SELF-EFFICACY THEORY AND THE SELF-REGULATION OF EXERCISE BEHAVIOUR

By

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AUTHOR'S DECLARATION FOR ELECTRONIC SUBMISSION OF A THESIS

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions as accepted by my examiners.

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Abstract

Why are people unable to adhere to an exercise program? Adhering to an exercise program is complex, and exercisers struggle with a variety of challenges that require self-regulation (e.g., making time, learning skills, changing behaviour). Bandura (1995b) has deemed the assessment of self-regulatory efficacy to manage the regular performance of health behaviours (e.g., exercise) essential. Despite this recommendation, few components of self-regulation have been examined in the exercise and self-efficacy research to date (McAuley & Mihalko, 1998). Furthermore, major reviews of the exercise-related self-efficacy literature have demonstrated that task self-efficacy has been the predominant operationalization of the self-efficacy construct, and barriers self-efficacy has been the most prevalent operationalization of self-regulatory efficacy (Culos-Reed, Gyurcsik, & Brawley, 2001; McAuley & Mihalko, 1998). However, self-regulation of behaviour involves more than managing barriers and overcoming their limitations (Barone, Maddux, & Snyder, 1997; Brawley, 2005; DuCharme & Brawley, 1995). In order to examine other aspects of self-regulatory efficacy, self-efficacy theory was used as the underpinning for the three studies in this dissertation (Bandura, 1986, 1997).

In Study One an expanded operationalization of exercise-related self-regulatory efficacy was investigated. The construction of various self-regulatory efficacy indices was informed by self-regulation frameworks (Barone et al., 1997; Baumeister et al., 1994). These indices as well as barriers efficacy were used to prospectively predict self-reported exercise behaviour. The hierarchical multiple regression analysis indicated that the expanded self-regulatory efficacy variables (i.e., scheduling, relapse prevention, goal-

setting self-efficacy) explained a significant amount of variance in exercise behaviour. In addition, barriers efficacy also contributed significant, but modest, variance to the model. These results underscore McAuley and Mihalko's (1998) recommendation that multiple measures of self-efficacy should be used to examine exercise behaviour. The findings also emphasize that a focus solely on barriers as the indicant of self-regulatory efficacy in exercise may be overlooking other aspects of the construct that contribute to prediction.

Study Two extended the descriptive findings of the first study and addressed a recognized research need (Dzewaltowski, 1994; McAuley & Blissmer, 2000; McAuley et al., 2001). Specifically, this study examined the possibility of individual differences (i.e., optimism, consideration of future consequences) influencing the relationship between self-regulatory efficacy and exercise behaviour. Results indicated that participants higher in optimism reported significantly greater self-regulatory efficacy and exercise intentions for intensity than did those lower in optimism. In addition, participants higher in consideration of future consequences (CFC) reported greater self-regulatory efficacy and exercise attendance than participants with moderate CFC. Finally, CFC significantly moderated the influence of various indices self-regulatory efficacy on subsequent exercise attendance. However the effect upon the prospective relationship was modest.

Whereas the first two studies examined the predictive relationship between self-regulatory efficacy and exercise behaviour, Study Three focused upon the influence of sources of self-regulatory efficacy in strengthening efficacy beliefs. This investigation concerned the effects of an acute manipulation of self-efficacy information in changing self-regulatory self-efficacy within a special population -- cardiac rehabilitation exercise

program participants. According to theory, sources of self-efficacy information are common to task and self-regulatory efficacy (Bandura, 1997).

The study used a 2 (message condition) by 2 (time) design in which cardiac rehabilitation program participants were randomly assigned to conditions. Utilizing a written message employing the self-efficacy sources of verbal persuasion and vicarious experiences, self-regulatory efficacy for the scheduling of *independent* exercise was targeted within an "efficacy enhancing" condition. This condition was compared to an "information control" message of other information relevant to cardiac rehabilitation participants. As hypothesized, the efficacy-enhancing condition exhibited increased scheduling self-efficacy compared to the control condition. As well, exercise-related cognitions (i.e., intentions for frequency, action plans, behavioural commitment to learning about independent exercise) were superior for the efficacy-enhancing condition participants compared to their control conditioncounterparts.

Taken together, the studies support and extend research on self-regulatory efficacy in the exercise domain. In part, this was accomplished by expanding the operationalization of exercise-related self-regulatory efficacy to represent more components of self-regulation than examined in the exercise literature to date. In addition, these studies extend previous descriptive research by examining the potential moderators of the influence of self-regulatory efficacy on exercise behaviour. Finally, the third study represented one of the first efforts to experimentally manipulate determinants of self-regulatory efficacy for independent exercise in a special population. It supported the hypothesis that informational determinants (i.e., vicarious experience, verbal

persuasion) can be acutely manipulated to increase self-regulatory efficacy among cardiac rehabilitation participants.

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General Introduction

Why are people unable to adhere to an exercise program? The answer, in part, may be that adherence requires behaviour change, and behaviour change is difficult (Meichenbaum & Turk, 1987). This issue is perhaps best highlighted by Bandura (1995a), who notes that health behaviour change would be trivially easy if there were not so many obstacles to overcome. Adhering to an exercise program is complex, and exercisers struggle with a variety of challenges that require self-regulation (e.g., making time, learning skills, changing behaviour). As such, one answer to the question of nonadherence to exercise implicates the importance of self-regulation – the ability to change oneself and exert control over one's inner processes (Baumeister & Vohs, 2004).

While numerous models have been used to study self-regulation (e.g., Bandura, 1997; Baumeister, Heatherton, & Tice, 1994; Carver & Scheier, 1981; Leventhal, Brissette, & Leventhal, 2003), this diversity of approaches is based on several commonalities focused on the executive function of the self and the capacity for self-reflection (Barone, Maddux, & Snyder, 1997; Leary & Tangney, 2003). Specifically, the compatible elements considered essential to successful self-regulation include goal-setting, self-monitoring, feedback, self-evaluative reactions to performance, and self-efficacy beliefs (Barone et al., 1997; Maddux & Gosselin, 2003).

Interestingly, a number of these common theoretical elements can be captured in social cognitive theory (Bandura, 1986; Bandura, 1995a; Maddux, Brawley, & Boykin, 1995). Social cognitive theory (SCT; Bandura, 1986) assumes that people are goal-directed and capable of forethought, symbolization, self-reflection, self-regulation, and vicarious learning.

Within SCT, self-efficacy expectations play a prominent role (Bandura, 1986, 1997). According to Maddux and Gosselin (2003), one of the most important consequences of the development of self-efficacy beliefs is the development of capacity for self-regulation. Self-efficacy beliefs encourage self-regulation by influencing goal-setting, activity choice, persistence, effort expenditure, and problem-solving.

Task versus Self-regulatory Efficacy

Major reviews of exercise-related self-efficacy have demonstrated that higher self-efficacy is associated with greater exercise participation (Culos-Reed, Gyurcsik, & Brawley, 2001; McAuley & Blissmer, 2000; McAuley & Mihalko, 1998; McAuley, Pena, & Jerome, 2001). Much of the research in this area has focused on task self-efficacy (McAuley & Mihalko, 1998). However, Bandura (1995b) has indicated that self-efficacy judgements are not solely about performing an isolated motor act (i.e., task self-efficacy), but about managing various skills during the performance of complex tasks (i.e., self-regulatory self-efficacy). As such, both Bandura (1995b) and Kirsch (1995) have suggested that for many health behaviours that must be performed regularly (e.g., condom use, smoking cessation, exercise participation), assessing task self-efficacy may have limited utility, but assessing self-regulatory efficacy is essential. Furthermore, Bandura (1995b) admonished "it is time to jettison the trifling conception of human efficacy as isolated motor tasks detached from agentive adaptational events" (p.371).

Operationalization of Self-regulatory Self-efficacy

Despite these recommendations, few components of self-regulation have been examined in the exercise and self-efficacy research. While there are several aforementioned elements common to models of self-regulation (cf. Barone et al., 1997),

barriers self-efficacy has been the predominant operationalization of self-regulatory efficacy to date (Brawley, 2005; McAuley & Mihalko, 1998). Interestingly, according to McAuley and Mihalko (1998), only four percent of reviewed exercise-related self-efficacy research dealt with self-regulatory efficacy beyond barriers (i.e., goal self-efficacy: Poag & McAuley, 1992; scheduling efficacy: DuCharme & Brawley, 1995).

Although exercise barriers self-efficacy continues to be widely utilized to represent self-regulatory efficacy beliefs, research in the last seven years has extended the representation of the construct through the use of other operationalizations (e.g., scheduling self-efficacy: Bray, Gyurcsik, Culos-Reed, Dawson, & Martin, 2001; Dawson & Brawley, 2000; Rodgers, Blanchard, Sullivan, Bell, Wilson, & Gesell, 2002; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002; Rodgers & Sullivan, 2001; Woodgate, Brawley, & Weston, 2005; self-efficacy for coping with acute thoughts: Gyurcsik & Brawley, 2000).

To address the self-regulation of exercise behaviour, the operationalization of self-regulatory efficacy needs to be expanded for three reasons. First, from a theoretical perspective, Bandura (1995b) states that self-regulatory self-efficacy encompasses *many* self-regulatory skills. Accordingly, major reviews of exercise-related self-efficacy have recommended that in order to properly assess the construct, investigators should employ *specificity* in its measurement and utilize *multiple indicators* of self-efficacy (Bandura, 1986; McAuley & Mihalko, 1998; McAuley et al., 2001). Second, exercise adherence is complex (Brawley, Rejeski, & King, 2003) if the multiple skills and challenges associated with the self-regulation of regular exercise participation are considered. Researchers may be under-representing the measurement of self-regulatory self-efficacy by exclusively focusing on barriers efficacy (Brawley, 2005). Finally, it has been suggested that people

use self-regulatory skills in an *integrated* fashion (Meichenbaum & Turk, 1987). For example, in order to manage exercise behaviour successfully, exercisers set goals, schedule exercise sessions, self-monitor progress towards their goals, and engage in problem solving and may overcome unexpected barriers. Thus, for reasons of more accurately representing the construct of self-regulatory efficacy as well as the measurement of its specific and multiple facets, there is a need for an expanded operationalization of self-regulatory efficacy.

Moderator Variables

While previous studies have demonstrated an association between self-regulatory efficacy and exercise behaviour, little is known about moderators of this influence. Indeed, recent reviews have advocated that researchers should determine potential moderators of the self-efficacy and exercise adherence relationship (Culos-Reed et al., 2001; McAuley et al., 2001). Within the exercise-related self-efficacy literature, the examination of moderators has received variable attention. Specifically, demographic moderators have received the most research attention (e.g., gender: McAuley, Courneya, & Lettunich, 1991; McAuley & Courneya, 1993; Rejeski, Brawley, Ambrosius et al., 2003; age: McAuley, Shaffer, & Rudolph, 1995; exercise experience: Bray et al., 2001; Poag-DuCharme & Brawley, 1993) and psychological traits have received the least attention (optimism: Gyurcsik & Brawley, 2001). However, it has been acknowledged that people differ in how well they self-regulate their behaviour (Barone et al., 1997). According to Barone and colleagues (1997), it is part of the current agenda of social cognitive psychology to acquire a better understanding of individual differences in self-regulation. In other words, why are some people better than others at self-regulating exercise? It has been suggested that trait-

like variables may impact self-regulatory cognitions (Barone et al., 1997; Gyurcsik & Brawley, 2001; Strachan, Woodgate, Brawley & Tse, in press). Two trait-like psychological variables that appear to be related to self-regulation are consideration of future consequences (CFC) and optimism.

Consideration of future consequences. One trait posited to be related to self-regulatory abilities is consideration of future consequences (CFC: Barone et al., 1997). CFC refers to the extent that people consider, and are influenced by, the distal outcomes of their behaviour (Strathman, Gleicher, Boninger, & Edwards, 1994). In other words, people may differ in the extent to which they consider the distant benefits of exercise when choosing their current behaviour (e.g., to exercise or watch TV). For example, an individual high in CFC would exercise regularly to improve their health, even if immediate outcomes were undesirable (e.g., muscle soreness, fatigue) or if there were immediate costs to exercising (e.g., cannot watch TV show).

There is evidence for an association between CFC and decision-making and behaviour (Barone et al., 1997). For example, CFC has been related to health and environmental behaviours, such as cigarette use, recycling behaviour, and academic achievement (Petrocelli, 2003). To date, however, the role of CFC in the self-regulation of exercise has not been investigated.

Optimism. An additional trait that may influence the self-regulation of exercise behaviour is optimism. Optimism refers to the general expectation that good things will be plentiful in the future and bad things will be scarce (Scheier & Carver, 1985). While optimism has been related to good health (Carver & Scheier, 2002), it remains unclear "how optimism works" (Aspinwall, Richter, & Hoffman, 2001, p.217). One avenue

through which optimism is posited to influence self-regulation is when individuals evaluate the challenges to achieving their goals. Optimists have generalized expectations about positive outcomes and when confronted with difficulties, they tend to view these challenges as manageable and believe that their goals can be achieved (Scheier & Carver, 1985). Accordingly, it has been suggested that "optimism leads to continued effort to attain the goal, whereas pessimism leads to giving up" (Peterson, 2000, p. 47). Given that optimists believe that desired outcomes are attainable and exert greater effort toward achieving such outcomes, it may be hypothesized that optimists are better at self-regulating exercise behaviour than pessimists. In turn, better self-regulation may result in their greater persistence, expenditure of effort, and stronger self-efficacy beliefs. In the exercise domain, it has been demonstrated that optimism predicted exercise intentions and was differentially related to coping with acute thoughts self-efficacy (Gyurcsik & Brawley, 2001). Regarding exercise *behaviour*, it has been shown that self-reported highly active individuals were more optimistic than lower active individuals (Kavussanu & McAuley, 1995). However, it has also been found that exercise adherers and dropouts did not differ on optimism (Fontaine & Shaw, 1995).

Examining the Sources of Self-regulatory Self-efficacy

Although self-regulatory self-efficacy has received research attention as a determinant of exercise behaviour (e.g., Bray et al., 2001; DuCharme & Brawley, 1995; Rodgers, Hall et al., 2002), it has rarely been examined as an outcome variable (cf. McAuley & Blissmer, 2000; McAuley et al., 2001; Woodgate et al., 2005). Self-efficacy is posited to act as a determinant of exercise behaviour and also as an important outcome of exercise participation (McAuley & Blissmer, 2000). Bandura (1986) has delineated four

major sources of self-efficacy information (i.e., mastery experiences, vicarious experiences, verbal persuasion, emotional arousal), and task self-efficacy has been successfully altered through the manipulation of sources of efficacy-related information in the exercise domain (McAuley et al., 2001). In most cases, manipulations consist of exposure to a bout of activity and if this exercise is a successful mastery experience, task efficacy is enhanced (McAuley & Blissmer, 2000).

Interestingly, little attention has been paid to the systematic manipulation of exercise-related self-regulatory efficacy. Recently, however, a cardiac rehabilitation randomized control clinical trial demonstrated that a group-mediated cognitive behavioural intervention focusing on developing multiple self-regulatory skills led to superior barriers self-efficacy compared to traditional exercise therapy alone (Rejeski et al., 2003). This study reflects one exception to the otherwise minimal attention paid to the systematic manipulation of conditions designed to affect self-regulatory efficacy for actions that facilitate exercise adherence.

Bandura's proposals for human agency (1997) suggest that exercise self-regulatory efficacy can be successfully manipulated. Therefore, it may be hypothesized that a manipulation focusing on Bandura's (1986, 1997) sources of self-efficacy information should enhance self-regulatory efficacy. Furthermore, a commensurate enhancement of different forms of exercise-related behaviour (e.g., improved intentions, action plans) might result as a function of such a manipulation.

Purpose

The general purpose of the following series of studies was to utilize self-efficacy theory and its conceptualization of self-regulatory efficacy to develop a representative

operational definition of that construct. Thus, the development of multiple indices of self-regulatory efficacy informed by frameworks that incorporate self-regulatory concepts (Barone et al., 1997; Baumeister et al., 1994) is consistent with this general purpose. These newly developed indices will be used as a set to examine self-regulatory efficacy and its relationship with exercise behaviour. Consistent with the conceptual view that people self-manage their behaviour by using self-regulatory skills in an integrated fashion, prediction of future exercise behaviour using a set of self-regulatory efficacy indices was deemed appropriate.

Study One expands the current operationalization of self-regulatory efficacy to examine multiple indicators of this construct as predictors of self-reported exercise participation. Study Two extends the descriptive research of Study One by examining the possible influence of trait moderator variables (i.e., CFC, optimism) on the strength of the prospective relationship between self-regulatory efficacy and exercise behaviour. Finally, Study Three addresses the effects of an acute manipulation of sources of self-regulatory efficacy in altering these beliefs within the context of a special population (i.e., cardiac rehabilitation participants).

This series of studies has the potential to provide valuable theoretical and practical information about self-regulatory efficacy for exercise behaviour. These studies may contribute to the advancement of self-efficacy theory in the exercise domain by focusing on the "crucial" concept of self-regulatory efficacy (Maddux, 1995, p.382). Specifically, Bandura's (1995b, 1997) assertion that the concept of self-regulatory self-efficacy encompasses numerous self-regulatory skills is addressed. Accordingly, the studies attempt to expand the operationalization of exercise-related self-regulatory efficacy to both

assess and utilize more components of self-regulation than examined in the exercise literature to date. In addition, these studies may extend previous descriptive research by examining the potential moderators of the influence of self-regulatory efficacy on exercise behaviour. Finally, the third study represents one of the first efforts to experimentally manipulate determinants of self-regulatory efficacy for independently managed exercise.

Study One

Consistent exercise participation is a complex, multi-faceted process that requires multiple behaviours (cf. Brawley & Rodgers, 1993). In fact, it has been advocated that researchers interested in the social psychology of exercise cannot afford to view exercise as a simple behaviour influenced by only one set of social cognitions (DuCharme & Brawley, 1995). Bandura (2004) notes that complex health behaviours, such as exercise, "are not changed by an act of will. It requires motivational and self-regulatory skills" (p.151). As such, successful exercise adherence and behaviour change requires self-regulation (Bandura, 2004; Meichenbaum & Turk, 1987). The key elements considered essential to successful self-regulation include goal-setting, self-monitoring, feedback, self-evaluative reactions to performance, and self-efficacy beliefs (Barone et al., 1997; Maddux & Gosselin, 2003).

Self-regulatory Self-efficacy

One pertinent variable related to the self-regulation of exercise behaviour is self-efficacy (Bandura, 2004). Much of the previous research on self-efficacy in exercise has focused on task efficacy (McAuley & Mihalko, 1998). However, Bandura (1995b) has indicated that self-efficacy judgements are not solely about performing an isolated motor act (i.e., task self-efficacy), but about managing various skills during the performance of complex tasks (i.e., self-regulatory self-efficacy). Echoing Bandura's propositions (1995b, 2004), Maddux (1995) claims that "in most of daily life, in fact, [self-regulatory] self-efficacy is more crucial than task self-efficacy" (p.382).

Despite the importance of self-regulatory efficacy, few components of self-regulation have been examined in the exercise and self-efficacy research. Barriers efficacy

has been the predominant operationalization and most widely recognized type of self-regulatory efficacy in the exercise literature (Brawley, 2005; McAuley & Mihalko, 1998). Conceptually and methodologically, barriers efficacy encompasses confidence to overcome obstacles. To date, however, it has provided little information about what to target for change and how to accomplish this change (i.e., exerciser is confident that they can overcome incidental or unexpected barriers, but *how* do they do this?). Researchers seem to draw the implicit conclusion from the extant relationship-based evidence that if exercisers are efficacious and adherent, they possess the self-regulatory skills to facilitate adherence in the face of barriers. However, the efficacy beliefs about the skills used to offset the limitations posed by real or perceived barriers has not been examined in any systematic way. Specifically, many barriers to exercise are transient and unreliable in occurrence (cf. Mannell & Zuzanek, 1991) or unpredictable and incidental (e.g., weather, no one with whom to exercise). Such characteristics raise the issue of whether people have sufficient exposure to barriers, and by logical extension, subsequent mastery of the barrier to influence efficacy. Also, when self-efficacy belief items do not examine exercisers' skills and actions to adapt and adjust to barriers, do they really reflect self–regulation? Are we simply *assuming* that people are confident in their self-regulatory abilities when they say that they can overcome barriers?

The measurement of barriers in health and exercise is associated with several methodological and conceptual issues (Brawley, Martin, & Gyurcsik, 1998; DuCharme & Brawley, 1995). One common conceptual problem is that reasons, excuses and attributions are frequently measured as opposed to true barriers. In addition, many barriers self-efficacy indexes have the inherent problem of aggregating incidental barriers (e.g., bad

weather, sick) with influential barriers. If exercisers are not aware of barriers or are not exposed to them, then confidence to overcome barriers may not encourage persistence in the face of actual challenges. While efficacy for overcoming barriers is one possible predictor of exercise behaviour, it may not be the *sole* operationalization of a multifaceted self-regulatory efficacy (Brawley, 2005). From a conceptual perspective, Bandura (1995b) suggests that a key feature of self-regulatory self-efficacy involves "selecting and testing strategies, restructuring environments, and many other self-regulatory skills" (p.371). Thus, is it reasonable that the operationalization of self-regulatory self-efficacy in the form of barriers efficacy would be sufficiently encompassing to represent this construct?

As early as a decade ago, DuCharme and Brawley (1995) advocated that measures of exercise-related self-regulatory efficacy "based solely on one dimension (e.g., barrier efficacy), as is the case in many exercise studies … may underrepresent the efficacy concept in this domain" (p.494). In addition, exercise self-efficacy reviews have recommended that future researchers assess a variety of specific efficacy beliefs when predicting the outcome of exercise behaviour (Culos-Reed et al., 2001; McAuley & Mihalko, 1998). This is consistent with the "specificity" notion of self-efficacy theory such that self-efficacy perceptions involve beliefs about specific skills and abilities needed for a given behavioural performance (Bandura, 1986, 1997). For example, for the purposes of adherence to a complex exercise program, it may not be sufficient for exercisers to only have efficacy in their ability to overcome barriers (i.e., barriers efficacy) or skills to overcome these barriers. In order to exercise regularly, individuals may also have to be efficacious in their ability to schedule the exercise session into their day (i.e., scheduling efficacy), strategize to prevent relapses (i.e., relapse prevention self-efficacy) and set and

adapt exercise prescription goals (i.e., goal-setting efficacy) as well as the abilities to master each of these aspects of behavioural self-management.

Over the last seven years, a slowly growing number of studies examining self-efficacy for other components of self-regulation have been examined in the exercise research in addition to barriers efficacy (e.g., scheduling self-efficacy, coping with acute thoughts self-efficacy). While these additional types of self-regulatory efficacy have been associated with exercise behaviour, the examination of multiple types in the same study has been infrequent. Further, they have not been considered as part of the larger whole of self-regulation. It has been recommended that the additional types of self-efficacy beliefs that have been examined more recently should also be assessed in future exercise-related self-efficacy studies (Culos-Reed et al., 2001; McAuley & Mihalko, 1998).

The added scientific value of assessing multiple facets of self-regulatory efficacy in the same study is that it may improve our understanding of both the prediction of exercise adherence (DuCharme & Brawley, 1995; McAuley, Mihalko, & Rosengren, 1997) and how to accomplish its maintenance. Indeed, assessing the efficacy beliefs associated with all abilities important for the performance of exercise in the same study would appear to be beneficial. This practice may account for a greater amount of the variance in exercise behaviour than when only one type of efficacy belief is assessed (Culos-Reed et al., 2001; DuCharme & Brawley, 1995) and may be useful in determining what facilitated behavioural change and maintenance.

Purpose

The general purpose of Study One was to expand the measurement of self-regulatory efficacy in the exercise literature (i.e., beyond barriers). The present study

sought to more thoroughly represent the operationalization of the construct of self-regulatory efficacy. The theoretical backdrop to this operationalization was to consider the key features of self-regulation as informed by frameworks that incorporate self-regulatory concepts (Barone et al., 1997; Baumeister et al., 1994). This expanded measurement and related specificity is consistent with guidelines suggested for the measurement of self-efficacy (Bandura, 1986, 1997). Thus, the specific purpose of the present study was to examine multiple, specific indicators of self-regulatory efficacy as predictors of exercise intentions and behaviour. Consistent with theoretical and measurement criteria for best representing the self-regulatory efficacy construct, the *set* of expanded self-regulatory efficacy measures (i.e., scheduling, goal-setting, relapse prevention) was viewed as best reflecting the efficacy beliefs that would be related to exercise behaviour requiring self-management (i.e., frequency of attendance). It was hypothesized that because this set of measures is more representative of self-regulatory efficacy beliefs, it would significantly predict exercise behaviour. In accordance with this theoretically-driven viewpoint, the self-regulatory efficacy set of variables was advanced a priori as the major predictor.

Method

Participants and Design

The sample consisted of 167 adult volunteers recruited from community-based structured exercise classes. The sample was predominantly female (70%) with a mean age of 32.9 years (*SD* = 9.9, range = 18 - 61 years). On average, participants reported engaging in three strenuous (i.e., heart beats rapidly) exercise bouts during the previous week (*SD* = 2.0). This active sample was selected in order to maximize the possibility that the various

forms of self-regulatory efficacy would be relevant and meaningful. The design was prospective observational.

Measures

The Time One study questionnaire can be found in Appendix A. The Time Two study questionnaire can be found in Appendix B.

Self-regulatory Self-efficacy

Each of the following self-regulatory efficacy measures (i.e., scheduling, barriers, goal-setting, relapse prevention) employed a confidence scale ranging from 0% (*not at all confident*) to 100% (*completely confident*). Item scores for each scale were then summed and averaged to provide an indication of the mean efficacy out of 100%. Lower scores reflected lower self-efficacy. The convention of a Cronbach's alpha of greater than .70 was used as a cutoff value for scale internal consistency in the present study (Nunnally, 1978).

Scheduling self-efficacy. The seven-item measure assessed participants' confidence in their ability to perform various organizational and scheduling tasks that would make exercise participation possible in the weeks ahead (DuCharme & Brawley, 1995; Rodgers et al., 2002; Woodgate et al., 2005). Participants were instructed to consider their confidence to engage in these behaviours over the next four weeks. An example item was, "Plan for the attendance of the exercise session in my daily activities". In previous research, this type of measure has been related to self-reported exercise (Rodgers et al., 2002), exercise attendance (Woodgate et al., 2005) and exercise intentions (DuCharme & Brawley, 1995). The internal consistency for the scale was good, $\alpha = 0.93$ (Nunnally, 1978).

Barriers self-efficacy. This measure was adapted from Garcia and King (1991) and is comparable to other measures typically used in the exercise literature to assess participants' confidence to overcome barriers that arise for exercisers in their pursuit of regular exercise participation (cf. McAuley & Mihalko, 1998). An example item was, "during bad weather". In previous research, the 14-item measure was found to predict 6-month and 1-year adherence to aerobic exercise (Garcia & King, 1991).

Pilot testing. Based on pilot testing with a sample of exercisers representative of participants in the present study (n=14, M age = 26.5 years; 64% female), the original 14-item measure was revised. First, one item that was deemed irrelevant to participants' regular exercise was removed (i.e., "when feeling depressed"). Second, one item that participants found represented relapse prevention efficacy was removed (i.e., "when I have not exercised for a prolonged period of time"). Additional item considerations can be found in Appendix C. The internal consistency for the final 12-item scale in the present study was good $\alpha = 0.92$ (Nunnally, 1978).

Goal-setting self-efficacy. This four-item measure assessed participants' confidence regarding their exercise goal setting ability (cf. Brawley Rejeski, Angove, & Fox, 2003; Dawson & Brawley, 2000). An example item was, "Set realistic goals for increasing and maintaining exercise". The internal consistency for the scale was acceptable $\alpha = 0.84$ (Nunnally, 1978).

Relapse prevention self-efficacy. This measure assessed participants' confidence to deal with lapses in their exercise regimen. The original relapse prevention self-efficacy scale utilized with older adults consisted of five items with adequate internal consistency

($\alpha = 0.92$; Brawley et al., 2003). An example item was, "Identify the key factors that trigger lapses in my exercise program".

Pilot testing. Based on pilot testing with a sample of exercisers representative of participants in the present study (n=14, M age = 26.5 years; 64% female), the original measure was revised to include two additional items. The first additional item added was "Resume regular exercise when it is interrupted and I miss exercise for a few weeks" in order to expand on one of the original items "Resume regular exercise when it is interrupted and I miss exercise for a few days". The second item, "Learn to accept lapses in my exercise program as normal and view them as challenges to overcome rather than failures" was modified because participants perceived this item to reflect two distinct statements. Thus, two items were created, "Learn to accept lapses in my exercise program as normal" and "Learn to view lapses in my exercise program as challenges to overcome rather than failures". The internal consistency for this seven-item scale in the present study was acceptable, $\alpha = 0.88$ (Nunnally, 1978).

Exercise Behaviour

Frequency. At Time One and at the four-week follow-up, participants completed a portion of the Godin Leisure-Time Exercise Questionnaire (GLTEQ) -- a scale that has demonstrated adequate psychometric properties in studies of healthy adults (Godin & Shephard, 1985). Participants indicated how many times they had engaged in strenuous, moderate, and mild exercise for more than 30 minutes over the past seven days. The GLTEQ provides examples of activity captured by each intensity level. However, for the purposes of this study, the main focus was on the strenuous exercise intensity.

Consequently, participants' recall of the frequency of *strenuous* activity was employed in subsequent analyses.

Exercise Intentions

Frequency. Intention was assessed as a behavioural self-prediction (cf. Fishbein & Stasson, 1990) and included measures of both frequency and strength. Participants were asked to forecast the number of times per week they would exercise over the next four weeks (i.e., frequency). The strength of their intention was then assessed using a nine-point scale (1 = "definitely will not"; 9 = "definitely will"). Only intentions for frequency were used in subsequent analyses.

Intensity. In order to gather more information regarding intentions about the management of physical activity, intensity of exercise was also examined. Participants used the Ratings of Perceived Exertion (RPE) scale (Borg, 1998) to estimate on average, how hard they intended to exercise during their exercise sessions over the next four weeks. The RPE scale ranged from 6 - 20, with a rating of six indicating a perception of low effort, while a rating of 20 indicated extreme perceived exertion. This scale represents a valid and reliable measure of perceptual intensity with robust utility (cf. Noble & Noble, 1998).

Procedure

Participants were recruited from structured exercise classes by a trained investigator over a two-week period. The investigator delivered a request for volunteer participation that adhered to university research ethics guidelines for research with human subjects. Participants volunteering for the study did so by providing their e-mail address to the investigator. Interested participants (n=178) were then emailed the link to the secure study website consisting of an informed consent letter and the baseline measures. Receipt of the

study website link did not obligate participants to continue as they could withdraw at any time. Of those emailed, 167 completed the Time One measures (94%). Upon electronic submission of their responses, an electronic feedback letter was provided to the participants. Within the Time One measures, participants indicated whether they were interested in participating in an additional questionnaire regarding their exercise participation in four weeks (yes / no). Of the 167 participants that completed the Time One measures, 155 indicated that they were interested in participating in the additional questionnaire and provided their email address (93%).

Four weeks following the completion of Time One measures, these participants were emailed the link to the secure study website consisting of the four-week follow-up measures. Four of the 155 participants were unable to be contacted (e.g., out of office for extended period). Of the 151 participants emailed, 100 completed the follow-up questionnaire (66%). These 100 participants were used for all subsequent prospective analyses.

Participants completed Time One measures of (a) scheduling self-efficacy, (b) barriers self-efficacy, (c) goal-setting self-efficacy, (d) relapse prevention self-efficacy (e) exercise intentions, (f) self-reported exercise frequency, (g) mode of exercise, and (h) demographics. At the four-week follow-up, participants completed a measure of self-reported exercise frequency.

Results

Data Management

Data management strategies were used to address missing data, the presence of outliers as well as to assess normality. Although these data screening procedures were used in all three studies, to avoid redundancy, they will only be described here.

Missing data. Missing data (<10%) was addressed according to the recommendations of Tabachnick and Fidell (2001). In the present study, there were no instances of entire scales being omitted in participants' responses. However, for participants missing any item(s) on a particular scale, their individual mean for the items on the remainder of the scale was used, thereby capturing the most representative value of the participants' unique responses to that scale.

Outliers. The procedures outlined by Tabachnick and Fidell (2001) were also followed when checking and adjusting for outliers. In the present study, two outliers were identified based on having a standardized Z-score greater than 3.29 (Tabachnick & Fidell, 1996). In both cases, the outliers occurred on the relapse prevention self-efficacy scale. These outliers remained in the data, but steps were taken to minimize their impact. As recommended by Tabachnick and Fidell (2001), the scores were transformed so that they were less deviant (i.e., adjusted to be one unit less than the next most extreme score). All subsequent analyses were performed with these changes to the two outliers.

Normality. Variables were examined for normality and when deviations were detected, transformations were preformed to normalize the data according to procedures outlined by Tabachnik and Fidell (2001). Analyses were conducted using both the raw and transformed data. In all cases where this approach was taken, no difference between the

results was observed. Thus, analyses of the raw data only are presented for ease of interpretation.

Analytic Strategy

The analyses in the present study were conducted in three stages. The first stage consisted of descriptive statistics for all assessed variables. The second stage of analysis was conducted to examine the correlations between the self-regulatory efficacy variables. The third stage included hierarchical multiple regression analyses conducted to determine whether a set of multiple indices of self-regulatory self-efficacy and barriers self-efficacy predicted various aspects of exercise behaviour (i.e., self-reported exercise behaviour, intended exercise frequency, intended exercise intensity).

Descriptive Statistics

Descriptive statistics indicated that participants were efficacious about their ability to self-regulate their regular exercise participation (see Table 1). They were also active and reported high exercise intentions (see Table 2).

Table 1.

Descriptive Statistics for the Self-regulatory Efficacy Measures

Variable	Mean	SD
Scheduling Self-efficacy	80.07	19.60
Barriers Self-efficacy	71.74	18.25
Goal-setting Self-efficacy	80.02	16.33
Relapse prevention Self-efficacy	78.11	17.01

Note. All self-efficacy variables assessed at Time One, $n = 164$.

Table 2.

Descriptive Statistics for the Exercise Measures

Variable	Mean	SD
Self-reported Exercise Behaviour	3.01	1.92
Exercise Intentions: Frequency	4.69	2.03
Exercise Intentions: Intensity	15.56	2.08

Note. Exercise intentions frequency and intensity assessed at Time One, $n = 164$; Self-reported exercise behaviour assessed at Time Two, $n = 99$. Self-reported exercise behaviour represents the mean frequency of weekly strenuous exercise bouts.

Relationships between Self-regulatory Efficacy, Exercise Intentions and Behaviour

First, prior to conducting regression analyses to predict exercise intentions and behaviour, the significant correlations between the self-regulatory self-efficacy variables were considered according to guidelines set forth by Cohen and colleagues (2003). Second, similar to previous studies of self-regulatory efficacy that have focused primarily on barriers self-efficacy, barriers efficacy was first examined as a sole predictor of exercise behaviour. However, consistent with Bandura's (1986) self-efficacy measurement guidelines, a purpose of the present study was to refine the operationalization of self-regulatory self-efficacy beyond barriers efficacy. Finally, in order to determine if multiple indices of self-regulatory efficacy were predictive of exercise behaviour, data were analyzed using hierarchical multiple regression procedures for each of the three dependent variables of self-reported exercise behaviour, exercise intentions, and intensity.

Consistent with Cohen, Cohen, Aiken and West's (2003) recommendations for the theory-driven use of hierarchical multiple regression procedures, the most theoretically

important set of predictors is entered first in a model as a priori hypothesized. Other predictors hypothesized as being secondary to the main set are entered next and entry continues to proceed in this fashion (i.e., "the least is last" guideline, pp.186 -187). For all three analyses, the theorized set of efficacy predictors including scheduling, relapse prevention, and goal-setting self-efficacy were entered on the first block with barriers efficacy entered on the second block of the regression equation (Cohen et al., 2003). The theoretical rationale for best representation of the self-regulatory efficacy construct by the set of self-regulatory efficacy predictors and thus for the a priori specified entry in the hierarchical regression was outlined in the general introduction.

Multicollinearity. As demonstrated in Table 3, the self-regulatory self-efficacy variables in the present study were significantly correlated. Cohen and colleagues (2003) provide several indices and corresponding statistical rule of thumb cutoff values for measuring the degree of multicollinearity between several independent variables in multiple regression analyses. Specifically, any variance inflation factor (VIF) of 10 or more or tolerance values of .10 or less indicate that there may be serious problems of multicollinearity. Based on these criteria, multicollinearity was not problematic in the regression analyses in the present study (i.e., VIF < 2.91; tolerance >.344). Consequently, all variables were entered into the regression equation with "no cause for concern" (Tabachnick & Fidell, 2001, p.157). Furthermore, Cohen and colleagues (2003) advocate that if "a researcher is interested solely in the prediction of Y or in the value of R^2, multicollinearity has little effect and no remedial action is needed" (p.425).

Table 3.

Bivariate Correlations for Self-regulatory Efficacy and Exercise Measures

Variable	1	2	3	4	5	6.	7.
1. Scheduling	--						
2. Barriers	.73**	--					
3. Goal-setting	.73 **	.73**	--				
4. Relapse prevention	.71**	.76**	.72**	--			
5. Intentions: Frequency	.53**	.53**	.50**	.37**	--		
6. Intentions: Intensity	.48**	.41**	.47**	.41**	.24**	--	
7. Self-reported Exercise	.50**	.50**	.29**	.25*	.29**	.57**	--

Note. *p <.05 **p <.01

Prediction of Exercise Behaviour

A prospective hierarchical multiple regression analysis was used to determine the strength of the relationship between self-reported exercise behaviour and self-regulatory efficacy (i.e., scheduling, goal-setting, relapse prevention, barriers self-efficacy), using only those participants who provided follow-up exercise frequency data at Time Two (n = 99). The overall model was significant, F (4,95) = 12.36, p < .001, explaining 32% of the total variance in self-reported exercise behaviour (R^2_{adj} = .315). The set of three self-regulatory efficacy measures accounted for 27% of the variance in the model (R^2 change = 0.268, p < .001), while barriers efficacy accounted for an additional 8% of the variance (R^2 change = 0.075, p < .001). A regression to examine whether barriers self-efficacy alone would predict self-reported exercise can be found in Appendix D.

Prediction of Exercise Intentions

Intentions for frequency. A hierarchical multiple regression analysis was used to determine the strength of the relationship between self-regulatory efficacy and intended exercise frequency, using the entire sample at Time One (n = 164). The overall model was significant, F (4,160) = 54.66, $p < .001$, explaining 31% of the total variance in intended exercise frequency ($R^2_{adj} = .311$). The three self-regulatory efficacy measures accounted for 28% of the variance in intended frequency (R^2 change = 0.281, $p < .001$), while barriers efficacy accounted for an additional 5% of the variance (R^2 change = 0.047, $p < .001$).

Intentions for intensity. A hierarchical multiple regression analysis was used to determine the strength of the relationship between self-regulatory efficacy and intended exercise intensity, using the entire sample at Time One (n = 164). The overall model was significant, F (4,160) = 54.66, $p < .001$, explaining 23% of the total variance in intended exercise intensity ($R^2_{adj} = .232$). The three self-regulatory efficacy measures accounted for 25% of the variance in intended intensity (R^2 change = 0.251, $p < .001$). However, barriers efficacy did not account for a significant increase in the amount of variance explained (p = .830).

Discussion

Previous exercise-related self-regulatory efficacy research has focused predominantly on the assessment of barriers efficacy. However, considering the broad conceptualization of self-regulation coupled with the complexity of exercise adherence, does self-regulatory efficacy involve more than merely overcoming unpredictable or infrequent barriers? This question is paramount given the importance placed on self-regulatory efficacy (cf. Bandura, 1995b; Maddux, 1995). If self-regulatory self-efficacy is

"more crucial than task efficacy" (Maddux, 1995, p.382), one would expect this construct to encompass more than overcoming barriers. In fact, it has been recommended that researchers assess *multiple* self-efficacy beliefs with respect to exercise behaviour (Culos-Reed et al., 2001; DuCharme & Brawley, 1995; McAuley & Mihalko, 1998).

In order to address this identified research need, the present study expanded the operationalization of self-regulatory efficacy. Key features of self-regulation informed by frameworks that incorporate self-regulatory concepts were utilized (Barone et al., 1997; Baumeister et al., 1994). Specifically, this study examined multiple indicators of self-regulatory efficacy as predictors of exercise behaviour.

Consistent with the a priori hypotheses, the set of self-regulatory efficacy measures (i.e., scheduling, goal-setting, relapse prevention) significantly predicted frequency of strenuous exercise and exercise intentions. These predictors accounted for the major portion of variance in the model. As such, the expanded operationalization of self-regulatory efficacy presents an alternate means to capture individuals' confidence in their ability to self-regulate exercise behaviour and is a viable predictor of that behaviour. Barriers efficacy also contributed significant, but less variance in the overall model. The observation that barriers efficacy adds significant variance to the model in addition to the set of self-regulatory efficacy variables suggests that barriers efficacy may also be useful in predicting exercise behaviour. Together, the results provide support for the notion that multiple indices of self-regulatory efficacy are important and advantageous in their use in prospectively predicting exercise.

These results are not in conflict with a previous study where barriers efficacy and scheduling efficacy were considered together (e.g., Rodgers & Sullivan, 2001). It is in

contrast to one study where scheduling self-efficacy but not barriers efficacy was a significant predictor of exercise (Poag-DuCharme & Brawley, 1993). However, the approach taken in this study assessed barriers efficacy with much greater specificity than Rodgers and Sullivan (2001) and the present investigation (i.e., only frequent barriers). The present results add to the growing literature examining different aspects of self-regulatory efficacy by offering some support for the broader conceptualization of self-regulatory efficacy, and the operational argument to use multiple indicators.

The different types of self-regulatory efficacy assessed were significantly correlated. However, given the active sample this finding is not surprising. From a theoretical perspective, it follows that exercisers' ability to schedule would not necessarily be independent from their confidence to set goals or prevent relapses. Consistent with Bandura's (1986) notion of skill integration among experts (e.g., driving ability), these are all pieces of an integrated skill set that together appear to be important in the self-regulation of exercise. This finding is also consistent with the theoretical notion that a variety of positive mastery experiences would bolster successful exercisers' confidence in their self-regulatory skills. Also, past interventions have been successful in teaching these skills in an integrated fashion (Gardner & Brawley, 2005; Rejeski et al., 2003).

The expanded set of self-regulatory efficacy measures also predicted intended exercise intensity. However, barriers efficacy did not add variance to the model predicting intensity. Exercise intensity may represent an area of exercise self-management that warrants further investigation. For example, self-regulating exercise intensity is an integral component of endurance athletes' training regimens (e.g., Strachan, Woodgate, Brawley, &

Tse, in press) as well as cardiac rehabilitation participants' exercise prescription (Woodgate et al., 2005).

Study Limitations

These results underscore the importance of considering a different conceptualization and operationalization of self-regulatory efficacy. While the focus on active participants in this study was considered essential in order to capture more types of the self-regulatory efficacy about skills relevant to self-management, it is important to note that these findings are not necessarily generalizable to other populations. For instance, it is unclear whether novice exercisers self-regulating their own exercise program would respond to the self-regulatory efficacy measures in a similar fashion. For example, future research might benefit from a longitudinal design with beginner exercisers in order to elucidate the developmental course of self-regulatory efficacy. This might provide insight regarding whether different forms of self-regulatory efficacy need to be initially considered discretely, whether confidence in different skills are important at different times, and whether these skills are used differentially depending on the exercise behaviour and demands of the context.

An additional generalizability issue concerns the nature of exercise behaviour assessed in the present study. Specifically, self-regulatory efficacy predicted *strenuous* exercise behaviour. As such, the relationship between self-regulatory efficacy and moderate or mild activity is unknown.

It would be premature to suggest that the types of self-regulatory efficacy addressed in this study are adequately inclusive. Nonetheless, it is apparent that, as DuCharme and Brawley (1995) and McAuley and Mihalko (1998) have suggested, relying on one

operationalization of self-regulatory efficacy may be under-representing the construct. With this in mind, and given the criticality of self-regulatory efficacy (Bandura, 1995b), it follows that it is unlikely to be captured by any single measure.

Study Strengths

The present study had important methodological and conceptual strengths. First, in addition to addressing an identified research need (Brawley, 2005; DuCharme & Brawley, 1995), the study used frameworks of self-regulation to inform the expanded operationalization of self-regulatory self-efficacy (Barone et al., 1997; Meichenbaum & Turk, 1987).

Second, the measurement specificity of self-regulatory efficacy in the present study is consistent with self-efficacy theory guidelines (cf. Bandura, 1986; 1997). This study represented a preliminary attempt to systematically apply measurement specificity to self-regulatory self-efficacy. This may be particularly noteworthy since several researchers have advocated that self-regulatory efficacy may be even more important for understanding regular exercise participation than task efficacy (cf. Maddux, 1995; Rodgers & Sullivan, 2001).

While the present results provide preliminary answers to the question does self-regulatory efficacy involve more than merely overcoming barriers, additional unanswered questions emerge. In future research examining exercise-related self-regulatory efficacy, the present results would suggest that other facets of self-regulation warrant attention (e.g., self-monitoring, problem-solving). For example, self-efficacy for solving problems is posited to influence the effectiveness of decision-making and lead to greater achievement

(Maddux & Gosselin, 2003). Study Two pursues problem-solving self-efficacy as an additional facet of self-regulation that may be important to exercise.

The present study was descriptive, and self-regulation theorists have proposed moderators of the relationship between self-regulation and health behaviour (Barone et al., 1997). An extension of this research might involve whether or not trait variables alter self-regulatory self-efficacy. If so, would these moderator effects be observed for parts of the construct (e.g., scheduling and relapse prevention only) or for all of the self-regulatory efficacy measures? Examining moderators of the self-regulatory efficacy – exercise relationship was the primary focus of Study Two.

Study Two

To date, the majority of studies examining the relationship between self-regulatory efficacy and exercise have been descriptive in nature. While a consistent relationship has been found to exist between these two constructs, we know little about *moderators* of the relationship between self-regulatory efficacy and exercise. Specifically, it is unclear under what circumstances or for which individuals this relationship varies.

Indeed, several recent reviews have advocated that researchers should determine potential moderators of the self-efficacy and exercise relationship (Angove & Brawley, 2003; Culos-Reed et al., 2001; McAuley & Blissmer, 2001; McAuley et al., 2001). McAuley and colleagues (2001) concluded their review on exercise-related self-efficacy with the recommendation that "the extent to which this variable interacts with other social cognitive, physiological, and cultural variables in influencing and being influenced by exercise is less well-established and warrants attention" (p.259). Over a decade ago, it was advocated that researchers shift their focus from establishing *whether* a relationship exists between self-efficacy and exercise behaviour to determining *when* the relationship exists (Dzewaltowski, 1994).

However, within the exercise-related self-efficacy literature, the examination of potential moderators (e.g., individual differences) has received only modest attention (e.g., gender: McAuley et al., 1991; McAuley & Courneya, 1993; Rejeski, Brawley, Ambrosius et al., 2003; age: McAuley et al., 1995; optimism: Gyurcsik & Brawley, 2001; exercise experience: Bray et al., 2001; Poag-DuCharme & Brawley, 1993). Moreover, most of the preliminary studies examining the influence of individual difference variables on self-efficacy have addressed *task* self-efficacy.

However, it has been acknowledged that people differ in how well they self-regulate their behaviour (Barone et al., 1997). According to Barone and colleagues (1997), it is part of the current agenda of social cognitive psychology to acquire a better understanding of individual differences in self-regulation. In other words, why are some people better than others at self-regulating exercise? It has been suggested that trait-like variables may impact self-regulatory cognitions (Barone et al., 1997; Gyurcsik & Brawley, 2001; Strachan, Woodgate, Brawley & Tse, in press). Two trait-like variables that appear to be related to self-regulation are consideration of future consequences (CFC; Barone et al., 1997) and optimism (Scheier & Carver, 1985).

Consideration of Future Consequences

CFC refers to the extent that people consider, and are influenced by, the distal outcomes of their behaviour (Strathman et al., 1994). CFC is considered distinct from Bandura's (1986) notion of outcome expectations. Unlike outcome expectations that are situation-specific and variable, CFC is posited to be a relatively stable characteristic. Barone and colleagues (1997) have suggested that future research should examine whether individual differences in CFC impact self-regulation and goal-directed behaviour. For example, people may differ in the extent to which they consider the distant benefits of exercise when choosing their current behaviour (e.g., to exercise or watch TV). In fact, it has been proposed that CFC may help to explain the difference between regular and irregular exercisers (Barone et al., 1997).

There is evidence for the association between CFC and decision-making and behaviour (Barone et al., 1997). For example, CFC has been related to health and environmental behaviours, such as cigarette use, recycling behaviour, and academic

achievement (Petrocelli, 2003). In a recent study that claims to be the first to examine CFC with respect to health behaviour, high CFC individuals were more likely to view participation in colorectal cancer screening as beneficial and reported greater perceived behavioural control and intentions to participate than low CFC individuals (Orbell, Perugini, & Rakow, 2004). To date, however, the role of CFC in the self-regulation of exercise behaviour has not been investigated. While it has been proposed that individuals high and low in CFC may exhibit characteristic differences in self-regulation and exercise behaviour (Barone et al., 1997), no research has examined this possibility.

Optimism

An additional dimension that may influence the self-regulation of exercise behaviour is optimism. Optimism refers to the general expectation that good things will be plentiful in the future and bad things will be scarce (Scheier & Carver, 1985). While optimism has been related to good health (Carver & Scheier, 2002), it remains unclear "how optimism works" (Aspinwall et al., 2001, p.217). One avenue through which optimism is posited to influence self-regulation is when individuals evaluate the challenges to achieving their goals. Optimists have generalized expectations about positive outcomes and when confronted with difficulties, they tend to view these challenges as manageable and believe that their goals can be achieved (Scheier & Carver, 1985). Accordingly, it has been suggested that "optimism leads to continued effort to attain the goal, whereas pessimism leads to giving up" (Peterson, 2000, p. 47).

Given that optimists believe that desired outcomes are attainable and exert greater effort toward achieving such outcomes, it may be hypothesized that optimists are better at self-regulating exercise behaviour than pessimists. In turn, better self-regulation may result

in their greater persistence, expenditure of effort, leading to mastery of exercise regulation and stronger self-regulatory efficacy beliefs.

One cross-sectional study that may support this hypothesis was conducted by Gyurcsik and Brawley (2001). They demonstrated that optimism predicted exercise intentions and was differentially related to scheduling self-efficacy and coping with acute thoughts self-efficacy. Regarding the link between optimism and exercise behaviour, it has been shown that self-reported highly active individuals were more optimistic than lower active individuals (Kavussanu & McAuley, 1995). However, it has also been found that exercise adherers and dropouts did not differ on optimism (Fontaine & Shaw, 1995). Thus the relationship between optimism and exercise behaviour is not straightforward and requires further attention.

Purpose

The general purpose of Study Two was to examine the moderation of the self-regulatory efficacy - exercise relationship by two different traits -- consideration of future consequences and optimism. The first purpose was to explore if participants higher and lower in CFC exhibited characteristic social cognitive and behavioural differences. Specifically, participants higher in CFC would be expected to exhibit greater self-regulatory efficacy, exercise intentions, and exercise attendance compared to their lower CFC counterparts. A second aspect of this first purpose was to examine whether participants higher and lower in optimism exhibited characteristic self-efficacy and behavioural differences. It was hypothesized that participants higher in optimism would report greater self-regulatory efficacy, exercise intentions and exercise attendance than participants lower in optimism.

A second purpose was to explore the effect of potential moderator variables upon the strength of the relationship between self-regulatory efficacy and exercise behaviour. Given the exploratory nature of the moderator analyses, and limited research on moderator variable effects, no specific hypotheses were advanced regarding the direction of the interactions.

Consistent with the overall objectives of the dissertation, it was also of interest to continue to examine the breadth of the conceptualization of self-regulatory efficacy relative to the exercise context. In addition to the aspects of self-regulatory efficacy examined in Study One, Maddux and Gosselin (2003) have argued that successful adaptation to circumstances and adjustment of behaviour (i.e., self-regulation) requires problem-solving ability. Bandura (1997) proposed that when faced with complex decisions, people who have confidence in their ability to solve problems use their cognitive resources more effectively. Since problem solving is important for the self-regulation of behaviour and was unexamined in Study One, the present study also investigated problem solving self-efficacy as a predictor of exercise attendance.

Method

Participants and Design

Members of a university fitness facility comprised the sample for the present study. The initial sample consisted of 259 adult exercisers (66% female) between the ages of 18 and 50 (*M* age = 21.5 years, SD = 3.6). Students comprised 96% of the sample, followed by faculty and staff (2%), and other (2%). Participants were active, reporting an average of 3.5 bouts of strenuous exercise per week. This active sample was selected to maximize the possibility that the measures of the various forms of self-regulatory efficacy would be relevant and meaningful. The study employed a prospective observational design.

Measures

Participants completed the Study One measures (i.e., self-reported exercise frequency, scheduling self-efficacy, goal-setting self-efficacy, relapse prevention self-efficacy, barriers self-efficacy) plus (a) optimism, (b) consideration of future consequences, and (c) problem solving self-efficacy. The Time One study questionnaire can be found in Appendix E. At the four-week follow-up, an actual attendance frequency was retrieved from the fitness facility's computerized tracking records.

Optimism

The 10-item Life-Orientation Test – Revised (LOT-R: Scheier, Carver, & Bridges, 1994) was used to assess dispositional optimism. This measure consisted of six items plus four filler items used to disguise the purpose of the scale. Of the six items, three were phrased in the positive direction. An example item was "In uncertain times, I usually expect the best". The remaining three items were phrased in the negative direction. An example item was "If something can go wrong for me, it will". Each item was scored on a 1 (*I disagree a lot*) to 5 (*I agree a lot*), with the negatively phrased items reverse-scored so that higher scores represented greater optimism. This measure has demonstrated adequate reliability and validity across a variety of populations (Peterson, 2000). The internal consistency in the present study was acceptable at 0.81 (Tabachnik & Fidell, 2001).

Consideration of Future Consequences

The revised Consideration of Future Consequences (CFC) scale was used to assess the extent to which participants consider distant outcomes of their current behaviour (Petrocelli, 2003; Strathman et al., 1994). This scale consisted of 8-items rated on a 5-point likert scale ranging from 1 (*extremely uncharacteristic*) to 5 (*extremely*

characteristic). An example item was "only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date". Consistent with the scoring procedure for the scale, seven items were reverse-scored so that higher scores indicated greater CFC. The item scores were then summed and averaged to provide an indication of mean CFC. The internal consistency for the scale in the present study was acceptable $\alpha = 0.82$ (Tabachnik & Fidell, 2001).

Problem Solving Self-efficacy

While social problem solving self-efficacy has not been assessed in the exercise literature, there are a variety of areas of psychology where problem-solving *ability* has been examined. In fact, one subscale of the problem solving inventory (Heppner & Petersen, 1982) has been called "problem solving self-efficacy" (Maydeu-Olivares D'Zurilla, 1997). However, closer scrutiny of the items that comprise this subscale suggest that it is more general in nature (i.e., ability) only, without the situational specificity of time, action and context. An example item was "When my first efforts to solve a problem fail, I become uneasy about my ability to handle the situation". Thus, an exercise-specific problem solving self-efficacy measure was developed for use in the present study.

Pilot testing. Carver and colleagues' (1989) problem solving ability measure was used to identify types of problem-solving strategies that might be employed by exercisers. Eight problem-focused coping items were adapted to reflect the exercise context. Participants were instructed that many people report encountering a "problem" that interferes with their regular exercise regimen (e.g., being too tired, having too many work or school commitments, being ill, being injured, being on vacation), and were asked to keep this kind of "problem" in mind when responding to the items. Participants then rated

their confidence to use the eight problem-solving strategies in order to maintain their regular exercise regimen over the next four weeks. In order to adhere to self-efficacy measurement guidelines (Bandura, 1986), the original measure was revised to reflect the specific exercise context and employed a confidence scale ranging from 0% (*not at all confident*) to 100% (*completely confident*). An example item that included a problem solving strategy was "Concentrate my efforts on doing something about my exercise problem". This exercise-related problem solving self-efficacy scale was then pilot-tested.

Based on pilot testing with a sample of student exercisers representative of participants in the present study (n=9, M age = 24 years; 78% female), the scale demonstrated adequate internal consistency ($\alpha = 0.96$) and a mean of 74 (SD= 15.2). The scale was used in the present study and examined for reliability using the full sample (n = 259). The internal consistency for the scale was good, $\alpha = 0.94$ (Tabachnick & Fidell, 2001).

Procedure

Participants were recruited from a university fitness centre by a trained investigator during ten 2-hour intervals over the course of two weeks. The investigator delivered a standardized request for volunteer participation that adhered to university research ethics guidelines for research with human subjects. Participants volunteering for the study did so by providing their e-mail address to the investigator. Interested participants were then emailed the link to the secure study website consisting of an informed consent letter and the Time One measures. Receipt of the study website link did not obligate participants to continue as they could withdraw at any time. Participants (n = 259) completed the Time

One measures. Upon electronic submission of their responses, an electronic feedback letter was provided to the participants.

Within the Time One measures, participants were asked to provide their fitness facility identification number so that attendance could be retrieved from the facility's tracking records. Of the 259 participants that completed the Time One measures, 174 participants provided sufficient information to track their attendance (67%). At the four-week follow-up, attendance was retrieved from the fitness facility's computerized tracking records using these participants' identification numbers. Thus, 174 participants were used in the prospective analyses.

Results

Data Management

Data management strategies were used to address missing data, the presence of outliers as well as to assess and insure normality. These data management procedures were used in all three studies. To avoid redundancy, these procedures were described in Study One.

Analytic Strategy

The overall analyses were conducted in five stages. The first stage consisted of descriptive statistics for all assessed variables.

The second stage of analysis was a twofold procedure. An examination of characteristic social cognitive differences among participants higher and lower in each potential moderator variable was conducted using an extreme groups comparison (i.e., highest and lowest tertiles determined through a tertile split). The rationale for the extreme groups procedure was that individuals who were most likely to exhibit characteristic self–

regulatory efficacy and behavioural differences would be participants who were most extreme in the potential moderator variable. If differences in social-cognitive characteristics did not manifest themselves among extreme moderator group participants, it is unlikely that they would be observed in the entire sample.

First, the higher and lower moderator variable groups were examined to be certain that they were truly significantly different using a t-test procedure. Second, if true groups existed, the overall analysis proceeded. For optimism, the second aspect of the procedure involved between-groups MANOVAs to examine the hypothesis that individuals higher in optimism would exhibit greater self-regulatory efficacy, exercise intentions and attendance compared to individuals lower in optimism. For CFC, the covariate of age was taken into account given its significant correlation with CFC in the present study. Accordingly, between-groups MANCOVAs were conducted to examine the hypothesis that individuals higher in CFC would exhibit greater self-regulatory efficacy, exercise intentions and attendance compared to individuals lower in CFC.

The third stage included analyses to examine the direct relationship between the moderator variables of CFC and optimism with exercise behaviour. A series of multiple regression analyses were conducted using the R^2 adjusted estimate to control for attenuation (Tabachnick & Fidell, 2001).

The fourth stage examined the trait CFC and optimism variables as moderators of the self-regulatory efficacy – exercise attendance relationship. Hierarchical multiple regression analyses were conducted. These equations utilized an a priori entry that entered the trait variable in the first block, the social-cognitive variables on the second block, and the entry of the moderator interaction term on the third block.

Finally, the fifth stage involved conducting hierarchical multiple regression analyses in order to further examine the prospective relationship between the set of self-regulatory efficacy variables and barriers efficacy in predicting exercise intentions and exercise attendance. This analysis was done to compare results to those of Study One.

Descriptive Statistics

Descriptive statistics indicated that, in general, participants were efficacious about their ability to self-regulate their regular exercise participation. Furthermore, participants were optimistic and considered future consequences of their actions (Table 4). In general, they also reported regular exercise attendance and high exercise intentions regarding the frequency and intensity of their exercise sessions (Table 5). In addition, the correlations between study variables can be found in Appendix F.

Table 4.

Descriptive Statistics for the Self-regulatory Efficacy Measures, Optimism and CFC

Variable	*Mean*	*SD*
Scheduling Self-efficacy	81.14	16.19
Barriers Self-efficacy	71.40	16.64
Goal-setting Self-efficacy	79.30	14.61
Relapse prevention Self-efficacy	76.67	14.25
Problem solving Self-efficacy	70.40	17.82
Optimism	3.64	0.69
CFC	3.49	0.61

Note. All variables were assessed at Time One, $n = 259$. Self-efficacy 0 - 100% scales, Optimism 1-5 scale, CFC 1-5 scale.

Table 5.

Descriptive Statistics for the Exercise Measures

Variable	*Mean*	*SD*
Exercise Attendance	3.06	1.57
Exercise Intentions: Frequency	4.63	1.75
Exercise Intentions: Intensity	15.88	2.09

Note. Exercise intentions frequency and intensity were assessed at Time One, $n = 259$; Exercise attendance was recorded at Time Two, $n = 174$. Exercise attendance is mean frequency of weekly attendance, Exercise intentions frequency 0-7 scale, Exercise intentions intensity 6-20 scale.

CFC Group Differences

Self-regulatory self-efficacy. An examination of characteristic social cognitive differences among participants high and low in CFC was conducted using an extreme groups comparison. An extreme groups split of the entire sample at Time One resulted in high ($M = 4.18$, $n = 75$) and moderate ($M = 2.79$, $n = 72$) CFC groups. A t-test indicated that these two groups significantly differed on CFC ($t = -27.11$, $p < .001$). Thus, further analyses proceeded.

A one-way between-groups MANCOVA was then conducted using the CFC groups (i.e., high vs. moderate) as the independent variable, and scheduling self-efficacy, goal-setting self-efficacy, barriers self-efficacy, relapse prevention self-efficacy and problem-solving self-efficacy as the dependent variables. Age was entered as a covariate due to its significant correlation with CFC in the present study. The overall MANCOVA was significant, $F(5, 140) = 3.27$, Wilks' $\lambda = 0.895$, $p < .008$, observed power = .884. As

hypothesized, univariate *F* tests indicated that the higher CFC group had significantly greater scheduling self-efficacy ($F = 3.76$, $p < .05$), goal-setting self-efficacy ($F = 8.18$, $p < .005$), relapse prevention self-efficacy ($F = 15.18$ $p < .001$), problem solving self-efficacy ($F = 5.39$, $p < .022$), and barriers self-efficacy ($F = 5.93$ $p < .016$) than the moderate CFC group (Table 6).

Table 6.

Self-regulatory Self-efficacy Differences between CFC Groups

Variable	High CFC Group $n = 75$	Moderate CFC Group $n = 72$	η^2	*p.*
Scheduling Efficacy	82.58	77.33	.025	.050
Goal-setting Efficacy	81.76	74.80	.054	.005
Relapse Prevention Efficacy	81.38	72.25	.095	.001
Problem Solving Efficacy	72.97	65.43	.036	.022
Barriers Efficacy	71.90	64.89	.040	.016

Note. Self-efficacy 0 - 100% scales.

Exercise intentions and attendance. An extreme groups split was conducted once again to examine the CFC values for participants with Time Two attendance data ($n = 174$). This resulted in high ($M = 4.19$, $n = 58$) and moderate ($M = 2.82$, $n = 53$) CFC groups. A t-test indicated that these two groups significantly differed on CFC ($t = -23.49$, $p < .001$) and further analyses could proceed.

A one-way between-groups MANCOVA was then conducted using the CFC groups (i.e., high vs. moderate) as the independent variable, age as a covariate, and exercise attendance, exercise intentions for frequency, and exercise intentions for intensity as the

dependent variables. The overall MANCOVA was not significant, F (3, 107) = 2.12, Wilks' $\lambda = 0.944$, $p > .05$. Normally, no further analyses are conducted in this case. Given the exploratory nature of the moderator hypothesis and no previous exercise research, post-hoc univariate F tests were considered to be certain that no information was overlooked (cf. Bock, 1975). These post-hoc analyses indicated that the higher CFC group had significantly greater attendance than the moderate CFC group ($F = 6.32$, $p < .013$). No other significant differences were evident (Appendix G).

Optimism Group Differences

Self-regulatory self-efficacy. Using the entire sample at Time One, an extreme groups split on optimism resulted in high ($M = 4.39$, $n = 78$) and moderate ($M = 2.77$, $n = 63$) optimism groups. A t-test indicated that these two groups significantly differed on optimism ($t = -27.18$, $p < .001$). Thus further analyses could proceed.

A one-way between-groups MANOVA was then conducted using the optimism groups (i.e., high vs. moderate) as the independent variable, and scheduling self-efficacy, goal-setting self-efficacy, barriers self-efficacy, relapse prevention self-efficacy and barriers self-efficacy as the dependent variables. The overall MANOVA was significant, F (5, 135) = 4.10, Wilks' $\lambda = 0.868$, $p < .002$, observed power = .949. As hypothesized, post-hoc univariate F tests indicated that the higher optimism group had significantly greater scheduling self-efficacy ($F = 5.38$, $p < .022$), goal-setting self-efficacy ($F = 11.17$, $p < .001$), relapse prevention self-efficacy ($F = 16.49$, $p < .001$), problem solving self-efficacy ($F = 9.89$, $p < .002$), and barriers self-efficacy ($F = 5.86$ $p < .017$) than the moderate optimism group (Table 7).

Table 7.

Self-regulatory Self-efficacy Differences between Optimism Groups

Variable	High Optimism Group $n = 78$	Moderate Optimism Group $n = 63$	η^2	*p*.
Scheduling Efficacy	86.54	80.61	.037	.022
Goal-setting Efficacy	85.20	77.20	.074	.001
Relapse Prevention Efficacy	83.75	74.61	.106	.001
Problem Solving Efficacy	77.71	68.65	.066	.002
Barriers Efficacy	75.30	68.44	.040	.017

Note. Self-efficacy 0 – 100% scales.

Exercise intentions and attendance. An extreme groups split was conducted once again to examine the optimism scores for participants with Time Two attendance data (n = 174). This comparison resulted in high (M = 4.38, n = 63) and moderate (M = 2.70, n = 45) optimism groups. A t-test indicated that these two groups significantly differed on optimism (t = -22.48, $p < .001$). Thus, further analysis could proceed.

A one-way between-groups MANOVA was then conducted using the optimism groups (i.e., high vs. moderate) as the independent variable, and exercise attendance, exercise intentions for frequency, and exercise intentions for intensity as the dependent variables. The overall MANOVA was not significant, F (3, 103) = 1.57, Wilks' $\lambda = 0.956$, $p > .05$ (Appendix H).

Relationships between Optimism and CFC and Exercise Behaviour

In order to examine whether either optimism or CFC would predict exercise intentions and attendance, four multiple regression analyses were conducted using the R^2 adjusted estimate to control for attenuation (Tabachnick & Fidell, 2001).

Optimism. Only those participants with follow-up exercise attendance data at Time Two (n = 174) were used in this prospective analysis. Optimism explained a modest 2% of the variance in exercise attendance ($p < .027$). Using the entire sample at Time One (n = 259), optimism was a significant predictor of exercise intentions for frequency, explaining 2% of the variance ($p < .030$).

CFC. Age was entered first into the regression analyses to control for its significant correlation with CFC in the present study. Only those participants with follow-up exercise attendance data at Time Two (n = 174) were used in the prospective analysis to predict attendance. The model was significant, F (2,172) = 4.17, $p < .017$, explaining 4% of the total variance in exercise attendance ($R^2_{adj} = .035$). Age was not a significant predictor (p = .078) while CFC accounted for a significant 3% increase in the amount of variance explained (R^2 change = .028, $p < .025$). Using the entire sample at Time One (n = 259) to predict exercise intentions for frequency, the overall model was not significant, F (2, 257) = 1.48, p = .229, and neither age nor CFC were significant predictors ($p > .05$; Appendix I).

Moderators of the Self-regulatory Efficacy – Exercise Attendance Relationship

Optimism was not a significant moderator of the relationship between any of the self-regulatory efficacy scales and exercise attendance. These hierarchical multiple regression results can be found in Appendix J.

CFC was a significant moderator of the relationship between scheduling, barriers, relapse prevention, and problem solving self-efficacy and exercise attendance. The pattern of results was the same for all of the interactions. For the sake of brevity, the analyses for CFC moderating the scheduling self-efficacy – exercise relationship are presented in the text. The hierarchical multiple regression analyses of the remaining interaction effects can be found in Appendix K.

Structure of the equation. A hierarchical multiple regression analysis was used to test the hypothesis that CFC moderates the relationship between scheduling self-efficacy and exercise attendance. Prior to conducting the regression analysis, the predictor variables were zero-centered (Tabachnick & Fidell, 2001). The dependent variable for the analysis was mean frequency of weekly exercise attendance. The order of entry of the variables into the regression analysis is presented in Table 8. Entry was determined based on results of past research, and conceptual and statistical considerations (Baron & Kenny, 1986; Barone et al., 1997; DuCharme & Brawley, 1995; Rodgers & Brawley, 1993). First, age was entered to control for its significant correlation with the moderator variable. Next, scheduling self-efficacy was entered to test for a conditional main effect of level of efficacy on attendance. Third, CFC was entered to test for a conditional main effect. Finally, the interaction between CFC and scheduling self-efficacy (i.e., created by multiplying the predictor and moderator variables) was entered to test the hypothesis that CFC moderates the relationship between scheduling self-efficacy and exercise attendance.

Table 8.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance

	adjR^2	R^2 change	*p* of *F* change
Step 1			
Age	.012	.018	.078
Step 2			
CFC	.035	.028	.025
Step 3			
Scheduling self-efficacy	.500	.463	.001
Step 4			
CFC x Scheduling self-efficacy	.538	.040	.001

According to the results of the hierarchical multiple regression analysis, the overall model was significant, adjusted $R^2 = .538$, $F\ (4, 170) = 51.65$, $p < .001$. A significant main effect was observed for both CFC (R^2 change = .028, $p < .025$) and scheduling self-efficacy (R^2 change = .463, $p < .001$).

As hypothesized, the CFC x scheduling self-efficacy interaction accounted for a significant increase in the amount of variance explained (R^2 change = .040, $p < .001$). In other words, beyond the variance already accounted for by the main effects, 4% of the variance in exercise attendance was predicted by the CFC x scheduling self-efficacy interaction, a small effect size (Cohen, 1992).

Interpreting the significant moderator effect. In order to evaluate the form of this interaction, statistical procedures recommended by Aiken and West (1991), Cohen and

Cohen (1983), and Frazier, Tix, and Barron (2004) were employed. First, two restructured simple regression equations were calculated with exercise attendance as the dependent variable (Aiken & West, 1991). Specifically, Aiken and West (1991) recommend choosing values of the moderator variable to generate two regression equations that are (a) one standard deviation below the mean moderator score, and (b) one standard deviation above the mean moderator score. To do this, new CFC variables were created for each participant by adding or subtracting the standard deviation of centered CFC (i.e., 0.611). Second, values for scheduling self-efficacy (i.e., +/- 1 standard deviation) were substituted into the regression equations, resulting in the derivation of a regression line for high and low CFC. Finally, these regression lines were plotted to display the interaction.

Predicted exercise attendance values were plotted for high and low CFC (Figure 1). As shown in Figure 1, for both CFC levels, scheduling self-efficacy was positively related to attendance such that as scheduling self-efficacy increased, reported frequency of exercise attendance increased. Specifically, inspection of the predicted values for individuals with high scheduling self-efficacy, those with lower CFC scores attended more frequently than those with higher CFC scores.

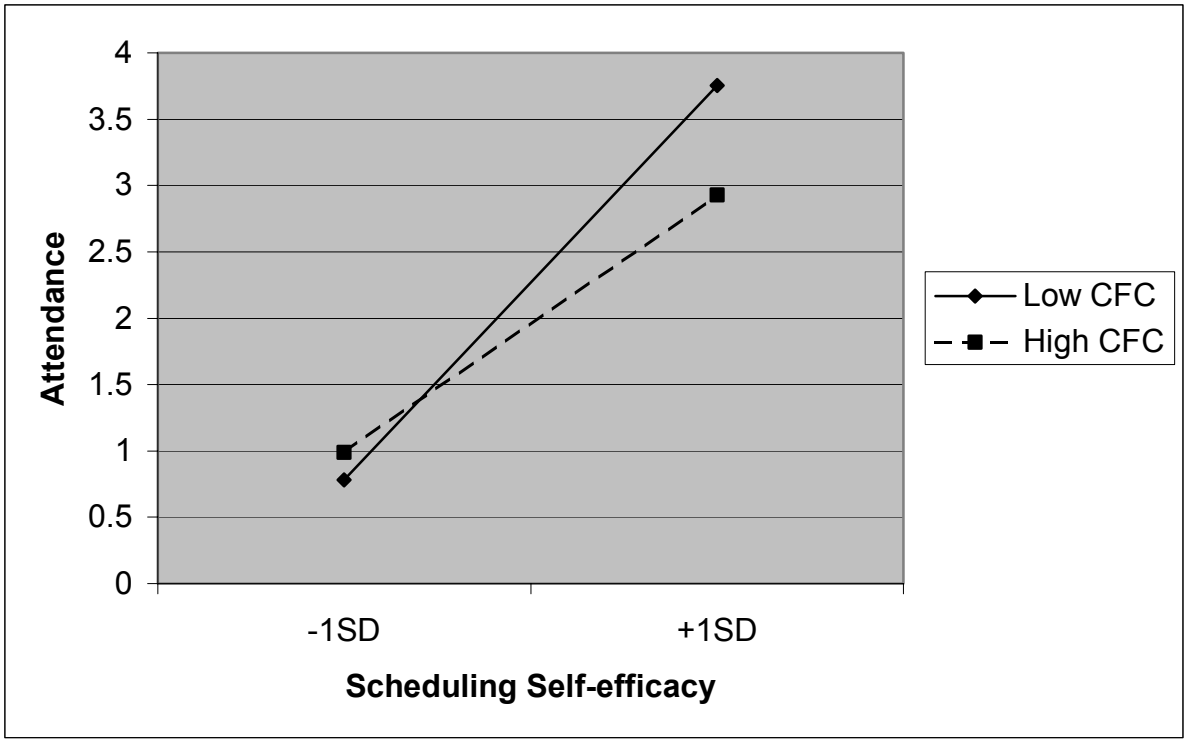

Figure 1. Plot of the interaction effect of CFC and scheduling self-efficacy on exercise attendance.

Relationships Between Self-regulatory Efficacy, Exercise Intentions and Attendance

Multicollinearity. As in Study One, prior to conducting regression analyses to predict exercise intentions and behaviour, the significant correlations between the self-regulatory self-efficacy variables were considered according to guidelines set forth by Cohen and colleagues (2003). The correlations between study variables can be found in Appendix F. Based on these criteria, multicollinearity was not problematic in the regression analyses in the present study (i.e., VIF < 3.27; tolerance >.306). Consequently, all variables could be entered into the regression equations with "no cause for concern" (Tabachnick & Fidell, 2001, p.157).

Prediction of exercise behaviour by self-regulatory self-efficacy. As in Study One, a prospective hierarchical multiple regression analysis was used to determine the strength

of the relationship between self-regulatory efficacy and exercise behaviour. Similar to Study One, the set of scheduling, goal-setting, relapse prevention, and problem-solving self-efficacy were entered on the first block, followed by barriers self-efficacy on the second block. Only those participants with follow-up exercise attendance data at Time Two (n = 174) were used in this prospective analysis.

The overall model was significant, F (5,169) = 44.73, p < .001, explaining 56% of the total variance in actual exercise attendance (R^2_{adj} = .555). The set of four self-regulatory efficacy measures accounted for 57% of the variance (R^2 change = 0.565, p < .001). However, barriers efficacy did not account for a significant increase in the amount of variance explained (p =.290).

Prediction of exercise intentions: Frequency. A hierarchical multiple regression analysis was used to determine the strength of the concurrent relationship between self-regulatory efficacy and intended exercise frequency, using the entire sample at Time One (n = 259). The overall model was significant, F (5,254) = 8.98, p < .001, explaining 14% of the total variance in intended exercise frequency (R^2_{adj} = .140). The set of four self-regulatory efficacy measures accounted for 16% of the variance in intended frequency (R^2 change = 0.156, p < .001). However, barriers efficacy did not account for a significant increase in the amount of variance explained (p =.690).

Prediction of exercise intentions: Intensity. A hierarchical multiple regression analysis was used to determine the strength of the concurrent relationship between self-regulatory efficacy and intended exercise intensity, using the entire sample at Time One (n = 259). The overall model was significant, F (5,254) = 17.48, p < .001, explaining 25% of the total variance in intended exercise intensity (R^2_{adj} = .250). The set of four self-

regulatory efficacy measures accounted for 26% of the variance in intended intensity (R^2 change = 0.263, $p < .001$). However, barriers efficacy did not account for a significant increase in the amount of the variance explained ($p = .365$).

Discussion

Study One results provided initial evidence supporting the use of an expanded operationalization of exercise-related self-regulatory efficacy in predicting exercise behaviour. Although this construct has been deemed a "critical" form of efficacy to measure in studying behaviour, the majority of previous self-regulatory efficacy studies have been descriptive in nature. Specifically, most of the extant literature has examined the most basic research questions (i.e., does a relationship exist between self-regulatory efficacy and exercise behaviour?). Consequently, we know little about *moderators* of the relationship between self-regulatory efficacy and exercise behaviour (e.g., when is the relationship strongest; for whom; in which contexts?).

Recent reviews (Culos-Reed et al., 2001; McAuley & Blissmer, 2000; McAuley et al., 2001) have advocated that researchers should determine potential moderators of the self-efficacy and exercise adherence relationship. Moreover, a decade ago, Dzewaltowski (1994) urged researchers to move beyond demonstrating that a relationship between self-efficacy and exercise exists to paying attention to the circumstances under which the relationship may be the strongest. To date, moderators have received limited attention. The current results extended the initial findings of Study One by considering the possibility of individual differences (i.e., optimism, consideration of future consequences) influencing the relationship between self-regulatory efficacy and exercise behaviour. These findings add to the small number of studies considering moderators.

Optimism

The previous work of Gyurcsik and Brawley (2001), suggested that optimism is differentially related to acute thoughts self-efficacy. As hypothesized, the present study demonstrated that exercisers who were more optimistic were also more confident in their ability to schedule sessions, set goals, overcome barriers, prevent relapses, and problem solve in order to exercise regularly than their moderately optimistic counterparts. In addition, participants higher in optimism reported greater exercise intentions for intensity compared to their moderate optimism counterparts. The optimism groups did not differ on intentions for frequency or exercise attendance.

This finding is similar to previous research that has demonstrated no difference between activity groups on optimism (Fontaine & Shaw, 1995). Thus, there appears to be support for the observation that social cognitive differences exist between optimism groups consistent with the previous research, but not for group differences relative to exercise behaviour. It should be noted that the previous study demonstrating significant differences between self-reported physical activity groups on optimism represents a different research question than the present study. Specifically, the present study examined whether optimism groups differed on exercise attendance. It is possible that the restricted range of optimism scores might have provided a limited test of this research question. Furthermore, contrary to hypothesis, optimism did not significantly moderate the self-regulatory efficacy – exercise attendance relationship. However, these results may also not be surprising given the restricted range of optimism scores and exercise attendance reported in the present study. It could be speculated that sampling individuals who struggle with exercise or illness might allow for the detection of lower optimism scores and exercise attendance.

Consideration of Future Consequences

Barone and colleagues (1997) have suggested that individual differences in CFC might influence self-regulatory constructs and goal-directed behaviour such as exercise. The current results provide initial, modest support for this postulation. As hypothesized, higher CFC was associated with greater self-regulatory efficacy and exercise attendance compared to exercisers with moderate CFC. The CFC groups did not differ on exercise intentions.

CFC was a significant moderator of the relationship between various indices of self-regulatory efficacy and exercise attendance. Specifically, for participants with both high and low CFC, there was a positive relationship between self-regulatory efficacy and exercise attendance. Inspection of the predicted values (Figure 1) indicated that for participants who were highly efficacious in their self-regulatory ability (i.e., illustrated as +1SD), low CFC was associated with greater attendance than high CFC. While this pattern of findings might be unexpected, it is important to keep in mind the characteristics of this study sample (i.e., active, efficacious, higher in CFC). For reasons of (a) sample size, (b) truncated data, and (c) direction contrary to the literature, it is unclear whether this is a reliable interaction that might be found in another sample. Given these characteristics of the data, and the fact that the interaction effect was small, it was reasoned that further interpretation of the finding would be speculative. Thus, post-hoc tests of the interaction were not conducted. Further investigation of this potential interaction effect is encouraged using a sample with a less truncated range of CFC scores (i.e., inclusion of individuals with low CFC scores).

Study Limitations

The results of the second study provide initial insight into the association between each of optimism and CFC and various indices of exercise-related self-regulatory efficacy. However, the limitations of this preliminary study should be recognized. First, the findings should be considered in light of the restricted range of CFC and optimism scores reported by the sample. Closer scrutiny of the present data indicates that the sample is active, efficacious, optimistic and high in CFC. Future research should sample to obtain more extreme CFC and optimism scores. It could be speculated that comparing exercisers with truly *low* CFC and optimism scores (i.e., below the scale midpoint) might elucidate differences not evident with a sample comprised entirely of exercisers reporting scores above the scale midpoint.

Another limitation concerns the size of the significant CFC interaction effects. By statistical conventions, the effect size is considered small (Cohen, 1992). However, it has been noted that it is difficult to detect significant interaction terms (McLelland & Judd, 1993). As such, future research should consider the aforementioned sampling issues and continue to explore the impact of CFC on the self-regulatory efficacy and exercise relationship. Specifically, in future studies of both CFC and optimism, sampling of infrequent exercisers (as well as regular exercisers) might shed light on whether they exhibit lower social cognitions, exercise intentions and behaviour. If so, differences might be exhibited that were not evident with the present sample comprised entirely of exercisers reporting scores (i.e., CFC, optimism, intentions) above the scale midpoint.

Study Strengths

In spite of its limitations, the present study had important conceptual strengths. First, the current study addressed a recurrent call for research on moderators of the self-efficacy – exercise relationship (Culos-Reed et al., 2001; Dzewaltowski, 1994; McAuley & Blissmer, 2000; McAuley et al., 2001. These findings advance our knowledge regarding potential trait-like moderators.

Second, this study represents the first examination of CFC in the exercise literature. The results provide preliminary support for Barone and colleagues' (1997) propositions regarding CFC and self-regulation with respect to exercise behaviour.

The study of moderators represents only one aspect of the shift beyond descriptive research in the exercise-related self-regulatory efficacy literature. Understanding whether self-regulatory efficacy can be manipulated acutely may have potential implications for advancing theory (cf. Bandura, 1986, 1997) and structuring efficacy enhancement interventions. This possibility was examined in Study Three.

Study Three

Self-regulatory self-efficacy has been shown to predict exercise behaviour (e.g., Bray et al., 2001; DuCharme & Brawley, 1995; Rodgers et al., 2002). Furthermore, results of Study One indicated that an expanded operationalization of self-regulatory self-efficacy predicted exercise behaviour. Study Two examined trait moderators of the self-regulatory efficacy – exercise relationship in order to consider whether the relationship varied as a function of the individual difference variables of optimism and consideration of future consequences. However, within the exercise domain, little research attention has been devoted toward the systematic manipulation of sources of self-regulatory efficacy.

According to theory, self-regulatory self-efficacy should be developed by four major sources of self-efficacy information (i.e., mastery experiences, vicarious experiences, verbal persuasion, emotional arousal) that contribute to efficacy beliefs (Bandura, 1997). Mastery experiences have been the most commonly manipulated determinant of exercise task self-efficacy (McAuley et al., 2001). In most studies, exposure to a bout of successful mastery activity increases task self-efficacy (McAuley & Blissmer, 2000).

Perhaps the only published demonstrations of manipulating self-regulatory efficacy have been in longer-term exercise intervention studies (e.g., Berkhuysen, Nieuwland, Buunk, Sanderman, & Rispens, 2001; Rejeski et al., 2003) as an outcome of several manipulations in the intervention treatment condition. For example, Rejeski and colleagues (2003) demonstrated that the use of a group-mediated cognitive behavioural intervention, focusing on developing self-regulatory skills, led to superior barriers self-efficacy and adherence compared to traditional cardiac rehabilitation exercise therapy alone. This study underscores the notion that self-regulatory skills to consistently attend

therapeutic programs are also important to rehabilitating individuals (Blanchard, Rodgers, Courneya, Daub & Knapik, 2002; Rejeski et al., 2003; Woodgate et al., 2005).

Despite this encouraging finding, the treatment intervention included the combined use of multiple sources of self-regulatory efficacy (i.e., mastery, verbal persuasion, vicarious experience). Thus it is unknown which sources played the strongest role in the Rejeski and colleagues (2003) study. To date, there is little empirical evidence of systematic experimental manipulation of specific sources of self-efficacy information to affect participants' self-regulatory efficacy beliefs. Evidence from a controlled study would advance the self-efficacy and exercise literature by demonstrating that self-regulatory efficacy can be influenced as a function of altering specific sources of self-efficacy information.

As highlighted by both Berkhuysen and colleagues (2001) and Rejeski and colleagues (2003), the CRP setting may be conducive to the targeted development of self-regulatory self-efficacy. Beyond the provision of structured exercise, CRPs also emphasize the importance of independent exercise beyond that carried out in the structured program. Self-regulatory self-efficacy may be especially important in the management of this independent exercise (cf. Bandura, 2004; Brawley et al., 2003; Clark, 2003). Traditional CRPs have been criticized for providing limited instruction and practice in developing *self-regulatory* skills for behaviour change toward an *independent* exercise regimen (Rejeski et al., 2003; Scholz, Sniehotta, & Schwarzer, 2005; Willich, Muller-Nordhorn, Kulig et al., 2001). If CRP participants could become efficacious toward self-managed independent exercise and related adherence, rehabilitation effects obtained through structured exercise might be sustained. Indeed, one form of self-regulatory efficacy that has been related to

CRP adherence is scheduling self-efficacy. Several studies have revealed it as a significant predictor of exercise attendance in asymptomatic populations (e.g., Bray et al., 2001; DuCharme & Brawley, 1995; Rodgers, Hall et al., 2002), as well as symptomatic individuals (e.g., CRP exercise: Bray & Cowan, 2004; Woodgate et al., 2005). One strategy to influence CRP participants in taking a first step toward home-based, independent exercise would be to enhance self-regulatory efficacy for *scheduling* the exercise prescription into the participants' lifestyle.

The present study attempted to influence CRP participants' self-efficacy for scheduling independent exercise. The manipulation was based on self-efficacy theory and focused upon varying two sources of self-efficacy information (i.e., vicarious experiences, verbal persuasion) as a means of altering scheduling self-efficacy (cf. Bandura, 1986, 1997).

Purpose

The primary purpose of Study Three was to attempt to acutely manipulate CR participants' independent exercise scheduling self-efficacy through a persuasive written message. This experiment provided the opportunity to manipulate scheduling self-efficacy information in order to bring about changes in scheduling self-efficacy and exercise intentions. It was hypothesized that the self-regulatory efficacy enhancing condition would foster greater increases in CRP participants' scheduling self-efficacy and exercise intentions than their counterparts in the information control condition.

The second purpose was to determine whether the efficacy-enhancing condition encouraged greater action plans for independent exercise and more behavioural

commitment toward learning how to become an independent exerciser than the information control condition.

Method

Participants and Design

The study was a 2 (message condition: efficacy enhancing / control) x 2 (time: pre-manipulation / post-manipulation) design with randomization of participants to message conditions. The volunteer participants in the study were 54 cardiac rehabilitation exercise program (CRP) participants recruited from two similar, well-established, rehabilitation programs in different provinces (i.e., Ontario, Saskatchewan). The sample sizes for the two programs were 33 and 21 respectively. A one-way between-groups MANOVA indicated that there were no significant differences among study participants on any of the variables as a function of their involvement in the two separate cardiac rehabilitation programs (Wilks' $\lambda = .787$, $p > .05$). Thus, all subsequent statistical analyses were conducted on the total sample ($n = 54$).

The vast majority of the participants (M age = 69 years, $S.D.$ = 7.82) were married (79%), while 21% were single, divorced or widowed. In addition, the majority of the participants were retired (78%) or employed (19%). The various cardiovascular events and procedures that were the original reasons for cardiac rehabilitation involvement were myocardial infarction (45%), followed by coronary artery bypass surgery (35%), and angioplasty / angiogram (8%). The sample was predominantly male ($n = 36$ [66.7%]) and the mean tenure of participation in the CRP was 10 months ($S.D.$ = 9.13 months, range: 2 months – 3 years). CRP participants with this experience were selected because adaptation

from structured to independent home-based exercise was posited to challenge participants' self-regulation.

Inclusion criteria were that participants (a) were engaged in the CRP between 2 months and three years, and (b) understood English. Participants were drawn from the two CRPs in order to obtain an adequate number of individuals with less than three years of experience.

Measures – Pre-Manipulation

The pre-manipulation study questionnaire can be found in Appendix L.

Scheduling self-efficacy. This seven-item measure from the first two studies was adapted in order to assess CRP participants' confidence in their ability to perform various organizational and scheduling tasks that would make regular *independent* exercise participation possible over the next week (DuCharme & Brawley, 1995; Rodgers et al., 2002; Woodgate et al., 2005). Participants were provided with a control definition of independent exercise as "exercise that you do outside of the cardiac rehabilitation program". An example item was, "Arrange my schedule to do independent exercise regularly no matter what next week". In previous research, this type of measure has been related to self-reported exercise (Rodgers et al., 2002), exercise attendance (Woodgate et al., 2005) and exercise intentions (DuCharme & Brawley, 1995). The internal consistency for the scale was good pre-manipulation and post-manipulation (α = 0.98, .98, respectively; Nunnally, 1978).

Exercise intentions. The exercise intentions measure was adapted for CRP from the first two studies to measure both frequency and strength. Participants were asked to forecast the number of times they intended to exercise *independently* over the next week

(i.e., frequency). The strength of the intention was then assessed using a 9-point, 1 (*definitely will not)* to 9 (*definitely will*) scale.

Measures – Post-Manipulation

The post-manipulation questionnaire was identical to the pre-manipulation questionnaire except for the post-manipulation exclusion of the demographics. In addition, the post-manipulation questionnaire included a series of manipulation check items, as well as action plan and behavioural commitment measures. The post-manipulation study questionnaire can be found in Appendix N.

Manipulation check. In order to heighten the effectiveness of written persuasive messages, the message must be perceived as informational and credible and designed for people like the reader (Bandura, 1997). To determine if participants in both conditions perceived that the message they read contained the qualities that have been suggested as effective communication (Bandura, 1997; Kopfman, Smith, Ah Yun, & Hodges, 1998), they were asked a series of questions about the message. In the current study, participants responded to six items with respect to these message attributes on a 1 (*strongly disagree*) to 9 (*strongly agree*) scale. An example item was, "The message was easy to understand". The item scores were then summed and averaged to provide an indication of mean message effectiveness. The internal consistency for the scale in the present study was $\alpha = 0.86$.

Action plans. Action plans, a form of specific goals (i.e., when, where, and how an individual will execute their intentions), were examined as a means of determining whether participants could express self-regulatory type actions that they intended for the future. Action plans have recently received attention as a measured outcome variable in exercise research (Rise, Thompson, & Verplanken, 2003). In the present study, a CRP-revised

version of a four-item action plans outcome measure was used to determine if the manipulation affected the extent of participants' action plans at post-manipulation (Rise et al., 2003). At post-manipulation, participants used the four items to rate the extent to which they had made detailed plans about when, where, what and how they would engage in independent exercise over the next week. The revised measure utilized a 1 (*strongly disagree*) to 9 (*strongly agree*) response scale. A sample item was "I have made detailed plans about where I will exercise independently over the next week". The internal consistency for the scale in the present study was $\alpha = 0.91$.

Behavioural commitment intentions. In order to determine the extent to which the manipulation of scheduling self-efficacy affected future behavioural commitment, three post-manipulation behavioural commitment intention items were assessed. These items served as intentions about "multiple-act" criteria (i.e., if the primary intention to engage in independent exercise was not influenced, perhaps intentions for learning behaviours would manifest themselves). The three related behavioural commitment intentions assessed in the present study were (a) reading an additional pamphlet that would be mailed to them about strategies to schedule independent exercise, (b) completing an interactive phone discussion with the researcher regarding scheduling independent exercise and CR, and (c) attending a free 30-minute workshop on how to improve independent exercise scheduling skills. Participants responded to these three items on a 1 (*definitely will not*) to 9 (*definitely will*) scale. The internal consistency for the scale in the present study was $\alpha = 0.84$.

Procedure

Recruitment and Research Ethics

Recruitment strategies consisted of posters at the CRP site, presentations by a study researcher at the respective CRP sites, and by word of mouth within the CRP (i.e., CRP staff, other CR participants). At the Ontario site, volunteer participants remained after a CRP session for initial study orientation and informed consent completion. Then, interested participants completed the questionnaire on-site under the supervision of the primary investigator either individually or in small groups (<6 participants).

At the Saskatoon site, participant recruitment occurred in four stages due to ethical and program stipulations. First, for reasons of privacy and arms length recruitment, interested participants contacted a CRP liaison and research coordinator regarding eligibility criteria and to provide their contact information. Second, the liaison provided the contact information for eligible participants to a study researcher. The study researcher then contacted the interested participants to schedule a convenient time to complete the questionnaire following one of their regularly scheduled CRP sessions.

The Written Message Manipulation

For the efficacy-enhancing condition, a written message was used in an attempt to manipulate CR participants' scheduling self-efficacy for regular *independent* exercise in addition to CR exercise program sessions (Appendix M). For the information control condition, the message was of similar length, and contained educational information that was relevant to cardiac rehabilitation and normally provided by the CRP interventionist (i.e., standard care information). Participants had already been exposed to this information as a part of their participation in CRP (Appendix M). A CRP exercise coordinator

reviewed the content of both written messages. Whereas both messages were deemed representative of information that would be disseminated throughout the course of the CRP, the normal delivery of the efficacy enhancing information was neither systematic nor necessarily delivered to every participant (e.g., independent exercise strategies were provided upon a participant's request).

Common message elements. Both written messages included a similar-other cardiac rehabilitation participant (i.e., Jack: male participant; Mary: female participant) who was described using participant demographic characteristics drawn from a previous CRP exercise study (Woodgate et al., 2005) with similar participants. In both messages, Jack/Mary was described as (a) 65 years old, (b) participating in a CRP for a year and a half, and (c) having a heart attack and some cardiovascular difficulties two years ago. Both messages were constructed to be similar in length (efficacy enhancing: $n = 681$ words; information control: $n = 646$ words).

Unique elements: Efficacy-enhancing message. The efficacy-enhancing message was designed to provide participants with how-to information about scheduling independent exercise (i.e., outside of the CRP). In order to enhance scheduling self-efficacy, Jack/Mary was described as utilizing several independent exercise scheduling strategies and commented on their ease of implementation. For example, one aspect of the message emphasized the importance of planning small blocks of time throughout the week for independent exercise. See Appendix M for full message text.

Unique elements: Information control message. The information control message described the standard information provided to CRP participants regarding lifestyle changes after a cardiovascular event. The lifestyle change recommendations were adopted

from the Heart and Stroke Foundation of Canada (2005) guidelines for healthy living following a heart attack. Jack/Mary described the general lifestyle changes as suggested by the CRP interventionist, which included standard care recommendations for exercise prescription, diet, monitoring stress, smoking, and alcohol consumption. For example, "the program staff suggested that Jack try to reduce the salt he eats by avoiding salty foods like potato chips and nuts". See Appendix M for full message text.

Pilot testing. In order to heighten the quality, clarity and relevance of a message, the message must be perceived by the reader as informational, credible, understandable, designed for people like themselves, and accurate (Bandura, 1997; Kopfman et al., 1998). A small pilot study was conducted to determine if these qualities were perceived in the two study messages. Pilot testing was conducted with a small sample of CRP participants representative of participants in the present study (n = 5 [3male, 2 female], M age = 67; M program participation = 9.2 months).

Pilot test participants read each message and responded to six items with respect to the aforementioned message attributes on a 1 (*strongly disagree*) to 9 (*strongly agree*) scale (i.e., informational, credible, understandable, designed for people like themselves, accurate). The item scores were then summed and averaged to provide an indication of mean message effectiveness. Results indicated that both written messages were considered informative, credible, understandable, designed for people like themselves, and accurate (M efficacy-enhancing message = 8.1; M information control message = 8.4).

These pilot participants were also asked for qualitative feedback regarding the content of both written messages. Two suggestions provided by the participants regarding the description of the individual in the written messages were incorporated in the final

messages. First, in order to ensure a sense of similarity with the individual in the message, Jack's past employment (i.e., retired manager) was omitted. Second, pilot participants suggested that creating gender-specific messages would also increase perceived similarity with the individual in the message. Consequently, written messages were created wherein the individual in the message was either male (i.e., Jack) or female (i.e., Mary). This resulted in the final, four gender-specific written messages previously described (a) female efficacy-enhancing, (b) male efficacy-enhancing, (c) female information control, and (d) male information control (see Appendix M for male and female messages).

Testing and Manipulation Protocol

At each site, participants were randomized to one of the two written message manipulation conditions: efficacy-enhancing or information control. Participants were informed of the voluntary and confidential nature of the study prior to completing the questionnaire. The study questionnaires were completed either individually or in small groups (i.e., < 6 participants) at the CRP site under the supervision of a study researcher.

Participants completed the pre-manipulation measures, then read the written message (i.e., efficacy-enhancing or information control). After reading the message, they completed the post-manipulation measures. Participants were then provided with a feedback letter describing the purpose of the study, dissemination of study findings, contact information and related references.

Results

Data Management

Data management strategies were used to address missing data, the presence of outliers as well as to assess and insure normality. These data management procedures were

used in all three studies. To avoid redundancy, these procedures were described in Study One.

Analytic Strategy

The analyses were conducted in four stages. The first set of analyses had the following two purposes (a) to produce descriptive statistics for the entire sample, as well as for participants within each written message condition, and b) to check for unintended selective assignment to condition. Relative to the second purpose, two MANOVA procedures were conducted to determine if randomization to condition had been effective. The first MANOVA tested for between-groups differences among the potential covariates of age, duration in the CRP, and gender. The second MANOVA was used to test for between-groups differences on the pre-manipulation theoretical variables of scheduling self-efficacy and exercise intentions.

The second stage of analysis was conducted as a manipulation check on equality of common characteristics of message quality for each written message condition. Specifically, an ANOVA procedure was performed to test whether the perception of message quality for each condition differed.

The third stage of analysis used a mixed model 2 (between: written message condition) x 2 (within: time) MANOVA to examine the hypothesis that the efficacy-enhancing condition would result in greater change in scheduling self-efficacy and exercise intentions than the control condition. In the case of unequal variance between groups (i.e., scheduling self-efficacy, strength of intentions), log transformations were conducted. Analyses were conducted with the transformed data. For ease of interpretation, the raw means are presented.

The fourth stage of analysis utilized a one-way, between-groups MANOVA to examine whether the efficacy-enhancing condition would elicit greater post-manipulation action plans and behavioural commitment intentions than the information control condition.

Pre-Manipulation Differences: Covariates and Theoretical Variables

Analysis of potential covariates. Prior to conducting analyses concerning theoretical variables, a one-way MANOVA was conducted to examine the possibility of written message group differences across the demographic variables of age, duration in the CRP, and gender. No significant differences were found between participants randomly assigned to either the efficacy-enhancing or information control written message conditions (Wilks $\lambda = .977$, $F\ (3, 50) = 0.513$, $p = .602$).

Pre-manipulation theoretical variable analysis. Descriptive analyses for the entire sample, as well as for participants within each written message condition can be found in Table 9. A one-way MANOVA was conducted to examine if there were any pre-manipulation group differences across the dependent variables of scheduling self-efficacy, exercise intentions for frequency, and strength of intentions (i.e., randomization of participants to conditions was effective). This pre-manipulation MANOVA revealed that there were no significant differences between the participants randomly assigned to either the efficacy- enhancing or information control written message conditions (Wilks' $\lambda = .987$, $F\ (3, 50) = 0.219$, $p = .883$). The random assignment of CRP participants to conditions was effective.

Table 9.

Pre-Manipulation Descriptive Statistics

	Entire Sample	Efficacy Enhancing	Control	*p*
Scheduling Efficacy	57.10 (23.10)	59.34 (17.75)	54.86 (27.60)	.481
Intentions Frequency	2.70 (1.70)	2.81 (1.66)	2.60 (1.76)	.636
Intentions Strength	6.94 (1.56)	6.96 (1.34)	6.93 (1.77)	.931

Note. $n = 54$ for the entire sample ($n = 27$ in each of the efficacy-enhancing and information control conditions). Scheduling efficacy 0 – 100% scale, Intentions frequency 0-7 scale, Intentions strength 1-9 scale. Standard deviations are in parentheses.

Manipulation Check on Message Quality

An ANOVA with written message condition as the independent variable and an index of message quality as the dependent variable indicated no significant differences between the efficacy-enhancing and information control message conditions, $F(1,52) = 1.152$, $p = .289$). The mean message quality for the efficacy enhancing condition was 8.35 (*S.D.* = .875) and the mean for the information control condition was 8.10 (*S.D.* = .792). CRP participants felt that both messages were equivalent in the qualities of persuasive communication (Bandura, 1997; Kopfman et al., 1998).

Differences between Experimental Conditions

A 2 between-subjects (condition: efficacy enhancing / information control) by 2 within-subjects (time: pre-manipulation / post-manipulation) MANOVA was used to test for differences among the dependent variables of scheduling self-efficacy, exercise intentions for frequency, and strength of intentions.

Message condition. The multivariate between-groups main effect for message condition (Wilks' $\lambda = .960$, F (3, 50) = .686, $p = .565$, observed power = .185) was not significant (Appendix O).

Time. A significant multivariate within-subjects main effect was found for time (Wilks' $\lambda = .702$, F (3, 50) = 7.08, $p = .001$, observed power = .973). Univariate F-tests indicated that participants reported significantly greater post-manipulation scheduling self-efficacy and exercise intentions for frequency than at pre-manipulation (Table 10).

Table 10.

Main Effects for Time

	Pre-manipulation	Post-manipulation	η^2	p
Scheduling Efficacy	57.10	65.60	.222	.001
Intentions Frequency	2.70	3.06	.112	.013
Intentions Strength	6.94	7.19	.019	.318

Note. Scheduling Efficacy 0 – 100% scale, Intention frequency 0-7 scale, Intention strength 1-9 scale.

Message condition by time interactions. These main effects, however, were superceded by a significant time by message condition multivariate interaction (Wilks' $\lambda = .685$, F (3, 50) = 7.68, $p = .001$, observed power = .982). Subsequent post-hoc univariate F-tests revealed that the interaction was significant for both scheduling self-efficacy ($F = 17.86$, $p < .001$, $\eta^2 = .256$) and exercise intentions for frequency ($F = 5.26$, $p = .026$, $\eta^2 = .092$).

Post-hoc tests for the interactive effect on scheduling efficacy indicated that participants in the efficacy enhancing message condition were more efficacious post-

manipulation. Specifically, participants in the efficacy-enhancing condition had significantly greater scheduling self-efficacy (M = 75.13) than information control participants (M = 56.07). The nature of this interaction is illustrated in Figure 2.

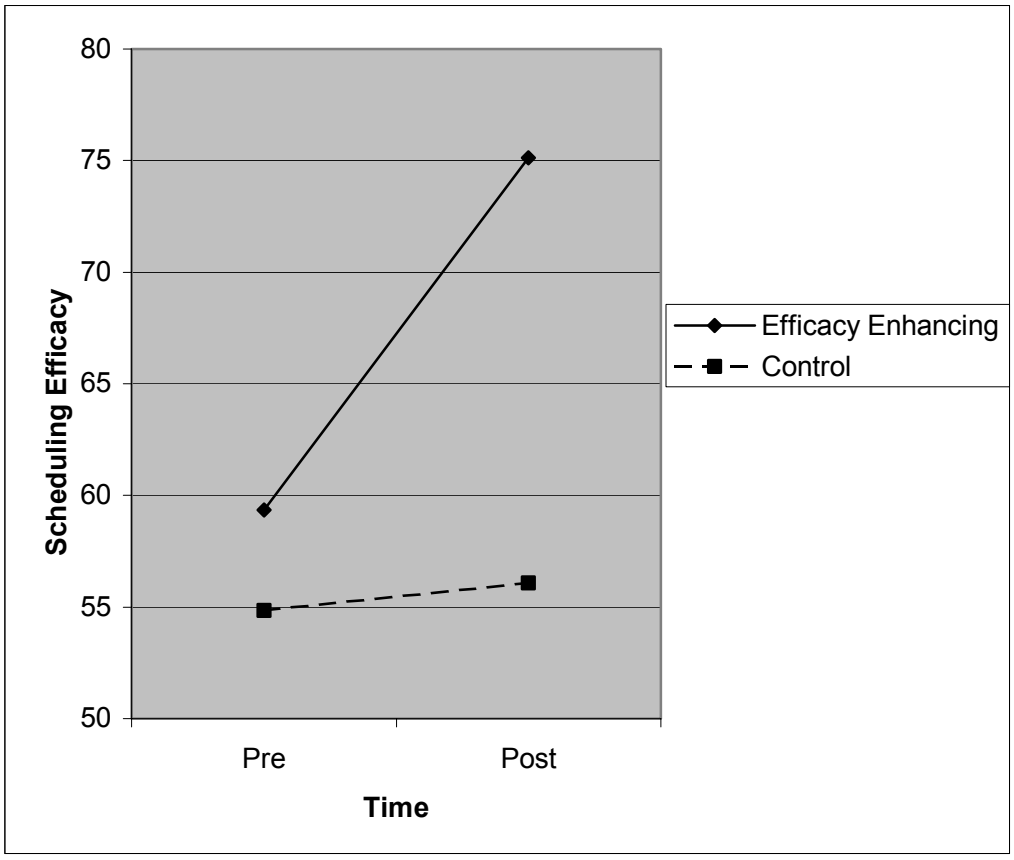

Figure 2. Message condition by time interaction for scheduling self-efficacy.

Participants in the efficacy-enhancing message condition also expressed significantly greater exercise intentions for frequency (M = 3.48) than their information control counterparts (M = 2.63). The nature of this interaction is illustrated in Figure 3.

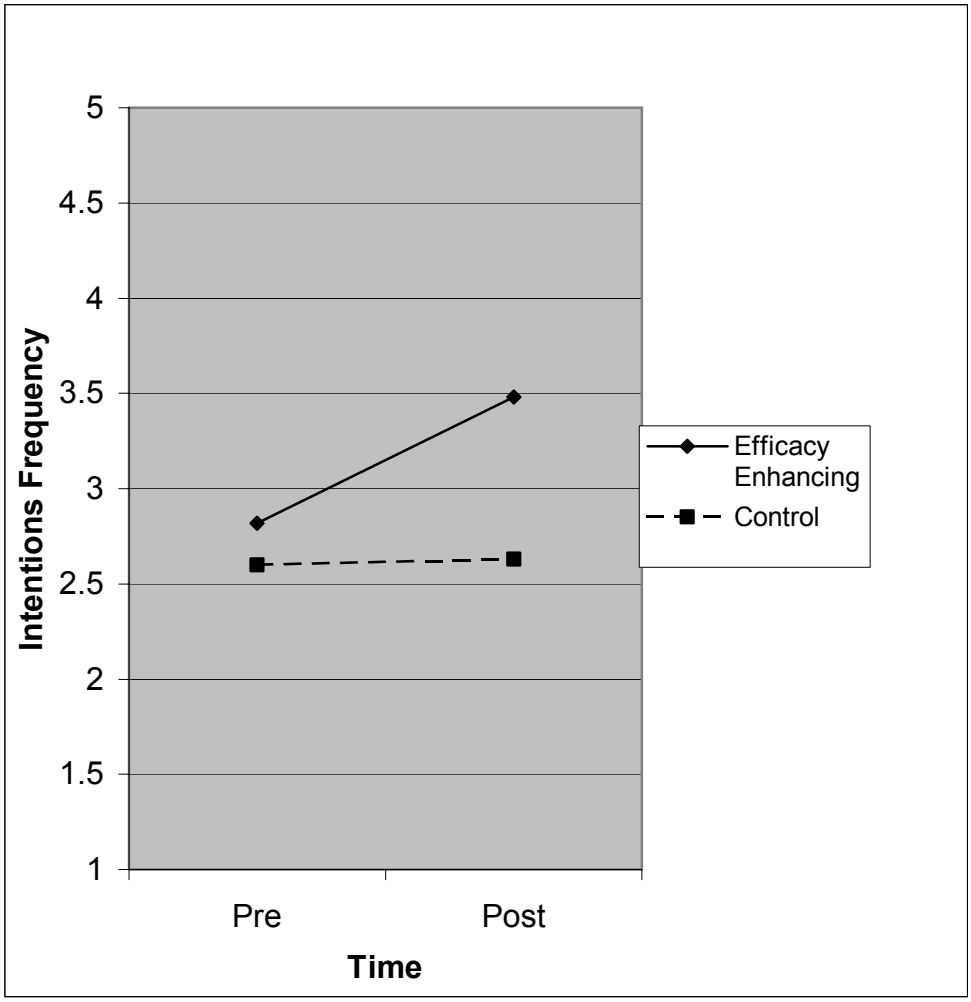

Figure 3. Message condition by time interaction for exercise intentions for frequency.

Behavioural Differences Between Conditions

Action plans and behavioural commitment intentions. A one-way between-groups MANOVA was conducted with the written message conditions as the between-groups factor and action plans and behavioural commitment intentions as the dependent variables. This between-groups MANOVA was significant (Wilks' $\lambda = .782$, F (2, 51) = 7.12, p = .002, observed power = .917), indicating a main effect for message condition.

Examination of the univariate F-tests revealed that the efficacy-enhancing condition participants reported significantly greater action plans and behavioural commitment

intentions than the information control participants (Table 11). These action plans and intentions to take first steps toward learning about independent exercise strategies are indications of initial actions following an acute manipulation by a persuasive message (cf. Brawley & Rodgers, 1993; Olson & Zanna, 1983). Post-manipulation bivariate correlations between scheduling efficacy, action plans and behavioural commitment for participants in the efficacy-enhancing message condition can be found in Appendix P.

Table 11.

Between Condition Differences: Action Plans and Behavioural Commitment Intentions

	Efficacy Enhancing	Control	η^2	*p*
Action Plans	6.94 (1.62)	5.95 (1.81)	.078	.041
Behavioural Commitment	8.15 (1.22)	6.38 (2.08)	.217	.001

Note. Action Plans 1 (*strongly disagree*) – 9 (*strongly* agree) scale, Behavioural Commitment 1 (*definitely will not*) – 9 (*definitely will*) scale. Standard deviations are in parentheses.

Discussion

The results of Study Three indicated that an acute efficacy-enhancing manipulation designed to target sources of scheduling self-efficacy among CRP participants was effective. This finding has relevance for both theory and clinical practice.

From a theoretical perspective, the results provide support for Bandura's (1997) assertion that self-regulatory efficacy can be developed through determinants of self-efficacy beliefs. Specifically, a written message manipulation that focused on the specific self-efficacy determinants of verbal persuasion and vicarious experience successfully influenced CRP participants' scheduling self-efficacy and exercise intentions for the

management of independent exercise. Furthermore, the interaction results indicated that participants exposed to the efficacy-enhancing message were more confident to schedule independent exercise sessions and intended to engage in more frequent independent exercise bouts than participants exposed to the CRP information control message.

The finding that acute exposure to an efficacy-enhancing written message encouraged CRP participants to become more efficacious towards independent exercise and exhibit more frequent independent exercise intentions also has clinical relevance. Specifically, this demonstration may represent an initial step in understanding how to promote CRP participants' adherence to this recommended lifestyle change (Rejeski et al., 2003; Willich et al., 2001). Furthermore, preliminary support for the clinical utility of this manipulation to foster CRP participants' independent exercise is offered by the finding that the efficacy-enhancing message elicited greater initial action plans for trying to schedule independent exercise and greater behavioural commitment to engaging in an opportunity for learning more about independent exercise.

Study Limitations

While the results underscore the importance of examining the development of exercise-related self-regulatory efficacy, limitations of this preliminary study should be taken into account. One limitation is that the results observed are restricted to a volunteer sample of CRP participants engaged in a structured CRP. Thus, sampling limits the ability to generalize these results to other CRP participants (e.g., long-term maintenance).

Another limitation concerns the relatively small sample size. Although the efficacy- enhancing message was found to influence CRP participants' confidence in their

ability to schedule independent exercise and frequency of exercise intentions, analyses may have benefited from increased statistical power.

Finally, it is impossible to completely rule out two potential alternate explanations for the efficacy-enhancing message effects. First, although it was not measured or systematically manipulated, one could argue that there might have been affective components to the efficacy-enhancing message. In other words, although verbal persuasion and vicarious experience information constituted the planned message content, participants' affective reactions to the message might have also strengthened self-regulatory efficacy beliefs. While not a systematically planned consequence of the message manipulation, the possibility of an affective reaction could be adding to the effects obtained. This possibility could be examined in a future study where affective reactions would be assessed and/or the affective quality of the message would be manipulated.

A second alternative explanation is that the efficacy-enhancing group might have reacted in a socially desirable manner to the message and that social desirability is responsible for the effects. However, this hypothesis would implicate socially desirable reactions from both groups if the social desirability was a result of participants giving a response as an expected favorable reaction to reading any positive message. For instance, there was a time effect of improvement in scheduling self-efficacy for participants regardless of condition. While this time effect could reflect a socially desirable reaction, it appears from the interaction result that the effect of the efficacy-enhancing message may have exceeded any socially desirable reaction to receiving the message. However, in some future study, the administration of a social desirability scale could provide responses that would help to either confirm or disconfirm the social desirability hypothesis.

Study Strengths

The present study also had important methodological and conceptual strengths. One strength of the present study is that the primarily descriptive past research on exercise-related self-regulatory efficacy (cf. Maddux & Gosselin, 2003; McAuley & Mihalko, 1998; McAuley et al., 2001) has been extended by the theory-based acute manipulation of scheduling self-efficacy (cf. Bandura, 1986, 1997).

Another strength of the study involved the use of an experimental design with random assignment of participants to the message conditions. This allowed for the examination of Bandura's (1997) assertion that sources of self-regulatory efficacy can be acutely enhanced by identified determinants. These results revealed that, like task self-efficacy, sources of self-regulatory efficacy information could be acutely manipulated.

However, replicating and extending these findings would strengthen the case advanced by Bandura (1997). One suggestion for future research is to examine whether other types of self-efficacy determinants alter scheduling or other forms of self-regulatory efficacy to an equal or greater extent. For example, a mastery-based intervention may enhance efficacy to even higher levels compared to a persuasive communication manipulation (cf. Bandura, 1997) or the exposure to vicarious experience and verbal persuasion information could be an initial step to acutely influence efficacy and mastery experiences could be the subsequent step with potentially longer lasting effects.

In addition, the long-term behavioural effects of the message are unknown. For example, does this initial enhancement of scheduling self-efficacy and related intentions and action plans correspond with commensurately greater independent exercise participation by CRP participants? Furthermore, it is unknown whether repeated exposure

to the efficacy-enhancing message would be beneficial in sustaining these enhanced cognitions.

General Discussion

Adhering to an exercise program is complex, and exercisers struggle with a variety of challenges that require self-regulation (Dishman, 1994; Rodgers & Brawley, 1993). Bandura (1995b) has deemed that the assessment of self-regulatory efficacy to manage the regular performance of health behaviours (e.g., exercise) is essential. Despite this recommendation, major reviews of the exercise-related self-efficacy literature have demonstrated that *task* self-efficacy has been the most investigated aspect of the self-efficacy construct (e.g., Culos-Reed et al., 2001; McAuley & Mihalko, 1998).

Comparatively, exercise-related self-regulatory efficacy research is less prevalent and few components of self-regulation have been examined. Specifically, barriers self-efficacy has been the predominant operationalization of self-regulatory efficacy (McAuley & Mihalko, 1998). While exercise-related self-regulatory efficacy research in the last seven years has used other operationalizations of the concept (e.g., coping self-efficacy, scheduling self-efficacy, acute thoughts self-efficacy), this has primarily occurred in the absence of reference to self-regulation frameworks (Brawley, 2005). Indeed, Bandura (1995b) has proposed that self-regulatory efficacy is comprised of multiple self-regulatory skills.

This series of dissertation studies represent an initial attempt to advance the exercise-related self-regulatory efficacy literature by (a) expanding the operationalization of the construct with reference to self-regulation frameworks, (b) assessing moderators of its influence on exercise behaviour, and (c) acutely manipulating sources of self-regulatory self-efficacy information.

Collectively, the results of these studies support Bandura's (1995b, 2004) proposition that self-regulatory efficacy consists of beliefs about self-regulatory skills in addition to confidence to overcome barriers. Moreover, the findings advance the extant descriptive research on self-regulatory efficacy in the exercise domain.

Contributions to Theory and Measurement

The results from these three studies support Bandura's (1997, 2004) contentions regarding self-regulatory efficacy and self-efficacy theory at three levels. First, these studies offer support for self-efficacy theory in exercise in regard to the concept of self-regulatory efficacy and its more "crucial" influence on behaviour (Maddux, 1995, p.382).

Second, these studies address Bandura's (1995b, 1997) assertion that the concept of self-regulatory self-efficacy encompasses numerous self-regulatory skills. Accordingly, the operationalization of exercise-related self-regulatory efficacy was expanded to detect more components of self-regulation than examined in the exercise literature to date. Moreover, this occurred with reference to existing frameworks of self-regulation.

Third, the acute manipulation of sources of self-regulatory efficacy information in Study Three is theoretically important. Specifically, this study demonstrated that sources of information that lead to the development and strengthening of scheduling self-efficacy can be acutely enhanced as proposed by self-efficacy theory (cf. Bandura, 1986, 1997). These initial findings are noteworthy in that they demonstrate that sources of self-regulatory efficacy information other than direct mastery experiences can alter self-regulatory efficacy beliefs for an acute exercise-related situation.

Contributions to the Exercise Literature

The assessment of several facets of self-regulatory efficacy is consistent with the decade old recommendation by DuCharme and Brawley (1995) and several more recent exercise-related reviews (cf. Brawley, 2005; Culos-Reed et al., 2001; McAuley & Mihako, 1998) to assess multiple aspects of self-efficacy. These measures were predicted exercise behavior in addition to the traditional use of barriers efficacy. To date these types of studies are in the minority but appear to offer more predictive information than any single measure.

An additional research recommendation made a decade ago (Dzewaltowski, 1994), but receiving limited attention, concerned the examination of moderators of the self-efficacy – exercise relationship. The second study served to advance self-regulatory efficacy research beyond the level of basic description by examining potential trait-like moderators of its influence on exercise behaviour. Furthermore, this study represented the first examination of CFC in the exercise domain and provided initial insight into Barone and colleagues' (1997) propositions regarding CFC and self-regulation with respect to exercise behaviour.

A priority for exercise research that has been considered essential to advance the exercise-related self-efficacy research beyond description is the manipulation of processes hypothesized to lead to adherence and health outcomes (Baranowski et al., 1998; Brawley et al., 2003; Rejeski et al., 2000). The results of Study Three indicate that a prototype strategy for manipulating sources of exercise-related self-regulatory efficacy information was effective. Furthermore, the increase in scheduling self-efficacy was paralleled by the finding that the participants in the efficacy-enhancing condition expressed stronger action

plans and behavioural commitment to learn more about how to manage independent exercise. If this type of manipulation was successfully replicated with other symptomatic and asymptomatic populations, it has potential applied implications for exercise behaviour change interventions.

Limitations

While the initial findings of this series of studies are promising, they should be considered in light of the limitations of the studies. One limitation is that the results observed are only applicable to the sample populations. Specifically, the findings of Studies One and Two are based upon self-selected, active young adult samples. A conscious decision to sample these individuals was made in order to heighten the possibility that the self-regulatory efficacy measures would be meaningful (cf. McAuley & Mihalko, 1998). Nonetheless, this limits generalizability.

The experiment in the third study was conducted with cardiac rehabilitation participants engaged in a structured therapeutic exercise program. As such, the generalizability of the manipulation effects to CRP participants engaged in longer term maintenance programs, or to individuals engaged solely in home-based exercise therapy or to asymptomatic exercisers is unknown.

A second limitation is that convenience sampling in Studies One and Two may have contributed to the truncated range of scores on the self-regulatory efficacy and moderator variable measures. However, it is worth noting that active participants were recruited from Canadian exercise contexts in winter months when the self-regulation of exercise is arguably more challenging (e.g., transportation, location of exercise). Given that the study participants were active during this time, it may not be surprising that they were

quite efficacious about their ability to self-regulate exercise participation and that the truncated range is representative of this type of exerciser.

With respect to the examination of the potential moderators of self-regulatory efficacy (i.e., optimism and CFC), sampling differently in order to obtain a less truncated range of scores (i.e., low optimism, CFC) might have been more desirable. Alternatively, it may be argued that regardless of the truncated range reported by participants on these measures, self-regulatory efficacy differences were still detected when high and moderate CFC and optimism groups were compared.

Strengths

Despite these limitations, the studies have important methodological and theoretical strengths. One of the general contributions of these studies is to move beyond a single mode of thinking about self-regulatory efficacy into an arena where that multifaceted concept (Bandura, 1995b, 2004; Brawley, 2005; DuCharme & Brawley, 1995; McAuley & Mihalko, 1998) and its operationalizations can be tested. This series of studies addressed Bandura's (1995b) contention that self-regulatory efficacy is comprised of many self-regulatory skills. Indeed, self-regulation frameworks advance this position (Barone et al., 1997; Meichenbaum & Turk, 1987). Accordingly, the conceptualization to operationalization link was informed by self-efficacy theory, self-regulation frameworks, and the exercise context.

With respect to methodology, the series of studies employed sound designs. Studies One and Two employed prospective designs, allowing for the use of self-regulatory efficacy to predict subsequent exercise. In this sense, Bandura's (1997) premise about the causal direction of self-efficacy as a potential determinant of future behaviour could be

examined. Study Three involved an experimental design with random assignment of CRP participants to conditions allowing for a more tenable case to be made about sources of efficacy information causally influencing efficacy beliefs. To ensure message effectiveness in both conditions, a message manipulation check was conducted. As such, both efficacy-enhancing and information control messages were equal in participants' perceptions of quality, believability, relevance and length. This check helped to rule out alternative explanations that the effects demonstrated in Study Three were due to differential message quality.

In addition, Study Three represented one of the first attempts to acutely manipulate sources of self-regulatory self-efficacy information in exercise Furthermore, this study was conducted in the context of cardiac rehabilitation, and the nature of the messages was salient to CRP participants, thereby providing ecological validity to the investigation.

Practical Implications

Given the non-adherence to regular exercise regimens (Dishman, 1994), the current findings may offer some future practical and research implications for exercise professionals and interventionists. The series of studies highlight the need for exercise professionals to extend the development of self-efficacy beyond the exercise prescription (e.g., duration, intensity) to promoting confidence to engage in the multi-faceted self-regulatory skills needed to self-manage exercise on a regular basis.

There is the potential benefit of translating this research to practice by providing exercise interventionists with preliminary information about how to alter sources of self-regulatory efficacy information in order to increase efficacy to self-manage exercise. Rejeski and colleagues (2003) highlighted the importance of disentangling the process

variable effects of global self-regulation interventions. This would further our understanding of whether the self-regulatory skills participants learn during the intervention translate to efficacy for those skills and thus, adherence to the intervention. Such information can be used to inform the development of future theoretically-driven interventions aimed at enhancing exercise-related self-regulatory efficacy and improving exercise adherence.

Future Research

The results of the present study underscore the theoretical and practical importance of developing relevant measures of self-regulatory efficacy. However, there is a need for continued research to reliably establish the relevant facets of the self-regulatory construct in the exercise domain. As Maddux and Lewis (1995) pointed out, there are facets of self-regulatory efficacy in addition to the behavioural domain that warrant future research attention (i.e., cognitive, emotional). For example, in the cardiac rehabilitation context, new participants may struggle with fear and anxiety about symptomatology and resuming exercise (Ewart, 1995). For the most part, these types of cognitive and emotional self-regulatory efficacy beliefs remain unexplored with respect to exercise.

A concurrent goal of future research should be to continue to examine potential moderators of the effects of self-regulatory efficacy on exercise behaviour among asymptomatic and symptomatic individuals. In addition to optimism and CFC, problem-solving *ability* might also impact upon an individual's confidence to self-regulate regular exercise behaviour. Individuals with greater problem-solving ability may be more efficacious to adjust and adapt their exercise regimen in the face of challenging circumstances (cf., Maddux & Lewis, 1995). The influence of these moderator variables

might be more pronounced in populations where exercise adherence is a greater struggle (e.g., osteoarthritis, fibromyalgia) because of symptomatology and limited physical functioning. Consider the example of individuals with fibromyalgia who have to adapt their exercise to daily fluctuations in symptomatology (e.g., fatigue, pain). Individuals with fibromyalgia with greater problem-solving ability may pace their exercise throughout the day, balancing exercise against fatigue and pain rather than giving up altogether on exercise that day.

In addition to the description of the relationships between various aspects of self-regulatory efficacy and exercise behaviour, we need to understand the sources of information that might alter the strength of self-regulatory efficacy beliefs. Study Three demonstrated that a brief written message containing vicarious experience and verbal persuasion information was effective in altering scheduling self-efficacy. However, the effects of the manipulation on self-efficacy and exercise-related intentions were *acute*. While it has been suggested that targeting change in specific, competency-related beliefs may help exercisers experience continued success in maintaining adherence (Maddux & Lewis, 1995), any potential long-term effects of the present manipulation on self-regulatory efficacy and exercise adherence are unknown.

Research in other populations for whom exercise is new or is being re-initiated might be undertaken using prospective designs. The benefit of the prospective design is that the developmental course of the relationship between self-regulatory efficacy and exercise behaviour could be studied and the nature of the changes in both variables observed. This seems possible for both the natural evolution of self-regulatory efficacy and for the changes that might be encouraged by an intervention. These studies could be

conducted in contexts where scheduling exercise and exercise adherence might be a challenge (e.g., first-year university students, Gyurcsik, Spink, Bray, Chad, & Kwan, in press; new mothers, Gardner & Brawley, 2005; symptomatic populations, Culos-Reed & Brawley, 2000).

In summary, the current studies only represent initial steps towards capturing self-regulatory efficacy in exercise. A need for further study in a number of areas has been identified. Without pursuing such research, will the study of self-regulatory efficacy continue to focus predominantly on barriers? If so, will the knowledge about self-regulation and our ability to effectively intervene be limited? Exercise adherence involves complex, agentive adaptation beyond the performance of motor tasks and overcoming barriers. To truly understand motivated behaviour, we should shift our research focus from task and barriers self-efficacy to the "crucial" multifaceted concept of self-regulatory efficacy (Maddux, 1995).

Appendix A

Study One

Time One Questionnaire

STUDY ONE TIME ONE QUESTIONNAIRE

Date: _____

Age: _____ **Gender**: M ☐ F ☐

Marital Status: Single ☐ Divorced ☐ Separated ☐ Married ☐ Widowed ☐ Cohabiting ☐

Considering **a typical 7-day period** (a week), how many times **on average** do you do the following kinds of exercise for **30 minutes or more** during your **free time** (write the appropriate number of times per week on each line)?

Times per week

STRENUOUS EXERCISE (your heart beats rapidly): _____
(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, skating)

MODERATE EXERCISE (not exhausting): _____
(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, dancing)

MILD EXERCISE (minimal effort): _____
(e.g., yoga, archery, fishing, bowling, horseshoes, golf, snow-mobiling, easy walking)

The following is a list of behaviours associated with participating in exercise for the next **4 weeks**. Please consider each specific behaviour as it applies to you.

Please indicate how confident you are that you can complete each of the following behaviours regularly over the next 4 weeks <u>using the scale below.</u>
Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
not at all confident					**somewhat confident**					**completely confident**

Over the next 4 weeks, I am confident that I can …

SCHEDULING SELF-EFFICACY

Attend exercise sessions three times per week for the next 4 weeks no matter what. _____

Plan for the attendance of my exercise sessions in my daily activities. _____

Arrange my schedule to exercise regularly no matter what over the next 4 weeks. _____

Maintain a definite plan to restart exercise if I should miss several sessions or weeks of sessions during the next 4 weeks. _____

Make up times when I missed my regular exercise session. _____

Make sure that I do not miss more than one week of exercise due to other obligations during the next 4 weeks. _____

Organize time and responsibilities around each exercise session during the next 4 weeks no matter what. _____

GOAL-SETTING SELF-EFFICACY

Set realistic goals for maintaining my exercise. _____

Set realistic goals for increasing my exercise. _____

Develop plans to reach my exercise goals. _____

Follow through with my exercise goals, even though it may be difficult at times. _____

Many people report that it is more difficult to exercise under some conditions compared to others. Please rate how confident you are that you could exercise under EACH of the following conditions **over the next 4 weeks**.
Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
not at all confident					**somewhat confident**					**completely confident**

Over the next 4 weeks, I am confident that I could be physically active …

BARRIERS SELF-EFFICACY

When I am tired. _____

During or following a crisis. _____

During bad weather. _____

When I am anxious or stressed. _____

When I am on vacation. _____

When I am feeling sick (e.g., cold-like symptoms). _____

When there are competing interests (like my favorite TV show). _____

When I have a lot of work or schoolwork to do. _____

When I haven't reached my exercise goals. ____

When I don't receive support from my family or friends. ___

When my schedule is hectic. ___

When I have no one to exercise with. ____

When I have an injury. ____

When my exercise workout is not enjoyable. _____

The following items concern your ability to deal with lapses in your exercise regimen. Please rate how confident you are to do the following **over the next 4 weeks**. Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
not at all confident					**somewhat confident**					**completely confident**

Over the next 4 weeks, I am confident that I can …

RELAPSE PREVENTION SELF-EFFICACY

Anticipate problems that might interfere with my exercise schedule. _____

Develop solutions to cope with potential barriers that can interfere with my exercise schedule. _____

Resume regular exercise when it is interrupted and I miss exercise for a few days. _____

Resume regular exercise when it is interrupted and I miss exercise for a few weeks. ____

Identify key factors that trigger lapses in my exercise program. _____

Learn to accept lapses in my exercise program as normal. ____

Learn to view lapses in my exercise program as challenges to overcome rather than failures. _____

EXERCISE INTENTIONS

Please indicate in the blank space below the average **number of times per week** that you **intend** to exercise over the next 4 weeks. Try to be as accurate as possible in your intentions.

On average, I will exercise _____ times per week over the next **4 weeks**.

Please **circle** the number that best represents the strength of your intentions (1 – 9).

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Definitely will not									**Definitely will**

Please indicate the average **intensity** that you intend to work at during your exercise sessions over the next **4 weeks**.
I will exercise at an average intensity that is ____ (use the following scale as a guide)

Very light - 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 – **Very intense**

Appendix B

Study One

Time Two Questionnaire

STUDY ONE TIME TWO QUESTIONNAIRE

Date: _____

Age: _____ **Gender**: M ☐ F ☐

Considering **a typical 7-day period** (a week), how many times **on average** do you do the following kinds of exercise for **30 minutes or more** during your **free time** (write the appropriate number of times per week on each line)?

Times per week

STRENUOUS EXERCISE (your heart beats rapidly): _____
(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, skating)

MODERATE EXERCISE (not exhausting): _____
(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, dancing)

MILD EXERCISE (minimal effort): _____
(e.g., yoga, archery, fishing, bowling, horseshoes, golf, snow-mobiling, easy walking)

Appendix C

Study One

Barriers Self-efficacy Pilot Test New Item Considerations

Barriers Self-efficacy Pilot Test New Item Considerations

Two items deemed of potential importance to the pilot test participants were added to the barriers self-efficacy measure (i.e., "when I have an injury", "when I am feeling sick"). However, initial examination of the descriptive statistics for these two new items indicated that participants in the present study reported high variability (i.e., *SD* = 30.0, 30.5) and the least confidence in these items (i.e., *M* = 48.0, 48.6). Thus, these two new items were not retained in subsequent analyses.

Appendix D

Study One

Prediction of Exercise by Barriers Self-efficacy

Table D1.

Prediction of Exercise Behavior by Barriers Self-efficacy

Variable	R^2 adjusted	*p*
Barriers Self-Efficacy	.24	.001

Note. $n = 99$

Appendix E

Study Two

Time One Questionnaire

STUDY TWO TIME ONE QUESTIONNAIRE

Date: _____

Age: _____ **Gender**: M ☐ F ☐

Marital Status: Single ☐ Divorced ☐ Separated ☐ Married ☐ Widowed ☐ Cohabiting ☐

At McMaster University, are you currently: ☐ student ☐staff ☐ other (specify):_____

Last 5 digits of your McMaster student/employee number:__X|_X_|___|___|___|___|___|

Considering **a typical 7-day period** (a week), how many times **on average** do you do the following kinds of exercise for **30 minutes or more** during your **free time** (write the appropriate number of times per week on each line)?

Times per week

STRENUOUS EXERCISE (your heart beats rapidly): _____
(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, skating)

MODERATE EXERCISE (not exhausting): _____
(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, dancing)

MILD EXERCISE (minimal effort): _____
(e.g., yoga, archery, fishing, bowling, horseshoes, golf, snow-mobiling, easy walking)

OPTIMISM

Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer. Please place the appropriate number in the line following each statement.

1 = I agree a lot 2 = I agree a little 3 = I neither agree nor disagree
4 = I DISagree a little 5 = I DISagree a lot

1. In uncertain times, I usually expect the best. _____
2. It's easy for me to relax. _____
3. If something can go wrong for me, it will. _____
4. I'm always optimistic about my future. _____
5. I enjoy my friends a lot. _____
6. It's important for me to keep busy. _____
7. I hardly ever expect things to go my way. _____
8. I don't get upset too easily. _____
9. I rarely count on good things happening to me. _____
10. Overall, I expect more good things to happen to me than bad. _____

CONSIDERATION OF FUTURE CONSEQUENCES

For each of the statements below, please indicate whether or not the statement is characteristic of you.
Please keep the following scale in mind as you rate each of the statements below.

1	2	3	4	5
extremely Uncharacteristic	**somewhat Uncharacteristic**	**uncertain**	**somewhat characteristic**	**extremely characteristic**

1. Often I engage in a particular behaviour in order to achieve outcomes that may not result for many years. _____

2. I only act to satisfy immediate concerns, figuring the future will take care of itself. _____

3. My behaviour is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions. _____

4. My convenience is a big factor in the decisions I make or the actions I take. _____

5. I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level. _____

6. I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time. _____

7. I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date. _____

8. Since my day to day work has specific outcomes, it is more important to me than behaviour that has distant outcomes. _____

The following is a list of behaviours associated with participating in exercise for the next **4 weeks**. Please consider each specific behaviour as it applies to you.

Please indicate how confident you are that you can complete each of the following behaviours regularly over the next 4 weeks <u>using the scale below.</u>
Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
not at all confident					**somewhat confident**					**completely confident**

Over the next 4 weeks, I am confident that I can …

SCHEDULING SELF-EFFICACY

Attend exercise sessions three times per week for the next 4 weeks no matter what. _____

Plan for the attendance of my exercise sessions in my daily activities. _____

Arrange my schedule to exercise regularly no matter what over the next 4 weeks. _____

Maintain a definite plan to restart exercise if I should miss several sessions or weeks of sessions during the next 4 weeks. _____

Make up times when I missed my regular exercise session. _____

Make sure that I do not miss more than one week of exercise due to other obligations during the next 4 weeks. _____

Organize time and responsibilities around each exercise session during the next 4 weeks no matter what. _____

GOAL-SETTING SELF-EFFICACY

Set realistic goals for maintaining my exercise. _____

Set realistic goals for increasing my exercise. _____

Develop plans to reach my exercise goals. _____

Follow through with my exercise goals, even though it may be difficult at times. _____

Many people report that it is more difficult to exercise under some conditions compared to others. Please rate how confident you are that you could exercise under EACH of the following conditions **over the next 4 weeks**.
Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
not at all confident					**somewhat confident**					**completely confident**

Over the next 4 weeks, I am confident that I could be physically active …

BARRIERS SELF-EFFICACY

When I am tired. _____

During or following a crisis. _____

During bad weather. _____

When I am anxious or stressed. _____

When I am on vacation. _____

When I am feeling sick (e.g., cold-like symptoms). _____

When there are competing interests (like my favorite TV show). _____

When I have a lot of work or schoolwork to do. _____

When I haven't reached my exercise goals. ____

When I don't receive support from my family or friends. ___

When my schedule is hectic. ___

When I have no one to exercise with. ____

When I have an injury. ____

When my exercise workout is not enjoyable. _____

The following items concern your ability to deal with lapses in your exercise regimen. Please rate how confident you are to do the following **over the next 4 weeks**. Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
not at all confident					somewhat confident					completely confident

Over the next 4 weeks, I am confident that I can …

RELAPSE PREVENTION SELF-EFFICACY

Anticipate problems that might interfere with my exercise schedule. _____

Develop solutions to cope with potential barriers that can interfere with my exercise schedule. _____

Resume regular exercise when it is interrupted and I miss exercise for a few days. _____

Resume regular exercise when it is interrupted and I miss exercise for a few weeks. ____

Identify key factors that trigger lapses in my exercise program. _____

Learn to accept lapses in my exercise program as normal. ____

Learn to view lapses in my exercise program as challenges to overcome rather than failures. _____

INSTRUCTIONS: Many people report encountering a "**problem**" that interferes with their regular exercise regimen (e.g., being too tired, having too many work or school commitments, being ill, being injured, being on vacation). Keep this kind of "problem" in mind when responding to the following items.
Please rate how confident you are that you could use the following problem-solving strategies in order to maintain your regular exercise regimen **over the next 4 weeks**.

During the next 4 weeks, I am confident that I can …

PROBLEM SOLVING SELF-EFFICACY

Take additional action to try to get rid of my exercise problem. _____

Concentrate my efforts on doing something about my exercise problem. _____

Try to come up with a strategy about what to do to maintain regular exercise._____

Make a plan of action to deal with my exercise problem._____

Put aside other activities (e.g., work, social activities, TV) in order to concentrate on maintaining my regular exercise. _____

Focus on dealing with my exercise problem, and if necessary, let other things (e.g., work, social commitments, homework) slide a little. _____

Keep myself from getting distracted by other thoughts or activities in order to maintain regular exercise. _____

Try hard to prevent other things from interfering with my efforts at dealing with my exercise problem. _____

EXERCISE INTENTIONS

Please indicate in the blank space below the average **number of times per week** that you **intend** to exercise over the next 4 weeks. Try to be as accurate as possible in your intentions.

On average, I will exercise _____ times per week over the next **4 weeks**.

Please **circle** the number that best represents the strength of your intentions (1 – 9).

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Definitely will not								**Definitely will**

Please indicate the average **intensity** that you intend to work at during your exercise sessions over the next **4 weeks**.
I will exercise at an average intensity that is ____ (use the following scale as a guide)

Very light - 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 – **Very intense**

Appendix F

Study Two

Bivariate Correlation Matrix

Table F1.

Bivariate Correlations for Self-regulatory Efficacy and Exercise Measures

Variable	1	2	3	4	5	6.	7.	8.	9.	10.	11.
1. Age	--										
2. Scheduling efficacy	-.02	--									
3. Goal-setting efficacy	.01	.74**	--								
4. Relapse prevention efficacy	.05	.63**	.65**	--							
5. Problem-solving efficacy	.06	.73**	.69**	.66**	--						
6. Barriers efficacy	.11	.77**	.67**	.70**	.71**	--					
7. CFC	.19**	.12	.19**	.29**	.18**	.24**	--				
8. Optimism	.11	.14*	.19**	.25**	.18**	.17**	.14*	--			
9. Attendance	.13	.69**	.68**	.57**	.62**	.63**	.20**	.17*	--		
10. Intentions: Frequency	.06	.36**	.32**	.25**	.37**	.31**	.10	.14*	.28**	--	
11. Intentions: Intensity	.03	.42**	.43**	.43**	.45**	.43**	.10	.13*	.38**	.21**	--

Note. *p <.05 **p <.01

Appendix G

Study Two

Exercise Differences between CFC Groups

Table G1.

Exercise Differences between CFC Groups

Variable	High CFC Group $n = 58$	Moderate CFC Group $n = 53$	p
Exercise Attendance	3.41	2.64	.013
Intentions: Frequency	4.79	4.58	.509
Intentions: Intensity	16.38	15.91	.232

Note. Exercise attendance is mean frequency of weekly attendance. Intentions for intensity = 6 – 20 scale.

Appendix H

Study Two

Exercise Differences between Optimism Groups

Table H1.

Exercise Differences between Optimism Groups

Variable	High Optimism Group $n = 62$	Moderate Optimism Group $n = 45$	p
Exercise Attendance	3.41	2.94	.169
Intentions: Frequency	4.94	4.60	.216
Intentions: Intensity	16.81	15.96	.049

Note. Exercise attendance is mean frequency of weekly attendance. Intentions for intensity = 6 – 20 scale.

Appendix I

Study Two

Prediction of Exercise Intentions for Frequency by CFC

Table I1.

Prediction of Exercise Intentions for Frequency by CFC

Variable	R^2 adjusted	R^2 change	*p*
Age	.001	.004	.350
CFC	.004	.008	.150

Note. $n = 259$ at Time One.

Appendix J

Study Two

Optimism x Scheduling Efficacy Hierarchical Multiple Regression

Optimism x Goal-setting Efficacy Hierarchical Multiple Regression

Optimism x Relapse Prevention Efficacy Hierarchical Multiple Regression

Optimism x Problem Solving Efficacy Hierarchical Multiple Regression

Optimism x Barriers Efficacy Hierarchical Multiple Regression

Table J1.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: Optimism x Scheduling Self-efficacy

	$adjR^2$	R^2change	*p*
Step 1			
Optimism	.022	.028	.027
Step 2			
Scheduling efficacy	.478	.456	.001
Step 3			
Optimism x Scheduling efficacy	.479	.004	.260

Table J2.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: Optimism x Goal-setting Self-efficacy

	$adjR^2$	R^2change	*p*
Step 1			
Optimism	.022	.028	.027
Step 2			
Goal-setting efficacy	.465	.443	.001
Step 3			
Optimism x Goal-setting efficacy	.464	.002	.387

Table J3.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: Optimism x Relapse Prevention Self-efficacy

	$adjR^2$	R^2change	*p*
Step 1			
Optimism	.022	.028	.027
Step 2			
Relapse prevention efficacy	.312	.293	.001
Step 3			
Optimism x Relapse prevention efficacy	.316	.008	.161

Table J4.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: Optimism x Problem Solving Self-efficacy

	$adjR^2$	R^2change	*p*
Step 1			
Optimism	.022	.028	.027
Step 2			
Problem solving efficacy	.386	.364	.001
Step 3			
Optimism x Problem solving efficacy	.382	.000	.795

Table J5.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: Optimism x Barriers Self-efficacy

	$adjR^2$	R^2change	*p*
Step 1			
Optimism	.022	.028	.027
Step 2			
Barriers efficacy	.388	.367	.001
Step 3			
Optimism x Barriers efficacy	.386	.002	.508

Appendix K

Study Two

CFC x Goal-setting Self-efficacy Hierarchical Multiple Regression

CFC x Relapse Prevention Self-efficacy Hierarchical Multiple Regression

CFC x Problem Solving Self-efficacy Hierarchical Multiple Regression

CFC x Barriers Self-efficacy Hierarchical Multiple Regression

Table K1.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: CFC x Goal-setting Self-efficacy

	adjR^2	R^2change	*p*
Step 1			
Age	.012	.018	.078
Step 2			
CFC	.035	.028	.025
Step 3			
Goal-setting efficacy	.481	.444	.001
Step 4			
CFC x Goal-setting efficacy	.483	.004	.221

Table K2.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: CFC x Relapse Prevention Self-efficacy

	adjR^2	R^2change	*p*
Step 1			
Age	.012	.018	.078
Step 2			
CFC	.035	.028	.025
Step 3			
Relapse prevention efficacy	.317	.285	.001
Step 4			
CFC x Relapse prevention efficacy	.334	.020	.024

Table K3.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: CFC x Problem Solving Self-efficacy

	adjR^2	R^2change	*p*
Step 1			
Age	.012	.018	.078
Step 2			
CFC	.035	.028	.025
Step 3			
Problem solving efficacy	.386	.353	.001
Step 4			
CFC x Problem solving efficacy	.420	.037	.001

Table K4.

Hierarchical Multiple Regression Analysis for the Prediction of Exercise Attendance: CFC x Barriers Self-efficacy

	adjR^2	R^2change	*p*
Step 1			
Age	.012	.018	.078
Step 2			
CFC	.035	.028	.025
Step 3			
Barriers efficacy	.397	.361	.001
Step 4			
CFC x Barriers efficacy	.416	.022	.011

Appendix L

Study Three

Pre-Manipulation Questionnaire

STUDY THREE PRE-MANIPULATION QUESTIONNAIRE

IMPORTANT: The information below is strictly for the purpose of describing participants in general and for record keeping. This information will be kept private.

Cardiac Rehabilitation Program Site:

_____

How long have you been a cardiac rehabilitation program participant? _____ (yrs / months)

ON AVERAGE, how many <u>times per week</u> do you attend the cardiac rehabilitation program session(s)? _____ time(s) per week

ON AVERAGE, how many <u>times per week</u> do you do independent exercise outside of the cardiac rehabilitation program sessions (i.e., exercise at home)? _____ time(s) per week

Age: _____ **Gender**: M ☐ F☐

Marital Status: Please check below beside the appropriate category.

Married ☐ Divorced ☐ Separated ☐ Single ☐ Widowed ☐

Employment Status: Please check below beside the appropriate category.

Retired ☐ Homemaker ☐ Employed ☐ Unemployed ☐ Other ☐

Diagnosis: Please check below beside the appropriate category.

Myocardial Infarction ☐ Angina ☐ Bypass Surgery ☐ Angioplasty/angiogram ☐ Other ☐

Health-related Problems: Please check below beside <u>all those that apply to you</u>.

Arthritis ☐ Asthma ☐ High Blood Pressure ☐ Diabetes ☐ Thyroid Problems ☐

High Cholesterol ☐ Stomach Problems ☐ Any Cancer ☐

Smoking Status: Please check below beside the appropriate category.

Never Smoked ☐ Past Smoker ☐ Current Smoker ☐

SCHEDULING SELF-EFFICACY

INSTRUCTIONS: The following is a list of behaviours associated with participating in INDEPENDENT exercise for the **next week**. For the purpose of this study, consider the exercise that you do OUTSIDE of the cardiac rehabilitation program as INDEPENDENT EXERCISE.
Please indicate how confident you are that you can complete each of the following behaviours over the next week **using the scale below.**
Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
not at all confident					**somewhat confident**					**completely confident**

In addition to attending your weekly cardiac rehabilitation program sessions, how confident are you that you can …

1. Participate in independent exercise three times per week next week. _____

2. Plan for participation in my independent exercise sessions in my daily activities next week. _____

3. Arrange my schedule to do independent exercise regularly no matter what next week. _____

4. Maintain a definite plan to restart my independent exercise if I should miss any sessions next week. _____

5. Make up times when I miss my regular independent exercise sessions next week. _____

6. Make sure that I do not miss more than one day of independent exercise due to other obligations next week. _____

7. Organize next week's time and responsibilities around each of my independent exercise sessions no matter what. _____

EXERCISE INTENTIONS

INSTRUCTIONS: Please indicate in the blank space below the average **number of times per week** that you **intend** to exercise **INDEPENDENTLY** over the next week. Try to be as accurate as possible in your intentions.

On average, I will exercise INDEPENDENTLY _____ times per week over the next week.

Now, please **circle** the number that best represents the strength of your intentions (1 – 9).

1 2 3 4 5 6 7 8 9
Definitely WILL NOT Definitely WILL

Appendix M

Study Three

Information Control Message: Jack

Information Control Message: Mary

Efficacy Enhancing Message: Jack

Efficacy Enhancing Message: Mary

INFORMATION CONTROL MESSAGE: JACK

Jack is 65 years old. He had a heart attack and some cardiovascular difficulties 2 years ago. He has been participating in a cardiac rehabilitation exercise program for a year and half now.

Jack's cardiac rehabilitation program staff have suggested that he make a number of lifestyle changes following his heart attack. The program staff have told Jack how important it is to do more exercise at home *in addition to* coming to the program. The program staff have suggested that he aim for 2 to 3 independent exercise sessions each week. They also instructed him to monitor his heart rate and perceived exertion level closely and to exercise at a mild to moderate intensity. They recommend that this exercise involve both aerobic (e.g., walking, cycling) and anaerobic (e.g., weight training) activities. As well as these exercise recommendations, the cardiac rehabilitation staff have given Jack tips about following a healthy diet, checking his stress levels, avoiding smoking and second hand smoke and limiting his alcohol intake.

Cardiac rehabilitation staff told Jack several things about the healthy diet. They recommended that Jack limit "bad" fats from his diet, such as the animal fats found in meat and poultry. High fat diets tend to raise blood cholesterol levels. As your blood cholesterol goes up, so does your risk of a heart attack. So, staff have told Jack that he should reduce the total amount of fat that he eats every day. Some of the tips they passed along were to cut the total amount of fat he eats by using less butter, switching from 2% to 1% milk, and eating low-fat cheese. They also recommended that he try to eat more foods that are high in fibre, such as oatmeal, oat bran, whole wheat bread, and fruits and vegetables.

The cardiac rehabilitation staff have also told Jack that it is important that he monitors and controls his cholesterol levels. They gave Jack some pretty good reasons that boil down to this. Cholesterol is a group of blood fats. It includes LDL ("bad") cholesterol and HDL ("good") cholesterol. LDL promotes the buildup of fatty plaque inside arteries while HDL protects arteries from plaque buildup. As the plaque builds up on the blood vessels, they become clogged and the blood can't flow to the heart properly. When this happens, the chances of another heart attack increase. Cardiac rehabilitation staff emphasized that it is important that Jack asks his doctor for a blood test regularly to monitor his cholesterol levels.

The program staff have also provided education about salt intake. They said that Jack should try to cut back on salt because it causes the body to hold onto more fluids. They explained that the added fluid makes your heart work harder. To reduce the salt he eats, cardiac rehabilitation staff recommended that Jack should try to use less or no salt in cooking, avoid salty snack foods like potato chips and nuts, and try to use pepper and spices instead of salt to flavour his meals.

Beyond a healthy diet, the cardiac rehabilitation program staff also want Jack to monitor his stress levels. High stress can contribute to high cholesterol levels, high blood pressure, and cause blood clotting abnormalities. Although stress can't always be eliminated, they want him to try to manage it better by trying relaxation techniques, getting support from family and friends and trying to modify stressful situations.

Cardiac rehabilitation staff have also told Jack about other situations he might consider avoiding. One is avoiding exposure to second-hand smoke. Since having his heart attack, Jack is trying to avoid second-hand smoke because smoking (or exposure to second-hand smoke) makes his heart work harder and decreases the oxygen carried in his blood. The program staff have also suggested that Jack make sure to only drink alcohol in moderation. This is important because alcohol can affect how Jack's medications work.

INFORMATION CONTROL MESSAGE: MARY

Mary is 65 years old. She had a heart attack and some cardiovascular difficulties 2 years ago. She has been participating in a cardiac rehabilitation exercise program for a year and half now.

Mary's cardiac rehabilitation program staff have suggested that she make a number of lifestyle changes following her heart attack. The program staff have told Mary how important it is to do more exercise at home *in addition to* coming to the program. The program staff have suggested that she aim for 2 to 3 independent exercise sessions each week. They also instructed her to monitor her heart rate and perceived exertion level closely and to exercise at a mild to moderate intensity. They recommend that this exercise involve both aerobic (e.g., walking, cycling) and anaerobic (e.g., weight training) activities. As well as these exercise recommendations, the cardiac rehabilitation staff have given Mary tips about following a healthy diet, checking her stress levels, avoiding smoking and second hand smoke and limiting her alcohol intake.

Cardiac rehabilitation staff told Mary several things about the healthy diet. They recommended that Mary limit "bad" fats from her diet, such as the animal fats found in meat and poultry. High fat diets tend to raise blood cholesterol levels. As your blood cholesterol goes up, so does your risk of a heart attack. So, staff have told Mary that she should reduce the total amount of fat that she eats every day. Some of the tips they passed along were to cut the total amount of fat she eats by using less butter, switching from 2% to 1% milk, and eating low-fat cheese. They also recommended that she try to eat more foods that are high in fibre, such as oatmeal, oat bran, whole wheat bread, and fruits and vegetables.

The cardiac rehabilitation staff have also told Mary that it is important that she monitors and controls her cholesterol levels. They gave Mary some pretty good reasons that boil down to this. Cholesterol is a group of blood fats. It includes LDL ("bad") cholesterol and HDL ("good") cholesterol. LDL promotes the buildup of fatty plaque inside arteries while HDL protects arteries from plaque buildup. As the plaque builds up on the blood vessels, they become clogged and the blood can't flow to the heart properly. When this happens, the chances of another heart attack increase. Cardiac rehabilitation staff emphasized that it is important that Mary asks her doctor for a blood test regularly to monitor her cholesterol levels.

The program staff have also provided education about salt intake. They said that Mary should try to cut back on salt because it causes the body to hold onto more fluids. They explained that the added fluid makes your heart work harder. To reduce the salt she eats, cardiac rehabilitation staff recommended that Mary should try to use less or no salt in cooking, avoid salty snack foods like potato chips and nuts, and try to use pepper and spices instead of salt to flavour her meals.

Beyond a healthy diet, the cardiac rehabilitation program staff also want Mary to monitor her stress levels. High stress can contribute to high cholesterol levels, high blood pressure, and cause blood clotting abnormalities. Although stress can't always be eliminated, they want her to try to manage it better by trying relaxation techniques, getting support from family and friends and trying to modify stressful situations.

Cardiac rehabilitation staff have also told Mary about other situations she might consider avoiding. One is avoiding exposure to second-hand smoke. Since having her heart attack, Mary is trying to avoid second-hand smoke because smoking (or exposure to second-hand smoke) makes her heart work harder and decreases the oxygen carried in her blood. The program staff have also suggested that Mary make sure to only drink alcohol in moderation. This is important because alcohol can affect how Mary's medications work.

EFFICACY ENHANCING MESSAGE: JACK

Jack is 65 years old. He had a heart attack and some cardiovascular difficulties 2 years ago. He has been participating in a cardiac rehabilitation exercise program for a year and half now. Jack has adjusted his schedule to be able to attend the weekly cardiac rehabilitation program sessions on a regular basis. The cardiac rehabilitation program staff told him how important it is to do *additional independent exercise at home*. His first reaction was that this independent exercise would be challenging. However, after working with the staff about suggestions for how the independent exercise might be accomplished, he came up with a personal strategy to make it happen.

First, Jack got confirmation from the staff that working this extra exercise into his weekly schedule could be done in a variety of ways. Second, he gained confidence in trying the independent exercise after staff praised him for his own interesting suggestions. Here's what Jack did. He adopted several simple scheduling strategies based upon the notion that some independent exercise was far better than no exercise at all! For example, Jack makes sure to plan small blocks of time throughout the day for his independent exercise based upon the fact that staff encouraged him to do at least 30 minutes of moderate level exercise (e.g., walking) each day. He asked if he could do some of this in 10 to 15 minute blocks and staff confirmed that this was a great idea. In trying his new plan, Jack found that this really offered him a lot of flexibility in the way he could manage his days and he found that the 10 minutes of exercise here and there really added up to the 30 minute goal he had set!

Jack also started to schedule some of his independent exercise with friends in order to help him keep a steady pace on longer walks. On the mornings that they walk, Jack meets his friends at a nearby neighbourhood corner and they walk at a steady, continuous pace for a full 30 minutes. He has also managed to arrange this type of walk on different evenings. Each week, Jack asked different family members to help him with his goals by taking turns walking with him to support his effort to be regularly active outside his program.

Jack has even come up with a strategy to adapt to events that interfere with his independent exercise. When poor weather, chores or some kind of work happen unexpectedly, he uses his "some exercise is better than none" strategy. He climbs stairs at home for about 10 minutes and later does 10 minutes of leg stretching while reminding himself that this helps him to stick with his independent exercise plan.

Although the extra exercise outside cardiac rehabilitation seemed like a challenge at first, Jack told staff that it has become really easy. "I've really learned how to adapt at home. I just started with adding one thing at a time and trying out different ways of adapting my day. Along with my regular program sessions, I've gradually worked my way up to doing something every day. Looking back, it is so easy to find and add up 10 to 15 minutes of time for my daily 30 minutes. It amazes me that I didn't think of doing this much earlier." Staff now send other members of the program to talk with Jack to get ideas for their own independent exercise. "I'm just like everyone else in the program. I'm certain that if I can make these changes with my own ideas, then others in my program can easily do this too", Jack emphasized. The program staff agreed, "Jack's managed to adapt what we have taught him in order to make daily exercise a fact in his life". Jack noted, "It's not about willpower or anything special, it's about making yourself adaptable, using my something's better than nothing rule, and looking for easy ways to find the time to grab the 10 to 15 minute blocks of time for yourself. It has become the easiest thing in the world".

EFFICACY ENHANCING MESSAGE: MARY

Mary is 65 years old. She had a heart attack and some cardiovascular difficulties 2 years ago. She has been participating in a cardiac rehabilitation exercise program for a year and half now. Mary has adjusted her schedule to be able to attend the weekly cardiac rehabilitation program sessions on a regular basis. The cardiac rehabilitation program staff told her how important it is to do *additional independent exercise at home*. Her first reaction was that this independent exercise would be challenging. However, after working with the staff about suggestions for how the independent exercise might be accomplished, she came up with a personal strategy to make it happen.

First, Mary got confirmation from the staff that working this extra exercise into her weekly schedule could be done in a variety of ways. Second, she gained confidence in trying the independent exercise after staff praised her for her own interesting suggestions. Here's what Mary did. She adopted several simple scheduling strategies based upon the notion that some independent exercise was far better than no exercise at all! For example, Mary makes sure to plan small blocks of time throughout the day for her independent exercise based upon the fact that staff encouraged her to do at least 30 minutes of moderate level exercise (e.g., walking) each day. She asked if she could do some of this in 10 to 15 minute blocks and staff confirmed that this was a great idea. In trying her new plan, Mary found that this really offered her a lot of flexibility in the way she could manage her days and she found that the 10 minutes of exercise here and there really added up to the 30 minute goal she had set!

Mary also started to schedule some of her independent exercise with friends in order to help her keep a steady pace on longer walks. On the mornings that they walk, Mary meets her friends at a nearby neighbourhood corner and they walk at a steady, continuous pace for a full 30 minutes. She has also managed to arrange this type of walk on different evenings. Each week, Mary asked different family members to help her with her goals by taking turns walking with her to support her effort to be regularly active outside her program.

Mary has even come up with a strategy to adapt to events that interfere with her independent exercise. When poor weather, chores or some kind of work happen unexpectedly, she uses her "some exercise is better than none" strategy. She climbs stairs at home for about 10 minutes and later does 10 minutes of leg stretching while reminding herself that this helps her to stick with her independent exercise plan.

Although the extra exercise outside cardiac rehabilitation seemed like a challenge at first, Mary told staff that it has become really easy. "I've really learned how to adapt at home. I just started with adding one thing at a time and trying out different ways of adapting my day. Along with my regular program sessions, I've gradually worked my way up to doing something every day. Looking back, it is so easy to find and add up 10 to 15 minutes of time for my daily 30 minutes. It amazes me that I didn't think of doing this much earlier." Staff now send other members of the program to talk with Mary to get ideas for their own independent exercise. "I'm just like everyone else in the program. I'm certain that if I can make these changes with my own ideas, then others in my program can easily do this too", Mary emphasized. The program staff agreed, "Mary's managed to adapt what we have taught her in order to make daily exercise a fact in her life". Mary noted, "It's not about willpower or anything special, it's about making yourself adaptable, using my something's better than nothing rule, and looking for easy ways to find the time to grab the 10 to 15 minute blocks of time for yourself. It has become the easiest thing in the world".

Appendix N

Study Three

Post-Manipulation Questionnaire

STUDY THREE POST-MANIPULATION QUESTIONNAIRE PACKAGE

MESSAGE QUALITY MANIPULATION CHECK

INSTRUCTIONS: Please keep in mind the written message about independent cardiac rehabilitation exercise you just read when answering the following questions.
Please CIRCLE the number that best describes your answer.

1. The written message was informative.

1	2	3	4	5	6	7	8	9
Strongly DISAGREE								**Strongly AGREE**

2. The written message was aimed at people like me.

1	2	3	4	5	6	7	8	9
Strongly DISAGREE								**Strongly AGREE**

3. The written message was believable.

1	2	3	4	5	6	7	8	9
Strongly DISAGREE								**Strongly AGREE**

4. The written message was easy to read.

1	2	3	4	5	6	7	8	9
Strongly DISAGREE								**Strongly AGREE**

5. The written message was easy to understand.

1	2	3	4	5	6	7	8	9
Strongly DISAGREE								**Strongly AGREE**

6. The information in the written message was accurate.

1	2	3	4	5	6	7	8	9
Strongly DISAGREE								**Strongly AGREE**

ACTION PLANS

INSTRUCTIONS: The following items relate to your INDEPENDENT exercise over the next week. For the purpose of this study, consider the exercise that you do OUTSIDE of the cardiac rehabilitation program as INDEPENDENT EXERCISE. Please rate the extent to which you agree with each statement (**circle** the number).

1. I have made detailed plans about **where** I will exercise independently over the next week (e.g., at a fitness center or around my neighbourhood).

1 2 3 4 5 6 7 8 9
Strongly DISAGREE Strongly AGREE

2. I have made detailed plans about **when** I will exercise independently over the next week (e.g., on Monday after lunch).

1 2 3 4 5 6 7 8 9
Strongly DISAGREE Strongly AGREE

3. I have made detailed plans about **what** type of exercise I will do to exercise independently over the next week (e.g., riding my bike or swimming).

1 2 3 4 5 6 7 8 9
Strongly DISAGREE Strongly AGREE

4. I have made detailed plans about **how** I will exercise independently over the next week (e.g., take the bus to the fitness center or meet up with friends at the swimming pool).

1 2 3 4 5 6 7 8 9
Strongly DISAGREE Strongly AGREE

EXERCISE INTENTIONS

INSTRUCTIONS: Please indicate in the blank space below the average **number of times per week** that you **intend** to exercise **INDEPENDENTLY** over the next week. Try to be as accurate as possible in your intentions.

On average, I will exercise INDEPENDENTLY _____ times per week over the next week.

Now, please **circle** the number that best represents the strength of your intentions (1 – 9).

1 2 3 4 5 6 7 8 9
Definitely WILL NOT Definitely WILL

SCHEDULING SELF-EFFICACY

INSTRUCTIONS: The following is a list of behaviours associated with participating in INDEPENDENT exercise for the **next week**. Please consider each specific behaviour as it applies to you.
Please indicate how confident you are that you can complete each of the following behaviours over the next week **using the scale below.**
Place the appropriate number from the scale (0 – 100) on the line following the statement.

0%	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
not at all confident					**somewhat confident**					**completely confident**

In addition to attending your weekly cardiac rehabilitation program sessions, how confident are you that you can …

1. Participate in independent exercise three times per week next week. _____

2. Plan for participation in my independent exercise sessions in my daily activities next week. _____

3. Arrange my schedule to do independent exercise regularly no matter what next week. _____

4. Maintain a definite plan to restart my independent exercise if I should miss any sessions next week. _____

5. Make up times when I miss my regular independent exercise sessions next week. _____

6. Make sure that I do not miss more than one day of independent exercise due to other obligations next week. _____

7. Organize next week's time and responsibilities around each of my independent exercise sessions no matter what. _____

BEHAVIOURAL COMMITMENT INTENTIONS

INSTRUCTIONS: There may be several opportunities for you to learn more about scheduling your independent exercise. Please indicate how you feel about each opportunity (**circle** the number).

1. I would attend a FREE 30-minute workshop next week at my cardiac rehabilitation program site to learn more about how to improve my scheduling skills for independent exercise.

1 2 3 4 5 6 7 8 9
Definitely WILL NOT Definitely WILL

2. I would read an additional pamphlet that would be mailed to me about strategies to schedule my independent exercise.

1 2 3 4 5 6 7 8 9
Definitely WILL NOT Definitely WILL

3. I would complete a phone interview with the researcher next week regarding scheduling independent exercise and cardiac rehabilitation.

1 2 3 4 5 6 7 8 9
Definitely WILL NOT Definitely WILL

THANK YOU FOR YOUR PARTICIPATION!

Appendix O

Study Three

Main Effects for Message Condition

Table O1.

Main Effects for Message Condition

	Efficacy Enhancing	Control	η^2	*p.*
Scheduling Efficacy	67.24	55.46	.069	.05
Intentions Frequency	3.15	2.61	.028	.23
Intentions Strength	7.17	6.96	.006	.59

Note. Scheduling Efficacy 0 - 100% scale, Intention frequency 0-7 scale, Intention strength 1-9 scale.

Appendix P

Study Three

Correlations Between Scheduling Efficacy, Action Plans and Behavioural Commitment

Table P1.

Bivariate Correlations Between Scheduling Efficacy, Action Plans and Behavioural Commitment.

Variable	1	2	3
1. Scheduling Efficacy	--		
2. Behavioural Commitment	.06	--	
3. Action Plans	.49**	.29	--

Note. $*p < .05$ $**p < .01$. All measures are within-subjects (i.e., efficacy-enhancing message condition, $n = 27$) post-manipulation. Action Plans 1 (*strongly disagree*) – 9 (*strongly* agree) scale, Behavioural Commitment 1 (*definitely will not*) – 9 (*definitely will*) scale.

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