known risks to participating in today’s tasks, although you may feel a little frustrated at times because the computer tasks are very fast. You may also experience some emotional distress as we are asking about your personal thoughts about exercise – which may be very sensitive. The researchers aim to restrict this potential distress by securing your responses with no personal identifiers and want to ensure you are able to withdraw from the study at any time without consequence. The benefit to you might be just helping us out and hopefully helping design future interventions to encourage people to do more exercise. The results of this study will be used to develop future studies and exercise interventions, and will be used in research papers and presentations. When you are finished the computer tasks and the questionnaire package you will be asked if you are interested in learning about a second study we are conducting.

All the information you provide to the researcher will be kept in the strictest confidence. You will be assigned an identification number and all data collected from you will be recorded and stored under this number only. All data will be stored in coded form on computers accessible only to research staff in a secure office. You will not be identified in any documents relating to the research. No information obtained during the study will be discussed with anyone outside of the research team. If the results of the study are published, your name will not be used.
Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your academic or employment status. If you decide to take part, you will be given this Letter of Information to keep and completion of the computer tasks and questionnaire package will signify your consent for this research study. If you withdraw from the study, you maintain the right to request that any data collected from you not be used in the study. If you make such a request, all of the data collected from you will be destroyed.

If you have any questions about your rights as a research participant or the conduct of the study you may contact the Office of Research Ethics (Phone: 519-661-3036; Email: ethics@uwo.ca).
Consent Form

Title of Project:  
*Health and psychological outcomes of physical activity*

I have read the Letter of Information, had the nature of the study explained to me, and I agree to participate. All questions have been answered to my satisfaction. I will be given a copy of the Letter of Information and consent form once it has been signed.

Please send me the overall conclusions from this trial:  Yes [ ] No [ ]

Consenting Signature:

Participant: ____________________________________________________
Please Print Name

Participant: ____________________________________________________
Please Sign Name

Date: ______________________

Researcher Signature:

Person obtaining informed consent: __________________________________
Please Print Name

Person obtaining informed consent: __________________________________
Please Sign Name

Date: ______________________
Letter of Information

Study Title: Health and psychological outcomes of physical activity (Part 2)

You are being invited to participate in a research study. The purpose of this project is to examine people's experiences of health and psychological outcomes of participating in exercise. If you agree, you will participate in a 12 month cardiovascular and strength training program. There is no cost for participating in the exercise program. The program involves exercising in our private exercise lab (Exercise and Health Psychology Lab, Room 408, Arthur and Sonia Labatt Health Sciences Building; Laboratory for Brain and Heart Health, Room 402, Arthur and Sonia Labatt Health Sciences Building) three times for twelve months. Our exercise site will be recruiting 150 participants which will add to the 300 total participants recruited (with the University of Alberta).

If you agree to participate in the fitness program, you will complete 5 testing sessions in addition to the exercise program. The schedule for these sessions and the tests you will do at each are outlined in the table.

<table>
<thead>
<tr>
<th>Testing session</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (before you start the fitness program)</td>
<td>Fitness test and DEXA scan (assesses body composition)</td>
</tr>
<tr>
<td>3 months</td>
<td>Computer tasks, questionnaires, fitness test</td>
</tr>
<tr>
<td>6 months</td>
<td>Computer tasks, questionnaires, fitness test, DEXA scan</td>
</tr>
<tr>
<td>9 months</td>
<td>Computers tasks, questionnaires</td>
</tr>
<tr>
<td>One year</td>
<td>Computer tasks, questionnaires, fitness test, DEXA scan</td>
</tr>
</tbody>
</table>

Each testing session after today will take between 45 and 90 minutes. They will all be conducted here in the exercise facility in a private room. Each time you will receive a $20 gift card for Loblaws (and affiliate) as compensation for your participation. At the end of the year-long study, you will be provided with your personal fitness and health information. You will not be provided with any study results until the end.

If you are eligible and agree to participate in the study, your participation would involve the following activities:

1. **Questionnaires**: You will be asked to respond to a variety of questionnaires at each of the 5 assessments. They will ask you about your intentions to exercise, your
motivation to exercise, and your expectations of exercise. Completion of the questionnaires should take approximately 15 minutes. There is a small possibility that a question could make you feel uncomfortable. You may skip questions you prefer not to answer.

2. **Computer Tasks:** The computer tasks are a measure of peoples’ attitudes and are the same as those you completed in Study 1. You will be asked to complete the computer tasks at each of the 5 assessments. You categorize words that belong to a target category by hitting the space bar (go). If a word does not belong to a group that is supposed to be categorized, the space bar is not pressed (no go). The total time it will take for you to complete the tasks is about 30 minutes.

3. **Fitness Testing:** You will undergo a fitness test at the beginning of the exercise program and again at 3 months, 6 months, and 12 months. Prior to the first fitness test you will be required to complete a health assessment questionnaire that helps determine whether exercise is safe for you. If any questions on the health assessment questionnaire suggest exercise might be a risk for you, you will be asked to seek approval from your physician to engage in the exercise program, at your own expense. If it is determined that exercise is safe for you, you will begin the test by standing still on a treadmill until a resting heart rate can be obtained (approximately 2 minutes). Once a resting heart rate has been established you will begin walking on the treadmill. The speed and the incline of the treadmill will be increased every two minutes and your heart rate will be monitored throughout the test. The test will continue until you reach a heart rate indicating you have reached the peak exercise tolerance for your age and sex. The test usually takes approximately 15 minutes to complete. A certified, trained kinesiologist will determine if the test should be terminated earlier if you are not able to conform to the exercise test protocol, or experience any signs of excessive discomfort. The test will also be terminated by your request if you feel you cannot continue for any reason. Fitness test results will not be provided but will be used to create your fitness program.

4. **Body Composition:** You will have a body composition (DEXA) examination at the beginning of the exercise program and again after 6 and 12 months. You will lie on a padded table. An x-ray generator will be located below you and an imaging device, or detector, will be positioned above. You must lie still while the scan is taken. The procedure takes between 7 and 13 minutes and is completely painless. To prepare for the procedure, you should simply wear loose, comfortable clothing, avoiding garments that have zippers, belts or buttons made of metal. The amount of radiation used is extremely small. The effective radiation dose from this procedure is about the same as the average person receives from background radiation in one day. No radiation will remain in your body after a scan and there are usually no side effects. No complications are expected with the DEXA procedure. The DEXA results will be provided to you only at the end of the study for all 3 scans.
5. **Fitness Program:** The fitness program involves exercising in our private lab three times per week for about 60 minutes each time for the entire program. Each participant will be randomly assigned to one of two exercise programs: either a cardiovascular training program with some strength training (3:1 ratio) or strength training with some cardiovascular training (3:1 ratio). Participants will be assigned to a particular training program at random, that being you will have a 1 in 2 chance of being placed in either the cardiovascular (with some strength) or strength (with some cardiovascular) training program. All sessions will be supervised.

**Benefits of participation:**
You may experience some of the benefits associated with increased physical exercise including cardiovascular health benefits, and improved fitness. You may experience other benefits. We are interested in the benefits you might experience over the course of this exercise program and will be assessing these during the study.

**Risks of participation:**
There are a few risks of participating in this research. Some risk is associated with the adoption of physical activity. It is possible that some people may suffer from discomforts associated with physical exercise including muscle soreness, muscle or joint injury, heat exhaustion/stroke, increased heart rate, dizziness, cardiovascular risks and in very rare instances heart attack. If any soreness or discomfort persists more than five days, or might be associated with a muscle or joint injury, you should see a physician.

We will manage your risk by having only certified exercise testers and monitors (according to the Canadian Society for Exercise Physiology (CSEP) guidelines). You will be screened prior to exercise with an approved (CSEP) instrument the "Physical Activity Readiness Questionnaire - Plus" (PAR-Q+). This instrument identifies people who should see a physician before beginning exercise. All exercise sessions will be monitored and you will be taught correct technique for performing all the exercises.

Should you become pregnant during the study, the fetus may be exposed to small doses of radiation during the DXA assessments. To eliminate this risk, the trained technician will always ask you, prior to each and every DXA scan, whether you are pregnant or whether there is any chance at all you may be pregnant. Any woman who is unsure or believes she may be pregnant will not be scanned until a doctor’s note confirms that she is not pregnant. As with all measures, you will have the option of foregoing the test if not completely comfortable, and may continue to be a part of the study.

Lastly, if any abnormalities are detected during the DXA scan, you will be provided with your personal data and be advised to contact your physician to seek certified medical advice.

**Confidentiality information:**
All the information you provide to the researcher will be kept in the strictest confidence. Upon enrolment in the study, you will be assigned an identification number (such as 001, 002, 003) which will be recorded on data collection material to ensure no personal contact information is linked to your responses. All electronic data will be kept on a password-protected computer, and only the researchers involved will have access. A master list (with your personal information) will be kept separately from all of your data/responses on a
separate, password-protected computer file. The electronic data obtained in this study will be sent to our co-investigators at the University of Alberta. At time of transfer, no personal information about participants will be enclosed. All paper copies of completed questionnaires will remain on-site at Western University.

No information obtained during the study will be discussed with anyone outside of the research team. If the results of the study are published, your name will not be used. Data will be shredded and disposed of after a period of six years.

**Voluntary participation:**
Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your academic or employment status. Should you decide to discontinue, if you are willing to tell us, we appreciate knowing why people choose to end their participation.

We understand that there is a significant time commitment to the study, but this is necessary for the successful completion of the research. This kind of research is important in the discovery of better ways to help people be healthy. We, the researchers, will be working very hard to support all the participants throughout this time period.

If you decide to take part, you will be given this Letter of Information to keep and complete a signed consent form (attached below). If you withdraw from the study, you maintain the right to request that any data collected from you not be used in the study. If you make such a request, all of the data collected from you will be destroyed.

If you have any questions about your rights as a research participant or the conduct of the study you may contact the Office of Research Ethics (Phone: 519-661-3036; Email: ethics@uwo.ca).
Title of Project:  *Health and psychological outcomes of physical activity (Part 2)*

I have read the Letter of Information, had the nature of the study explained to me, and I agree to participate. All questions have been answered to my satisfaction. I will be given a copy of the Letter of Information and consent form once it has been signed.

Please send me the overall conclusions from this trial:   Yes [ ]   No [ ]
APPENDIX H

PARQ + AND PARMED-X

PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

Regular physical activity is fun and healthy, and more people should become more physically active every day of the week. Being more physically active is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

GENERAL HEALTH QUESTIONS

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.

1) Has your doctor ever said that you have a heart condition OR high blood pressure?
   YES  NO
   □    □

2) Do you feel pain in your chest at rest, during your daily activities of living, OR when you do physical activity?
   YES  NO
   □    □

3) Do you lose balance because of dizziness OR have you lost consciousness in the last 12 months?
   Please answer NO if your dizziness was associated with over-breathing (including during vigorous exercise).
   YES  NO
   □    □

4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)?
   YES  NO
   □    □

5) Are you currently taking prescribed medications for a chronic medical condition?
   YES  NO
   □    □

6) Do you have a bone or joint problem that could be made worse by becoming more physically active?
   Please answer NO if you had a joint problem in the past, but it does not limit your current ability to be physically active. For example, knee, ankle, shoulder or other.
   YES  NO
   □    □

7) Has your doctor ever said that you should only do medically supervised physical activity?
   YES  NO
   □    □

If you answered NO to all of the questions above, you are cleared for physical activity. Go to Page 4 to sign the PARTICIPANT DECLARATION. You do not need to complete Pages 2 and 3.

- Start becoming much more physically active - start slowly and build up gradually.
- Follow Canada’s Physical Activity Guidelines for your age (www.csep.ca/guidelines).
- You may take part in a health and fitness appraisal.
- If you have any further questions, contact a qualified exercise professional such as a Canadian Society for Exercise Physiology - Certified Exercise Physiologist® (CSEP-CEP) or a CSEP Certified Personal Trainer® (CSEP-CPT).
- If you are over the age of 45 yr and NOT accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional (CSEP-CEP) before engaging this intensity of activity.

If you answered YES to one or more of the questions above, GO TO PAGES 2 AND 3.
Delay becoming more active if:
- You are not feeling well because of a temporary illness such as a cold or fever - wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X before becoming more physically active.
- Your health changes - answer the questions on Pages 2 and 3 of this document and/or talk to your doctor or qualified exercise professional (CSEP-CEP or CSEP-CPT) before continuing with any physical activity program.
# FOLLOW-UP FOR MEDICAL CONDITIONS

1. **Do you have Arthritis, Osteoporosis, or Back Problems?**
   - If the above condition[s] is/are present, answer questions 1a-1c
     - **YES**
     - **NO**
   - **GO TO question 2**

   1a. **Do you have difficulty controlling your condition with medications or other physician-prescribed therapies?**
     - **Answer NO if you are not currently taking medications or other treatments**
     - **YES**
     - **NO**

   1b. **Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/or spondyloysis/pars defect (a crack in the bony ring on the back of the spinal column)?**
     - **YES**
     - **NO**

   1c. **Have you had steroid injections or taken steroid tablets regularly for more than 3 months?**
     - **YES**
     - **NO**

2. **Do you have Cancer of any kind?**
   - If the above condition[s] is/are present, answer questions 2a-2b
     - **GO TO question 3**

   2a. **Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and neck?**
     - **YES**
     - **NO**

   2b. **Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)?**
     - **YES**
     - **NO**

3. **Do you have Heart Disease or Cardiovascular Disease? This includes Coronary Artery Disease, High Blood Pressure, Heart Failure, Diagnosed Abnormality of Heart Rhythm**
   - If the above condition[s] is/are present, answer questions 3a-3e
     - **GO TO question 4**

   3a. **Do you have difficulty controlling your condition with medications or other physician-prescribed therapies?**
     - **Answer NO if you are not currently taking medications or other treatments**
     - **YES**
     - **NO**

   3b. **Do you have an irregular heart beat that requires medical management?**
     - **e.g., atrial fibrillation, premature ventricular contraction**
     - **YES**
     - **NO**

   3c. **Do you have chronic heart failure?**
     - **YES**
     - **NO**

   3d. **Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication?**
     - **Answer YES if you do not know your resting blood pressure**
     - **YES**
     - **NO**

   3e. **Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?**
     - **YES**
     - **NO**

4. **Do you have any Metabolic Conditions? This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes**
   - If the above condition[s] is/are present, answer questions 4a-4c
     - **GO TO question 5**

   4a. **Is your blood sugar often above 13.0 mmol/L? (Answer YES if you are not sure)**
     - **YES**
     - **NO**

   4b. **Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, and the sensation in your toes and feet?**
     - **YES**
     - **NO**

   4c. **Do you have other metabolic conditions (such as thyroid disorders, pregnancy-related diabetes, chronic kidney disease, liver problems)?**
     - **YES**
     - **NO**

5. **Do you have any Mental Health Problems or Learning Difficulties? This includes Alzheimer’s, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome**
   - If the above condition[s] is/are present, answer questions 5a-5b
     - **GO TO question 6**

   5a. **Do you have difficulty controlling your condition with medications or other physician-prescribed therapies?**
     - **Answer NO if you are not currently taking medications or other treatments**
     - **YES**
     - **NO**

   5b. **Do you also have back problems affecting nerves or muscles?**
     - **YES**
     - **NO**
6. Do you have a Respiratory Disease? This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure
   If the above condition(s) is/are present, answer questions 6a-6d
   If NO, go to question 7
   6a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies?
       (Answer NO if you are not currently taking medications or other treatments)
       YES ☐ NO ☐
   6b. Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?
       YES ☐ NO ☐
   6c. If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last 6 months?
       YES ☐ NO ☐
   6d. Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?
       YES ☐ NO ☐

7. Do you have a Spinal Cord Injury? This includes Tetraplegia and Paraplegia
   If the above condition(s) is/are present, answer questions 7a-7c
   If NO, go to question 8
   7a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies?
       (Answer NO if you are not currently taking medications or other treatments)
       YES ☐ NO ☐
   7b. Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?
       YES ☐ NO ☐
   7c. Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?
       YES ☐ NO ☐

8. Have you had a Stroke? This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event
   If the above condition(s) is/are present, answer questions 8a-8c
   If NO, go to question 9
   8a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies?
       (Answer NO if you are not currently taking medications or other treatments)
       YES ☐ NO ☐
   8b. Do you have any impairment in walking or mobility?
       YES ☐ NO ☐
   8c. Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?
       YES ☐ NO ☐

9. Do you have any other medical condition not listed above or do you have two or more medical conditions?
   If you have other medical conditions, answer questions 9a-9c
   If NO, read the Page 4 recommendations
   9a. Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months OR have you had a diagnosed concussion within the last 12 months?
       YES ☐ NO ☐
   9b. Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?
       YES ☐ NO ☐
   9c. Do you currently live with two or more medical conditions?
       YES ☐ NO ☐

GO to Page 4 for recommendations about your current medical condition(s) and sign the PARTICIPANT DECLARATION.
If you answered NO to all of the follow-up questions about your medical condition, you are ready to become more physically active - sign the PARTICIPANT DECLARATION below:

- It is advised that you consult a qualified exercise professional (e.g., a CSEP-CEP or CSEP-CPT) to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually - 20-60 min of low to moderate intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate intensity physical activity per week.
- If you are over the age of 43 yr and NOT accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional (CSEP-CEP) before engaging this intensity of activity.

If you answered YES to one or more of the follow-up questions about your medical condition:

- You should seek further information before becoming more physically active or engaging in a fitness appraisal. You should complete the specially designed online screening and exercise recommendations program - the ePARmed-X+ at www.eparmedx.com and/or visit a qualified exercise professional (CSEP-CEP) to work through the ePARmed-X+ and for further information.

Delay becoming more active if:

- You are not feeling well because of a temporary illness such as a cold or fever - wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ before becoming more physically active.
- Your health changes - talk to your doctor or qualified exercise professional (CSEP-CEP) before continuing with any physical activity program.

You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.

The PAR-Q+ Collaboration, the Canadian Society for Exercise Physiology, and their agents assume no liability for persons who undertake physical activity. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.

PARTICIPANT DECLARATION

Please read and sign the declaration below:

If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that a Trustee (such as my employer, community/fitness centre, health care provider, or other designate) may retain a copy of this form for their records. In these instances, the Trustee will be required to adhere to local, national, and international guidelines regarding the storage of personal health information ensuring that they maintain the privacy of the information and do not misuse or wrongfully disclose such information.
The PARmed-X is a physical activity-specific checklist to be used by physicians with patients who have had positive responses to the Physical Activity Readiness Questionnaire (PAR-Q). In addition, the conveyance/referral form in the PARmed-X can be used to convey clearance for physical activity participation, or to make a referral to a medically-supervised exercise program.

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. The PAR-Q by itself provided adequate screening for the majority of people. However, some individuals may require a medical evaluation and specific advice (exercise prescription) due to one or more positive responses to the PAR-Q.

Following the participant's evaluation by a physician, a physical activity plan should be devised in consultation with a physical activity professional (CSEP Certified Exercise Physiologist). To assist in this, the following instructions are provided:

**PAGE 1:** Sections A, B, C, and D should be completed by the participant BEFORE the examination by the physician. The bottom section is to be completed by the examining physician.

**PAGES 2 & 3:** A checklist of medical conditions requiring special consideration and management.

**PAGE 4:** Physical Activity & Lifestyle Advice for people who do not require specific instructions or prescribed exercise.

Physical Activity Readiness Conveyance/Referral Form - an optional tear-off tab for the physician to convey clearance for physical activity participation, or to make a referral to a medically-supervised exercise program.

---

**A ** PERSONAL INFORMATION:

NAME ____________________________

ADDRESS ____________________________

TELEPHONE ____________________________

BIRTHDATE ___________________ GENDER ________

MEDICAL No. ____________________________

---

**B ** PAR-Q: Please indicate the PAR-Q questions to which you answered YES

- Q 1: Heart condition
- Q 2: Chest pain during activity
- Q 3: Chest pain at rest
- Q 4: Loss of balance, dizziness
- Q 5: Bone or joint problem
- Q 6: Blood pressure or heart drugs
- Q 7: Other reason:

---

**C ** RISK FACTORS FOR CARDIOVASCULAR DISEASE:

- Check all that apply
- Less than 30 minutes of moderate physical activity most days of the week.
- Currently smoker (tobacco smoking 1 or more times per week).
- High blood pressure reported by physician after repeated measurements.
- High cholesterol level reported by physician.

Please note: Many of these risk factors are modifiable. Please refer to page 4 and discuss with your physician.

---

**D ** PHYSICAL ACTIVITY INTENTIONS:

What physical activity do you intend to do?

---

**This section to be completed by the examining physician**

**Physical Exam:**

<table>
<thead>
<tr>
<th>Ht</th>
<th>Wt</th>
<th>BP ( )</th>
<th>/</th>
</tr>
</thead>
</table>

---

**Physical Activity Readiness conveyance/Referral:**

Based upon a current review of health status, I recommend:

- No physical activity
- Only a medically-supervised exercise program until further medical clearance
- Progressive physical activity:
  - with avoidance of:
  - with inclusion of:
- Under the supervision of a CSEP Certified Exercise Physiologist
- Unrestricted physical activity—start slowly and build up gradually

---

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Supplied by: Health Canada  Santé Canada
PARmed-X

**PHYSICAL ACTIVITY READINESS MEDICAL EXAMINATION**

Following is a checklist of medical conditions for which a degree of precaution and/or special advice should be considered for those who answered "YES" to one or more questions on the PAR-Q, and people over the age of 69. Conditions are grouped by system. Three categories of precautions are provided. Comments under Advice are general, since details and alternatives require clinical judgment in each individual instance.

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
<th>Relative contraindications</th>
<th>Special prescriptive conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent restriction or temporary restriction until condition is resolved, subside, and/or pass acute phase.</td>
<td>Highly variable. Value of exercise testing and/or program may exceed risk. Activity may be restricted. Direct or indirect medical supervision of exercise program may be desirable.</td>
<td>Individualized prescriptive advice generally exempt:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Limited time imposed; and/or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Special exercise prescribed. May require medical monitoring and/or initial supervision in exercise program.</td>
</tr>
</tbody>
</table>

**Cardiovascular**
- Arterial aneurysm (dissecting)
- Aortic aneurysm (aneurysmal)
- Congestive heart failure
- Hypertrophic cardiomyopathy
- Myocardial infarction (acute)
- Mitral valve prolapse
- Pulmonary or systemic embolism—acute
- Aortic stenosis
- Other arterial aneurysms (e.g., multiple vascular or ventricular activity)

**Infections**
- Acute infectious disease (regardless of etiology)
- Subacute or chronic recurrent infectious disease (e.g., melitus, others)
- Chronic infections
- HIV

**Metabolic**
- Uncontrolled metabolic disorders (diabetes melitus, thyrotoxicosis, myxedema)
- Renal, hepatic, or other metabolic insufficiency
- Obesity
- Diabetes mellitus
- Nephritis

**Pregnancy**
- Complicated pregnancy (e.g., toxemia, hemorrhage, incompetent cervix, etc.)
- Advanced pregnancy (last trimester)
- Refer to the PARmed-X for PREGNANCY.

**ADVICE**
- Clinical exercise test may be warranted in selected cases, for specific determination of functional capacity and limitations on exercise (if any).
- Slow progression of exercise to levels based on test performance and individual tolerance.
- Consider individual need for initial conditioning program under medical supervision (induced or direct).

**References:**
<table>
<thead>
<tr>
<th>Special prescriptive conditions</th>
<th>ADVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td></td>
</tr>
<tr>
<td>Chronic pulmonary disorders</td>
<td>Special relaxation and breathing exercises.</td>
</tr>
<tr>
<td>Obstructive lung disease</td>
<td>Breath control during endurance exercises to tolerance; avoid polluted air.</td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
</tr>
<tr>
<td>Exercise-induced bronchospasm</td>
<td>Avoid hyperventilation during exercise; avoid extremely cold conditions; warm up adequately; use appropriate medication.</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td></td>
</tr>
<tr>
<td>Low back conditions (pathological, functional)</td>
<td>Avoid or minimize exercises that precipitate or exacerbate e.g., forced extreme flexion, extension, and sudden twisting, correct posture, proper back exercises.</td>
</tr>
<tr>
<td>Arthritis—acute (infective, rheumatic, gout)</td>
<td>Treatment, plus judicious blend of rest, splinting and gentle movement.</td>
</tr>
<tr>
<td>Arthritis—subacute</td>
<td>Progressive increase of active exercise therapy.</td>
</tr>
<tr>
<td>Arthritis—chronic (arthritis and above conditions)</td>
<td>Maintenance of mobility and strength; non-weight-bearing exercises to minimize joint trauma (e.g., cycling, aqua aerobics, etc.).</td>
</tr>
<tr>
<td>Orthopedic</td>
<td></td>
</tr>
<tr>
<td>Hernia</td>
<td>Minimize straining and twisting; strengthen abdominal muscles.</td>
</tr>
<tr>
<td>Osteoporosis or low bone density</td>
<td>Avoid exercises with high fall for fracture such as push-ups, curl-ups, weight lifting and trunk forward. Engage in low-impact weight-bearing activities and resistance training.</td>
</tr>
<tr>
<td>CNS</td>
<td></td>
</tr>
<tr>
<td>Concussion disorder not completely controlled by medication</td>
<td>Minimize or avoid exercises in hazardous environments and/or exercising alone (e.g., swimming, snowshoeing, etc.).</td>
</tr>
<tr>
<td>Recent concussion</td>
<td>Thorough examination if history of two concussions; review for discontinuation of contact upon if three concussions, depending on duration of unconsciousness, retrograde amnesia, persistent headaches, and other objective evidence of cerebral damage.</td>
</tr>
<tr>
<td>Blood</td>
<td></td>
</tr>
<tr>
<td>Anemia—severe (&lt; 10 G/dL)</td>
<td>Control preferred; exercise as tolerated.</td>
</tr>
<tr>
<td>Electrolyte disturbances</td>
<td></td>
</tr>
<tr>
<td>Medications</td>
<td></td>
</tr>
<tr>
<td>Antihypertensive</td>
<td></td>
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<tr>
<td>Antithrombotic</td>
<td></td>
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<tr>
<td>Antidepressive</td>
<td></td>
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<tr>
<td>Anticonvulsants</td>
<td></td>
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<tr>
<td>Beta-blockers</td>
<td></td>
</tr>
<tr>
<td>Diuretics</td>
<td></td>
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<tr>
<td>Gastrointestinal blockers</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Post-exercise syncope</td>
<td>Moderate program.</td>
</tr>
<tr>
<td>Heat intolerance</td>
<td>Policing cool-down with light activities; avoid exercise in extreme heat.</td>
</tr>
<tr>
<td>Temporary minor illness</td>
<td>Postponed until recovered.</td>
</tr>
<tr>
<td>Cancer</td>
<td>If potential metastases, use by cycle ergometry, consider non-weight-bearing exercises; exercise at lower end of prescriptive range (40-65% of heart rate reserve), depending on condition and recent treatment (radiation, chemotherapy); monitor hematocrit and lymphocyte count; add dynamic lifting exercises to strengthen muscles, using machines rather than weights.</td>
</tr>
</tbody>
</table>

*Refer to special publications for elaboration as required*

The following companion forms are available online: [www.cseep.ca/publications](http://www.cseep.ca/publications)

The Physical Activity Readiness Questionnaire (PAR-Q) - a questionnaire for people aged 15-69 to complete before becoming much more physically active. Please return the completed form to the participant or their physical activity professional.

The Physical Activity Readiness Medical Examination for Pregnancy (PAR-Med for PREGNANCY) - to be used by physicians with program patients who wish to become more physically active. Please return the completed form to the participant or their physical activity professional.

For more information, please contact the Canadian Society for Exercise Physiology, 370-10 Louise Street, Ottawa, Ontario K1R 6Y5, Tel. 1-877-651-3788 - Online: [www.cseep.ca](http://www.cseep.ca)

**Nota to physical activity professionals:**

It is a prudent practice to train the completed Physical Activity Readiness Questionnaire/Referral Form in the participant's file.

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Supported by: Health Canada, Sama Canada

Continued on page 4...
# APPENDIX I

## RESEARCH ETHICS BOARD APPROVAL NOTICES

**Use of Human Participants - Ethics Approval Notice**

Principal Investigator: Dr. Craig Hall  
File Number: 103403  
Review Level: Full Board  
Approved Local Adult Participants: 250  
Approved Local Minor Participants: 0  
Protocol Title: Outcome expectations and their relationship to exercise  
Department & Institution: Health Sciences/Kinesiology, Western University  
Sponsor:  
Ethics Approval Date: February 22, 2013 Expiry Date: June 30, 2017

### Documents Reviewed & Approved & Documents Received for Information:

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Comments</th>
<th>Version Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western University Protocol</td>
<td></td>
<td>2013/01/09</td>
</tr>
<tr>
<td>Board Recommendations</td>
<td>Response to REB items #10 and #11 - reference to current protocol submission (#103283 - SECONDARY STUDY)</td>
<td>2013/02/14</td>
</tr>
<tr>
<td>Letter of Information &amp; Consent</td>
<td>Revised letter of information with written consent</td>
<td>2013/02/14</td>
</tr>
<tr>
<td>Instruments</td>
<td>Recommendation #14 - Please see attached instruments used in the study.</td>
<td>2013/02/14</td>
</tr>
<tr>
<td>Recruitment Items</td>
<td>Mass Email Recruitment with REB Recommendations</td>
<td>2013/02/14</td>
</tr>
<tr>
<td>Recruitment Items</td>
<td>Revised Recruitment Poster with REB recommendations</td>
<td>2013/02/14</td>
</tr>
</tbody>
</table>

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above named research study on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussions related to, nor vote on, such studies when they are presented to the NMREB.

The Chair of the NMREB is Dr. Riley Hinson. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000541.
Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Craig Hall
File Number: 103263
Review Level: Full Board
Approved Local Adult Participants: 150
Approved Local Minor Participants: 0
Protocol Title: You can't always get what you want: A self-determination based examination of the differences between implicit and explicit outcome expectations and their influence on exercise adherence
Department & Institution: Health Sciences/Kinesiology, Western University
Sponsor:
Ethics Approval Date: March 13, 2013
Ethics Expiry Date: June 30, 2017

Documents Reviewed & Approved & Documents Received for Information:

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<th>Comments</th>
<th>Version Date</th>
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<tr>
<td>Other</td>
<td>Training Programs - Received for information</td>
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</tr>
<tr>
<td>Other</td>
<td>PARQ</td>
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<tr>
<td>Recruitment Items</td>
<td>Information Session Outline Recruitment</td>
<td>2013/01/14</td>
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<td>Recruitment Items</td>
<td>Mass email for recruitment</td>
<td>2013/01/14</td>
</tr>
<tr>
<td>Recruitment Items</td>
<td>Recruitment Poster</td>
<td>2013/01/14</td>
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<tr>
<td>Western University Protocol</td>
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<td></td>
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<td>Other</td>
<td>Computer Task Examples</td>
<td>2013/02/15</td>
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<td>Instruments</td>
<td>Pre-screen questionnaire for participation</td>
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<td></td>
<td>(prior to questionnaire package)</td>
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<tr>
<td>Instruments</td>
<td>Updated Questionnaire Package</td>
<td>2013/02/14</td>
</tr>
<tr>
<td>Letter of Information &amp; Consent</td>
<td>Revised Information Session PowerPoint</td>
<td>2013/02/14</td>
</tr>
<tr>
<td>Other</td>
<td>REB Recommendation response letter</td>
<td></td>
</tr>
</tbody>
</table>

This is to notify you that the University of Western Ontario Health Sciences Research Ethics Board (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/KCH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this HSREB also complies with the membership requirements for REBs as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the University of Western Ontario Updated Approval Request form.

Member of the HSREB that are named as investigators in research studies, or declare a conflict of interest, do not participate in discussions related to, nor vote on, such studies when they are presented to the HSREB.

The Chair of the HSREB is Dr. Joseph Gilbert. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000000.
CURRICULUM VITAE

Alison Divine

EDUCATION

2012 – Present  
**PhD (Candidate) in Psychological Bases of physical Activity and Movement Control**  
Western University, London, ON

2012  
**Masters Human Kinetics in Sport and Exercise Psychology**  
University of Windsor, Windsor, ON  
Thesis: “Examining the Relationship between Team Cohesion and Self-presentation in Sport”

2010  
**Bachelor of Kinesiology**  
Minor: Psychology  
University of British Columbia, Vancouver, BC

2009  
**Diploma in Exercise Science**  
Capilano University, North Vancouver, BC

AWARDS

2013 – 2016  
Social Sciences and Humanities research Council – Joseph-Armand Bombardiers CGS Doctoral Scholarship  
Value: $105,000

2012-2013  
Ontario Graduate Scholarship  
Value: $15,000

2011-2012  
Social Sciences and Humanities Research Council- Joseph-Armand Bombardiers Master’s Scholarship  
Value: $17,500

2010-2012  
Tuition Scholarship – University of Windsor  
Value: $12,822

2008  
Presidents Entrance Scholarship – University of British Columbia  
Value: $1000

PUBLICATIONS


**CONFERENCE PRESENTATIONS**


**Divine, A.,** & Munroe-Chandler, K. J. (2012). The relationship between appearance self-
schema and self-determined exercise motivation. *Journal of Sport & Exercise Psychology*, 34, S221.


### TEACHING EXPERIENCE

2016  Co – Instructor, *Psychological Interventions in Sport, Exercise and Injury Rehabilitation*

2011  Graduate Teaching Assistant, *Mental Skills Training*

2011  Graduate Teaching Assistance, *Health and Wellness*

2010  Graduate Teaching Assistance, *Mental Skills Training*

### SCHOLARLY ACTIVITIES

**Research Activities**

2016  Presentation judge for Kinesiology graduate student symposium

2012 – 2016  Research Co-ordinator, CIHR funded research Exercise Intervention to change attitudes and outcome expectations towards exercise

2015  Co-reviewer, *Psychology & Health*

2012  Research Assistant, SSHRC funded research Imagery Interventions within elementary physical education

2010  Course Design, *Exercise and Fitness Psychology*
University of Windsor

2009 Research Assistant, Sport Psychology Lab., University of British Columbia

RELATED EXPERIENCE

2013 Mental Performance Consultant, and Assistant Coach Southwest Soccer Club, Girls U-15

2012-2013 Mental Performance Consultant, Tri-city Roller Derby Teams, Kitchener, ON.

2010-2012 Mental Performance Consultant, Varsity Women’ Soccer Team, University of Windsor

MEMBERSHIPS

Canadian Society for Psychomotor Learning and Sport Psychology

North American Society for the Psychology of Sport and Physical Activity