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# Motivational determinants of physical activity in patients diagnosed with coronary artery disease

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School of Psychology

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## DEDICATION

This thesis is dedicated to Alex, Eva, Riccardo and Teofil.

To Alex for always believing I could achieve whatever I set my mind on and for caringly teaching me to strive to be my best, until the effort ceases to be enjoyable.

A day doesn't pass without me reflecting on all that I learned from you and without missing you.

To you mami, for lovingly supporting me in whatever way you could, especially during the last year with your round-the-clock "on-call" services.

You are a constant reminder of what unconditional and unlimited love is all about.

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## SUMMARY

In patients with coronary artery disease (CAD), physical activity has a positive impact on physiological and psychological health. Despite the clear benefits of regular physical activity (PA) on recovery from CAD and overall health, only a small proportion of cardiac patients are active enough to derive any health benefits. While some cardiac patients might attain adequate levels of PA without assistance, research suggests that most inactive people will remain sedentary without intervention. Unfortunately, of patients who participate in exercise-based cardiac rehabilitation programs, 25% to 50% withdraw within the first six months (Oldridge, 1988,1991; Oldridge, Donner, & Buck, 1983; Radtke, 1989) and less than 25% of the dropouts continue an activity program sufficient to maintain or improve cardiorespiratory fitness (Radtke, 1989). This suggests that many individuals who engage in organized exercise programs are not motivated to self-regulate their PA behaviour. To promote adherence to regular PA in the cardiac patient population, an understanding of the factors, both intrapersonal and interpersonal, underlying the regulation of PA behaviours is required. Theoretical frameworks are needed to link these factors and to identify change agents and targets suitable for intervention in this population. The purpose of the present thesis was to test a motivational model of physical activity regulation in patients with CAD. The Self-Determination Theory (SDT; Deci & Ryan, 1985a, 2000a), a theory of human motivation found to be useful in explaining regulation of health behaviors, was used to relate the various model components. The model links intra- and inter-personal antecedents and consequences of self-determined and non-self-determined motivation (regulatory styles) to predict physical activity regulation directly and indirectly through mediator variables. The present thesis is comprised of two studies designed to test the hypothesized model and verify the overarching role of motivational style in the successful regulation of physical activity behaviours. In the first study physical activity intentions were

modelled using a correlational design. Participants diagnosed with CAD completed a one-time questionnaire at the time of admission into hospital or while participating in a hospital-based rehabilitation program. The second study employed a prospective, longitudinal design to predict physical activity behaviour in CAD patients six months after admission to hospital for a CAD diagnosis. Baseline information was collected at time of recruitment, and follow-up data was collected at 2 and 6 months after study intake. Structural equation modeling was used to test the models. Results of the two studies showed that the motivational model reliably predicted self-regulation of PA behavior. That is, the model, consisting of intra- and inter-personal variables, explained a relevant amount of variance in both physical activity intentions and behaviour. In particular, self-determined modes of motivation, at both the general and contextual levels, were found to be pivotal in the successful regulation of physical activity behaviour. The implications of the findings of this thesis research are discussed in relation to the SDT, as well as the design and implementation of exercise-based cardiac rehabilitation programs to facilitate long-term adherence to regular physical activity in the cardiac patient population.

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## ORGANIZATIONAL NOTE

The thesis begins with a general introduction describing the relevance of physical activity in patients affected by heart disease, the problem of non-adherence to physical activity programs, and the importance of motivation in ameliorating this problem. The next section presents a review of the Self-Determination Theory and supportive evidence for the motivational model of physical activity regulation in the cardiac patient population. Following that, the two studies are presented; first Study 1 and then Study 2. Study 1 involved the design and initial test of the motivational model of physical activity regulation. In this study intentions to be active were modeled and the design was correlational as all variables were assessed using a one-time questionnaire. The aim of the first study was to evaluate the theory- and research-based relationships proposed in the model within the context of physical activity behaviour. The goal of Study 2 was to confirm the model of physical activity regulation in a larger sample of cardiac patients and using a prospective design to predict physical activity behaviour. Finally, the theoretical and practical implications of the present research are briefly discussed.

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# INTRODUCTION

## Physical Activity and Cardiovascular Disease

In patients diagnosed with heart disease, physical activity influences positively both physiological and psychological health aspects; it has been shown to decrease cardiovascular mortality, improve exercise tolerance and coronary risk factor levels (e.g., obesity, hypertension, and elevated blood lipids), and enhance health-related quality of life (e.g., via reductions in anxiety and depression) as well as to increase perceptions of subjective well-being (Ades & Coello, 2000; Agency for Health Care Policy and Research, 1995; Dishman, 1982; Gordon & Haskell, 1997; Oldridge, Guyatt, Fischer, & Rimm, 1988; Taylor, Sallis, & Needle, 1985). This has lead to recommendations that all patients with myocardial infarction (MI), those who have undergone coronary revascularization, and those with stable angina pectoris be considered for participation in exercise-based cardiac rehabilitation programs (CRPs), unless otherwise contraindicated (MOH, 2000).

Despite the clear benefits of regular physical activity in rehabilitation from CAD and to health overall, only a small proportion of cardiac patients are active enough to accrue the recommended level of physical activity in order to derive maximal health benefits. While some cardiac patients might attain adequate levels of physical activity without assistance (DeBusk et al., 1994; Haskell et al., 1994; Mayou, MacMahon, Sleight, & Florencio, 1981), research suggests that most inactive people will remain sedentary without intervention (Marcus, Nigg, Riebe, & Forsyth, 2000). Of patients who do participate in exercise-based cardiac rehabilitation programs, 25% to 50% drop out within the first six months (Oldridge, 1988,1991; Oldridge, Donner, & Buck, 1983; Radtke, 1989) , and less than 25% of the dropouts continue an activity program sufficient to maintain or improve cardiorespiratory fitness (Radtke, 1989).

Unfortunately, many individuals who engage in organized fitness or exercise programs are not motivated to continue regulating their physical activity behaviours and consequently withdraw before any health benefits have been realized or discontinue with their physical activity efforts once intervention is withdrawn.

A major issue in cardiac health promotion then concerns how to facilitate adherence to physical activity regimen. In an effort to develop strategies to help people adopt and maintain recommended physical activity behaviours, research has drawn on various models of health behavior to identify relevant determinants of successful behavior change, including the health belief model (Rosenstock, 1974), social cognitive theory (Bandura, 1986b), theory of reasoned action (Ajzen & Fishbein, 1980), and transtheoretical model of behaviour change (Prochaska, DiClemente, & Norcross, 1992). Socio-demographic, psychosocial, cognitive, contextual and situational variables related to health behavior have been examined within frameworks of intervention strategies to help cardiac patients make the required lifestyle adjustments. While some factors were found to be associated with short-term regulation of physical activity behaviours, they did not prove to be predictors of sustained change. In this regard few strategies have been successful in promoting long-term maintenance of physical activity.

It can be appreciated that regular participation in physical activities depends on individuals' willingness to undertake and maintain required behaviours. For the most part, it can be assumed that individuals are willing to change and that self-directed behaviour change is both possible and desirable. Sustained health behaviour change, however, is dependent on more than just good reason to act. Lasting behavioural change is the result of persistent self-regulation. Self-regulation is the effort made by an individual to change his/her natural response (Baumeister, Heatherton, & Tice, 1994). Through self-regulation individuals are able to

substitute a so-called "natural" response in a given situation by another response (e.g., action, thought, feeling, desire, or performance). The decision to become active, rather than succumb to the more comfortable and perhaps "natural" alternative of remaining sedentary, is an example of self-regulation. Competition between responses is inherent to this regulatory mechanism; successful self-regulation requires that the desired responses carry enough strength to override the lower tendencies. As such, achievement of desired behavioural outcomes depends on the strength of motives that drive self-regulatory responses and on accepting the regulation of change as one's own.

Given, the low adherence rates to physical activity regimens, it appears that many approaches to physical activity promotion may not be achieving self-regulation of desired behaviours. One possible explanation is that these approaches focus on external regulation of activities, thereby creating conditions where the incentives have to be maintained; once the incentives are withdrawn, a decline in behavioural commitment is likely to follow. To promote sustained health behaviour changes over it is thus important that programs focus on integration of behavioural changes into individuals' lives, social and personal, and ongoing daily activities.

While some psycho-social factors to predict physical activity behaviour have been identified (e.g., self-efficacy, perceived susceptibility and seriousness of illness, perceived behavioural control, social support) evidence regarding how these factors interact to predict sustained regulation (i.e., self-regulation) of behaviour is limited. Accordingly, there is a need for evidence-based frameworks to conceptualize effective regulation of physical activity behaviours. Such frameworks would provide a structure for the mechanisms underlying regulation of physical activity behaviours and thereby suggest how relevant factors can be intervened with to

achieve integration and long-term behaviour change. A comprehensive framework would also allow for systematic evaluations of various theoretical constructs across different populations.

One theoretical perspective that could have important implications for the understanding of a successful integration and maintenance of the regulation of physical activity behaviors is the Self-Determination Theory proposed by Deci and Ryan (SDT; Deci & Ryan, 1985a, 2000a). This theory is of particular interest for the following reasons: First, it postulates the existence of different regulatory styles that vary in the degree to which the regulatory processes underlying behaviours have been internalized and brought into harmony with other processes of the person's innate, core self. Second, it explains the process of internalization of behaviours, that is, how behaviours initially regulated by sources outside the self (e.g., partner, physicians and other health professionals) can be self-regulated and form a permanent part of the individual's character. Finally, it postulates various consequences associated with the different regulatory styles. The theory comprises a set of hypotheses specifically concerning the effects of internal versus external events on motivational orientation and has had a significant impact on research examining motivation in sport and exercise contexts (see Frederick & Ryan, 1995, for a review). The current research draws on the SDT to propose and test a motivational model of physical activity regulation in patients with cardiovascular disease. The model incorporates existing knowledge regarding the antecedents and consequences of different forms of motivation to explain how cardiac patients integrate physical activity into their lives. The findings this research will yield are expected to contribute to current theory of human motivation and to the field of health behaviour promotion in clinical populations.

## The Self-Determination Theory

The Self-Determination Theory (SDT) differentiates among different types of motivation along a continuum of self-determination based on the degree of involvement of the self in the initiation and regulation of behaviour. *Amotivation* represents a state of lacking intention to act. When people are amotivated, they either do not act at all, or they are passive in their actions, that is, they go through the motions with no sense of intending to do what they are doing. A person experiences amotivation and thus does not engage in goal-directed behaviour as a result of either feeling unable to achieve desired outcomes because of a lack of perceived competence (Bandura, 1977; Deci, 1975), a lack of value attributed to the activity or the outcomes it would yield (Ryan, 1995), or a lack of perceived contingency (Rotter, 1966; Seligman, 1975). *Externally regulated* behaviours, though intentional, are dependent on contingencies overtly external to the person (e.g., interpersonal relationships with family members, friends, physicians, etc.) and are thus considered controlled rather than chosen or self-determined. The person is driven by some incentive, is striving to attain approval from someone, or is trying to avoid negative consequences. *Introjected regulation* follows internalization of external controls; behaviours no longer require overtly external prompts, but are still motivated by regulatory processes external to the core self. The person feels coerced by internal processes and his/her behaviours are directed by internal pressures, such as feelings of guilt (e.g., "I'll feel guilt if I don't exercise") or avoidance of anxiety. *Identified regulation* refers to extrinsically motivated actions that have become more self-determined because one has consciously accepted their value as useful and personally important and meaningful. The person values the behaviours (e.g., person will exercise because he/she values the associated benefits) and holds them as central to his/her identity, yet because the behaviour is motivated out of a sense of personal conviction it might not

be perceived as enjoyable. Amotivation plus the three regulatory styles described above reflect the degree to which an extrinsic goal or regulatory process has been taken in by the person and integrated with his/her sense of self (Deci & Ryan, 1995; Deci, Vallerand, Pelletier, & Ryan, 1991).

The consequence of a full assimilation of regulatory processes is *integrated* behaviour. Integrated regulation is the most self-determined or autonomous form of extrinsic motivation that results when particular "identified" values and actions are fully incorporated with one's other values and actions; the person thus acts willingly with a sense of choice that accords with the whole sense of self. *Intrinsically motivated* behaviours are the prototypes of autonomous or self-determined actions; they arise from the person's developing interests and are free from pressures and controls and no incentives or contingencies are required. Intrinsically motivated behaviour is assumed to be inherently enjoyable, autonomous, and self-integrated (Deci & Ryan, 1985a). The person performs the behaviour for the satisfaction he/she gains from engaging in the activity itself, and for the interest and enjoyment that accompany it. The difference between integrated regulation and intrinsic motivation is that intrinsic motivation is characterized by interest in the activity itself, while integrated regulation is characterized by the activity's being personally important for a valued outcome (Deci & Ryan, 1991). Someone exercising for integrated reasons, for example, would do so because exercising is part of what he/she is and, hence maintenance of fitness is of utmost importance to that person. Someone exercising for intrinsic reasons, on the other hand, would do so for the enjoyment and stimulation gained from the act of exercising (Deci & Ryan, 1985a; Deci et al., 1991).

The gradation of reasons for performing a behaviour are a reflection of an internalization process whereby external regulatory processes (i.e., those reinforced by external sources, such as

incentives or a significant other) are converted into internal regulatory process (i.e., regulation of behaviour is taken in to be governed by the self and to form a permanent aspect of the individual's disposition). It is through the processes of internalization, whereby external regulatory processes are converted into internal regulatory processes (Schafer, 1968), that autonomous self-regulation is believed to evolve. Internalization can occur to varying degrees and will be reflected in autonomous regulation of behaviour accordingly. Accordingly, the SDT puts forth two types of internalization, namely introjection and integration (Deci & Ryan, 1991). Extrinsically motivated behaviours for which the regulations have been well integrated would be the basis for autonomous self-regulation, whereas those for which the regulations have been taken in but not integrated (i.e., introjected) within the self, would be the basis for more controlled forms of extrinsic motivation (would instead function more as controllers of behaviour) (Ryan & Deci, 2002).

Introjection (the first level of the internalization process) is only a partial internalization in which the person takes in a value or extrinsically motivated regulation, but does not identify with it or accept it as his/her own (Deci, Eghrari, Patrick, & Leone, 1994). Thus, with introjection, the regulation of behaviour becomes internally controlling (Ryan, 1982) and the person will not be autonomous in carrying out the behaviour (Deci & Ryan, 1991). In contrast, integration is a much more complete internalization in which the person identifies with the value of the behaviour (i.e., recognizes its importance for one's personal goals) and accepts full responsibility for its regulation. As regulation of behaviour becomes "integrated" with other aspects of the self, the person will feel volitional in carrying out the behaviour and its regulation becomes autonomous (Deci & Ryan, 1991). The more fully a regulation is internalized, the more it becomes part of the integrated self and the basis for self-determined behaviour. Accordingly,

while integration is associated with more persistence and positive health outcomes, introjection is linked with less positive outcomes.

It must be kept in mind that the internalization process is dependent on the importance to the individual of the particular activity that is to be regulated. For instance, for many individuals the regulation of physical activity behaviours does not represent a pleasurable activity. However, some people will choose to be physically active on a regular basis because they highly value being in good health. Subsequently, the internalization process will be activated because individuals are inherently motivated to internalize within themselves the regulation of activities that are conducive to effective functioning even though they may not be inherently interesting (Deci et al., 1994). In other words, as long as people consider physical activity to be important for them, because of their CAD diagnosis for instance, they will internalize the regulation of physical activity behaviours. The self-determination continuum contains identifiable gradations of reasons that go from non self-determined, or extrinsically motivated, forms of regulation to self-determined, or intrinsically motivated, types of regulation. Non-self-determined forms include amotivation, extrinsic regulation, and introjected regulation, and are also referred to as controlled regulatory styles. Self-determined forms include identified regulation, integrated regulation, and intrinsic motivation, and are also referred to as autonomous regulatory styles. Intrinsically motivated behaviours are the most autonomous or self-determined, whereas amotivated behaviours are the least self-determined (Deci & Ryan, 1985a, 1987, 1991; Deci et al., 1991; Ryan & Connell, 1989). Accordingly, the different forms of motivation predict different levels of behaviour. The self-determination continuum is not a developmental continuum in that people do not necessarily have to pass through each grade of internalization. Rather, individuals can begin regulation at any point along the continuum, provided that they

have relevant prior experience and that their immediate interpersonal climate is supportive of autonomy, competence, and relatedness (Deci & Ryan, 1991; Ryan, Deci, & Grolnick, 1995a).

The existence and validity of the self-determination continuum has been supported by several studies that obtained a distinct correlational pattern between the different behavioural regulatory styles that comprise the continuum (see Vallerand, 1997, for a review). This correlational structure is referred to as the "simplex pattern" (Guttman, 1954). In this structure, regulatory styles that are nearer in conception, and thus closer on the continuum, display a greater positive correlation than those deemed more discrepant and further apart on the continuum. The magnitude of the correlations between a particular form of regulation and the others is expected to decrease progressively and become negative eventually as a function of the distance separating the regulatory styles on the continuum. The simplex pattern has been identified in several different life domains such as education (Ryan & Connell, 1989; Vallerand & Bissonnette, 1992a; Vallerand et al., 1993), work (Blais, Briere, Lachance, Riddle, & Vallerand, 1993), leisure (Pelletier, Vallerand, Green-Demers, Blais, & Briere, 1995b; Pelletier, Vallerand, Green-Demers, Blais, & Briere, 1996), sports (Pelletier et al., 1995a), couple relationships (Blais, Sabourin, Boucher, & Vallerand, 1990), religious beliefs (O'Conner & Vallerand, 1990), pro-environmental action (Pelletier, Green-Demers, & Beland, 1997; Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998), politics (Loisier, Perreault, Koestner, & Vallerand, 2001), and sexuality (Seguin, Green-Demers, Chantal, Ladouceur, & Pelletier, 1997).

Vallerand (1997) proposed that the different motivations exist at different levels of generality, namely the global, contextual and situational levels. In the present research motivation at the global, or general, level as well as at the contextual level, specifically within the context of physical activity behaviours, will be considered and assessed.

## General Motivation

At the general level, motivation is considered to be an enduring individual difference regarding people's tendencies to be intrinsically versus extrinsically motivated or amotivated across situations in life overall. Accordingly, this global orientation yields general consequences. Although general motivation may not be strongly associated with modes of functioning within specific contexts, it predisposes individuals to adopt more or less self-determined modes of regulation within different life domains (Vallerand, 1997). An autonomous motivational orientation describes the general tendency to be self-regulating, or autonomous, take responsibility for one's actions, and to orient toward contextual factors that promote choice and individual initiative. More self-determined modes of motivation at the general level facilitate integration of new behaviours into one's cognitive mindset. A general tendency to be non-self-determined, on the other hand, implies reliance on external incentives to act and is associated with the absence of agency and involves feelings of incompetence and lack of control (Deci & Ryan, 1987; Vallerand, 1997).

General assessments of intrinsic and extrinsic motivation and amotivation have been related to adaptive versus maladaptive outcomes. For instance, Deci and Ryan (1985b) found that individuals who are generally amotivated (i.e., generally experience their behaviour as being beyond their control), as assessed by the General Causality Orientation Scale (GCOS), tend to have high levels of external locus of control, self-derogation, depression, social anxiety, and low levels of self-esteem. Individuals who are generally autonomous in their actions (i.e., generally experience pleasure and choice in the initiation and regulation of behaviour) tend to have high levels of ego development and self-esteem and a low level of anxiety. As an example, the autonomy orientation has predicted cardiac surgery patients' viewing their surgery more as a

challenge than a threat and having more positive postoperative attitudes (King, 1984). While all forms (i.e., intrinsic, integrated, and identified) of general autonomous motivation have been found to be positively related to life satisfaction, external regulation and amotivation were negatively related to it (Guay, Blais, Vallerand, & Pelletier, 1996).

Based on the way general motivational orientation relates to one's tendencies to self-regulate and to the quality of adjustment and functioning in life, it can be hypothesized that a cardiac patient's global motivational orientation can influence the manner in which he/she copes with the diagnosis of heart disease and what he/she decides to do about it. It would be expected that patients who are generally more self-determined will take on more responsibility in rehabilitating from and managing the long-term implications of their heart disease. This will partly be reflected in regulation of health behaviours including physical activity.

## Contextual Motivation

Contextual motivation reflects one's usual motivational orientation within a particular life context, such as engagement in health behaviours and, even more specifically, in physical activity behaviours. At the contextual level, motivation is more subject to change than at the general level; that is, people's motivational orientation may vary greatly across different contexts. Accordingly, contextual motivation yields different consequences depending on the particular context (Vallerand, 1997). In order to better predict more specific modes of functioning, it is therefore important that motivation also be assessed within specific contexts or domains of human activity (Emmons, 1995). As indicated earlier, SDT has been applied in a wide variety of life domains or contexts. Within each of the domains, the different types of motivation have been associated with several different types of consequences. For the purpose of

the current paper, we will examine how SDT is relevant to the study of health-related behaviours, specifically physical activity behaviours.

Physical Activity Regulation in Healthy Populations

As the concept of integration within personality is important to understanding the process of healthy psychological development and adjustment, it can be appreciated that self-determined motivation is important for the regulation of physical activity behaviours. Self-determined regulation leads to a sense of enjoyment and satisfaction for engaging in physical activity and promotes sustained effort, even in the face of obstacles.

The relevance of the distinction between intrinsic and extrinsic motivational orientations in the context of physical activity regulation has been well established. The majority of studies examining the relationship between different motivational orientations and physical activity behaviour have queried exercise participation in healthy adult populations. Unequivocally, conclusions derived from these studies point at intrinsic motivation for exercise to be a relevant factor in the regulation of physical activity behaviours. Specifically, empirical evidence supports a positive relationship between intrinsic (e.g., enjoyment and feeling good) versus extrinsic (e.g., compliance with external pressures or attainment of rewards) motives for exercise and levels of adherence to exercise behaviours (McAuley, Courneya, & Lettunich, 1991; Wankel, 1985, 1988, 1993). In two prospective studies to predict adherence to different physical activities, Ryan, Frederick, Lepes, Rubio, and Sheldon (1997) showed that program participants who were higher in initial enjoyment and competence motives relative to body-related motives displayed better adherence to exercise programs over a 10-week period; enjoyment motives were found to mediate group differences in adherence. Similarly, in their research examining motives for engaging in sport or exercise activities in a sample of university students who signed up in

physical activity programs and registrants at a university fitness center, Frederick and Ryan (1993) found intrinsic motives (i.e., motives oriented toward enjoyment, competence and social interaction goals for exercising) to be positively associated with attendance and adherence to exercise programs. Motivations conceptualized as having an extrinsic focus (i.e., body-related motives, such as the desire to improve appearance) were not related to adherence. Furthermore, in a recent study on a sample of competitive swimmers, Pelletier, Fortier, Vallerand, and Briere (2001) showed that while self-determined forms of motivation for competitive physical activity were positively associated with continued effort, non self-determined modes predicted dropout behaviour over time. The investigators showed that athletes who were intrinsically motivated and self-determined (i.e., regulated for identified reasons) showed more persistence at both 10 and 22 months. Athletes who regulated their physical activity behaviour for non self-determined motives (i.e., external and amotivated), on the other hand, did not persist in their physical activity efforts over time. Specifically, introjected regulation was found to be a significant predictor of persistence at 10 months, but ceased to be relevant at 22 months, and external regulation was a non-significant factor at 10 months, becoming a significant predictor of dropout at 22 months. Amotivated individuals had the highest rate of attrition at both follow-up assessments. These results supported the proposition that the regulation of behaviour can vary greatly in its relative autonomy and that the different regulatory styles can uniquely predict persistence of behaviour over time. Moreover, this study demonstrated the dynamic aspect of different forms of regulation, confirming that better (i.e., more autonomous) regulation leads to better outcomes related to physical activity.

In research, the impact of motivation on physical activity behaviour is commonly operationalized in terms of persistence with self-initiated behavior (Blais et al., 1990; Deci,

1971; Vallerand & Bissonnette, 1992b; Vallerand, Fortier, Daoust, & Blais, 1996), yet studies have also considered cognitive correlates of effective behavioural regulation. Pelletier et al. (1995a), for instance, showed that in a large sample of university students more self-determined forms of motivation toward sport were positively correlated with positive consequences (lower distraction in training, greater effort, and stronger future intentions to practice the sport) and negatively correlated with negative consequences (greater distraction in training, less effort, and weaker future intentions to practice the sport).

While self-determined motivation appears to be fundamental to physical activity adherence, extrinsic motives, such as improved fitness, disease avoidance, or weight loss, are often the initial change catalysts for adoption of physical activity behaviours. Nevertheless, regardless of the focus on one's initial motives, greater task enjoyment is associated with self-determined forms of contextual motivation. The self-determination continuum conceptualizes how one can simultaneously be extrinsically motivated to be physically active (i.e., do it to improve appearance, maintain fitness, lose weight) yet feel quite self-determined in the regulation of physical activity behaviour (Mullan, Markland, & Ingledew, 1997). The continuum also illustrates that regulatory processes can become more self-determined and new activities fully integrated into an individual's sense of self over time, providing that the context within which this occurs is autonomy supportive. In other words, under the right conditions there is likely to be a shift in an individual's motivational focus from extrinsic to intrinsic between initial activity adoption and adherence to a program of regular activity (Mullan et al., 1997). This qualification bears particular significance in situations where health behaviours, such as regular physical activity, are a central part of a rehabilitation process. When health behaviours are "prescribed" to patients as part of a treatment, they are likely construed as a means to an end

rather than as activities that will be satisfying and enjoyable in and of themselves. In this manner, prescribed or recommended behaviours represent, at least initially, non-self-determined motives for behavioural engagement. As a result, one can appreciate that the motivational mechanisms underlying regulation of physical activity behaviours are likely to be different in clinical populations compared to healthy individuals.

Physical Activity Regulation in Clinical Populations

Research examining motivational processes underlying regulation of physical activity behaviours in healthy populations generally focuses on the implications of interest and enjoyment motives versus motives regarding body appearance. In clinical populations, the motives patients adopt for engaging in physical activity behaviours vary according to their particular health condition and related outcome expectations. Cardiac patients who have physical endurance limitations that may or may not influence their competence for physical activities, who have varying levels of perceived health threat, and who are required to make immediate lifestyle adjustments, hold a unique set of disease-specific motives for engaging in physical activity behaviours. The important implication is that the efforts aimed at physical activity promotion need to be specific to the varying motives and needs of target populations. In fact, the concept of self-determined motivation may be especially important for the regulation of physical activity in chronic disease populations, such as cardiac patients. Cardiac patients, many of whom may not have been physically active for many years leading up to their CAD diagnosis, are likely to experience greater difficulties during physical activity adoption or initiation. The likelihood of them having internalized the regulation of physical activity behaviours is low. It is much more likely that these individuals are starting with an external or less self-determined regulatory style.

The process of internalization may thus be of particular significance to healthful adaptation for these individuals.

Effectiveness of any health promotion program is directly related to adherence with intervention strategies. Indeed, exercise-based rehabilitation interventions for cardiac patients are effective only to the extent that patients continue to adhere to a recommended level of physical activity beyond the duration of the formal program. As such, the goal of these risk factor reduction and rehabilitation programs is to facilitate successful adaptation of a more active lifestyle; this implies long-term maintenance of a regular physical activity routine. The rate of adherence with these interventions is not overly encouraging, however, particularly when there is considerable disability, if existing habits need to be changed extensively, and if it needs to be carried out over extended periods of time (Haynes, 1979, in Dishman, 1988).

Although specific motives for exercising vary with different populations and contexts, support for the relevance of the distinction between autonomous versus controlled forms of behaviour-oriented motivation in the prediction of sustained health behaviour regulation has been found in clinical populations also. In a study with adult outpatients, for example, Williams, Rodin, Ryan, Grolnick, and Deci (1998b) found that autonomous regulation accounted for 68% of the variance in adherence to long-term medication use. Specific to the cardiac population, Pelletier, Dion, Slovinec D'Angelo, and Reid (2004) examined the role of general and contextual self-determination as predictors of successful dietary behaviour change in individuals at increased risk for heart disease. Over a 26-week period, during which participants received dietary counseling and step-by-step information on healthy eating, they did on average adopt and maintain healthier dietary patterns, as reflected by reduced consumptions of dietary fat and saturated fat, and furthermore in objective physiological measures, namely lower levels of LDL-

cholesterol and a mean drop in body weight. The SDT construct was found to be a relevant predictor of adherence to the desired changes in dietary patterns. Specifically, the more self-determined participants' motives for healthy dietary regulation were, the more they persisted in their efforts to reduce their intake of total dietary fat and saturated fat 26 weeks after the initiation of the intervention. Contextual motivation explained an additional 17% of the variance in total fat intake and 7% in saturated fat intake after controlling for each dietary variable at baseline. Moreover, individuals' general motivational tendencies were confirmed to reliably predict the extent to which their motives for regulating dietary behaviours were self-determined.

In the cardiac patient population, more extrinsic motives, such as disease risk reduction are, for obvious reasons, prominent influences on physical activity initiation. As alluded to previously, extrinsic motives are not sufficient to sustain long-term regulation of necessary behaviours. Maintenance of a regular physical activity regime rests on sustained regulatory efforts that are contingent on patients' competencies as well as inherent qualities and enjoyment of the activities. These qualities facilitate integration of physical activity behaviours into a healthy lifestyle and make them less susceptible to abandonment in the face of obstacles or lack of immediate progress. Accordingly, individuals successful in developing a self-determined motivational structure will find long-term regulation of physical activity behaviours easier and will be more likely to experience associated physical and psychological benefits.

Consequences of Contextual Motivation

Ample research has revealed that different types of motivation are associated with different outcomes (Vallerand, 1997). Theoretically, the association between the different regulatory styles proposed by SDT and their consequences should vary with the level of self-determination, with more self-determined forms of motivation being associated with positive

behavioural, cognitive, and emotional outcomes and those at the lower end of the continuum with negative outcomes (for a review see {Vallerand, 2001 #1269}. This pattern of consequences has been supported by studies conducted in a variety of life domains, including education (Fortier, Vallerand, Briere, & Provencher, 1995), environmental activism (Green-Demers, Pelletier, & Menard, 1997), leisure (Pelletier et al., 1995b), politics (Koestner, Losiers, Vallerand, & Carducci, 1996), religion (Ryan, Rigby, & King, 1993), interpersonal relationships (Blais et al., 1990), health (Williams, Grow, Freedman, Ryan, & Deci, 1996), and sports (Pelletier et al., 2001). In general, these studies showed that the more self-determined regulatory styles lead to better functioning, more interest, greater effort, better performance, higher self-esteem, increased life satisfaction, persistence, and enhanced health, whereas the less self-determined regulatory styles were negatively related to these outcomes.

While both autonomous and controlled behaviours are purposive and motivated, their different source of initiation and regulation has important implications on the quality of behavioural engagement and functioning (Deci & Ryan, 1985a, 2000a). Lasting health behaviour change depends on accepting the regulation of change as one's own. When regulation of behaviour is self-determined individuals tend to assume greater responsibility and exert greater effort toward the achievement of positive outcomes, and remain task involved in the face of setbacks or challenges (Ryan, Plant, & O'Malley, 1995b; Ryan, Sheldon, Kasser, & Deci, 1996). All three forms of autonomously motivated regulation – intrinsic, integrated, and identified - have been shown to predict intended and actual effort (Deci & Ryan, 1991), with intrinsic motivation often operationally defined in terms of persistence of self-initiated behaviour. Sheldon and Elliot (1998), for instance, found that autonomous goals were better attained than controlled goals. Although both autonomy and control were correlated with intended effort

(geared toward objectives one is typically trying to attain in his/her daily life), only autonomy was correlated with early (8 weeks) and later effort (15 weeks), both of which predicted goal attainment. Apart from the mediated effect, autonomy also had a direct promotional effect on goal attainment. The positive effects of autonomy remained significant when controlling for expected competence, initial commitment and the interaction of expected competence with initial commitment. These results led to the conclusion that while control may provide sufficient motivation at the decisional phase, the effect of controlled motivation is significantly reduced when it comes to the implementation of intentions (i.e., action phase during which plans are carried out). This suggests that individuals may have difficulty translating their controlled motives into action. When motives are autonomous, on the other hand, individuals tend to invest more sustained effort into their goals and subsequently show greater task persistence (Ryan & Connell, 1989; Sheldon & Elliot, 1998). Further support for this comes from an already noted study by Pelletier et al. (2004) on the regulation of dietary behaviours in individuals at increased risk for heart disease. These investigators showed that the more self-determined individuals' motives for healthful regulation of dietary behaviours were, the more sustained effort they invested in making healthful changes, as evidenced by reductions in total fat and saturated fat intake 26 weeks after intake to a dietary change program. Their persistent effort at improving eating habits was, in turn, associated with favourable physiological markers of a healthier diet and ultimately CAD risk factor reduction, namely body weight, LDL-cholesterol, the ratio of total cholesterol to HDL-cholesterol, and triglycerides.

This evidence regarding consequences of contextual motivation has direct as well as indirect implications on outcomes of health-directed actions. Different motives can either directly promote or inhibit attainment of regular physical activity and/or enhance or undermine

the formation of intentions (proximal indicator of behaviour) to be physically active. The effect of regulatory style on behavioural outcomes can also be mediated by situational variables during the pre-actional phase (in which planning occurs). These mediators include self-efficacy beliefs and planning (i.e., cognitive organization of future behaviour). These intermediate consequences of regulatory style are described in the following sections.

Self-efficacy. Self-efficacy is a central component of the Social Cognitive Theory (Bandura, 1977, 1986a; Baranowski, Perry, & Parcel, 1996) and has been shown to predict physical activity as well as other health-related behaviours. By definition, self-efficacy is the belief that one can successfully perform in a given situation (Bandura, 1986b; Gist, 1987) and this is usually assessed in terms of removing barriers. A number of studies have demonstrated the positive association between task-specific self-efficacy beliefs and health-directed outcomes, including attainment of regular physical activity. For example, Kaplan, Atkins, and Reinsch (1984) showed that adherence (over 3 months) to an exercise program among older patients with chronic obstructive pulmonary disease was significantly increased by training that increased their sense of self-efficacy for walking and related behaviours.

Behavioural predictions based on self-efficacy beliefs rely on the condition that, if people feel confident that they can do something, or overcome barriers to action, then they will do it. This explanation, however, does not shed light on how people attain the required confidence or on who is able to remove barriers and who is not; nor does it explain how individuals regulate their physical activity behaviours. As such, the self-efficacy construct itself cannot explain why confident people too fail to act or simply discontinue activities. Studies reporting on the reliability of self-efficacy as a direct predictor of behaviour fail to take these shortcomings of the construct into consideration.

Sallis, Hovell, Hofstetter, and Barrington (1992) used a regression model that included 21 social, cognitive and environmental variables (theorized or previously found to influence physical activity behaviour) to predict change in physical activity behaviour over a period of 24 months in a community sample of 1739 adults. Two assessments of physical activity were considered: (1) Exercise change – the change between baseline and 24 months in the number of times that people did physical exercise during a usual week; and (2) Months active - the number of months individuals did exercise at least 9 times per month during the past 24 months. In two hierarchical regression analyses, these physical activity measures were regressed onto 21 static (baseline scores only) and six dynamic (change scores over 24 months) independent variables. From their results the authors concluded that situational self-efficacy (i.e., confidence in ability to set aside time to exercise and to exercise when feeling sad or under stress or when family or social demands are great) was the most significant predictor of physical activity behaviour. Although its relationship to physical activity behaviour was statistically significant, baseline self-efficacy actually accounted for very little variance in the regression model. To give an indication, the total variance accounted for by all 21 static predictor variables was only about 2% and 8% for measures of exercise change and months active respectively[1]. With the addition of the dynamic social learning variables to the regression model, substantially more variance in physical activity behaviour was explained (12.3% and 15.5% for the two measures respectively). However, given that the dynamic variables were assessed at the same time as the activity outcome measure, these results do not imply directional causation, but rather a correlational relationship. Indeed, this is consistent with social learning theory's concept of reciprocal determinism among variables (Bandura, 1977, 1986a); namely that causal relationships between determinants and behaviour are bidirectional, and that both the behaviour and its influence are

subject to change over time. From our point of view, however, this is not considered to be equivalent to prediction.

Similarly, Plotnikoff, Brez, and Hotz (2000) reported that in a subsample of adults with type 1 or type 2 diabetes (n = 46), self-efficacy (i.e., perceived confidence to carry out the behaviour under various conditions) was the most relevant predictor of energy expenditure of physical activity assessed at 6 months. In this case, a true predictive relationship was implied as self-efficacy was measured at baseline. However, based on total variance explained by all selected determinants of energy expenditure (2%), the baseline measure of self-efficacy again accounted for only a small portion of variance in the outcome. As with the other study, the association between self-efficacy and energy expenditure was stronger, and more variance was explained when both determinants and outcome were assessed at the same time. Furthermore, as pointed out by the authors, the interpretability of these results may have been limited by the use of generic measures of determinants in a subpopulation with unique obstacles to physical activity attainment. In another prospective study of sedentary middle-aged adults, McAuley (1992) showed exercise-specific self-efficacy cognitions (perceived capabilities to overcome barriers to exercise) to predict adoption (at 12 weeks) of exercise behaviour (frequency and intensity), but not subsequent exercise participation (at 20 weeks). The authors reasoned that, while self-efficacy is a significant predictor of frequency in the early adoption stage of exercise participation, efficacy cognitions regarding barriers to participation cease to play an important function as exercise becomes more of a habitual activity.

It appears then that while the self-efficacy construct is associated with probability of physical activity behaviour and may even be a good predictor relative to some other socio-cognitive and environmental variables, support for self-efficacy as a reliable predictor of

maintained physical activity behaviour is scarce. This is in line with McCaul, Glasgow, and O'Neill's (1992) inference that although the reciprocal relationship between perceived self-efficacy and behaviour is well documented, the association does not offer an explanation for why successfully enacted changes in behaviour are not maintained.

We recognize the relevance of self-efficacy beliefs in the process of behavioural goal attainment, but are suggesting that rather than being a direct predictor of future behaviour or intentions (a proximal indicator of behaviour), self-efficacy is an intermediate variable that mediates the effect of contextual motivation on these outcomes. More specifically, self-efficacy is posed to mediate the effect of regulatory style on pre-actional cognitions, namely planning of behaviour (described in the next section) that is a proximal determinant of intentions or of action. Self-efficacy is posed as a consequence of motivational style because, while it reflects one's confidence in removing barriers to action, motivation, and more specifically the extent to which it is self-determined, corresponds to one's desire to overcome barriers. Thus, while self-efficacy is relevant in the pre-action phase (i.e., planning/formation of implementation intentions), motivation drives behaviour. The reach of self-efficacy beliefs is limited because they do not distinguish between different forms of psychological functioning and hence do not offer an explanation for how people regulate physical activity behaviours nor for why people cease to be active. Examination of people's motives for engaging in physical activity, on the other hand, yields this kind of information. Thus, in accordance with the SDT, we do not discount the importance of efficacy, but recognize the different function of motivational orientation in predicting behavioural outcomes.

On a more general note, the function of self-efficacy as a mediator rather than a direct determinant of behaviour also has implications beyond those on physical activity attainment.

Self-efficacy alone is not sufficient to ensure psychological well-being. If one is driven by external motives that interfere with one's general autonomy, he/she will not derive a sense of personal satisfaction from pursuing the motive even if feeling efficacious; instead, the individual becomes vulnerable to experiencing interpersonal dissonance due to internal vs. external interests (Williams, 2002). Such dissonance may impede psychological growth and thereby negatively impact on various realms of life. Accordingly, the present research places self-efficacy as a consequence of motivational style and advocates the overarching function of autonomous motivation in the prediction of sustained regulation of physical activity behaviour. In sum, both self-determined motivation and high self-efficacy beliefs are desirable factors in the context of physical activity promotion; while the latter is considered an important mediator of physical activity attainment, the former is a necessary ingredient of meaningful and enjoyable activities (Deci & Ryan, 1985a) and is believed to override situationally negative efficacy beliefs.

Planning. Planning defines the cognitive organization of physical activity behaviours. It occurs in the pre-action phase and is proposed to mediate the relationship between contextual motivation, or regulatory style, and behaviour, as well as that between self-efficacy and behaviour. The concept of planning is similar to Gollwitzer's concept of implementation intentions (Gollwitzer, 1993). Implementation intentions facilitate initiation of goal-directed behaviour by linking goal intentions closely to specified opportunities (Gollwitzer, 1997). In forming implementation intentions, people commit themselves to a plan that specifies the when and where they intend to carry out the goal-directed behaviours. Similarly, planning refers to an action plan. This plan consists of a set of cognitive and behavioral skills to help people deal with behavioural lapses and thereby serves to prevent relapse. In this manner, planning is contingent on self-efficacy (Schwarzer, 1992). Motivation is needed to transform a plan into action; to the

extent that regulation of behaviour is self-determined, it is believed to promote the formulation and execution of a plan of action that, in turn, guides behaviour over time. Some recent studies have provided empirical evidence for the idea that self-determined regulation leads to more effective planning. In a sample of 201 women, for instance, autonomous regulation was positively associated with more effective planning of eating behaviours and subsequently with healthier eating habits compared to controlled regulation (Otis & Pelletier, 2004).

We explained how motivational orientation is associated with different outcomes and justified the important role of autonomous motivation in the regulation of physical activity behaviours, thereby substantiating why a motivational framework would be useful in the prediction of physical activity engagement. Next we will address relevant antecedents of motivation to show how motivation can be modified, specifically how more self-determined motivational styles can be promoted (or external motives internalized).

Antecedents of Contextual Motivation

Motivation is a dynamic variable and can be influenced by external and internal factors. Specifically, the extent to which motivation for a particular behaviour is self-determined depends on both interpersonal and intrapersonal factors. While some variables function to enhance intrinsic motivation, others undermine intrinsic motivation. Given the far-reaching consequences of motivation described above, recognition of factors that influence the level of self-determination is important to sustained behaviour change. In other words, antecedents of contextual motivation represent potential targets for intervention. Numerous studies have examined the antecedents or determinants of self-determined motivation. In the sections below we present descriptions of the interpersonal and intrapersonal antecedents posed to be of particular relevance in the promotion of autonomous regulation of physical activity behaviour in

the cardiac patient population. In particular, we focus on one widely recognized interpersonal factor, autonomy support from relevant others, and two types of intrapersonal factors, namely general motivation and perceived competence.

Interpersonal autonomy support. The perceived nature of social and interpersonal environments individuals find themselves in influence the integration of regulatory processes and thereby plays a role in promoting effective, long-term behaviour change (Deci & Ryan, 1985a, 1987). The SDT proposes that the innate positive processes of intrinsic motivation and the internalization of extrinsic motivation are both dependent upon social-contextual supports pertaining to basic human psychological needs. Three innate psychological needs have been identified as the source of energy of any self-determined action: the need for autonomy, competence, and relatedness. Social contexts that support these basic needs facilitate intrinsic motivation and the internalization of extrinsic motivation. In particular, interpersonal autonomy support, being informational, yields mastery and intrapersonal synthesis. Choice and the opportunity for self-direction have been shown to increase self-determination and intrinsic motivation. Conversely, social contexts that are controlling, too demanding, and rejecting stall the satisfaction of basic needs and are believed to diminish motivation, growth, performance, integrity and well-being. In both exercise and health promotion domains, support of autonomy has received more attention and support than the other two sources of interpersonal support (e.g., Williams et al., 1996, 1998a; Wilson et al., 2002). For these reasons, the model tested in the present research focused specifically on this interpersonal factor.

The distinction between interpersonal relationships that are perceived as autonomy supportive versus controlling has been shown to influence the regulation of behaviours within different life domains. Interpersonal behaviours are supportive of autonomy when a significant

other acknowledges the individual's perspective and feelings, provides choice and a meaningful rationale, and encourages the individual's initiative, participation in decision making and independent problem solving, while minimizing pressure. In contrast, controlling interpersonal behaviours occur when a significant other pressures an individual to perform up to external standards or uses rewards and constraints to manipulate the individual's behaviour (Pelletier et al., 2001). Interpersonal contexts that are perceived as autonomy supportive endorse greater interest, more cognitive flexibility, more creativity, and more persistence compared to contexts that are perceived to be controlling. Accordingly, relationships that offer interpersonal autonomy support versus control promote self-initiation and autonomous regulation of specific behaviours, as well as facilitate the internalization of self-determined extrinsically motivated behaviours (Deci & Ryan, 1987, 1991).

Previous research has demonstrated that regulation of different health behaviours becomes more autonomous, resulting in desirable outcomes, when parents, educators, coaches, health care providers, and treatment programs are autonomy supportive (Curry, Wagner, & Grothaus, 1991; Deci et al., 1994; Williams & Deci, 1996a; Williams et al., 1996; Williams et al., 1998b). Controlling relationships have the opposite effect. Pelletier et al. (2001) for instance, assessed the influence of athletes' perceptions of coaches' interpersonal behaviours (autonomy support vs control) on the different forms of regulation for the practice of competitive swimming (intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation). The results showed that perception of coaches' control was positively associated with non-self-determined forms of regulation (external regulation and amotivation), while perception of autonomy support was associated positively with self-determined forms of regulation (intrinsic motivation and identified regulation).

In the context of healthcare settings, Williams et al. (1996) showed that controllingness of health care providers negatively predicted adherence to a weight loss program. This finding can be extended to suggest that by supporting patients' autonomy, interpersonal relationships have the potential to improve adherence to health behaviours by promoting autonomous regulation of behaviour. Williams et al. (1998b) showed that both autonomous regulation as well as perceived autonomy support were strongly related to adherence to long-term medication prescriptions, and that the effects of the latter were mediated by the former. Furthermore, both autonomous regulation and perceived autonomy support were negatively correlated with perceived barriers to adherence, implying that individuals whose regulatory style is more autonomous and/or who perceive interpersonal autonomy support tend to also perceive fewer barriers to adherence. This is consistent with our previous point regarding the importance of self-determined motivation in overcoming barriers to action and thereby enhancing situational efficacy beliefs.

The nature of interpersonal contexts has also been shown to promote autonomous regulation by enhancing perceived competence. Early experiments showed that positive feedback enhanced intrinsic motivation relative to no feedback (Boggiano & Rubble, 1979; Deci, 1971) and that negative feedback decreased intrinsic motivation relative to no feedback (Deci & Cascio, 1972). This suggests that events which signify effectance and foster perceived competence enhance intrinsic motivation, whereas events that convey ineffectance foster perceived incompetence and thus undermine intrinsic motivation (Deci & Ryan, 1980, 2000b). Research has confirmed that the impact of social factors on self-determined motivation is mediated by perceived competence (Guay & Vallerand, 1997; Vallerand, Fortier, & Guay, 1997; Vallerand & Reid, 1984).

General motivation. As mentioned at the onset of this section, general motivation refers to relatively enduring individual differences with respect to people's motivations. It has been linked to general life satisfaction as well as psychological functioning, and reflects an individual's typical interactions with the environment. A general autonomy orientation describes the general tendency to be self-regulating and to orient toward contextual factors that promote choice and individual initiative. Accordingly, a general tendency to be self-determined predisposes individuals to adopt more self-determined modes of regulation within specific regulatory contexts, including the regulation of health-directed behaviours. That is, individuals who are generally autonomous are likely to also adopt autonomous modes of regulation for health behaviours.

Apart from the impact on one's own regulatory tendencies, an individual's global motivational orientation (i.e., level of self-determination) is believed to shape the nature of his/her interpersonal relationships with people he/she interacts with on a regular basis. In other words, a person's general motivational tendency is thought to influence the manner in which others respond to him/her under various circumstances. This implies an integration of motivational orientation and behavioural confirmation paradigms that was first explored by Pelletier and Vallerand (1996). According to this premise, other's perceptions of an individual's motivational orientation (intrinsic or extrinsic) engender a certain style of interpersonal interaction (either supporting autonomy or being controlling) that, in turn, induces the individual to behave in a way that confirms others' initial beliefs. To illustrate, Pelletier and Vallerand (1996) showed that supervisors who believed that a subordinate was intrinsically motivated, as opposed to extrinsically motivated, were more supportive of autonomy and less controlling. Furthermore, these differences in supervisor's response style elicited and nurtured behaviours of

the subordinate that were consistent with the supervisor's initial perceptions. Subordinates who were perceived to be intrinsically motivated came to demonstrate more intrinsic motivation than subordinates whose supervisors believed them to be extrinsically motivated.

The implication is such that when individuals are self-determined, others are likely to support their autonomy; whereas when individuals are not self-determined, others will treat them in a controlling manner. Furthermore, interpersonal relationships, and social contexts in general, influence contextual motivation and thereby behavioural regulation by either facilitating or undermining the natural tendency to integrate new behaviours. Accordingly, a person's general level of self-determination bears an indirect influence on his/her motivational tendencies within specific contexts by means of others' reactions to his/her global motivational style. In the context of health behaviour regulation in the cardiac patient population, this means that whether a patient's relevant others respond to his/her needs in an autonomy supportive versus controlling fashion will depend on the extent to which the patient is generally self-determined.

Perceived competence. Perceived competence represents a second intrapersonal factor. It was defined by White as an individual's subjective perception of his or her skills and abilities to interact effectively with the environment. This perception of confidence and effectance in action is a product of one's cumulative learning experiences, but may or may not correspond to one's actual competencies (White, 1960, 1963, 1972). Moreover, the concept also represents an individual's ability to experience opportunities to be physically active and express one's competencies (Deci, 1975; Harter, 1983; White, 1959). In line with the cognitive evaluation theory (CET; Deci, 1975; Deci & Ryan, 1980, 1985a, 1991), a sub-theory of SDT, people are believed to have a need for competence that leads them to seek challenges that are optimal for

their skills and abilities, and to persist at trying to maintain and enhance those capacities through activity (Elliot, McGregor, & Thrash, 2002).

On a very superficial level, perceived competence can be viewed as a sense of general self-efficacy. Indeed, both factors tap into a person's own sense of confidence within a particular context. Competence, real or perceived, however, differs from feelings of efficacy, or self-efficacy as defined by SCT. The former represents structural elements of the self and personhood that cohere over many encounters with the environment; the latter, in contrast, applies to single episodes or situational experiences with the environment (White, 1963). Therefore, while self-efficacy tends to be situation-specific and malleable, perceived competence represents a more stable construct that is the product of a lifetime of experiences (Eden & Kinnar, 1991). The implication is such that, although the two concepts could be measured by somewhat similar items, they have a different origin and, as such, can be modified through different means. Moreover, the theoretical frameworks associated with each perceived competence and self-efficacy differ in how they relate the construct to regulation of physical activity behaviour and therefore how they explain maintenance of behaviour. SDT views perceived competence as a need; accordingly, the more this need is fulfilled, the more self-determined individuals are in regulating their activities. SCT, on the other hand, defines self-efficacy as a prerequisite to physical activity engagement and operationalizes the construct in terms of overcoming barriers or obstacles to activity. We recognize the relevance of both perceived competence and self-efficacy in the process of health behaviour regulation and therefore incorporated both constructs into our hypothesized model to help us more thoroughly understand and better predict physical activity regulation.

According to CET, perceived competence has a direct impact on motivation: when an event increases perceived competence, intrinsic motivation will be enhanced, whereas when an event reduces perceived competence, intrinsic motivation will be undermined. As such, a change in perceived competence is viewed as a cognitive process through which contextual factors, such as feedback from relevant others, influence intrinsic motivation (Deci & Ryan, 1980). Moreover, there is an emphasis on the interdependence among inter- and intrapersonal factors in the regulation of behaviour. Perceptions of competence, among those of autonomy and relatedness, are posed to mediate the impact of social factors on motivation. To the extent that social factors foster perceptions of competence, autonomy and relatedness in individuals, self-determined types of motivation are expected to be enhanced whereas non-self-determined types of motivation to be reduced (Deci et al., 1991). Specifically, research showed that while positive feedback in general led individuals to feel more competent and, in turn, more self-determined (Vallerand & Reid, 1984, 1988; Whitehead & Corbin, 1991), self-determined motivation was enhanced more when the social environment also supported individuals' autonomy (e.g., Fisher, 1978; Ryan, 1982). As summarized by Deci and Ryan (2000a), feelings of competence are necessary for any type of motivation, yet a sense of autonomy is required for the motivation to be intrinsic. Accordingly, both perceived competence together with perceived autonomy are recognized to be relevant predictors of individuals' motivation for regulation of physical activity behaviour, but, in addition, perceived competence is placed as a mediator between interpersonal autonomy support and regulatory style.

Finally, both perceived competence and motivation, in particular the extent to which it is self-determined, are considered essential for optimal functioning (Deci & Ryan, 1985a, 1991; Vallerand, 1997); in addition, motivation mediates the effect of perceived competence on

behavioural attainment and effective performance. Frederick and Ryan (1993), for instance, showed that both competence and enjoyment motives (i.e., self-determined motives) significantly predicted better program attendance and greater adherence to one's chosen physical activity. Moreover, enjoyment motives were found to mediate the impact of perceived competence on behaviour regulation. In sum, the optimal circumstances for self-determined regulation of behaviour are those that allow satisfaction of the needs for autonomy, competence and relatedness (Deci & Ryan, 1980, 1985a; Ryan & Deci, 2002).

## Overview of the Studies

Sustained behaviour change depends on effective regulation, that is, self-regulation. What is being proposed here is that, in line with SDT, motivational style, as defined by the degree to which regulation of behaviour is self-determined, is central to effective regulation of behaviour. In the context of health behaviour modification, especially in chronic disease populations, behaviour change is meaningful only to the extent that it is maintained over time. A self-determined regulatory style is believed to promote sustained behaviour regulation. Moreover, the concept of a self-determination continuum affords the progression of motives from non-self-determined forms to self-determined forms. This may be particularly relevant to the promotion of desired health behaviours in clinical populations. For individuals whose health may depend on immediate yet sustained health behaviour change, the integration of initially extrinsic, or controlled, motives for becoming physically active is essential for lasting health benefits. All in all, desired health behaviour outcomes are believed to be contingent on effective regulation of behaviour.

Behavioural regulation is considered effective to the extent its underlying motives are self-determined. A self-determined motivational style is posed to drive behaviour directly, as

well as indirectly, by enhancing intermediate process variables, such as self-efficacy beliefs and planning. While the positive consequences of an autonomous regulatory style are evidenced during the planning and early action phases, its value relative to other variables becomes especially pertinent during behavioural maintenance because self-determination promotes self-regulation. The quality of motives is influenced by personal and social factors. Individuals' general motivational tendencies predispose them to adopt a certain regulatory style across different contexts, yet regulatory style is also influenced by modifiable intrapersonal and interpersonal factors, including perceived competence and interpersonal autonomy support. In this manner, motivation at the contextual level is malleable and the degree to which it becomes self-determined depends on both the social environment and the individual's perceived competencies.

Based on the principles and relationships presented in the preceding sections, two studies were conducted to develop and test a motivational model of physical activity regulation. If proven valid, the model will offer a comprehensive explanation of the processes underlying effective regulation of physical activity behaviours in patients with heart disease. An understanding of these mechanisms is critical to the promotion of long-term behaviour maintenance. The conceptual hypothesized model is depicted in Figure 1. This motivational model of physical activity regulation links intrapersonal and interpersonal factors together to model physical activity intentions in Study 1 and physical activity behaviour in Study 2. In so doing, the model provides a medium to test four interesting concepts in a real-life setting.

First, the model incorporates a measure of motivation at two levels of generality, general and contextual, allowing for a test of the relations among different levels of motivation, as depicted by Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation. Second,

the model integrates both intrapersonal and interpersonal components of SDT to afford an examination of the relationships among these factors (i.e., impact of general motivation on interpersonal relationships and the effect of the latter on contextual motivation) and their combined influence on the process of sustained behaviour regulation. Third, the model incorporates a dominant construct from another theoretical framework, namely self-efficacy from SCT, to test its function in relation to motivational style, as defined by SDT, in the prediction of physical activity behaviour. Fourth, by relating factors in sequential order, the model allows for examination of both antecedents and consequences of autonomous and controlled forms of contextual motivation. The proposed sequence is based on theory and evidence from previous research.

Both studies represent a test of the relationships proposed in the hypothesized model (refer to Figure 1). Study 1, however, sets the stage for Study 2; its objective was to test the reliability of the proposed associations in a smaller sample and using a basic design before embarking on a larger and more demanding study. The nature of the first study was cross-sectional (i.e., all variables were measured at the same point in time) and the outcome being modeled was intentions, a cognitive precursor to behaviour. Study 2 was a true longitudinal design comprised of three waves and predicting behaviour in a large sample. Whether the outcome of interest was intentions or behaviour, motivational style was posed to be central in the sequence linking intrapersonal and interpersonal factors, and the same hypotheses regarding the antecedents and consequences of motivational style applied.

With respect to antecedents, we aimed to show that the degree to which cardiac patients are autonomous (i.e., self-determined) in regulating their physical activity behaviours would depend on both intrapersonal and interpersonal factors; namely patients' general motivational

orientation, the quality of others' autonomy support, and perceived competence. General motivational orientation was believed to be the most stable determinant of the motivational style an individual adopts for regulating physical activity; in effect, it predisposes individuals to be either autonomous or controlled in regulating behaviour within specific contexts. Interpersonal autonomy support was theorized to endorse more self-determined regulation of physical activity behaviours by promoting integration of extrinsic motives; a social context that is not supportive of autonomy, in contrast, was hypothesized to be associated with controlled forms of regulation. Similarly, perceived competence was expected to enhance autonomous regulation given that the need for competence is recognized to be a positive and adaptive source of motivation (Elliot et al., 2002); whereas a lack thereof was expected to be associated with controlled modes of regulation. In addition, two instances where intra- and interpersonal factors interact to shape contextual motivation were considered. One, patients' general tendency to be self-determined was expected to influence the nature of interpersonal relationships, specifically with respect to autonomy support. Two, the impact of interpersonal autonomy support on regulatory style was posed to be mediated by patients' perceived competence; specifically, autonomy supportive interactions were expected to endorse feelings of competence for physical activity behaviours in this population.

With respect to consequences of motivational style, our main aim was to support our central position that regulatory style is a relevant determinant of outcome. In particular, autonomous regulation was posed to be associated with more desirable physical activity outcomes, whereas controlled regulation was hypothesized to be related to weaker physical activity outcomes. In addition, motivational style was expected to exert its effect on outcome via proximal process variables, namely self-efficacy beliefs and planning. Again, while an

autonomous regulatory style was hypothesized to endorse feelings of self-efficacy and encourage planning of behaviour, a controlled style was theorized to undermine these variables.

Both Study 1 and Study 2 were conducted in a real-life setting and, apart from the initial personal contact at time of recruitment and collection of follow-up information, were designed to be non-invasive, that is participants were not subjected to any treatment or intervention. Patients hospitalized with a cardiac event were recruited directly from hospital admissions (as well as rehabilitation classes in the case of Study 1) and were required to complete a paper-and-pencil survey evaluating potential determinants of their physical activity behaviours prior to discharge from hospital. In both studies, the SDT was used to model the relationships between general motivational orientation, interpersonal relationships, perceived competence, contextual motivation, proximal mediating variables, and markers of effective physical activity regulation (i.e., intentions or behaviour).

## Study 1

The main goal of the first study was to establish the validity of the theory-and-research-based relationships proposed in the motivational model within the context of physical activity and in the cardiac patient population. In this study, the design was tested by modeling patients' intentions to be physically active after the occurrence of a cardiac event. We posed that intention formation would be determined by an interplay among intrapersonal and interpersonal variables that are linked through motivational style in a theory- and evidence-based sequence.

In order to conduct a sound test of a model, it is necessary to ensure that the scales used to measure indicator variables are valid. While most of the scales used in the present design have been extensively validated, some were adapted for the purpose of this research. Therefore, in addition to being a "first" test of the proposed motivational model, Study 1 also served the

purpose of confirming the validity of measurement scales within the specific context of physical activity in the cardiac population, as deemed necessary.

## Study 2

An understanding of the intrapersonal and interpersonal mechanisms underlying the formation of a cognitive precursor to physical activity behaviour is important; a theoretical framework modelling the regulation of actual behaviour over time, however, is paramount. The goal of the second study was, therefore, to test a three-wave, longitudinal design modeling physical activity behaviour in cardiac patients. Our aim was to confirm the central function of autonomous motivation in the regulation of physical activity behaviour over time, as well as to test the relationships modeled in Study 1 in a time-dependent sequence to provide a thorough understanding of the determinants of effective regulation of physical activity behaviour. The design was expected to capture the dynamic nature of the regulatory process and to be responsive to individuals' psycho-social, behavioural, and physiological experiences over time.

In sum, with the incorporation of both individual-difference and social-context variables, our hypothesized model was furnished to predict which patients are likely to adopt and maintain a regime of regular physical activity after diagnosis or treatment for CVD and which are not, as well as how they can be motivated to do so. Overall, it is believed that this research will provide evidence for a theory-driven framework of health behaviour promotion in patients with heart disease. This framework could be valuable in guiding the design and evaluation of future interventions to promote regular physical activity in the cardiac population.

## Study 1: Model of Human Motivation to Predict Physical Activity Intentions

### Research Aim

The primary goal of Study 1 was to propose and test a theory-driven model of physical activity intentions in patients with coronary artery disease (CAD). The hypothesized model is presented in Figure 2. The motivational model links antecedents and consequences of self-determined and non-self-determined forms of motivation to predict intentions to be physically active. Behavioural intention is considered to be a relevant predictor of physical activity participation; several social cognitive models applied in the health behaviour domain (e.g., theories of reasoned action, interpersonal behaviour, planned behaviour and protection motivation) have explicitly hypothesized intentions to be an immediate determinant of physical activity behaviour (Courneya & McAuley, 1993). In the present research intention was considered to be a proximal cognitive precursor to action; without intention to be physically active, it is highly unlikely that an individual will engage in physical activity behaviours.

The following theoretical positions regarding the mechanisms that shape physical activity intentions in a clinical population were examined in this first study: (1) Vallerand's (1997) stance regarding the hierarchical structure of human motivation (i.e., the relationship among measures of motivation at two levels of generality, general and contextual); (2) the behavioural confirmation paradigm (Pelletier & Vallerand, 1996) regarding the impact of an enduring motivational style on the nature of interpersonal behaviours (i.e., how patients' general motivational tendencies influence the manner in which others provide support regarding regulation of rehabilitative health behaviours) and how general motivational orientation and interpersonal factors in combination influence physical activity behaviour regulation; (3) the importance of perceived competence as a building block for self-determined motivation within

the given behavioural domain; and (4) the role of constructs from the Social Cognitive Theory and Gollwitzer's (Gollwitzer, 1993)work on implementation intentions as mediators in the unfolding sequence of physical activity behaviour regulation.

Another important objective of Study 1 was to confirm the validity of a measurement scale. All the instruments used to assess the constructs in the proposed model are standardized measures that have been validated in various contexts and populations. One of the scales, however, has been adapted specifically for the purposes of the present research. This study will therefore serve the purpose of examining the psychometric properties of the Physical Activity Regulation Scale (PARS) used to assess motivational style within the context of physical activity behaviours in the cardiac patient population.

## Hypotheses

The research hypotheses were formulated in line with our central premise that contextual motivation has an overarching role in the process of behavioural regulation and, as such, are presented as antecedents and consequences of contextual motivation.

### Antecedents of Contextual Motivation

The front half of the model (refer to Figure 2) depicts the antecedents of an autonomous versus controlled regulatory style within the domain of physical activity. The hypotheses that emerged are as follows. First, general autonomy orientation will be associated with autonomous modes of regulation within the context of physical activity, while a general control orientation will be associated with controlled modes of regulation. Second, in line with the behavioural confirmation paradigm, a general autonomy orientation will engender interpersonal relationships that are supportive of an autonomous regulatory style. That is, the more autonomous individuals are in general, the more inclined they will be to perceive their interpersonal relationships as

autonomy supportive in the context of health behaviour regulation. In contrast, individuals with a control orientation will be more likely to foster interpersonal relationships that are less supportive of autonomy. The third hypothesis addresses the relevance of perceived competence in the determination of regulatory style. We expected perceived competence to play a mediating role between interpersonal autonomy support and contextual motivation. Autonomy supportive behaviours from relevant social agents were hypothesized to enhance patients' perceptions of competence for partaking in physical activity. Positive perceptions of competence, in turn, were expected to support the evolution of patients' self-determined motivation for physical activity regulation.

Consequences of Contextual Motivation

The back half of the model depicts the regulatory consequences of contextual motivation on the formation of intentions to be physically active. The hypotheses that emerged are as follows. First, autonomous regulation of physical activity behaviour will positively influence the formation of intentions to be physically active. Second, controlled regulation of physical activity will negatively influence the formation of intentions to be active. Third, both regulatory styles will impact on self-efficacy beliefs to indirectly influence planning, a proximal process variable that defines the cognitive organization of physical activity behaviour. Autonomous regulation will strengthen self-efficacy beliefs, whereas controlled regulation will weaken them. Fourth, the relationship between regulatory style and intentions to be physically active will be mediated by planning. While an autonomous regulatory style will promote planning and thereby yield stronger intentions, a controlled style will undermine planning to weaken intentions. Fifth, intentions to be physically active will be positively associated with pre-hospitalization physical activity behaviours. As past behaviour tends to be the best predictor of

future behaviour, this path was included to account for the influence of prior physical activity habits on current intention formation. However, while prior physical activity habits may shape future intentions to be physically active, the alarming cardiac event each patient experienced may destabilize the relationship between past behaviour and future intentions.

## Method

### Participants

A total of 200 patients with documented CAD were recruited from hospital admissions and cardiac rehabilitation classes from the Ottawa Heart Institute. Patients were eligible to participate in the research study if they were between the ages of 20 and 85 years, were proficient in English (reading) and had documented CAD and/or were participating in a cardiac rehabilitation program. Documentation of CAD was based on the following requirements: (1) a coronary angiogram showing $\geq$ 60% obstruction of at least one major coronary artery or one of its primary branches; (2) a documented myocardial infarction; (3) a clinical history typical of angina pectoris (AP) together with a treadmill test result or nuclear scan consistent with myocardial ischemia; and (3) hospital admission for Coronary Artery Bypass Grafting (CABG) or angioplasty (percutaneous transluminal coronary angioplasty; PTCA) procedures. Exclusion criteria included contraindications to exercise (e.g., unresolved unstable angina; uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise; neuromuscular, musculoskeletal, or rheumatoid disorders that are exacerbated by physical activity; uncontrolled diabetes; chronic infectious diseases such as mononucleosis, hepatitis, AIDS; and pregnancy).

### Procedure

The project research coordinator approached eligible and willing patients on an individual basis in the case of admitted patients; participants in rehabilitation classes were

addressed in groups. The coordinator explained the purpose of the study to the patients and asked them to complete the study questionnaire. Patients were required to drop off the completed questionnaires to the study coordinator or their nurse before hospital discharge or at the end of their rehabilitation class. Those unable to complete the survey while in the hospital were asked to complete the questionnaire at home and mail it back to us in a stamped, addressed envelope that was provided to them. Informed consent was obtained from all participants.

Measures

A questionnaire package was assembled that included scales to assess demographic, clinical, psychological, social and physical environmental, and physical activity behaviour variables. In the present study the measures of interest included past physical activity habits, general motivation, regulatory style toward physical activity behaviours, perceived competence, interpersonal support of autonomy, self-efficacy beliefs, planning of physical activities, and finally the outcome variable, intentions to be physically active. For validation purposes, measures of outcome expectations, life satisfaction, perceived stress, depressive symptomatology, and anxiety were also included. These measures are described below.

Physical activity behaviour. The Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985) was used to assess the frequency and intensity of physical activity behaviour during the 6-months prior to the patient's most recent hospitalization. Specifically, the patients were asked, "Considering a typical week in the last six months, how many times on average do you do the following kinds of leisure time physical activity for more than 15 minutes during your free time?" Participants were required to indicate the *times per week* for each mild, moderate and strenuous exercise; examples of activities for each intensity were provided. A leisure score index (LSI) was derived by weighting each frequency by its estimated intensity in metabolic equivalents

(METs); a weight of 3 was applied to mild activities, a weight of 5 to moderate and a weight of 9 to strenuous. The total weekly LSI was calculated in arbitrary units by summing the products of the separate components: (3 x mild) + (5 x moderate) + (9x strenuous). This instrument was selected as the variable for physical activity because it has been found to be easily administered and brief, and has demonstrated validity and reliability for measuring physical activity in free-living populations. Studies have reported test-retest reliability coefficients of .74, .81 and .62 and concurrent validities (correlations with objective measures of physical functioning, including maximum oxygen consumption, accelerometer caloric expenditure, body fat, treadmill time to reach target heart rate, as well as other activity measures) (Godin & Shephard, 1985; Jacobs (Jr) & et al., 1993; Miller, Freedson, & Kline, 1994; Sallis, Buono, Roby, Micale, & Nelson, 1993).

General motivation. The General Self-Determination Scale (GSDS; Pelletier et al., 2003) was used to assess patients' general motivational orientation, as defined by SDT, at baseline. The GSDS represents a broad orientation to be intrinsically or extrinsically regulated, or amotivated in general; it reflects the degree of involvement of the self and the amount of autonomy in the regulation of daily behaviours. The GSDS consists of 18 items and is comprised of six subscales to independently measure the six constructs of intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation. Each subscale consists of three items. Participants are presented with the statement "In general, I do things…" and are asked to indicate on a 7-point Likert-type scale, ranging from 1 (*do not agree at all*) to 7 (*completely agree*) the extent to which each of the 18 items corresponds to their own motives for behaviour in general. The following are sample items from each of the six subscales of the GSDS: (1) "… for the pleasure of learning something new" (intrinsic motivation); (2) "… because they reflect what I value most in life" (integrated regulation); (3) "… because I chose to

make a commitment to what is important to me" (identified regulation); (4) "... because I force myself to do them" (introjected regulation); (5) "... in order to show others what I am capable of" (external regulation); (6) "... even though it does not make a difference whether I do them or not" (amotivation).

Results of five studies supported the six-factor structure of the construct validity of the scale. Test-retest reliability of the GSDS was found to be adequate (ranged between .71 and .82). Alpha reliability coefficients for the six subscales range between .73 and .90 for all studies: intrinsic motivation =.88; integrated=.81 ; identified=.78 ; introjected=.86 ; external=.73 ; amotivation=.90. In the present research we were interested in examining the antecedents and consequences of autonomous versus controlled forms of motivation within the process of intention formation and subsequently behavioural regulation. Therefore, two scores, one for general autonomous motivation and one for general controlled motivation, were generated. To create this dichotomy, items are combined in a way to form indicators of equal weight for each of the two styles of regulation. This method yields as many indicators per factor as there are items per subscale; thus for this scale each factor had three indicators. Each indicator for autonomous regulation consisted of the sum of one item from the intrinsic motivation subscale plus one item from the integrated regulation subscale plus one item from the identified regulation subscale. Likewise, each indicator for controlled regulation was comprised of the sum of three items, one from the subscale of each introjected regulation, external regulation, and amotivation. The items for each indicator were grouped in an arbitrary fashion.

Regulatory style. The Physical Activity Regulation Scale (PARS) was used to assess self-determination within the context of physical activity behaviour regulation. The PARS is an extended version of the 15-item Behavioral Regulation in Exercise Questionnaire (BREQ;

Mullan et al., 1997). The BREQ consists of four subscales that measure external regulation, introjected regulation, identified regulation and intrinsic motivation. The amotivation and integrated regulation subscales were added to the BREQ to form the PARS, which thereby assesses all of the six forms of regulation defined by the SDT continuum. The construct validity of the behavioural regulation continuum is well established (Blais et al., 1990; Ryan & Connell, 1989). Mullan et al. (1997) dropped the amotivation items from their questionnaire based on their findings that these items were highly skewed due to the majority of their respondents reporting that the amotivation items did not apply to them. Their study sample, however, consisted of attendees of a local sports centre who, based on their attendance alone, must have been somewhat motivated to engage in physical exercise; thus, items assessing amotivation were likely not applicable. Inclusion of the amotivation subscale was warranted in the present research because, given the target population and the fact that recruitment was completely independent of past or current physical activity habits, it was conceivable for the study participants not to be motivated to engage in regular physical activity. We also added three items representing integrated regulation to afford measurement of the multiple types of motivation that fall along the self-determination continuum (Deci & Ryan, 1985a).

The resulting 18-item PARS is comprised of six subscales to independently assess the six constructs of intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation within the context of physical activity regulation. Each subscale consists of three items. Participants are presented with the statement, "I am trying to be physically active because ..." and are asked to indicate on a 7-point Likert-type scale, ranging from 1 (*not at all true*) to 7 (*completely true*) the extent to which each of the 18 reasons applies to him/her. The following are sample items from each of the six subscales of the PARS:

(1) "... I enjoy my exercise sessions" (intrinsic motivation); (2) "... healthy activity is part of my life goals" (integrated regulation); (3) "... I value the benefits of exercise" (identified regulation); (4) "... I feel guilty when I don't exercise" (introjected regulation); (5) "... other people say I should" (external regulation); and (6) "... I really don't think about being or becoming physically active" (amotivation). As with the GSDS, the PARS was scored to yield two global scores, one for autonomous regulation and one for controlled regulation.

While the PARS scale has not been validated, the psychometric properties and validity of the 15-item BREQ were established as part of the original development of the scale (Mullan et al., 1997), and more recently replicated using a sample (N=500) of individuals enrolled in exercise classes emphasizing cardiovascular conditioning (Wilson, Rodgers, Fraser, 2002). Confirmatory factor analysis (CFA) revealed acceptable goodness-of-fit indices ($\chi^2$/df= 3.87, NFI = .91, IFI = .92, CFI = .92, SRMSR = .04, RMSEA = .09, 90% confidence interval = .07-.10). Alpha reliability coefficients for the four subscales were also acceptable (external = .89; introjected = .74; identified = .79; intrinsic = .91). The pattern of interfactor correlations supported the presence of a simplex pattern, indicating that the BREQ subscales were related but represented distinct aspects of exercise motives. Construct validity was further supported by relations between BREQ subscales and constructs relevant to the promotion of exercise behaviour (e.g., perceived behavioural control).

Interpersonal autonomy support. The autonomy support subscale of the Interpersonal Behaviours Scale (IBS; Otis & Pelletier, 2001) was used to assess interpersonal autonomy support. The subscale consists of 4 items. Participants are presented with the statement "People in my life (defined as partner/spouse, children, parents, friends, health professionals, and/or work colleagues)..." and are asked to indicate on a 7-point Likert-type scale, ranging from 1 (*Never*)

to 7 (*Always*) the extent to which each of the items corresponds to their interactions with relevant others regarding their health behaviours. The following are the four items of the autonomy support subscale: (1) "… provide me with lots of opportunities to make my own decisions in what I do;" (2) "… openly respect my thoughts and feelings although theirs may be different;" (3) "… encourage me to be myself;" and (4) "… ask me what I think before giving me their opinion when I ask them to help with a problem." The sum of the four items represented the interpersonal autonomy score. The IBS has been validated in different life domains including education and sports. Internal consistency of the autonomy subscale is .77. Construct validity was assessed via correlations between IBS subscales and forms of motivation, and those between the subscales and motivational consequences (e.g., intentions, stress, life satisfaction, purpose in life, self-esteem). Correlations between the IBS subscales and forms of motivation were consistent with the SDT, providing support for construct validity: self-determined forms (i.e., intrinsic motivation and identified regulation) of academic and sport motivation correlated positively with interpersonal behaviours supportive of autonomy and relatedness, and correlated negatively with interpersonal behaviours that were not supportive of competence. Amotivation was generally found to correlate negatively with interpersonal behaviours supportive of autonomy and relatedness.

Perceived competence. Perceived competence was assessed by three questions used to measure the construct of Perceived Behavioural Control as suggested by Ajzen & Madden (1986): (1) "If I wanted to I could easily engage in regular physical activity", rated on a scale ranging from -3 (*strongly disagree*) to 3 (*strongly agree*); (2) "For me to engage in regular physical activity is…", rated on a scale ranging from -3 (*extremely easy*) to 3 (*extremely difficult*); and (3) "How much control do you have over whether or not you engage in regular physical activity?", rated on a scale

ranging from -3 (*no control at all*) to 3 (*complete control*). The three items were summed to yield a total perceived competence score. Internal consistency (Cronbach's alpha) for this three-item scale was 0.83 (Ajzen & Madden, 1986). Perceived behavioural control has been previously found to explain 36% of the variance in exercise behaviour (Godin & Kok, 1996).

Self-efficacy beliefs. Self-efficacy was assessed using a 12-item Self-Efficacy Scale which tapped into participants' confidence in their ability to engage in regular physical activity under various circumstances. Specifically, the items represented possible obstacles to physical activity engagement. The items were presented following a general statement: "Please indicate how confident you are that you will be able to engage in regular physical activity over the next 4 weeks even …". Participants were asked to indicate on a 7-point Likert-type scale, ranging from 1 (*not at all confident*) to 7 (*completely confident*) their confidence level for each of the 12 items. A composite score of self-efficacy beliefs was obtained by summing the 12 items. The items were also categorized into four groupings, according to the type of obstacle, in order to reduce the number of indicators of the self-efficacy factor in the structural equation modeling analyses. The four categories of obstacles were social obstacles, activity related obstacles, mental strain obstacles, and physical strain obstacles. The following are sample items from each of the four categories: (1) "… without support from family or friends" (social strain); (2) "… when you become bored with the activities" (activity related); (3) "… when you are feeling anxious or stressed" (mental strain); and (4) "… when you feel physical discomfort when you exercise" (physical strain).

This instrument consisted of items selected from previously standardized scales assessing self-efficacy beliefs (Bandura, 1995; Plotnikoff & Higginbotham, 2002) based on their relevance to the cardiac patient population. Six items were drawn from Bandura's original exercise self-

efficacy scale (Bandura, 1986a, 1995). These items were found to have high internal consistency (alpha = .94) and test-retest correlations (r= .77) (Shin, Jang, & Pender, 2001). An additional six items were drawn from the work of Plotnikoff and Higginbotham (1995) and were also found to have excellent internal consistency (Cronbach's alpha = .91) and high test-retest reliability (Pearson Correlations, r = .77).

Planning. Planning, or cognitive organization, of physical activity was assessed with two items, one asking about participants' activity routine and the other about their implementation plans. While routine is a behavioural measure that refers to habitual activities, implementation plans are cognitive in nature - they specify the when, where, and how of goal intentions. Both routine and implementation plans are believed to represent an intermediate step in the process of regulation of physical activity behaviours on which motivational orientation exerts a direct effect. The routine item stated, "Do you tend to follow a regular exercise routine (i.e., exercise at the same time of day) or do your physical activity habits tend to differ from week to week?"; participants were provided with the following responses options: (1) Never follow routine (differs from day to day); (2) Seldom follow a routine; (3) Sometimes follow a routine; (4) Most of the time follow a routine; and (5) Always follow a regular routine (same time everyday). The implementation plan item stated, "To what extent do you make specific plans (when, where, how) to be physically active?"; the response options to this question were: (1) Never plan my physical activity; (2) Seldom plan my physical activity; (3) Sometimes plan my physical activity; (4) Most of the time plan my physical activity; and (5) Always plan my physical activity.

Intentions to be physically active. Physical activity intentions were evaluated with two items used in previous physical activity research (Courneya & McAuley, 1993, 1994). The items were in the form of the following two statements: (1)"I intend to exercise regularly over the next month" and

(2) "I intend to exercise regularly over the next six months". Participants were asked to indicate on a 7-point Likert-type scale, ranging from 1 (*do not agree at all*) to 7 (*completely agree*), the extent to which they agree with each of the statements. Correlations between the measures of intention and physical activity were reported to be .44 (Courneya & McAuley, 1994).

Analytical Strategy

Data were analyzed in three steps. The first step involved preliminary analyses which addressed issues related to structural equation modeling and the validation of the PARS instrument. Second, descriptive statistics were calculated to provide summary statistics on each of the variables under study. The third step was the central analysis of this study and consisted of structural equation modeling (SEM) procedures. This final step involved estimation of the hypothesized model of intentions to be physically active and a modified model. Structural equation modeling procedures were conducted using EQS 6.1 Structural Equations Program (Bentler & Wu, 2004). The SEM analyses were based on the covariance matrix and estimation was performed using maximum likelihood (ML) fitting function (Bollen, 1989). Multiple statistical and practical criteria were considered to afford an informed evaluation of overall model fit. These included the chi-square likelihood ratio ($\chi^2$), the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990), the Goodness of Fit Index (GFI; Joreskog & Sorbom, 1996), and the Comparative Fit Index (CFI; Bentler, 1990). These fit indices are described below.

The chi-square likelihood ratio ($\chi^2$) measures the magnitude of discrepancy between the sample and estimated or fitted covariance matrices (Hu & Bentler, 1999). Theoretically, if the hypothesized model yields a perfect estimation of the observed sample covariance, the sample covariance matrix should not differ from the estimated covariance matrix. Accordingly, the null

hypothesis is that the residuals resulting from subtraction of the reproduced covariance matrix from the sample covariance matrix are equal to zero, and as such low and non-significant values of the chi-square are desired. The chi-square statistic, however, tends to be oversensitive to sample size and, for this reason, the null hypothesis is usually rejected (Bentler & Bonett, 1980; Byrne, 1994; Hu & Bentler, 1995; Mulaik et al., 1989). Although this may make the use of the chi-square to test for overall model fit not suitable in most cases, this index continues to be widely used to assess the fit between the model and the observed data (Gierl & Mulvenon, 1995). It has been suggested that to reduce the sensitivity of the $\chi^2$ to sample size, the $\chi^2$ be divided by the degrees of freedom ($\chi^2$/df) to yield a lower value. While there is no clear-cut guideline regarding the minimally acceptable value for $\chi^2$/df, a ratio of less than 3 is frequently reported as being acceptable (Kline, 1998). We will consider this ratio in our evaluation of model fit.

The Root Mean Square Error of Approximation (RMSEA; Steiger, 1990) evaluates the estimated discrepancy, per degree of freedom, between the population covariance matrix and the model. As such, the RMSEA provides information regarding the parsimony of the estimated model. If the fit of the model was perfect, the RMSEA value would be zero. Values smaller than .05 are indicative of a good fit and values smaller than .08 a reasonable fit (Browne & Cudeck, 1993).

The Goodness of Fit Index (GFI; Joreskog & Sorbom, 1996) is an absolute fit index that represents the relative amount of variance in the sample covariance matrix that is accounted for by the estimated model (Bollen, 1989). The value of the GFI is analogous to the $R^2$ value in regression analyses in that it indicates the proportion of the observed covariances explained by the model-implied covariances (Hoyle & Panter, 1995). Values of GFI theoretically range from 0 (poor fit) to 1 (perfect fit). A value of one indicates that the observed variances and covariances

are identical to those anticipated by the theoretical model. GFI values above .90 are considered satisfactory. The GFI, however, is affected by sample size (Joreskog & Sorbom, 1996; Marsh, Balla, & McDonald, 1988); when the sample is not very large GFI values below .90 can be expected, particularly if the model is complex (Bollen, 1989) and if the latent constructs are not independent from one another (Hu & Bentler, 1995).

The Comparative Fit Index (CFI; Bentler, 1990) is one of several non-statistical indices that are referred to as incremental fit indices (Bollen, 1989). The CFI indicates the proportion in the improvement of the overall fit of the estimated model relative to a null model (i.e., an independence model that assumes all observed variables to be uncorrelated); that is, the chi-square value of the estimated model is compared to the chi-square of the null model. The ratio of the fit of the estimated model to the null model represents the gain in adjustment resulting from the inclusion of the covariance between the variables of the estimated model. The benefit of the CFI over other incremental fit indices (e.g., the Normed Fit Index; Bentler & Bonett, 1980) is that it is less affected by sample size (Kline, 1998). CFI values can range from 0 to 1, with values above .90 indicative of an acceptable fit to the data (i.e., reflective of a well-fitting model).

## Results

### Preliminary Analyses

Preliminary analyses were conducted to assess whether the data[2] from the sample under study conformed to some basic assumptions underlying Maximum Likelihood estimation and structural equation modeling procedures.

Absence of outliers. Examination of the means and standard deviations of the variables included in the model to be tested indicated that all values were within the theoretical expected range. The distribution of the standardized scores for each variable included in the model was

examined to detect potential univariate outliers. No case with standardized scores greater than |3|, which would be indicative of an outlier, was identified. To screen for multivariate outliers, Mahalanobis' and Cook's distances were computed. Cook's distances below 1.00 are considered acceptable (Hamilton, 1992). No values above this cut-off were identified in the present sample. Likewise, no case with Mahalanobis' distance above the cut-off for this sample ($\chi^2_{(df=31)} > 61.10$, $p < .001$) was noted.

Sample size. Structural equation modeling is a statistical method designed for larger samples. To obtain a stable solution in structural equation modeling, a minimum sample size of two hundred cases is generally required (Ullman, 1996). The present sample size (N = 200) was thus just sufficient for this type of analysis.

Normality. The means, standard deviations, kurtosis and skewness values of all variables included in the motivational model were first examined. Summary statistics for all indicators and factors are presented in Table 1. Mean and standard deviation values revealed that the variables displayed acceptable dispersion. Skewness values ranged from -1.73 to 4.13 and kurtosis values ranged from -.87 to 19.24. Skew indexes greater than |3| and a kurtosis index greater than |10| tend to be regarded as extreme by researchers (Kline, 1998). The extreme values for skewness and kurtosis occurred on two variables; on one indicator of interpersonal autonomy support and one of baseline physical activity behaviour; all other variables displayed acceptable values. Skewness and kurtosis were in the acceptable range for all factors (mean values), thus there was no reason to suspect that the distribution of variables departed significantly from normality. Furthermore, from a multivariate perspective, the distribution of standardized residuals appeared normal.

Linearity and homoscedasticity. A random selection of bivariate scatterplots was examined to detect potential departure from linearity and to identify uneven distributions of the variance between the pairs of variables. There was no evidence of non-linearity or heteroscedasticity.

Absence of multicollinearity. Correlations between all possible pairs of variables included in the study were screened for multicollinearity. The absence of any correlations above .85 (Tabachnik & Fidell, 1996) indicated the absence of multicollinearity.

Validation of the PARS

Confirmatory Factor Analysis. In the present study, the psychometric integrity of the PARS was also confirmed: the model fit indexes confirmed that the proposed six-factor measurement model was acceptable (Q [$\chi^2$/df] = 1.89; NFI=.91; CFI=.96; SRMR=.05; RMSEA=.07, 90% CI=.05-.08).

Correlations among the six PARS subscales. Pearson correlations were computed among the six subscales to test for the SDT continuum proposed by Deci and Ryan (1985a). The Pearson correlations between the six subscales of the PARS are presented in Table 2. Correlations among the six PARS subscales supported the presence of a simplex structure consistent with the SDT continuum, demonstrating that the PARS measures are related, but represent discrete aspects of physical activity motives. While the simplex pattern was supported, the correlations between introjected regulation and each of the self-determined (intrinsic, integrated, and identified) regulations were larger (r=.50 to r=.52) than would have been expected theoretically, although such large positive correlations between introjected regulation and self-determined forms have been observed in other research, including in the validation of

the BREQ (Wilson et al., 2002). Internal consistency of the subscales were adequate (.68 ≤ Cronbach $\alpha \leq .96$).

The results supported the presence of a self-determination continuum; adjacent subscales showed higher Pearson correlations (e.g., intrinsic motivation and integrated regulation, $r = .84$, $p < .01$) than subscales that are theoretically further apart (e.g., intrinsic motivation and identified regulation, $r = .74$, $p < .01$). Internal consistency of the PARS subscales was adequate (.68 ≤ Cronbach $\alpha \leq 96$).

Correlations between the PARS subscales and related constructs. Construct validity of the PARS was further confirmed with correlations between each of the PARS subscales and constructs related to the regulation of physical activity behaviours and psychological adjustment variables; the correlations are presented in Table 3. In general, constructs with a negative valence (i.e., perceived stress, depressive symptomatology, and anxiety) displayed positive correlations with the non-self-determined regulatory styles, whereas constructs with a positive valence (i.e., life satisfaction) displayed negative correlations with these same regulatory styles. A reverse pattern was observed for the self-determined regulatory styles; constructs with a negative valence displayed negative or no correlation with the self-determined regulatory styles, whereas constructs with a positive valence displayed positive correlations with these same regulatory styles. Among the non self-determined regulatory styles, amotivation displayed the highest positive correlation with constructs having negative valence, followed closely by external regulation; both amotivation and external regulation displayed significant negative correlation with life satisfaction. Among the self-determined regulatory styles, intrinsic motivation displayed the highest negative correlation with constructs having a negative valence and the highest positive correlation with life satisfaction, closely followed by integrated regulation.

Examination of correlations between the different subscales of the PARS and other variables related to physical activity behaviours revealed that the regulatory styles defined by the self-determination continuum differentiated among various attitudes regarding physical activity, psychological adjustment variables and physical activity habits. For the most part the relationships were in the expected direction: Autonomous regulatory styles shared strong positive correlations with patients' beliefs regarding benefits of physical activity behaviours, physical activity habits, intentions, and with general life satisfaction; the correlations were negative with items that were indicative of lower quality of life (e.g., perceived stress, depressive symptomatology and anxiety). The more controlled patients' regulatory styles were, the more the relationships leaned in the opposite direction. Positive intentions and outcome expectancies, however, were not always found to be linked to the most self-determined forms of motivation. Beliefs that were more qualitative in nature were clearly related to the self-determined end of the continuum, while those that reflected "hard", though still positive, outcomes were also positively correlated with non-self-determined regulatory styles. This is consistent with the SDT, because while the value attributed to qualitative outcomes reflects enjoyment of the activity itself, hard outcomes are likely to have a more extrinsic origin (i.e., they represent reasons others might prescribe or value). Specifically, patients' beliefs that regular physical activity would improve their quality of life, make them feel more energetic and improve their endurance for performing their daily activities, were strongly related to only self-determined regulatory styles, with intrinsic motivation displaying the strongest association, followed closely by integrated regulation. Expectancies related to hard outcomes included patients' beliefs that exercise would improve their chances of living longer, would reduce their chances of further heart problems and would allow them to meet people (a marker for experiences of enjoyment). These were again

positively associated with self-determined forms of regulation, but also with introjected regulation; beliefs regarding life expectancy were also positively correlated with external regulation. Pre-hospitalization physical activity habits and intentions to be physically active were also positively related to introjected regulation. These correlations were negative or approached zero for external regulation and amotivation. These results confirm that individuals may hold positive attitudes toward physical activity and form intentions that are in accordance with prescribed "shoulds", yet they may do so either in order to satisfy others' expectations (i.e., for introjected reasons) or because of inherent interest (i.e., for self-determined reasons). Consideration of the consequences associated with the different regulatory styles is believed to be important in the prediction of sustained physical activity regulation.

As suggested by Pelletier (2002), assessment of each regulatory style may be desirable in order to identify which specific style is the best predictor of a particular outcome or to examine the impact of a determinant on each of the different forms of regulation. When the research interest is the test of a parsimonious or an integrative theoretical model that involves two types of consequences (e.g., healthy vs. pathological), however, grouping the six regulatory styles into two categories (i.e., autonomous vs. controlled) may be more appropriate (Elliot & Sheldon, 1998; Sheldon & Elliot, 1998). Accordingly, in the present research the three self-determined subscales (i.e., those assessing intrinsic motivation and integrated and identified forms of regulation) were grouped to form a score for autonomous regulation, and the three non-self-determined subscales (i.e., those assessing introjected and external forms of regulation, and amotivation) were grouped to form a score for controlled regulation. Correlations between the two aggregate forms of regulation (autonomous vs. controlled) and the various related constructs are presented in Table 3.

Clear distinctions were observed between the two aggregate forms of regulation and their associations with psychological adjustment variables and other constructs related to physical activity regulation. While controlled regulation of physical activity behaviours displayed positive associations with all constructs with a negative valence (i.e., perceived stress, depressive symptomatology, and anxiety) and a negative correlation with life satisfaction, the opposite was true for autonomous regulation. Furthermore, as expected, autonomous regulation was positively correlated with all beliefs regarding physical activity and with consequences of motivational style, whereas controlled regulation was mostly unrelated to or, as in the case of pre-hospitalization physical activity habits, negatively correlated with these variables.

Descriptive Statistics

Demographic characteristics. Baseline characteristics of our study sample are presented in Table 4. Our sample consisted of 81% males (mean age 64, with a range of 37 to 93). The mean age of female participants was 62, with a range of 44 to 79. Our sample was relatively well educated; 35.5% completed high school and 50.5% completed college or university education. The majority of our participants were retired and most were living with a partner.

General self-determination. The general self-determination index (SDI), which was the weighted sum of the six subscale means, ranged from -6.0 to +36.0, with an average of 14.7 (SD=8.9). The theoretical range of the general SDI is -42 to +42. Negative scores indicate an overall controlled type of functioning, while positive scores indicate a generally autonomous level of functioning. The range and mean level of self-determination in the sample indicate that our sample was overall more autonoumous, with self-determination scores being normally distributed on either side of the mean (kurtosis = -.51; skewness = -.02).

Sex differences. As shown in Table 4, a comparison of the means using independent samples t-tests (continuous variables) or chi-square tests (categorical variables) indicated that men and women differed significantly only in terms of their living arrangement at baseline; men were more likely to be married.

Test of the Hypothesized Motivational Model of Physical Activity Intentions

Structural equation modeling was used to test the hypothesized model predicting intentions to be physically active. The hypothesized model of intentions to be physically active is presented in Figure 2. The model consists of 10 latent variables, 31 measured variables, 19 standardized structural regression coefficients showing the hypothesized directional influences among the latent variables, 31 factor loadings from the factors to the indicators, and 31 error variances associated with observed variables.

The statistical hypotheses for the structural portion of the model are as follows. First, the regression coefficient of perceived interpersonal autonomy support on general autonomous motivation was hypothesized to be positive and significant, while that on general controlled motivation was expected to be negative and significant. Second, the regression coefficient of perceived competence on interpersonal autonomy support was expected to be positive and significant. Third, the regression coefficients of autonomous regulation of physical activity on general autonomous orientation, interpersonal autonomy support and perceived competence were hypothesized to be positive and significant. Fourth, the regression coefficient of controlled regulation of physical activity on general controlled orientation was expected to be positive and significant, while the coefficients on interpersonal autonomy support and perceived competence were hypothesized to be negative and significant. Fifth, the regression coefficients of self-efficacy beliefs on perceived competence and autonomous regulation of physical activity were

expected to be positive and significant, while that on controlled regulation of physical activity was hypothesized to be negative and significant. Sixth, the regression coefficients of planning on autonomous regulation and on self-efficacy beliefs were expected to be positive and significant, while the coefficient on controlled regulation was hypothesized to be negative and significant. Seventh, the regression coefficients of intentions to be physically active on autonomous regulation and on planning were expected to be substantial, positive and significant, while that on controlled regulation was hypothesized to be negative and significant. The regression coefficient of intentions on baseline activity was included to adjust for pre-hospitalization physical activity habits. Finally, the covariance between general autonomy and general control was hypothesized to be negative and significant, that between general autonomy and baseline physical activity to be positive and significant, and that between general control and baseline physical activity to be negative and significant. Also, the disturbance correlation (covariance) between the disturbances associated with autonomous and controlled regulatory styles was hypothesized to be significant and positive. Finally, for purposes of identification, the loadings between the first indicator of each latent construct and its target factor were fixed to 1.0[3].

The resulting model is depicted in Figure 3. Due to space constraints, the structural measurement coefficients (factor loadings) and residual (error) variances for each construct from the completely standardized solution under the maximum likelihood method of estimation are presented separately in Table 5. Intercorrelations among the ten latent constructs included in the model are displayed in Table 6. Model estimation yielded a satisfactory fit; that is, the fit indices revealed that the correspondence between the estimated model and the sample covariance was satisfactory, ($\chi^2_{(df=381,N=200)}$=666.03, p<.001; $\chi^2$/df = 1.75; RMSEA = .06, 90% CI=.05-.07;

GFI=.82; AGFI=.90; CFI=.92). The RMSEA and CFI were within an acceptable range. The GFI indicated that the model explained 82% of the sample covariance.

The results of the SEM provided strong support for the role of autonomous forms of motivation, both general and within the context of physical activity behaviour, in the process of intention formation. Controlled types of motivation, on the other hand, were not found to bear much influence in this process. The regression coefficients, squared multiple correlations (variance explained), and disturbance terms for the hypothesized structural paths are shown in Table 7a.

Antecedents of contextual motivation. Our hypotheses regarding the antecedents of contextual motivation (i.e., regulatory style) were supported. As hypothesized, interpersonal autonomy support was predicted positively by general autonomy, interestingly, however, it was not significantly affected by general control orientation. Despite this, a moderate amount of variance was explained in interpersonal autonomy support (21%). Similarly, interpersonal autonomy support was associated positively and significantly with autonomous regulation, but was unrelated to controlled regulation. Thus, while the quality of interpersonal autonomy support mediated the relationship between general autonomy and autonomous regulation, it did not influence the path between controlled motivational orientation and the coinciding regulatory style. Interpersonal autonomy support was also associated positively and significantly with perceived competence for physical activity; the magnitude of this regression coefficient was relatively large. General autonomy, interpersonal autonomy support and perceived competence significantly predicted autonomous regulation of physical activity behaviour; the valence of these regression coefficients was positive and their magnitude moderate. Together, these constructs predicted 40% of the variance in autonomous regulation. Examination of parameter

indirect effects[4] showed perceived competence to be a significant mediator of the relationship between interpersonal autonomy support and autonomous regulation ($\gamma$=.14, p<.001). Controlled regulation of behaviour was only associated with general control orientation; this effect was positive and its magnitude was large. Thus, the 28% of explained variance in controlled regulation can be mostly attributed to general control orientation.

Consequences of contextual motivation. All of our hypotheses regarding the consequences of contextual motivation were supported for autonomous regulation of behaviour, but not for controlled regulation. Specifically, autonomous regulation of physical activity was confirmed to be a positive and strong determinant of self-efficacy beliefs, planning, and intentions to be physically active; its effects on planning and intentions were larger than those of any other model component. Controlled regulation, on the other hand, was significantly associated only with self-efficacy beliefs; the magnitude of this effect was modest and its valence negative. As hypothesized, controlled regulation was also negatively associated with intentions to be active, but this path coefficient did not attain statistical significance. Examination of parameter indirect effects further confirmed the overarching influence of autonomous regulation and the limited effect of controlled regulation. Specifically, the effect of autonomous regulation on planning was significantly mediated by self-efficacy beliefs ($\gamma$=.11, p<.01) and its effect on intentions by planning ($\gamma$=.16, p<.01), whereas controlled regulation did not have any relevant indirect effects. As expected, self-efficacy was also positively and significantly affected by perceived competence and had a positive and significant effect on planning, which was positively and significantly associated with intentions to be active. Together, autonomous regulation, controlled regulation and competence explained 63% of the variance in self-efficacy; 44% of variance was explained in planning and 56% in intentions to be physically active.

These results provide support for the central role of autonomous regulation in the process of intention formation. In considering parameter total effects (direct plus indirect effects), autonomous regulation had the greatest effect on planning of physical activity ($\gamma$=.54, $p<.001$; 29% explained variance) and on intentions to be physically active ($\gamma$=.65, $p<.001$; 42% explained variance). Moreover, parameter indirect effects revealed that autonomous regulation also mediated the effects of interpersonal and intrapersonal factors on intention formation; specifically, the effect of interpersonal autonomy support ($\gamma$=.10, $p<.01$) and perceived competence ($\gamma$=.15, $p<.01$) on intentions to be physically active were mediated by autonomous regulatory style.

Baseline level of physical activity was observed to have a negative effect on intentions to be physically active; although this effect was not significant, the negative relationship was surprising. Finally, the estimated covariance between general autonomy and general control was found to be positive, significant, but of modest magnitude ($r$ =.16; $p<.05$). This positive covariance could be due to an overlap between self-determined and non-self-determined forms of motivation when the subscales are combined to form two aggregate forms (autonomous versus controlled). The covariances between pre-event physical activity behaviour and each general autonomy and general control, on the other hand, were found to be non-significant, as was the disturbance correlation (covariance) between the disturbances associated with autonomous and controlled regulation.

In sum, the results are in accordance with the hypothesized model, with the exception of five paths between the antecedents and consequences of controlled regulation, thus supporting mainly the relevance of autonomous forms of regulation in the prediction of physical activity

intentions. In particular, the effect of autonomous regulation of behaviour on intention formation was shown to be the largest.

We expected that controlled forms of motivation would impact negatively on the process of forming intentions to engage in future physical activity behaviours through the same pathways as autonomous forms enhanced intention formation; specifically, by predisposing individuals to less favourable social support conditions, by undermining vital intrapersonal process variables, and by directly weakening intentions. The finding that general control orientation did not have an effect on perceptions of interpersonal autonomy support and that the negative impact of controlled regulation extended only as far as undermining self-efficacy beliefs, suggests that in the given cardiac population this motivational style is associated with an overall indifference regarding engagement in regular physical activity behaviours. This inference is supported by our results. First, the non-significant covariance between physical activity at baseline and controlled motivation indicates that such lack of interest was not necessarily due to controlled tendencies being related to inactivity. Second, interpersonal climate was found to have no influence on controlled regulation of physical activity, this indicating that a controlled orientation renders regulation of physical activity behaviour resistant to these external influences. Third, while controlled regulation was negatively related to self-efficacy, this effect ended there; that is, the effect on self-efficacy had no further impact on planning or intentions, as indicated by non-significant indirect effects. On this basis, the model of physical activity intentions was revised by removing the non-relevant paths involving controlled modes of motivation.

Test of the Revised Motivational Model of Physical Activity Intentions

The originally hypothesized model was trimmed of the non-significant path between general control and interpersonal autonomy support and the four non-significant paths between

controlled regulation of physical activity behaviour and each autonomy support, competence, planning and intentions. The covariances between pre-event physical activity behaviour and each general autonomy and general control were also dropped as was the covariance between the disturbances associated with autonomous and controlled regulatory styles. The difference between the originally hypothesized and final model was non-significant ($\Delta\chi^2_{(\Delta df=8,N=200)}$=11.30, ns) and the fit of the final model was not notably changed. Model estimation yielded a satisfactory fit ($\chi^2_{(df=389,N=200)}$ = 698.73, p<.001; $\chi^2$/df = 1.80; RMSEA = .06, 90% CI=.05-.07; GFI=.81; AGFI=.78; CFI=.92). The RMSEA and CFI were within an acceptable range. The GFI indicated that the model explained 81% of the sample covariance. The model trimming procedure also did not result in noteworthy differences in regression coefficients for the remaining paths and covariances between the hypothesized and final models. The final structural model is depicted in Figure 4. The regression coefficients for the structural paths, the squared multiple correlations (variance explained), and the disturbance terms for this final model are shown it Table 7b.

In addition to its direct effect on interpersonal autonomy support and autonomous regulation of physical activity behaviour, general autonomy had significant indirect effects on autonomous regulation, perceived competence, self-efficacy, planning, and on intentions. These indirect effects were positive and of moderate size. An autonomous motivational orientation was found to have an extensive influence on the process of positive intention formation. Interpersonal support of autonomy was also found to have relevant indirect positive effects to complement its direct effect on autonomous regulation and perceived competence. As hypothesized, perceived competence mediated the impact of interpersonal autonomy support on regulatory style ($\gamma$=.14, p<.001), although only on autonomous regulation, and also mediated its effect on self-efficacy

beliefs ($\gamma$=.22, $p<.001$). Furthermore, interpersonal autonomy support had significant indirect effects on planning and on intentions to be physically active. These results highlight the importance of autonomy support and showed that a social context perceived to be supportive of autonomy acts to enhance positive intention formation via several pathways.

Our consideration of indirect effects also confirmed the positive role of perceived competence in the overall process of intention formation; on top of its direct effects on self-efficacy and autonomous regulation, perceived competence had mediated effects on self-efficacy beliefs, planning, and intentions that were positive and of moderate size. Finally, autonomous regulation, in addition to its large direct effect on each planning and intentions, also had relevant indirect effects on these variables, thereby providing evidence for the hypothesis that self-efficacy and planning mediate the impact of autonomous regulation on physical activity intentions. A look at the total effects again confirmed that autonomous regulation had the most prominent impact on formation of physical activity intentions ($\gamma$=.59, $p<.001$); this was followed by the total effect of perceived competence ($\gamma$=.27, $p<.001$), and then by interpersonal autonomy support ($\gamma$=.24, $p<.001$). The effect of self-efficacy on intentions was considerably smaller ($\gamma$=.11, $p<.01$). The standardized maximum likelihood estimates of all the direct, indirect, and total effects for the final model of physical activity intentions are presented in Table 8.

## Discussion

The goal of this first study was to build a motivational model of physical activity regulation and to test its ability to explain variance in intentions to be physically active in heart disease patients. The hypothesized model was found to be satisfactory and, in general, the results of the SEM analysis supported the proposed paths. As hypothesized, motivational style was found to be a central component of our model depicting the relationships among distal and

proximal determinants of positive intentions. In particular, this research substantiated the pivotal role of autonomous motivation in the cognitive preparation for physical activity engagement, that is, in the process of intention formation. This study also confirmed that the PARS is a valid and reliable instrument to assess motivational orientation within the context of physical activity behaviours.

When patients first learn of their diagnosis and are informed of potential ways to ameliorate their health situation, their motivation for making healthful lifestyle modifications, such as increasing physical activity behaviours, is expected to increase. While motivational strength or interest accounts only for a limited amount of variance in behaviour or in proximal indicators of behaviour, the type of motivation, namely self-determined versus non-self-determined, as defined by the SDT, is able to explain a significant amount of variance. These distinct motivational styles are theorized to have varying consequences on behavioural regulation. We hypothesized that following a cardiac event, the steps leading to intentions regarding future physical activity engagement would be positively influenced by autonomous motivation and negatively by controlled motivation. We also expected that autonomous versus controlled forms of regulation would be affected differentially by antecedent inter- and intra-personal factors, namely interpersonal autonomy support and perceived competence, in addition to their predisposing motivational orientation.

Analysis of the hypothesized model offered strong support for the antecedents of autonomous regulation of physical activity. First, the general tendency to be self-determined provided a medium conducive to effective regulation of physical activity. Specifically, consistent with the behavioural confirmation paradigm, general autonomy was positively associated with interpersonal autonomy support, and in support of the hierarchy of motivation, also directly with

autonomous forms of regulation. This means that individuals who are self-determined in their typical interactions with the environment are predisposed to be self-determined in regulating health behaviours, including physical activity. In addition, these individuals are more likely to perceive their interpersonal interactions as being supportive of autonomy, which further promotes an autonomous regulatory style in the given context, as indicated by the positive path between interpersonal autonomy support and autonomous regulation. Interpersonal autonomy support also had a strong positive effect on perceived competence, which, in turn, was positively associated with autonomous regulation. This confirmed the mediating role of perceived competence and provided support for the notion that it is the manner in which social support is provided that benefits regulation of health behaviours.

Our results also provided convincing support for the consequences of autonomous regulation of physical activity. An autonomous regulatory style was shown to have a positive effect on patients' intentions to be physically active, as well as to mediate the positive effects of other intra- and inter-personal variables in the process of intention formation. Consistent with our hypotheses, the paths between autonomous regulation and each of self-efficacy, planning and intentions were positive and relatively large, as were the paths between self-efficacy and planning, and between planning and intentions. This showed that autonomous regulation influences intentions directly, as well as via other relevant process variables. Regarding its mediated effects, autonomous regulation strengthened self-efficacy beliefs and enhanced the extent to which patients planned activities and tried to follow a routine. Self-efficacy beliefs further boosted planning tendencies, which, in turn, had a positive effect on intentions to be physically active in the near future. Autonomous regulation also mediated the effects of general autonomy, interpersonal autonomy support and perceived competence on physical activity

intentions. Altogether these findings support the overarching role of autonomous motivation in the process of intention formation.

While autonomous motivation, both at the general level and within the context of physical activity, was relevant in the entire process of intention formation, the impact of controlled motivation was more limited. Specifically, as far as statistical significance was concerned, general control had an effect only on its respective style of regulation and the consequences of controlled regulation extended only as far as self-efficacy beliefs; the path coefficients approached significance for the paths between general control and interpersonal autonomy support and between controlled regulation and intentions. As expected, non-self-determined motivation for the regulation of physical activity in this sample of cardiac patients undermined self-efficacy beliefs. The fact that the two styles of regulation had opposite effects on self-efficacy supported our position regarding the differential role of motivational style versus self-efficacy beliefs in the process of behavioural regulation; it implied a dependence of self-efficacy beliefs on motivational style. That is, the amount of confidence patients had regarding overcoming various barriers to physical activity engagement was contingent on how self-determined their motives for participating in physical activity were. Our finding that the effect of controlled modes of regulation on planning was negligible, however positive, indicates that the cognitive conceptualization of physical activity participation is not influenced by controlled motives. This could have one of two possible explanations: 1) that, as speculated earlier, controlled motivation is associated with an indifference regarding health behaviour modifications in this patient population; or (2) that even external motives may stimulate the planning of activities. We will consider the results of Study 2 before drawing any firm conclusions regarding this finding.

Apart from the effect of general control, the controlled regulatory style was influenced only marginally by perceived competence, which had a negative effect. That interpersonal autonomy support was not associated with controlled regulation suggests that a controlled motivational orientation not only predisposes individuals to adopt a controlled style for regulating physical activity behaviour, but also renders regulation of physical activity behaviour resistant to external influences. Such resistance would make a control orientation difficult to intervene with. Moreover, our observation that controlled regulation was unrelated to planning also implies that this motivational style may be associated with an indifference regarding engagement in physical activity behaviour and possibly other behaviour-based health promotion efforts.

As our results mostly supported the role of autonomous, as opposed to controlled, forms of motivation in the process of intention formation, the hypothesized model was trimmed by constraining some of the inconsequential paths (i.e., those that did not explain much variance in the model) to zero. It is noteworthy, however, that while the path between controlled regulation and intentions to be physically active was excluded because it was not interesting relative to the statistically significant paths in the model, the effect was negative as predicted. This revised model was tested and was fully supported by the results, with the exception of the path between past physical activity habits and future intentions. The final model of physical activity intentions is depicted in Figure 4.

This model of cardiac patients' intentions to be physically active revealed much about the integral relationships among interpersonal and intrapersonal variables that precede positive intention formation. The model identifies the variables relevant in the process of intention formation and offers an explanation for the sequence in which these variables are linked, as well

as how the links among them lead to positive intentions. Autonomous motivation is central to the entire sequence. At the general level it sets the stage for effective regulation of behaviour.

Our research showed that for individuals who had a potentially life threatening experience, a general autonomy orientation predisposed them to adopt self-determined motives for engaging in health-promoting strategies, specifically in physical activity behaviours. Our research also showed that individuals who have autononomous tendencies in life general, are prone to make the best of their resources, both social and internal, in an effort to effectively manage problems, particularly problems requiring action, including those that threaten health. To the extent that individuals were autonomously oriented, they perceived their social environment as supportive of autonomy. This may mean three things: (1) autonomous individuals select social relationships that are more autonomous; (2) general autonomy "orients" individuals to interpret social interactions as more autonomy supportive; and (3) autonomous individuals have an effect on their social interactions that causes others to respond in an autonomous manner.

In any case, a general autonomy orientation inclined patients to perceive feedback they received from relevant others regarding health behaviour as autonomy supportive and this had further advantages. Perceptions of autonomy support contributed to heightened feelings of competence with respect to physical activity behaviour and promoted self-determination in the context of physical activity regulation. As competence is a source of self-determined motivation, stronger feelings of competence also contributed to more autonomous forms of regulation. Both an autonomous regulatory style and a solid sense of competence were associated with stronger self-efficacy beliefs regarding overcoming a variety of situational barriers to engaging in physical activities. Here, perceived competence established a general confidence regarding physical activity engagement, whereas autonomous regulation provided the inner energy

required to persevere in the face of obstacles. Being self-determined means being motivated for the sake of the activity itself, thus there is the inherent interest to overcome any barriers to attaining the desired outcome, that is, not to let anything stand in the way of progress. Self-determined motives for physical activity regulation together with strong self-efficacy beliefs improved the likelihood that patients would think about planning physical activities and would try to establish a physical activity routine. While self-efficacy beliefs facilitated planning by furnishing the patient with a sense of confidence under various possible circumstances, self-determination provided the patient with personally-relevant motives for regulating physical activity behaviours and in so doing stimulated planning. Finally, the extent to which patients were able to construct a mental plan and the degree to which their motives for engaging in physical activity were self-determined together influenced positive intentions to be active. Again, self-determined motives provided the drive to form positive intentions; planning, in turn, supplied the strategy for forming reasonable intentions.

Finally, our finding that the relationship between past physical activity behaviour and intentions was very small and negative could be a reflection of our study sample, namely the fact that it was composed of patients who had just experienced a cardiac event (i.e., a serious threat to their health) and/or underwent a treatment procedure. Given the uncertainty surrounding their health expectations, and thus future physical capabilities, it may have been difficult for patients in these early stages post cardiac event to link past and future behaviours. While reporting on their current motives, feelings and attitudes may have been more conceivable, their foresight regarding future physical activity behaviours may have been compromised by reservations about their future health condition, or alternatively, their recollection of past behaviour may have been affected by their current state. The negative nature of the relationship could be the result of

patients' current worries about their future health as well as ambiguity regarding physical activity recommendations following discharge from hospital, in the case of the newly admitted patients, or following supervised classes, in the case of the rehabilitation patients. We retained the path between past physical activity habits and future intentions in the final model, despite its non-significance, in recognition that accounting for past physical activity habits is important.

In sum, the results of the present study supported the main hypotheses depicted by the proposed model of physical activity regulation. However, several limitations inherent to the present study may have favourably and/or unfavourably affected our conclusions. Most importantly, from a methodological point of view, the cross-sectional research design is very weak in terms of establishing causality. Despite the use of sophisticated statistical procedures to evaluate the models, the fact that all explanatory as well as outcome variables were measured at the same time point limits our ability to draw conclusions regarding causal relationships among variables. Thus, although the proposed motivational model of physical activity regulation was designed to be predictive so as to identify target variables and potential change agents for future physical activity behaviour, the correlational nature of the design precluded this study from confirming the model's ability to predict future intention. On the one hand, this limitation may have made our results look more promising than they actually are, because associations between variables are typically stronger when the variables are measured at the same point in time, particularly when they are all of the same sort (i.e., cognitive versus behavioural). On the other hand, while the cross-sectional design afforded an understanding of the function of the factors relevant in the process of physical activity regulation, it did not furnish the model to explain the behaviour change process and consequently the sustained impact of some of the variables could not be evaluated.

Another limitation was that all the variables were measured at an uncertain time in the participants' lives; specifically, either at the time of hospital admission or while they were enrolled in an exercise-based cardiac rehabilitation program. During these times there would have been much uncertainty regarding their health and relative risk as well as hesitation about their ability/safety to exercise without professional supervision. This issue possibly strengthened the relationships proposed by our model by stimulating positive thoughts about doing something to improve health or reduce future risk, which given the single assessment, would have been reflected in their intentions. However, it is also possible that the uncertainty associated with the early stages of recovery clouded the patients' self-reports; patients may not have had much insight into their health condition and its consequences regarding physical abilities and this would have yielded inaccurate results. Another aspect that restricted the generalizability of our current findings was the reliance on intention to act as a marker of behavioural outcome. Finally, our sample size was just sufficient to test the relationships among the various variables using SEM techniques.

Despite these shortcomings, the motivational model depicts the dynamics through which intrapersonal and interpersonal factors impact on cardiac patients' intentions to be physically active and, more importantly, identifies distal and proximal variables that are key in the process of intention formation. To confirm the model's capacity to predict physical activity behaviour, however, a measure of actual behaviour and a longitudinal design are needed. Accordingly, Study 2 will be a test of the hypothesized motivational model using a three-wave longitudinal design to predict physical activity behaviour in a large sample of cardiac patients recruited from three different sites and followed for a period of 6 months after hospital discharge. This research design will afford valid claims about causal inferences as well as the long-term impact of

predictor variables. Even though the results of Study 1 were in favour of a revised, trimmed-down model, given the more sophisticated design of Study 2, the originally hypothesized conceptual model will be tested again.

# Study 2: Prospective Cohort Study: Model of Human Motivation to Predict Physical Activity Behaviour

## Research Aims

Research suggests that most inactive people will remain sedentary without intervention (Plotnikoff & Higginbotham, 1995). It would be misleading to conclude, however, that participation in an intervention program is sufficient to solve the problem of sedentary lifestyles. There are three reasons behind this: first, of those individuals who do engage in organized interventions, such as exercise-based cardiac rehabilitation programs, many (i.e., 25% to 50%) withdraw before any health benefits are attained (i.e., within the first six months) (Oldridge, 1988, 1991; Oldridge et al., 1991; Oldridge et al., 1983; Radtke, 1989); second, few (i.e., less than 25%) of the dropouts continue to be active enough to maintain or improve cardio-respiratory fitness (Radtke, 1989); and thirdly, once intervention is withdrawn, few people continue to be sufficiently active.

Behavioural intervention programs are not intended to be quick fixes or cures for heart disease. Rather, they are designed to improve health by facilitating the adoption of healthy behaviours. Yet in order to have lasting health benefits, these behaviours need to be maintained. A rehabilitation program for cardiac patients is therefore effective only to the extent that participants adhere to the recommended behaviours; in other words, the extent to which patients integrate the health behaviours into their lifestyles as a standard part of their daily routine. The question thus goes beyond how to facilitate adoption of physical activity behaviour in the cardiac population. The greater, though more complex, issue concerns how to intervene with patients after a CAD diagnosis so as to achieve sustained behavioural change; that is, how to promote long-term regulation of physical activity behaviours.

In Study 1 we found that self-determined motivation is a relevant construct in the sequence that leads to the formation of positive intentions to be physically active. Although intentions precede action and may predict proximal behaviour, they are not a reliable indicator of future behaviour. The purpose of Study 2 was, therefore, to test a three-wave prospective design modeling regulation of actual physical activity behaviour over a 6-month period. By imposing a chronological sequence on the relationships assessed in Study 1, Study 2 represents a systematic evaluation of our motivational model to conceptualize the sustained regulation of physical activity behaviour in the cardiac population. The dimension of time will also grant the terms *antecedents* and *consequences* of contextual motivation their true meaning and, combined with the behavioural measure of physical activity, will afford a test of the model's true predictive power.

## Hypotheses

Study 2 was a test of time; the stability of the unfolding sequence modeled in Study 1 was assessed in the prediction of physical activity behaviour months after patients' life-threatening experience. This research was guided by five hypotheses regarding the time-dependent interplay between intrapersonal and interpersonal factors that underlies effective regulation of physical activity. Hypotheses are presented here in order of the proposed chronological sequence. The hypothesized model is presented in Figure 5.

The first hypothesis concerned the hierarchical structure of human motivation. We expected general motivational orientation assessed during hospitalization (Time 1) to be a strong predictor of self-determination level within the context of physical activity regulation assessed two months after hospital discharge (Time 2). The second hypothesis dealt with the behavioural confirmation paradigm. An autonomous general orientation was assumed to be reflected in

participants' interpersonal response style and was thereby believed to engender interpersonal behaviours supportive of autonomy. Specifically, we proposed that the more self-determined an individual's general tendencies were at Time 1, the more he/she would perceive his/her interpersonal relationships to be supportive of autonomy in the context of health behaviours at Time 2 (i.e., during rehabilitation from cardiac event).

The third hypothesis addressed the role of interpersonal autonomy support in the regulatory sequence of physical activity behaviour. Perceived support of autonomy from relevant others regarding health behaviours was expected to be reflected in more self-determined regulation of physical activity behaviours (i.e., higher levels of autonomous regulation and lower levels of controlled regulation) assessed at Time 2.

The fourth hypothesis placed perceived competence in the scheme of the motivational model. Perceived competence was posed as a mediator of the path between perceived autonomy support and contextual motivation, assessed at Time 2. Interpersonal relationships supportive of autonomy were expected to enhance feelings of competence regarding the regulation of physical activity behaviours, which, in turn, were theorized to engender a more self-determined regulatory style (i.e., higher levels of autonomous regulation and lower levels of controlled regulation).

Finally, the fifth hypothesis related to autonomous motivation as the central and most reliable determinant of physical activity behaviour. Based on existing literature in the area of health behaviour change and our results obtained in Study 1, both contextual motivation and self-efficacy beliefs are recognized to be relevant factors during the decisional as well as the early adaptation phases of regular physical activity, particularly for cardiac patients for whom the concept of exercise may be completely new or may need to be performed differently due to actual or perceived health limitations. Once an individual acquires a basic skill-set and becomes

accustomed to exercising, or once some integration of regulatory processes occurs, however, situational self-efficacy is believed to lose its value as a predictor of behavioural regulation and instead to function as a mediator. Accordingly, the paths between each of the two regulatory styles and physical activity behaviour were posed to be mediated by self-efficacy beliefs and planning. As in Study 1, autonomous regulation was hypothesized to prevail as the strongest direct predictor of physical activity behaviour assessed at six months.

## Method

### Participants

A total of 827 patients with documented CAD were recruited from hospital admissions from 3 sites (Ottawa Heart Institute, Ottawa Hospital- General Campus, Kingston General Hospital) and followed for a period of 6 months. Patients between the ages of 20 and 80 years, with English proficiency, mailing address and contact number, who were admitted to hospital with a recent occurrence of documented CAD were eligible. Documentation of CAD was based on the following criteria: (1) hospital admission for documented myocardial infarction; (2) hospital admission for CABG or PTCA procedures; (3) hospital admission for angina pectoris that would be stabilized by hospital discharge and would be accompanied by a treadmill test result consistent with myocardial ischemia or a nuclear scan consistent with myocardial ischemia; and (4) a coronary angiogram showing $\geq$ 60% obstruction of at least one major coronary artery or one of its primary branches. To assist with the interpretation of eligibility criteria, a "time zero" reference point was established for all participants at the time of study enrolment. Time zero was defined as a cardiac event that could trigger cognitive process associated with behaviour change.

Exclusion criteria included the following contraindications to exercise: (1) unresolved unstable angina; (2) uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise; (3) neuromuscular, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise; (4) uncontrolled diabetes; (5) chronic infectious diseases, such as mononucleosis, hepatitis, and AIDS; (6) pregnancy; (7) resting systolic blood pressure of greater than 200 mm Hg or resting diastolic blood pressure of greater than 110 mm Hg (evaluated on a case-by-case basis); (8) orthostatic blood pressure drop of greater than 20 mm Hg with symptoms; (9) critical aortic stenosis (peak pressure gradient of greater than 50 mm Hg with an aortic valve orifice area of less than 0.75 cm squared in an average size adult); (10) acute systemic illness or fever; (11) uncontrolled tachycardia (greater than 120 beats per minute); (l2) uncompensated congestive heart failure; (13) third degree AV block (without pacemaker); (14) active pericarditis or myocarditis; (15) recent embolism; (16) thrombophlebitis; (17) resting ST segment displacement (greater than 2mm); (18) other metabolic conditions, such as acute thyroiditis, hypokalemia or hyperkalemia, hypovolemia, etc.; and (19) psychiatric disorders (assessed on a case by case basis).

Procedure

Eligible patients were approached on an individual basis by a research coordinator at each site. The coordinator explained the purpose of the research project to willing participants, obtained written consent to participate in the study from them and asked them to complete the baseline questionnaire. Informed consent was obtained from all participants. The baseline (Time 1) questionnaire included measures of general motivational orientation, pre-hospitalization physical activity habits, as well as items to assess demographic and clinical variables. Patients were asked to drop off the completed questionnaire to the study coordinator or their nurse before

hospital discharge. Those unable to complete the survey during time of hospitalization were provided with a stamped, addressed envelope to mail it back upon completion.

Follow-up information was collected at 2 and 6 months after study intake by means of a questionnaire mailed to the participants in the case of both psychosocial variables and physical activity behaviour. Information regarding physical activity behaviour was also confirmed via structured telephone interviews conducted by the research coordinator. At 2 months after hospital discharge (Time 2) participants were mailed the 2-month follow-up questionnaire, which included measures of interpersonal behaviours, perceived competence, contextual motivation (regulatory style), self-efficacy beliefs, and planning. At 6 months after hospital discharge (Time 3) participants once again completed the measures of physical activity behaviours, this time to assess engagement in recommended physical activity behaviours several months post-cardiac event or medical intervention.

Measures

Baseline and follow-up surveys were designed to assess the components of the proposed motivational model. The predictor variables included all those factors considered in Study 1, but a measure of actual physical activity behaviour was now the main outcome variable. Accordingly, the measures of interest in Study 2 included demographic variables (age, gender, marital status, education), general motivational orientation, regulatory style, interpersonal autonomy support, perceived competence, self-efficacy beliefs, and planning. The Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin, Jobin, & Bouillon, 1986; Godin & Shephard, 1985) was again used at baseline to assess patients' physical activity behaviour during the 6-months prior to the patient's most recent hospitalization. The LSI of the GLTEQ was also selected as the dependent variable for physical activity at six months. Physical activity behavior

at 6 months can be viewed as the change in activity from baseline because the frequency and intensity of physical activity are dramatically reduced for most patients in the immediate post-cardiac (as well as pre-cardiac for some) event period. At the same time, past behaviour is typically the best predictor of future behaviour, and for this reason physical activity habits pre-cardiac event were taken into account. All, except one, constructs in Study 2 were assessed using the same measures described for Study 1. Therefore, this information will not be repeated here. The exception was perceived competence, which in Study 2 was assessed using a validated scale designed specifically to measure perceived competence in the context of physical activity behaviours. This scale is described below.

Perceived Competence Scale. The Perceived Competence Scale (PCS) concerns feelings about behaving in healthy ways. This is a short 4-item questionnaire that assesses the degree to which participants feel confident about being able to make (or maintain) a change toward a healthy behaviour, participate in a health-care program, or carry out a treatment regimen. Consistently, people who feel more competent with regard to a particular behaviour have been found to be more likely to make and maintain behavioural change and to evidence positive health care outcomes. The PCS can be adapted as needed for studying other behaviours. Items are worded slightly differently for different target behaviours. In the current study participants were asked specifically about how competent they feel about doing physical activity using four different questions scored on a 7-point Likert-type scale ranging from 1 (*do not agree at all*) to 7 (*completely agree*). The following is a sample item: "*I feel capable of engaging in regular physical activity*". Two examples of research that have used the PSC are a study by Williams, Freedman, and Deci (1998a) on the management of glucose levels among patients with diabetes and that by Williams & Deci (1996a) on medical students learning material in an interviewing

course. The alpha measure of internal consistency for the perceived competence items in these studies was above 0.80.

Analytical Strategy

The data analyses involved three steps, as is Study 1. First, preliminary analyses were conducted to address issues related to structural equation modeling. The second step involved descriptive analyses to provide summary statistics on each of the variables under study. The third step was again the central statistical procedure and consisted of structural equation modeling (SEM). Structural equation modeling procedures using EQS 6.1 (Bentler & Wu, 2004) were performed to test the hypothesized model predicting physical activity behaviour, as well as an improved final model. The SEM analyses were based on the covariance matrix and estimation was performed using maximum likelihood (ML) fitting function (Bollen, 1989). To afford an informed evaluation of overall model fit, multiple statistical and practical criteria were considered, including the chi-square likelihood ratio ($\chi^2$), the ratio $\chi^2$/df, the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990), the Goodness of Fit Index (GFI; Joreskog & Sorbom, 1996), and the Comparative Fit Index (CFI; Bentler, 1990). For a description of these fit indices and the criteria used for evaluation of model fit, the reader is encouraged to refer to the methods section of Study 1.

## Results

Participant Recruitment and Follow-Up

Figure 6 summarizes the recruitment and subsequent follow-up of enrolled participants. A total of 2415 patients met the inclusion criteria for the study across the three sites. Of those eligible, 894 (37%) were discharged from the hospital before the research coordinator had a chance to meet with them. Of the 1521 patients approached, 305 (20%) declined participation in

the study. Of the 1216 patients recruited into the study, 389 (32%) failed to return the baseline questionnaire. The remaining 827 patients constituted our baseline study sample. At 2-months, 160 (19.3%) participants dropped-out (did not return follow-up questionnaire), and at 6-months another 37 (4.5%) participants dropped-out.

Descriptive Statistics

Demographic characteristics. Baseline characteristics of our study sample are presented in Table 9. Our sample consisted of 75.5% males (mean age 61, with a range of 29 to 86). The mean age of female participants was 63, with a range of 25 to 80. Our sample was relatively well educated; 21% completed high school and 40% completed college or university education. The majority of our participants were retired and most were living with a partner.

General self-determination. The general self-determination index (SDI), which was the weighted sum of the six subscale means, ranged from -8.0 to +36.0, with an average of 11.0 (SD=7.4). The theoretical range of the general SDI is -42 to +42. Negative scores indicate an overall controlled type of functioning, while positive scores indicate a generally autonomous level of functioning. The range and mean level of self-determination in the sample indicate that our sample was overall more autonoumous, with self-determination scores being normally distributed on either side of the mean (kurtosis = -.30; skewness = .15).

Sex differences. As shown in Table 9, a comparison of the means using independent samples t-tests indicated that men and women differed significantly on demographic, motivational and activity variables at baseline. Specifically, men were somewhat younger, more educated, and more likely to be employed and married. Men were also more autonomous in their daily functioning and more physically active.

Preliminary Analyses

Preliminary analyses were conducted to assess whether the data[2] from the sample under study conformed to some basic assumptions underlying Maximum Likelihood estimation and structural equation modeling procedures.

Absence of outliers. Examination of the means and standard deviations of the variables included in the model to be tested indicated that all values were within the theoretical expected range. The distribution of the standardized scores for each variable included in the model was examined to detect potential univariate outliers. Twelve cases (1.4%) with standardized scores greater than $|3|$ were identified; the outlying values occurred in the physical activity behaviour scores. These outliers were retained in further analyses because they were observed in the indicators of physical activity behaviour, which does not have a theoretically acceptable range and really no upper limit. Moreover, as the present research is based on an observational cohort study, all values of physical activity level were deemed interesting and relevant contributors to true population variance. To screen for multivariate outliers, Mahalanobis' and Cook's distances were computed. Cook's distances below 1.00 are considered acceptable (Hamilton, 1992). No values above this cut-off were identified in the present sample. Fifty-nine cases (8%) presented significant Mahalanobis' distances ($\chi^2_{(df=32)} > 62.49$, $p < .001$). These participants were excluded from further analyses, yielding a final sample size of 768.

Sample size. Structural equation modeling is a statistical method designed for larger samples. To obtain a stable solution in structural equation modeling, a minimum sample size of two hundred cases is generally required (Ullman, 1996). The present sample size (N = 768) met this requirement.

Normality. The means, standard deviations, kurtosis and skewness values of all variables included in the motivational model were first examined. Summary statistics for all indicators and factors are presented in Table 10. Mean and standard deviation values revealed that the variables displayed acceptable dispersion. Skewness values ranged from -1.72 to 2.92 and kurtosis values ranged from -.73 to 9.05. Skew indexes greater than |3| and a kurtosis index greater than |10| tend to be regarded as extreme by researchers (Kline, 1998). Thus, despite a few high values, skewness and kurtosis were generally judged to be acceptable. Moreover, the high values occurred in the indicators of overall physical activity behaviour; when the indicators were combined, skewness and kurtosis were reduced. The sum of the indicators for physical activity behaviour are considered to be a more accurate depiction of physical activity participation as they represent the different activity levels (i.e., mild, moderate and strenuous). Overall, there was no reason to suspect that the distribution of variables departed significantly from normality. Furthermore, from a multivariate perspective, the distribution of standardized residuals appeared normal.

Linearity and homoscedasticity. A random selection of bivariate scatterplots was examined to detect potential departure from linearity and to identify uneven distributions of the variance between the pairs of variables. There was no evidence of non-linearity or heteroscedasticity.

Absence of multicollinearity. Correlations between all possible pairs of variables included in the study were screened for multicollinearity. The absence of any correlations above .85 (Tabachnik & Fidell, 1996) indicated the absence of multicollinearity.

Test of the Hypothesized Motivational Model of Physical Activity Behaviour

The hypothesized model, incorporating both autonomous and controlled forms of each general motivation and regulation within the context of physical activity, is depicted in Figure 5. It is comprised of 10 factors, 32 measured variables serving as indicators, 19 standardized structural regression coefficients showing the hypothesized directional influences among the latent variables, 32 factor loadings from the factors onto the indicators, and 32 error variances associated with observed variables.

The statistical hypotheses corresponding to the structural portion of the model are described below. First, the regression coefficient of perceived interpersonal autonomy support on general autonomous motivation was hypothesized to be substantial, positive, and significant, while that on general controlled motivation was expected to be negative and significant. Second, the regression coefficient of perceived competence on interpersonal autonomy support was expected to be substantial, positive, and significant. Third, the regression coefficients of autonomous regulation on general autonomous motivation, interpersonal autonomy support and perceived competence were hypothesized to be substantial, positive, and significant. Fourth, the regression coefficient of controlled regulation of physical activity on general controlled motivation was expected to be substantial, positive, and significant, while the coefficients on interpersonal autonomy support and perceived competence were hypothesized to be negative and significant. Fifth, the regression coefficients of self-efficacy beliefs on perceived competence and autonomous regulation of physical activity were expected to be substantial, positive and significant, while that on controlled regulation of physical activity was hypothesized to be negative and significant. Sixth, the regression coefficients of planning on autonomous regulation of physical activity and self-efficacy beliefs were expected to be substantial, positive, and

significant, while the coefficient on controlled regulation of physical activity was hypothesized to be negative and significant. Seventh, the regression coefficients of 6-month physical activity behaviour on autonomous regulation and planning were expected to be substantial, positive and significant, while that on controlled regulation was hypothesized to be negative and significant. The regression coefficient of 6-month physical activity behaviour on baseline activity was included to adjust for baseline (i.e., pre-hospitalization) physical activity habits. Finally, the covariance between general autonomy and general control was hypothesized to be negative and significant, and that between general autonomy and baseline physical activity to be positive and significant. Also, the disturbance correlation (covariance) between the disturbances associated with autonomous and controlled regulation was hypothesized to be significant and positive. Finally, for purposes of identification, the loadings between the first indicator of each latent construct and its target factor were fixed to 1.0.

The resulting model is depicted in Figure 7. Due to space constraints, the structural measurement coefficients (factor loadings) and residual (error) variances for each construct from the completely standardized solution under the maximum likelihood method of estimation are presented separately in Table 11. Intercorrelations among the ten latent constructs included in the model are displayed in Table 12. Model estimation yielded a satisfactory fit; that is, the fit indices revealed that the correspondence between the estimated model and the sample covariance was satisfactory, ($\chi^2_{(df=442,N=768)}$=1155.75, $p<.001$; $\chi^2/df = 2.61$; RMSEA = .046, 90% CI=.04-.05; CFI=.95; NFI=92; NNFI=.95; GFI=.92; AGFI=.90). The RMSEA and CFI were within an acceptable range. The GFI indicated that the model explained 92% of the sample covariance.

Most hypothesized structural paths were supported by the results; particularly, all the paths leading to and from autonomous regulation of physical activity were found to be

significant and of substantial magnitude, while those to and from controlled regulation were found to be less influential and even non-significant. The regression coefficients, squared multiple correlations (variance explained), and disturbance terms for each hypothesis are shown in Table 13. As hypothesized, interpersonal autonomy support was predicted positively by general autonomy and negatively by general control, with general autonomy being a stronger predictor. While these regression coefficients were significant and of moderate magnitude, the amount of variance they explained in interpersonal autonomy support was modest (7%). Interpersonal autonomy support, in turn was associated positively and significantly with perceived competence for physical activity; the magnitude of this regression coefficient was moderate. General autonomy, interpersonal autonomy support and perceived competence significantly predicted autonomous regulation of physical activity behaviour; the valence of these regression coefficients was positive and their magnitude moderate to large. Together, these constructs predicted 50% of the variance in autonomous regulation. Only one of the hypothesized paths predicting controlled regulation was supported, namely that from general control orientation. While this path was positive, significant and of moderate magnitude, the paths from interpersonal autonomy support and perceived competence were nonsignificant and had a negligible effect. Thus the 10% of the explained variance in controlled regulation was mostly attributable to general control orientation.

Each of perceived competence, autonomous regulation and controlled regulation were significantly associated with self-efficacy. The effects of perceived competence and autonomous regulation were positive and of medium to high magnitude; as predicted, the regression coefficient between controlled regulation and self-efficacy was negative, but of smaller magnitude. Together, perceived competence, autonomous regulation, and controlled regulation

accounted for 78% of the variance in self-efficacy. As hypothesized, self-efficacy and autonomous regulation were positively, significantly and moderately associated with planning of physical activity, however, the path between controlled regulation and planning was found to be non-significant and although small, of positive valence. Together, these three constructs explained 41% of the variance in planning, with self-efficacy and autonomous regulation making the greatest contribution. Our hypothesis regarding the mediating role of self-efficacy was supported by a significant indirect effect of controlled regulation on planning ($\gamma$= -.03, $p<.01$) via self-efficacy. Contrary to our hypothesis, planning did not mediate the relationship between controlled regulation and behaviour.

The hypothesized regression paths predicting physical activity behaviour at 6 months were mostly supported. Specifically, planning and autonomous regulation positively predicted physical activity behaviour at 6 months; these effects were medium and significant. As predicted, the path from controlled regulation to physical activity behaviour at 6 months was negative, but its effect was small and non-significant. Also, the regression of 6-month physical activity behaviour on pre-event behaviour yielded a moderate, significant and positive coefficient. Together, planning, autonomous regulation, controlled regulation and pre-event physical activity predicted 26% of the variance in physical activity behaviour at 6 months. Finally, the estimated covariance between general autonomy and general control was found to be positive, significant, and of medium magnitude ($r = .44$; $p<.001$), as was the covariance between general autonomy and pre-event physical activity behaviour ($r = .12$; $p<.05$). The disturbance correlation (covariance) between the disturbances associated with autonomous and controlled regulation was also found to be positive, significant and of acceptable magnitude ($r = .16$; $p<.001$).

The amount of explained variance in autonomous and controlled regulation was 50% and 10% respectively, the amount of variance explained in planning was 41%, and the amount of explained variance in physical activity behaviour at six months after a cardiac event was 26%. In considering parameter total effects (direct plus indirect effects), perceived competence had the greatest effect on autonomous regulation ($\gamma$=.61, $p<.001$; 37% explained variance) and general control had the greatest effect on controlled regulation ($\gamma$=.31, $p<.001$; 10% explained variance). Autonomous regulation ($\gamma$=.51, $p<.001$; 26% explained variance) had the greatest effect on planning of physical activity, followed by perceived competence ($\gamma$=.47, $p<.001$; 21% explained variance). Finally, autonomous regulation ($\gamma$=.32, $p<.001$; 10% explained variance) also had the greatest effect on physical activity behaviour at six months, closely followed by pre-event physical activity behaviour ($\gamma$=.31, $p<.001$; 9% explained variance) and then by planning ($\gamma$=.27, $p<.001$; 7% explained variance).

In sum, the results are in accordance with the hypothesized model, with the exception of four paths between the antecedents and consequences of controlled regulation, which were of the predicted valence, but not statistically significant, thus supporting mainly the relevance of autonomous forms of regulation in the prediction of physical activity behaviour. The failure of this study's data to support the hypothesized relationships between controlled regulation and two of its antecedents, namely interpersonal autonomy support and perceived competence, nor its relationships with planning and physical activity behaviour was congruent with the results obtained in Study 1. On the basis of the consistent finding that these paths related to controlled forms of regulation were not relevant in the prediction of physical activity intentions or behaviour, a revised model of physical activity regulation was estimated.

Test of the Revised Motivational Model of Physical Activity Behaviour

The original model was trimmed of the four non-significant effects related to controlled regulation of physical activity as described above. Specifically, the regression coefficients from autonomy support and competence to controlled regulation and those from controlled regulation to planning and physical activity behaviour were constrained to equal zero. The covariance between general autonomy and pre-event physical activity behaviour and that between the disturbances associated with autonomous and controlled regulation were also dropped. By dropping these effects, model parsimony was also increased. The difference between the originally hypothesized and final model was non-significant ($\Delta\chi^2_{(\Delta df=4,N=768)}=3.22$, ns) and the fit of the final model was unchanged. Model estimation yielded a satisfactory fit ($\chi^2_{(df=446,N=768)}=1158.97$, $p<.001$; $\chi^2/df = 2.60$; RMSEA = .046, 90% CI=.04-.05; CFI=.95; NFI=92; NNFI=.95; GFI=.92; AGFI=.90). The RMSEA and CFI were within an acceptable range. The GFI indicated that the model explained 92% of the sample covariance. The model trimming procedure did not result in noteworthy differences in regression coefficients for the remaining paths and covariances between the hypothesized and final models. The final model is depicted in Figure 8.

Consistent with Study 1, in addition to their direct effects on interpersonal autonomy support and regulatory style, general autonomy and general controlledness revealed significant indirect effects on autonomous regulation, perceived competence, self-efficacy and planning, with general autonomy also having an indirect effect on physical activity behaviour. As expected, the indirect effects of general autonomy were all positive, whereas those of general controlledness were negative. These results confirmed the overarching role of general motivational orientation in behavioural regulation and revealed the various pathways through

which motivation exerts its influences. Apart from its direct effect on autonomous regulation and perceived competence, interpersonal support of autonomy had an indirect positive effect on autonomous regulation, self-efficacy, planning, and physical activity behaviour. This observation supported the hypothesis that perceived competence mediates the impact of autonomy support on regulatory style, although only in the case of the autonomous style, and confirmed that a supportive social context has far-reaching positive ramifications on behavioural regulation via other variables.

Similarly, the relevance of perceived competence was shown to extend beyond its direct effect on autonomous regulation and self-efficacy. In addition to a direct effect on self-efficacy and autonomous regulation, perceived competence exerted an indirect positive effect on self-efficacy, planning, and physical activity behaviour. This finding revealed that, although competence did not promote physical activity behaviour by diminishing non-self-determined forms of regulation, it influenced other proximal precursors of behaviour to positively predict physical activity. In fact, its total effect on planning and on physical activity behaviour was the second largest only to autonomous regulation. Indeed, autonomous regulation had the largest total effect on both planning and behaviour. Apart from having substantial direct effects on self-efficacy, planning and behaviour, autonomous regulation also displayed a significant and positive indirect effect on planning and behaviour. These results provided evidence for the hypothesis that self-efficacy and planning mediate the impact of autonomous regulation on physical activity behaviour and also confirmed that autonomous regulation is the strongest direct predictor of physical activity behaviour. Finally, despite its non-significant direct effect on planning, controlled regulation had an indirect negative effect on this variable. Again, this supported the hypothesis regarding the role of self-efficacy as a mediator between regulatory

style and a proximal precursor of physical activity behaviour, namely planning. The direct, indirect and total effects of the different constructs in the final model of physical activity behaviour are reported in Table 14.

## DISCUSSION

Study 2 demonstrated that the proposed model of physical activity regulation has the capacity to predict future behaviour. While Study 1 was a sound test of a comprehensive model that integrated both intrapersonal and interpersonal variables to afford an explanation for the sequence that underlies the formulation of positive intentions to be physically active (a cognitive precursor to behaviour), the incorporation of a behavioural measure of physical activity and the longitudinal design of Study 2 added value by substantiating the capacity of this model to predict behaviour. In addition, the longitudinal design afforded a comprehensive explanation of the processes underlying not only the regulation of physical activity behaviours in patients with heart disease, but also those influencing the development of cardiac patients' motives for health behaviour change.

Overall, it was expected that sustained regulation of physical activity behaviour in cardiac patients would be primarily contingent on individuals' motivational style, which is influenced by interpersonal and intrapersonal factors. First, it was hypothesized that within each autonomous and controlled orientation, general motivation assessed at study intake (Time 1) would reliably predict contextual motivation, or regulatory style, at two months (Time 2). Second, it was hypothesized that the more self-determined individuals were in general at Time 1, the more they would perceive their interpersonal relationships to be supportive of autonomy within the context of health behaviour change at Time 2. Third, it was hypothesized that the nature of interpersonal autonomy support would be a relevant factor in the adoption of

autonomous versus controlled regulation of physical activity at Time 2. That is, higher perceptions of autonomy support should be associated with self-determined forms of regulation, while lower perceptions with non-self-determined forms. Fourth, it was believed that perceived competence would mediate the relationship between interpersonal autonomy support and regulatory style. Specifically, autonomy support should enhance feelings of competence and these should be positively associated with autonomous regulation and negatively with controlled regulation. The hypothesis of greatest interest pertained to the central role of regulatory style in the process of behavioural regulation. Autonomous regulation of physical activity at Time 2 was expected to be the most reliable positive predictor of behaviour at six months (Time 3) and its effect was also expected to be mediated by process variables, namely self-efficacy beliefs and planning assessed at Time 2. Controlled regulation, in contrast, was hypothesized to be a negative predictor of behaviour. Globally, the results supported the hypotheses and were consistent with those reported in Study 1. General motivational tendencies predicted how the cardiac patients regulated physical activity at Time 2. That is, a self-determined general orientation positively predicted autonomous regulation and non-self-determined general tendencies positively predicted controlled regulatory styles assessed two months later. The extent to which regulation was autonomous was also related to the patients' perceptions of interpersonal autonomy support and their competence at Time 2. The more cardiac patients perceived their interpersonal relationships to be supportive of autonomy, the more autonomous their motives for physical activity regulation were and this relationship was mediated by positive perceptions of competence. Autonomous regulation of physical activity was confirmed to be the most reliable and relevant predictor of participation in physical activity behaviours at Time 3. Moreover, this relationship was mediated by self-efficacy beliefs regarding overcoming various situational

barriers to physical activity engagement and by planning of physical activities measured at Time 2. However, as in Study 1, the paths between controlled regulation and its antecedents and consequences were found to be of negligible relevance. Thus, overall, our results supported the proposition that self-determined regulation of behaviour is the most important factor in the prediction of sustained physical activity behaviour in patients affected by cardiac disease.

That controlled forms of regulation had neither a significant effect on planning at two months, nor significantly predicted behaviour at 6 months was surprising, but congruent with our Study 1 findings. We propose two explanations for this observation. One has to do with our cardiac patient population and the other with a broader consequence of the autonomy versus control dichotomy. Our results could be a reflection of our study sample because two months post-cardiac event was still relatively early with respect to health behaviour modification and extrinsic motives may have been driving behaviour. As described in an earlier section, while both self-determined and extrinsic motives are believed to be predictive of short-term behaviour, only self-determined motives are expected to remain influential in long-term adherence. A recent study of persistence in competitive swimmers (Pelletier et al., 2001) supported this position. While self-determined forms of motivation were predictive of persistence in both the shorter term (10 months) and long-term (22 months), introjected regulation was a significant predictor of persistence at 10, but not 22 months, and external regulation was not a significant predictor of behaviour at 10 months, but became negatively associated with persistence at 22 months. Our study sample was completely different and our concern was with adoption and subsequent maintenance of physical activity behaviours as opposed to persistence with already high activity levels, nonetheless our results our comparable. We did not assess physical activity behaviour at two months, but the positive, although small, association with planning of physical activity also

supported the relevance of extrinsic motives in the short-term (i.e., early phases of behavioural regulation). The association between autonomous regulation and planning was positive, significant and substantial. As hypothesized, self-efficacy beliefs played an important role during this early stage. This was evidenced by the relevant direct effect of self-efficacy on planning, plus the indirect effect of controlled regulation on planning that was entirely mediated by self-efficacy beliefs. Subsequently, at 6 months post-event or treatment, the cardiac patients were considered to be in the maintenance phase. At this point in time we observed that autonomous regulation directly, positively and relevantly predicted physical activity behaviour. Controlled regulation negatively predicted physical activity behaviour, though this effect was small and only indirect. Likewise, the positive effect of self-efficacy beliefs was only indirect and relatively small. The second explanation is rooted in the autonomy versus control dichotomy at the general level. Namely, general motivational orientation is posed to render individuals to be differentially receptive to new experiences and information. As this explanation applies to both Study 1 and Study 2 and has more global implications, further elaboration is reserved for the General Discussion.

## GENERAL DISCUSSION

This research examined the role of motivational style in the regulation of physical activity behaviour in cardiac patients in order to identify both change agents and targets for intervention. In the first study autonomous and controlled regulation of physical activity were assessed during the decisional phase in terms of patients' intentions to be physically active in the near future. In the second study both regulatory styles were assessed during the action phase in terms of sustained physical activity behaviour. Study 1 served the purpose of verifying the theory- and evidence-based relationships proposed in the hypothesized model and validating the

PARS instrument used to assess regulatory style. The test of the model supported the role of autonomous or self-determined motivation, both at the general and contextual level in effective regulation of physical activity behaviour. Self-determined forms of regulation were positively associated with the strength of patients' intentions to be physically active. Moreover, an autonomous regulatory style was found to be positively associated with general autonomy, perceptions of interpersonal autonomy support and perceived competence, suggesting that regulation of behaviour can be influenced by targeting both interpersonal and intrapersonal factors. The validity of the PARS instrument as an appropriate tool to measure regulation of physical activity in the cardiac patient population was also confirmed. In Study 2 the motivational model was tested in a larger sample using a 3-wave longitudinal design. The results of the second study were consistent with those obtained in the first study; that is, the validity of the proposed relationships, in particular those with autonomous forms of motivation, depicted in the motivational model of physical activity regulation was confirmed. In this case, however, the role of autonomous regulatory style as a predictor of sustained physical activity behaviour was substantiated. The more autonomous patients' regulation was at Time 2, the more physically active they were at Time 3. Moreover, general autonomy at Time 1 predisposed individuals to adopt more self-determined forms of regulation within the context of physical activity at Time 2. Thus, the overarching role of motivational style was supported across three time points. As in Study 1, autonomous regulation was also associated with patients' reports of interpersonal support of autonomy, which, in turn, was influenced by general autonomy orientation. This showed that the influence of general autonomy is not limited to regulatory styles, but also shapes the way in which individuals view their environments. Again, consistent with Study 1, autonomous regulation of behaviour was associated with patients' perceived competencies

regarding physical activity behaviours, which were related to their reports of interpersonal autonomy support. Regarding the effects of regulatory style on intermediate process variables, the associations between an autonomous style and each self-efficacy beliefs and planning were positive and relevant. The more self-determined individuals were in regulating their physical activity behaviours, the more confident they felt regarding overcoming potential situational barriers (i.e., more self-efficacious) and the more likely they were to plan for being active and to try to establish a regular routine. In turn, the more they planned their physical activities, the more they were physically active at Time 3.

While the present research did not provide support for the negative impact of non-self-determined forms of motivation on the process of physical activity regulation, focusing on both autonomous and controlled regulatory styles afforded an examination of important distinctions concerning the relative contribution of each type of motivation. That neither interpersonal autonomy support nor competence were significantly associated with controlled regulation, but were significantly and substantially associated with autonomous regulation suggests two things. One, that a general control orientation is a stable individual difference that prevails within different contexts more so than a general tendency to be autonomous; and two, that compared to autonomous regulation, controlled regulation of physical activity is less "open" to accepting information from interactions with social and physical environments, in particular information that is inconsistent with their self-structure. Our research confirms previous claims that the extent to which regulation is internalized depends on individuals' general motivational orientation. However, our results also indicate that interpersonal relationships impact differentially on individuals with general autonomous tendencies versus those who have control-oriented tendencies. Specifically, it is argued here that interpersonal autonomy support promotes

internalization within the already more self-determined, but is not sufficient to diminish controlledness among those who are either amotivated or tend to regulate behaviours for non-self-determined reasons. This deduction is supported by statistical and theoretical considerations. Statistically, we observed that general control motivation was the only variable predicting controlled regulation and only via a direct path. Autonomous regulation, on the other hand, was predicted directly and indirectly by general autonomy, indirectly by general controlled motivation, and was correlated with interpersonal autonomy support and perceived competence. Moreover, the direct effect of general control on its respective contextual regulation was almost three times larger than the effect of general autonomy on regulation ($\gamma$=.31 vs. $\gamma$=.12). Thus, the differential effect of social contexts on regulatory styles comes down to an issue of openness to, versus defensiveness against, experience.

Our stance regarding differential receptiveness to external experiences by individuals with a control versus autonomy orientation is in line with Hodgins' suggestion that the motivation underlying self-structures determines how individuals encounter novel experiences; the choices they make are congruent with integrated self-structures (Hodgins & Knee, 2002). To the extent that individuals function autonomously, they are open to novel experiences. This means they are ready to perceive ongoing experiences accurately and are willing to assimilate them into self-structures. In this sense individuals who are functioning autonomously are responsive to reality and consequently have a high tolerance for encountering experience without being threatened or defending against it. Accordingly, to the extent that individuals function autonomously and are open to experience, they are expected to show more evidence of readiness to make required modifications in response to their cardiac event and benefit from interpersonal

autonomy support in the context of health behaviours, including physical activity, to improve their health.

In contrast, when individuals have control-oriented tendencies, they accept reality only to the extent that it matches their constructed reality of themselves, even at the expense of their overall well-being (Hodgins & Knee, 2002). This implies that under controlled functioning people respond to new experiences by avoiding or denying events and information that are inconsistent with their self-structure. Behaviourally this translates to rigid functioning. Accordingly, to the extent individuals operate in a controlled manner, they are "closed" to new encounters and do not learn from their experiences, nor do they utilize interpersonal support systems to their advantage. In failing to benefit from their experiences and interpersonal support systems, these individuals deny themselves opportunities to become more integrated and to achieve healthy adaptation to circumstances that affect their quality of life, such as heart disease, resulting in maladaptive coping strategies with disease as opposed to proactive coping applied by individuals with autonomous tendencies. Research by Hodgins, Koestner, and Duncan (1996) showed that whereas autonomy is associated with greater enjoyment, honesty, and openness in social situations, an orientation toward control predicts a defensive dislike of honesty and disclosure. As such, persons with a control orientation may fail to choose goals that are relevant to their intrinsic needs and that promote growth (Sheldon & Elliott, 1999; Sheldon & Kasser, 1995).

There appears to be a gap in the literature regarding any dichotomously dependent consequences of interpersonal autonomy support on autonomous versus controlled regulations. It is well recognized that social contexts can influence the internalization of extrinsic motivation (Deci & Ryan, 1985a, 1987). In particular, interpersonal autonomy support (i.e., the degree to

which socializing agents encourage independent problem solving, choice, and participation in decisions while providing a rationale, acknowledging feelings, and conveying choice) is a very important factor in the process of internalization and self-determination (Grolnick & Ryan, 1989). Research studies (e.g., Deci, Koestner, & Ryan, 1999; Deci et al., 1994; Deci & Ryan, 1987, 1991; Grolnick & Ryan, 1989; Pelletier et al., 2001) have clearly illustrated that social contexts that are autonomy supportive promote internalization, particularly in the form of integration, thereby enhancing self-determined regulation, whereas social contexts that are controlling yield less overall internalization and undermine self-determination. Research in physical activity and health contexts (Goudas, Fox, Biddle, & Underwood, 1995; Pelletier et al., 2001; Williams & Deci, 1996b; Williams et al., 1996) also demonstrated that autonomy-supportive interpersonal behaviours promoted the occurrence of self-determined forms of regulation while controlling interpersonal behaviours favoured the occurrence of non-self-determined regulation. The effect of general motivational predispositions (i.e., autonomy-oriented versus control-oriented tendencies) on the extent to which autonomy support facilitates internalization or enhances self-determination, however, has not been established. The present research provides some evidence that the influence of interpersonal autonomy support on regulatory style is contingent on general motivational orientation; specifically, a controlled motivational orientation limits the impact of interpersonal autonomy support on regulatory style. This means that significant others can influence an individual to internalize an activity's regulation only to the extent that the individual is open to integrating new information into his/her self-structure; as already established, such openness seems to be consistent only with a general autonomous orientation. As interpersonal support and regulatory style were assessed at the same point in time, a causal relationship cannot be inferred, however, these results do imply

that support of autonomy promotes self-determination only among already more autonomous regulations.

Indeed, the present research confirmed only a positive association between interpersonal autonomy support and the occurrence of autonomous types of regulation. In both Study 1 and Study 2 we observed that the higher the perceptions of interpersonal autonomy support, the higher the level of autonomous regulation (i.e., indicative of integrated internalization). However, we found interpersonal autonomy support to be unrelated to controlled regulatory styles (i.e., a negative relationship here would have suggested introjected internalization). Essentially these results suggest that autonomy support may not be sufficient to enhance self-determined regulation in people who generally have controlled tendencies. This interpretation is consistent with a conclusion drawn by Pelletier et al. (2001) that the two types of interpersonal behaviours (autonomous vs. controlled) are associated with different types of motivation. These investigators observed that perceptions of autonomy support and the absence of control were associated positively with self-determined types of motivation, whereas perceptions of control and the absence of autonomy support were associated with external regulation. Furthermore, only self-determined modes of regulation have been linked to interpersonal autonomy support in the literature.

As it is typically the non-self-determined that have problems self-regulating and adhering to prescribed health behaviours, the position that the provision of autonomy support may not diminish non-self-determined forms of regulation is of practical relevance to health promotion interventions which are dependent on self-regulation to effect long-lasting behaviour change. Persons with a controlled orientation may need more than just autonomy support, they may also need structure. Structure refers to the extent to which socializing agents provide consistent

guidelines, expectations, and rules for behaviour, irrespective of any particular style in which they are promoted (Koestner & Losier, 2002). As pointed out by Connell and Wellborn (1991), autonomy support and structure exist as two independent contextual variables that can be complementary and mutually supportive. We are in agreement with Koestner et al.'s (2002) proposition that both autonomy support and structure are required to promote internalization of controlled regulations. The provision of structure within a particular domain, such as a physical activity program, is believed to help individuals, particularly those with non-self-determined motivational tendencies, understand why it is personally important and meaningful to perform activities that might not be personally interesting initially.

Consistent with our findings, perceived competence has also been mostly linked to autonomous forms of motivation. Research has shown that positive feedback leading individuals to feel more competent, led them to be more intrinsically motivated or to have self-determined motives for behavioural regulation (Pelletier et al., 1995a; Vallerand, Blais, Briere, & Pelletier, 1989; Vallerand & Reid, 1984, 1988; Whitehead & Corbin, 1991). Evidently, if people do not feel competent to perform a behaviour, they are unlikely to internalize regulation of the behaviour (Ryan & Deci, 2002); our findings indicate that external regulation is not contingent on perceived competence.

Considering all these arguments, it can be appreciated that autonomous individuals affected by a chronic disease are more likely to make positive health behaviour changes in their lives than their controlled counterparts. Nevertheless, in the context of health promotion, all individuals who have at least some intention to act are considered to be capable of making healthful changes. Those individuals who have no intention to act would first need to be assisted with forming intentions, primarily via provision of information to help them understand their

condition, their need to make some behavioural changes, and by enhancing their competencies regarding the required behaviours. The type of information would likely vary with each individual case and depend on individuals' reasons for not intending to make some health behaviour changes in the near future. Here, consideration of motivational tendencies would again be helpful. Based on our findings, more self-determined individuals are more open to considering new information. In particular, autonomous individuals are most likely to benefit from assistance if their perspectives are taken into account, if relevant information and opportunities for choice are provided, and if they are encouraged to accept more responsibility for their health behaviours; that is, if their interpersonal climate is autonomy-supportive. Non-self-determined individuals would likely require more structure to help them see their current condition and future alternatives in black and white. In other words, while respecting their view and choices, these individuals may need to be overwhelmed with facts and guided through the process of intention formation step by step. In either case, individuals would need to be assisted with making realistic plans regarding physical activity participation and finding ways of removing potential barriers to action.

By providing an explanation for how people regulate behaviour, the self-determination continuum is able to distinguish between plans and intentions that result in action and those that do not. This is what makes this construct so useful. Indeed, self-efficacy has also been shown to be strongly associated with, and even predictive of, intentions and behaviour, yet this construct does not offer an explanation of the mechanisms underlying formation of intentions or their translation into action. As such, self-efficacy does not link intentions to action, and thus does not distinguish between intentions that result in action and those that do not. Consequently, the self-efficacy construct does not provide an understanding for why even those with high self-efficacy

beliefs fail to regulate and/or fail to act on intentions. The self-determination continuum offers such an explanation and can therefore be a useful target for achieving adoption and maintenance of physical activity behaviour. By focusing on increasing the level of self-determination, positive physical activity outcomes can be achieved via three distinct pathways; first, via its contribution to the development of self-efficacy; second, via its contribution to the planning of physical activities (directly and indirectly through self-efficacy); and third, via its direct contribution to continued persistence with physical activity. As such, self-determined motivation represents a useful construct for our understanding of how sustained physical activity could develop and why it could be sustained by some individuals yet be of short duration for others.

## Implications for Practice

The results of the present research have relevant implications for the promotion of regular physical activity in the cardiac patient population, but the findings can also be extended to other clinical and healthy populations. By specifying potential change agents (i.e., interpersonal relationships) and target variables for intervention (i.e., perceived competence, motivation underlying behaviour regulation, self-efficacy beliefs, planning), as well as a temporal sequence, the motivational model can be used to inform the design and evaluation of physical activity interventions, particularly those aimed at increasing physical activity levels and achieving maintained change. The motivational model of physical activity regulation delineates a dynamic process through which individuals confronted with the arduous task of taking on a prescribed behaviour in the face of a potentially life-threatening condition may either succeed or fail at making a lifestyle change. Initially, these individuals may be willing to try anything to ameliorate their condition, however, with time the perceived eminence of the threat subsides and along with it also the drive to devote further effort into the behavioural modifications. Therefore,

intervention strategies focusing on outcome (i.e., physical activity participation) solely may bear less weight over the long-term. Our findings suggest that intervention strategies need to focus on process variables in order to achieve continued adherence to regular physical activity. As behavioural persistence is a desired corollary of health-directed interventions, our findings regarding the overarching role of motivational style in continued regulation of physical activity behaviour is of particular importance.

While the motivational model is structurally complex in that it integrates different theoretical constructs and defines different paths through which interpersonal and intrapersonal factors interact to promote effective regulation of physical activity behaviour, its application is relatively simple. Mainly, it suggests that intervention strategies focus on increasing autonomous (i.e., self-determined) regulation of behaviour and it identifies the target variables through which this can be achieved. It also identifies variables that are proximal indicators of behaviour and can thus be relied upon to afford a more detailed assessment of progression toward the desired outcome, namely sustained regulation of physical activity behaviour. Moreover, information regarding the antecedents of regulatory style might be applied to screening program participants, grouping them for tailored program components, developing program elements, and identifying outcome measures for program evaluation.

## Implications for Future Research

As noted earlier, while empirical evidence has shown that social contexts can influence the internalization of extrinsic motives, there is a gap in the literature regarding any dichotomously dependent consequences of interpersonal autonomy support on autonomous versus controlled regulations. Furthermore, only self-determined modes of regulation have been linked to interpersonal autonomy support in the literature. Given the lack of previous evidence

for an effect of autonomy support on controlled regulation and for the role of general motivational orientation in this relationship, our finding that interpersonal autonomy support and controlled regulation were unrelated (i.e., social contexts may not have a bearing on internalization within controlled regulatory styles) is an interesting contribution to the literature on motivation. Future research is needed, however, to replicate these findings as well as to establish the mediating role of perceived competence on diminishing non-self-determined forms of motivation. This would require a comparison of the effects of both autonomy supportive and controlling contexts on controlled regulations.

Regarding our unexpected neutral results regarding the impact of controlled regulatory style on intentions, behaviour or proximal process variables, there are two plausible explanations. One, as already described, is that non-self-determined individuals are more or less indifferent to making these behavioural changes. The second explanation relates, once again, to the far-reaching consequences of motivational style. Specifically, it could be that in face of an eminent life threat both self-determined and non-self-determined motives lead to behaviour initiation. Should that be the case, both types of regulation would be positively associated with physical activity levels during the first few weeks after discharge from hospital. Because we only had a measure of physical activity behaviour at six months, we were unable to test this speculation regarding initiation of physical activity participation. One-year follow-up data would better depict the negative consequences of controlled regulatory styles on maintenance physical activity behaviour. Furthermore, research is needed to examine the process of internalization of health behaviours separately for cardiac patients who are autonomously oriented and those whose functioning is generally controlled in order to reveal variables (albeit likely external ones) that would facilitate integration, even introjection during the early phases, of new behaviours

into their self-structures. A related issue is that of representation of non-self-determined individuals. In the current research our sample populations were generally and contextually more self-determined; while this is a common finding across studies examining self-determination, this may have underpowered our ability to find significant relationships with the controlled forms of motivation. Future studies should attempt to deliberately recruit more individuals who are generally not self-determined.

Accordingly, if this research was to be replicated, in addition to recruiting a sample with a more even split between self-determined and non-self-determined motivational orientations, physical activity behaviour would be assessed at more regular intervals, perhaps monthly to 1) afford a closer examination of the dynamic processes depicted in the motivational model (e.g., internalization), and 2) to provide a more accurate depiction of participants' behaviour and afford less reliance on retrospective reports. Also, if we had the chance to redo this study, we would assess interpersonal autonomy support at more time points (e.g., at baseline or one month, and six months) so that any variation in interpersonal climate could be monitored. In addition, we would assess the effect of specific social contexts that might be most influential in the patients' lives rather than considering interpersonal relationships in general. In particular, we would focus on the influence of spouses and we would do this by assessing both the participants' perceptions of spousal support as well as spouses' actual support. Moreover, we would redesign the study in such a way as to allow for a test of purely predictive relationships. Specifically, interpersonal autonomy support and perceived competence would be measured prior to the assessment of regulatory style, but post-intake so as to retain general motivation as their precursor; self-efficacy would be assessed after regulatory style and planning. Such time-line requirements, would of course place a greater demand on participants to complete questionnaires. Ideally, the duration of

the study would be prolonged and this would resolve some of these issues. Finally, given the purpose of promoting physical activity in the cardiac population, it would also appear important to examine whether the maintenance of physical activity, as well as maintenance of motivational style driving the behaviour, namely self-determined versus non-self-determined, leads to an improvement in patients' health and the prevention versus reoccurrence of future cardiac problems.

Indeed, as already indicated, the next logical step would be to look at persistence in behaviour over a longer time period. Furthermore, the generalizability of the motivational model could be evaluated by testing it in other populations, clinical and healthy. Generalizability would also be evaluated by applying the model to other health behaviours, such as dietary habits, tobacco use, and medication taking. Perhaps an even stronger design would examine several of these lifestyle contexts, which are pertinent to heart disease prevention and management, at once to see if patients show a true sign of integration of different domains in their efforts to stunt disease progression and improve overall health. Any programs derived from such integrative research would, of course, be very complex, but also comprehensive as many of these lifestyle behaviours are co-related; healthy behaviours tend to coexist with other healthy habits, and health-compromising habits co-exist with other dysfunctional behaviours. We believe that the potential to improve health or prevent further disease is greater if related health behaviours are targeted at once. Therefore, the health outcome benefits associated with addressing several health behaviours within one intervention would likely outweigh any concerns regarding the complexity of the design.

Finally, these research findings need to be translated into practice. That is, the findings need to be used as a framework for intervention design, and the intervention implemented and

evaluated to confirm the practical usefulness of the motivational model. Moreover, while the present research was concentrated around motivational style, future studies might more thoroughly examine the antecedents and more extensive consequences of perceived competence. Such an examination would be able to inform the design of an intervention that would promote both competence and autonomy and would thereby be more powerful.

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Footnotes

[1] Because correlation matrices were not reported, the amount of variance explained by self-efficacy beliefs could not be isolated/calculated. However, based on the overall variance explained, it could be deduced that baseline self-efficacy scores accounted for very little variance in the regression model.

[2] Missing, or incomplete, data were replaced by gender using the expectation-maximization (EM) algorithm for covariance matrices. When data are missing at random, which in our studies they were, the EM algorithm estimates are unbiased (Shafer & Graham, 2002). In Study 1, we had 5% missing data and in Study 2, 14% data was missing.

[3] In this analysis, as in all subsequent SEMs performed in the context of this thesis, the first indicator of each latent construct was fixed o 1.0 to ensure statistical identification. The decision to constrain the first indicator is arbitrary, however, and for each latent construct any other indicator could have been selected for this purpose.

[4] A direct effect is the unmediated impact of one variable on another. Direct effects correspond to the regression coefficients of the model. Indirect effects represent the mediating influence of at least one intervening variable (Bollen, 1989). Total effects are the sum of direct and indirect effects.

Table 1

Descriptive Statistics for the Factors and Indicators Included in the Motivational Model of Physical Activity Intentions (Study 1)

| Variable (N=200) | Mean | SD | Skewness | Kurtosis | Theoretical range |
|---|---|---|---|---|---|
| General Autonomy | 49.82 | 10.22 | -.69 | .18 | 9/63 |
| GSDI-1 | 16.86 | 3.37 | -.59 | -.29 | 3/21 |
| GSDI-2 | 16.22 | 3.64 | -.74 | .69 | 3/21 |
| GSDI-3 | 16.74 | 3.92 | -1.07 | 1.06 | 3/21 |
| General Control | 29.62 | 9.65 | .42 | .17 | 9/63 |
| GNSDI-1 | 9.20 | 3.98 | .36 | -.44 | 3/21 |
| GNSDI-2 | 9.79 | 3.29 | .26 | .28 | 3/21 |
| GNSDI-3 | 10.63 | 3.78 | .26 | -.08 | 3/21 |
| Interpersonal Autonomy Support | 21.65 | 4.52 | -.73 | .98 | 4/28 |
| IAS-1 | 6.02 | 1.24 | -1.73 | 3.81 | 1/7 |
| IAS-2 | 5.62 | 1.35 | -.99 | .90 | 1/7 |
| IAS-3 | 5.36 | 1.72 | -1.02 | .39 | 1/7 |
| IAS-4 | 4.68 | 1.55 | -.30 | -.11 | 1/7 |
| Perceived Competence | 5.52 | 1.19 | -1.01 | 1.15 | 3/21 |
| PC-1 | 5.97 | 1.22 | -1.45 | 2.08 | 1/7 |
| PC-2 | 5.63 | 1.49 | -1.22 | 1.24 | 1/7 |
| PC-3 | 4.94 | 1.45 | -.58 | .10 | 1/7 |

(table continues)

Table 1 (cont'd)

| Variable N=200 | Mean | SD | Skewness | Kurtosis | Theoretical range |
|---|---|---|---|---|---|
| Autonomous Regulation of PA | 47.31 | 12.90 | -.81 | .16 | 9/63 |
| CSDI-1 | 16.04 | 4.33 | -.87 | .30 | 3/21 |
| CSDI-2 | 15.66 | 4.42 | -.82 | .15 | 3/21 |
| CSDI-3 | 15.61 | 4.55 | -.78 | -.04 | 3/21 |
| Controlled Regulation of PA | 22.06 | 6.68 | .33 | .25 | 9/63 |
| CNSDI-1 | 8.24 | 2.84 | -.01 | -.44 | 3/21 |
| CNSDI-2 | 6.59 | 2.72 | .64 | .36 | 3/21 |
| CNSDI-3 | 7.23 | 2.81 | .36 | -.06 | 3/21 |
| Self-Efficacy for PA | 18.64 | 5.38 | -.24 | -.39 | 4/28 |
| SE-1 | 4.91 | 1.50 | -.39 | -.43 | 1/7 |
| SE-2 | 4.85 | 1.39 | -.32 | -.40 | 1/7 |
| SE-3 | 4.69 | 1.36 | -.18 | -.45 | 1/7 |
| SE-4 | 4.18 | 1.53 | .07 | -.54 | 1/7 |
| Planning | 6.27 | 2.29 | -.38 | -.82 | 2/10 |
| PO-1 | 3.13 | 1.18 | -.40 | -.80 | 1/5 |
| PO-2 | 3.14 | 1.21 | -.33 | -.87 | 1/5 |

(table continues)

Table 1 (cont'd)

| Variable N=200 | Mean | SD | Skewness | Kurtosis | Theoretical range |
|---|---|---|---|---|---|
| PA Behaviour at Baseline | 18.06 | 16.40 | 1.22 | 1.13 | 0/∞ |
| PA-b mild | 7.86 | 7.20 | .53 | -.71 | 0/∞ |
| PA-b mod | 7.78 | 10.66 | 1.51 | 2.51 | 0/∞ |
| PA-b strenuous | 2.43 | 8.00 | 4.13 | 19.24 | 0/∞ |
| Intentions | 10.87 | 3.50 | -1.05 | .28 | 2/14 |
| INT-1 | 5.14 | 2.04 | -.85 | -.52 | 1/7 |
| INT-6 | 5.73 | 1.64 | -1.42 | 1.46 | 1/7 |

Table 2

Internal Consistencies (diagonal) and Pearson Correlations (above diagonal) Among the PARS Subscales (Study 1)

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Intrinsic Motivation (1) | (.96) | .84 | .74 | .50 | -.23 | -.38 |
| Integrated Regulation (2) | | (.90) | .80 | .52 | -.16 | -.32 |
| Identified Regulation (3) | | | (.91) | .51 | -.08 | -.30 |
| Introjected Regulation (4) | | | | (.76) | .14 | -.22 |
| External Regulation (5) | | | | | (.78) | .06 |
| Amotivation (6) | | | | | | (.68) |

Note. $r \geq .16$, $p < .05$ ($N = 200$); $r \geq .22$, $p < .01$ ($N = 200$)

Table 3

Correlations Between the Different Subscales of the PARS and Related Constructs as well as Correlations Between the Two Aggregate Forms of Physical Activity Regulation (in bold) and Related Constructs (Study 1)

| Related construct | PARS subscales | | | | | | **Aggregate forms of regulation** | |
|---|---|---|---|---|---|---|---|---|
| | IM | INTEG | IDEN | INTRO | ER | AMO | **Autonomous regulation** | **Controlled regulation** |
| **To what extent patients believe exercise will …** | | | | | | | | |
| … reduce their chances of having further heart problems | .17 | .15 | .31 | .16 | .03 | -.23 | **.23** | **.05** |
| … improve their chances of living longer | .22 | .19 | .32 | .20 | .20 | -.10 | **.33** | **.11** |
| … improve their quality of life | .51 | .41 | .49 | .19 | .03 | -.24 | **.57** | **.07** |
| … make them feel more energetic | .40 | .34 | .33 | .13 | .04 | -.10 | **.44** | **.08** |
| … improve their endurance for performing their daily activities | .35 | .34 | .34 | .07 | -.08 | -.03 | **.41** | **-.02** |
| …allow them to meet new people | .43 | .41 | .26 | .21 | .05 | -.11 | **.45** | **.12** |
| **Consequences of the regulatory styles of physical activity behaviours** | | | | | | | | |
| Pre-hospitalization physical activity habits | .41 | .39 | .37 | .14 | -.28 | -.18 | **.42** | **-.13** |
| Intentions to be physically active | .51 | .61 | .65 | .31 | -.08 | -.27 | **.62** | **.05** |
| **Psychological Adjustment** | | | | | | | | |
| Perceived stress | -.26 | -.18 | -.08 | .10 | .17 | .23 | **-.21** | **.27** |
| Depressive symptomatology | -.35 | -.28 | -.19 | -.01 | .14 | .24 | **-.31** | **.19** |
| Anxiety | -13 | -.05 | .03 | .17 | .16 | .19 | **-.08** | **.30** |
| Life satisfaction | .41 | .40 | .34 | .12 | -.16 | -.18 | **.42** | **-.13** |

Note. $r \geq .13$, $p < .05$ ($N = 200$); $r \geq .20$, $p < .01$ ($N = 200$)

Table 4

Baseline Characteristics of All Study Participants and by Gender (Study 1)

| | All N=200 | Men n=162 | Women n=38 | p-value |
|---|---|---|---|---|
| Age, M (SD) | 64.0 (10.1) | 64.4 (10.3) | 61.9 (8.9) | .16 |
| Education Completed, % | | | | |
| High School | 35.5 % | 33.3 % | 44.7% | .41 |
| College/University | 50.5 % | 52.5 % | 42.1 % | |
| Employment Status | | | | |
| Working Full-Time % | 25.0 % | 26.5 % | 18.4 % | .42 |
| Working Part-Time % | 9.0 % | 8.0 % | 13.2 % | |
| Unemployed/Retired % | 66.0 % | 65.4 % | 68.4 % | |
| Married or Living Together % | 79.9% | 83.5 % | 64.3 % | .02 |
| General Motivation Index, M (SD) | 14.7 (8.9) | 14.5 (9.0) | 15.5 (8.4) | .56 |
| Physical Activity Behaviour (LSI), M (SD) | 18.1 (16.4) | 18.0 (16.9) | 18.4 (14.2) | .89 |

Note. For continuous variables, Levene's test for equality of variance revealed significant differences for the pairs compared above for education, general motivation index and physical activity behaviour. Consequently, a t-test for groups with unequal variances was used for education (df=402.85), general motivation index (df=288.41) and physical activity behaviour (df=392.72). A t-test for groups with equal variances was performed for age (df=766). For discrete variables, the Pearson Chi-Square test was performed.
LSI = leisure score index of the Godin Leisure Time Exercise Questionnaire.
LSI = (3 x freq. mild exercise) + (5 x freq. of moderate exercise) + (9 x freq. strenuous exercise)
METs = metabolic equivalents = (3 x freq. mild exercise) + (5 x freq. of moderate exercise) + (9 x freq. strenuous exercise)

Table 5

Standardized Maximum Likelihood Estimates (Factor Loadings) and Residuals (in brackets) for the Ten Latent Factors of the Final Motivational Model of Physical Activity Intentions (Study 1)

| | Latent factors | | | | |
|---|---|---|---|---|---|
| Items | General autonomy (GA) | General control (GC) | Interpersonal autonomy support (IAS) | Perceived competence (PC) | Autonomous regulation (ARPA) |
| GA-1 | .87 (.49) | | | | |
| GA-2 | .92 (.39) | | | | |
| GA-3 | .91 (.41) | | | | |
| GC-1 | | .80 (.60) | | | |
| GC-2 | | .84 (.54) | | | |
| GC-3 | | .78 (.63) | | | |
| IAS-1 | | | .71 (.70) | | |
| IAS-2 | | | .75 (.66) | | |
| IAS-3 | | | .64 (.77) | | |
| IAS-4 | | | .58 (.81) | | |
| PC-1 | | | | .75 (.67) | |
| PC-2 | | | | .82 (.57) | |
| PC-3 | | | | .77 (.63) | |
| ARPA-1 | | | | | .95 (.31) |
| ARPA -2 | | | | | .94 (.34) |
| ARPA -3 | | | | | .97 (.24) |

(table continues)

Table 5 (cont'd)

| | Latent Factors | | | | |
|---|---|---|---|---|---|
| Items | Controlled regulation (CRPA) | Self-efficacy (SE) | Planning (PL) | PA Behaviour at baseline (PA-b) | PA intentions (INT) |
| CRPA-1 | .69 (.72) | | | | |
| CRPA -2 | .78 (.63) | | | | |
| CRPA -3 | .58 (.81) | | | | |
| SE-1 | | .87 (.49) | | | |
| SE-2 | | .94 (.34) | | | |
| SE-3 | | .95 (.30) | | | |
| SE-4 | | .86 (.50) | | | |
| PL-1 | | | .92 (.40) | | |
| PL-2 | | | .90 (.43) | | |
| PA-b 1 | | | | 1.00 (.00) | |
| PA-b 2 | | | | .09 (.99) | |
| PA-b 3 | | | | .09 (.99) | |
| INT 1 | | | | | 1.00 (.00) |
| INT 2 | | | | | .80 (.59) |

Note. All standardized factor loadings are significant at $p<.001$. Numbers in parentheses are standardized residuals.

Table 6

Pearson Correlations Among the Factors of the Model of Physical Activity Intentions (Study 1)

| Variable | GA | GC | IAS | PC | ARPA | CRPA | SE | PL | PAB-B | INT |
|---|---|---|---|---|---|---|---|---|---|---|
| General Autonomy (GA) | - | .14 | .39 | .19 | .42 | .05 | .27 | .29 | .22 | .12 |
| General Control (GC) | | - | .13 | .07 | .17 | .44 | .13 | .16 | .20 | -.03 |
| Interpersonal Autonomy Support (IAS) | | | - | .27 | .42 | .06 | .42 | .16 | .33 | .08 |
| Perceived Competence (PC) | | | | - | .43 | -.06 | .64 | .42 | .54 | .29 |
| Autonomous Regulation of PA (ARPA) | | | | | - | .08 | .58 | .58 | .62 | .42 |
| Controlled Regulation of PA (CRPA) | | | | | | - | -.11 | .02 | .05 | -.13 |
| Self-Efficacy for PA (SE) | | | | | | | - | .50 | .62 | .27 |
| Planning (PL) | | | | | | | | - | .60 | .34 |
| PA Behaviour at Baseline (PAB-B) | | | | | | | | | - | .32 |
| PA Intentions (INT) | | | | | | | | | | - |

Note. N=200. $r > .14$, $p < .05$; $r > .19$, $p \leq .01$.

Table 7a.
Maximum Likelihood Estimates for the Structural Portion of the Hypothesized Motivational Model of Physical Activity Intentions (Study 1)

| Variable | | Regression coefficients | | | | |
|---|---|---|---|---|---|---|
| Endogenous | Predictor | Unstandardized[α] | Standardized | D | $R^2$ | $1-R^2$ |
| Interpersonal Autonomy Support (IAS) | General Autonomy (GA) | .13*** (.02) | .44 | .89 | .21 | .79 |
| | General Control (GC) | .03[ns] (.02) | .10 | | | |
| Perceived Competence (PC) | IAS | .41*** (.10) | .40 | .92 | .16 | .84 |
| Autonomous Regulation of PA (ARPA) | GA | .39*** (.10) | .28 | .77 | .40 | .60 |
| | IAS | 1.04* (.40) | .22 | | | |
| | PC | 1.58*** (.34) | .35 | | | |
| Controlled Regulation of PA (CRPA) | GC | .32*** (.06) | .53 | .85 | .28 | .72 |
| | IAS | -.05[ns] (.21) | -.02 | | | |
| | PC | .24[ns] (.20) | -.11 | | | |
| Self-Efficacy for PA (SE) | PC | .76*** (.11) | .53 | .61 | .63 | .37 |
| | ARPA | .12*** (.02) | .37 | | | |
| | CRPA | -.08* (.04) | -.12 | | | |
| Planning (PL) | SE | .26*** (.07) | .31 | .75 | .44 | .56 |
| | ARPA | .11*** (.02) | .43 | | | |
| | CRPA | .03[ns] (.04) | .05 | | | |
| PA Intentions (INT) | PAB-B | .32[ns] (.20) | -.28 | .66 | .56 | .44 |
| | PL | .73*** (.14) | .38 | | | |
| | ARPA | .23*** (.04) | .44 | | | |
| | CRPA | -.11[ns] (.07) | -.10 | | | |

Note. [α]Robust statistics based on ML estimations; values in parentheses are standard errors. D, disturbance term associated with endogenous variable. *p< .05; ***p<.001.

Table 7b
Maximum Likelihood Estimates for the Structural Portion of the Final Motivational Model of Physical Activity Intentions (Study 1)

| Variable | | Regression coefficients | | | | |
|---|---|---|---|---|---|---|
| Endogenous | Predictor | Unstandardized[α] | Standardized | D | $R^2$ | 1-$R^2$ |
| Interpersonal Autonomy Support (IAS) | General Autonomy (GA) | .14*** (.03) | .46 | .89 | .21 | .79 |
| Perceived Competence (PC) | IAS | .41*** (.09) | .40 | .92 | .16 | .84 |
| Autonomous Regulation of PA (ARPA) | GA | .38*** (.10) | .27 | .78 | .40 | .60 |
| | IAS | 1.01* (.40) | .22 | | | |
| | PC | 1.58*** (.34) | .35 | | | |
| Controlled Regulation of PA (CRPA) | GC | .32*** (.06) | .52 | .85 | .28 | .72 |
| Self-Efficacy for PA (SE) | PC | .77*** (.11) | .54 | .62 | .62 | .38 |
| | ARPA | .12*** (.02) | .37 | | | |
| | CRPA | -.08* (.04) | -.12 | | | |
| Planning (PL) | SE | .24*** (.06) | .29 | .75 | .44 | .56 |
| | ARPA | .12*** (.02) | .44 | | | |
| PA Intentions (INT) | PAB-B | -.03[ns] (.02) | -.09 | .72 | .49 | .51 |
| | PL | .74*** (.14) | .38 | | | |
| | ARPA | .19*** (.04) | .38 | | | |

Note. [α]Robust statistics based on ML estimations; values in parentheses are standard errors. D, disturbance term associated with endogenous variable. *p< .05; ***p<.001.

Table 8

Standardized Maximum Likelihood Estimates of the Direct, Indirect and Total Effects of Causal Constructs on Endogenous Constructs of the Final Model of Physical Activity Intentions (Study 1)

| | Endogenous Construct | | | | | | |
|---|---|---|---|---|---|---|---|
| Causal Construct | IAS | PC | ARPA | CRPA | SE | PL | INT |
| General Autonomy (GA) | | | | | | | |
| Direct Effect | .46*** | | .27*** | | | | |
| Indirect Effect | | .18*** | .16*** | | .26*** | .27*** | .27*** |
| Total Effect | .46*** | .18*** | .44*** | | .26*** | .27*** | .27*** |
| General Control (GC) | | | | | | | |
| Direct Effect | | | | .52*** | | | |
| Indirect Effect | | | | | -.06* | -.02$^{ns}$ | -.01$^{ns}$ |
| Total Effect | | | | .52*** | -.06* | -.02$^{ns}$ | -.01$^{ns}$ |
| Interpersonal Autonomy Support (IAS) | | | | | | | |
| Direct Effect | | .40*** | .22* | | | | |
| Indirect Effect | | | .14*** | | .34*** | .26*** | .24*** |
| Total Effect | | .40*** | .36*** | | .34*** | .26*** | .24*** |
| Perceived Competence (PC) | | | | | | | |
| Direct Effect | | | .35*** | | .54*** | | |
| Indirect Effect | | | | | .13*** | .35*** | .27*** |
| Total Effect | | | .35*** | | .66*** | .35*** | .27*** |

(table continues)

Table 8 (cont'd)

| | Endogenous Construct | | | | | | |
|---|---|---|---|---|---|---|---|
| Causal Construct | IAS | PC | ARPA | CRPA | SE | PL | INT |
| Autonomous Regulation of PA (ARPA) | | | | | | | |
| Direct Effect | | | | | .37*** | .44*** | .38*** |
| Indirect Effect | | | | | | .11** | .21*** |
| Total Effect | | | | | .37*** | .55*** | .59*** |
| Controlled Regulation of PA (CRPA) | | | | | | | |
| Direct Effect | | | | | -.12* | | |
| Indirect Effect | | | | | | -.04$^{ns}$ | -.01$^{ns}$ |
| Total Effect | | | | | -.12* | -.04$^{ns}$ | -.01$^{ns}$ |
| Self-Efficacy for PA (SE) | | | | | | | |
| Direct Effect | | | | | | .29*** | |
| Indirect Effect | | | | | | | .11** |
| Total Effect | | | | | | .29*** | .11** |
| Planning (PL) | | | | | | | |
| Direct Effect | | | | | | | .38*** |
| Indirect Effect | | | | | | | |
| Total Effect | | | | | | | .38*** |
| PA Behaviour at Baseline (PAB-B) | | | | | | | |
| Direct Effect | | | | | | | -.09$^{ns}$ |
| Indirect Effect | | | | | | | |
| Total Effect | | | | | | | -.09$^{ns}$ |

Note. The total effect is not always the exact sum of the direct plus indirect effects due to rounding-off to two decimal places.
N= 200. *p< .05; **p<.01; ***p<.001.

Table 9

Baseline Characteristics of All Study Participants and By Gender (Study 2)

| | All N=768 | Men n=580 | Women n=188 | p-value |
|---|---|---|---|---|
| Diagnosis | | | | |
| MI % | 36.8 % | 36.6 % | 37.8 % | .94 |
| PTCA % | 36.7 % | 36.7 % | 36.7 % | .94 |
| CABG % | 26.4 % | 26.7 % | 25.5 % | .94 |
| Age, M (SD) | 61.4 (10.2) | 61.0(10.1) | 62.8 (10.2) | .04 |
| Years of Education, M (SD) | 12.9 (3.6) | 13.2 (3.7) | 12.1 (2.9) | <.001 |
| Employment Status | | | | |
| Working Full-Time % | 33.6 % | 37.6 % | 21.3 % | <.001 |
| Working Part-Time % | 6.8 % | 5.9 % | 9.6 % | <.001 |
| Unemployed/Retired % | 59.6 % | 56.6 % | 69.1 % | <.001 |
| Married or Living Together % | 80.3 % | 86.4 % | 61.5 % | <.001 |
| General Motivation Index, M (SD) | 10.96 (7.4) | 11.4 (7.2) | 9.7 (8.1) | .01 |
| Physical Activity Behaviour (LSI), M (SD) | 23.1 (20.0) | 25.0 (20.7) | 17.4 (16.5) | <.001 |

Note. For continuous variables, Levene's test for equality of variance revealed significant differences for the pairs compared above for education, general motivation index and physical activity behaviour. Consequently, a t-test for groups with unequal variances was used for education (df=402.85), general motivation index (df=288.41) and physical activity behaviour (df=392.72). A t-test for groups with equal variances was performed for age (df=766). For discrete variables, the Pearson Chi-Square test was performed.
LSI = leisure score index of the Godin Leisure Time Exercise Questionnaire.
LSI = (3 x freq. mild exercise) + (5 x freq. of moderate exercise) + (9 x freq. strenuous exercise)
METs = metabolic equivalents = (3 x freq. mild exercise) + (5 x freq. of moderate exercise) + (9 x freq. strenuous exercise)

Table 10
Descriptive Statistics for the Factors and Indicators Included in the Motivational Model of the Regulation of Long-Term Physical Activity Behaviour (6 Months) (Study 2)

| Variable (N=768) | Mean | SD | Skewness | Kurtosis | Theoretical Range |
|---|---|---|---|---|---|
| General Autonomy | 46.07 | 9.32 | -.79 | 1.19 | 9/63 |
| GA-1 | 15.24 | 3.62 | -.74 | .83 | 3/21 |
| GA-2 | 14.93 | 3.46 | -.57 | .41 | 3/21 |
| GA-3 | 15.90 | 3.55 | -.91 | 1.00 | 3/21 |
| General Control | 31.14 | 9.81 | .23 | .00 | 9/63 |
| GC-1 | 10.14 | 3.91 | .24 | -.28 | 3/21 |
| GC-2 | 9.99 | 3.70 | .32 | -.12 | 3/21 |
| GC-3 | 11.01 | 3.79 | .02 | -.17 | 3/21 |
| Interpersonal Autonomy Support | 21.19 | 4.10 | -1.04 | 2.71 | 4/28 |
| IAS-1 | 5.79 | 1.34 | -1.72 | 3.30 | 1/7 |
| IAS-2 | 5.51 | 1.19 | -1.32 | 2.80 | 1/7 |
| IAS-3 | 5.69 | 1.29 | -1.67 | 3.42 | 1/7 |
| IAS-4 | 4.20 | 1.59 | -.31 | -.19 | 1/7 |
| Perceived Competence | 20.60 | 5.04 | -.83 | .96 | 4/28 |
| PC-1 | 5.40 | 1.32 | -.91 | 1.06 | 1/7 |
| PC-2 | 5.40 | 1.38 | -.96 | .92 | 1/7 |
| PC-3 | 4.49 | 1.47 | -.34 | .16 | 1/7 |
| PC-4 | 5.30 | 1.35 | -.91 | 1.03 | 1/7 |

(table continues)

Table 10 (cont'd)

| Variable | Mean | SD | Skewness | Kurtosis | Theoretical range |
|---|---|---|---|---|---|
| Autonomous Regulation of PA | 47.81 | 9.90 | -1.11 | 2.27 | 9/63 |
| ARPA-1 | 16.01 | 3.43 | -1.06 | 2.11 | 3/21 |
| ARPA -2 | 15.89 | 3.39 | -1.12 | 2.35 | 3/21 |
| ARPA -3 | 15.91 | 3.47 | -.94 | 1.60 | 3/21 |
| Controlled Regulation of PA | 24.97 | 6.80 | .40 | 1.39 | 9/63 |
| CRPA-1 | 9.34 | 2.84 | .11 | .92 | 3/21 |
| CRPA -2 | 6.94 | 2.73 | .90 | 1.89 | 3/21 |
| CRPA -3 | 8.69 | 2.61 | .28 | 1.24 | 3/21 |
| Self-Efficacy for PA | 19.45 | 4.97 | -.70 | .98 | 4/28 |
| SE-1 | 5.26 | 1.37 | -.90 | .94 | 1/7 |
| SE-2 | 4.88 | 1.28 | -.69 | .79 | 1/7 |
| SE-3 | 4.82 | 1.23 | -.54 | .83 | 1/7 |
| SE-4 | 4.49 | 1.32 | -.38 | .31 | 1/7 |
| Planning | 6.23 | 2.06 | -.42 | -.39 | 2/10 |
| PL-1 | 3.00 | 1.16 | -.38 | -.73 | 1/5 |
| PL-2 | 3.23 | 1.05 | -.55 | -.02 | 1/5 |
| PA Behaviour at Baseline | 23.13 | 20.02 | 1.27 | 2.15 | 0/∞ |
| PA-b mild | 9.07 | 7.72 | 1.08 | 4.45 | 0/∞ |
| PA-b mod | 9.42 | 10.85 | .98 | -.02 | 0/∞ |
| PA-b strenuous | 4.63 | 10.74 | 2.92 | 9.05 | 0/∞ |

(table continues)

Table 10 (cont'd)

| Variable | Mean | SD | Skewness | Kurtosis | Theoretical Range |
|---|---|---|---|---|---|
| PA Behaviour at 6 Months | 37.86 | 17.64 | .66 | 1.56 | 0/∞ |
| PA-6 mild | 12.43 | 5.95 | 1.30 | 8.91 | 0/∞ |
| PA-6 mod | 16.82 | 9.57 | .59 | 2.44 | 0/∞ |
| PA-6 strenuous | 8.69 | 10.28 | 2.22 | 6.06 | 0/∞ |

Table 11

Standardized Maximum Likelihood Estimates for the Ten Latent Factors of the Final Motivational Model of Physical Activity Behaviour (Study 2)

| | Latent Factors | | | |
|---|---|---|---|---|
| Items | General Autonomy (GA) | General Control (GC) | Interpersonal Autonomy Support (IAS) | Perceived Competence (PC) |
| GA-1 | .79 (.61) | | | |
| GA-2 | .82 (.58) | | | |
| GA-3 | .82 (.58) | | | |
| GC-1 | | .72 (.70) | | |
| GC-2 | | .81 (.59) | | |
| GC-3 | | .82 (.57) | | |
| IAS-1 | | | .50 (.87) | |
| IAS-2 | | | .79 (.61) | |
| IAS-3 | | | .76 (.65) | |
| IAS-4 | | | .45 (.89) | |
| PC-1 | | | | .92 (.38) |
| PC-2 | | | | .93 (.37) |
| PC-3 | | | | .82 (.58) |
| PC-4 | | | | .87 (.50) |

(table continues)

Table 11 (cont'd)

| | Latent Factors | | | |
|---|---|---|---|---|
| Items | Autonomous Regulation (ARPA) | Controlled Regulation (CRPA) | Self-Efficacy (SE) | Planning (PL) |
| ARPA-1 | .95 (.32) | | | |
| ARPA -2 | .93 (.38) | | | |
| ARPA -3 | .95 (.32) | | | |
| CRPA-1 | | .80 (.60) | | |
| CRPA -2 | | .75 (.66) | | |
| CRPA -3 | | .65 (.76) | | |
| SE-1 | | | .89 (.46) | |
| SE-2 | | | .92 (.38) | |
| SE-3 | | | .94 (.34) | |
| SE-4 | | | .83 (.56) | |
| PL-1 | | | | .82 (.58) |
| PL-2 | | | | .88 (.48) |

(table continues)

Table 11 (cont'd)

| | Latent Factors | |
|---|---|---|
| Items | PA Behaviour at Baseline (PA-b) | PA Behaviour at 6 Months (PA-6) |
| PA-b 1 | .34 (.94) | |
| PA-b 2 | .71 (.70) | |
| PA-b 3 | .32 (.95) | |
| PA-6 1 | | .25 (.97) |
| PA-6 2 | | .67 (.74) |
| PA-6 3 | | .39 (.92) |

Note. All standardized factor loadings are significant at $p<.001$.
Numbers in parentheses are standardized residuals.

Table 12

Pearson Correlations Among the Factors of the Regulation of Physical Activity Model (Study 2)

| Variable | GA | GC | IAS | PC | ARPA | CRPA | SE | PL | PAB-B | PAB-6 |
|---|---|---|---|---|---|---|---|---|---|---|
| General Autonomy (GA) | - | .35 | .16 | .17 | .25 | .10 | .20 | .17 | .06 | .04 |
| General Control (GC) | | - | -.01 | -.08 | -.06 | .23 | -.12 | -.04 | -.03 | -.08 |
| Interpersonal Autonomy Support (IAS) | | | - | .22 | .32 | .08 | .22 | .15 | .06 | .08 |
| Perceived Competence (PC) | | | | - | .62 | .05 | .79 | .46 | .23 | .28 |
| Autonomous Regulation of PA (ARPA) | | | | | - | .18 | .72 | .55 | .25 | .26 |
| Controlled Regulation of PA (CRPA) | | | | | | - | -.01 | .10 | -.08 | -.02 |
| Self-Efficacy for PA (SE) | | | | | | | - | .51 | .24 | .29 |
| Planning (PL) | | | | | | | | - | .22 | .26 |
| PA Behaviour at Baseline (PAB-B) | | | | | | | | | - | .25 |
| PA Behaviour at 6 Months (PAB-6) | | | | | | | | | | - |

Note. N=768. $r > .07$, $p < .05$; $r > .09$, $p \leq .01$.

Table 13a

Maximum Likelihood Estimates for the Structural Portion of the Hypothesized Motivational Model of Physical Activity Behaviour (Study 2)

| Variable | | Regression coefficients | | | | |
|---|---|---|---|---|---|---|
| Endogenous | Predictor | Unstandardized[α] | Standardized | D | $R^2$ | $1-R^2$ |
| Interpersonal Autonomy Support (IAS) | General Autonomy (GA) | .07*** (.01) | .29 | .97 | .07 | .93 |
| | General Control (GC) | -.03** (.01) | -.14 | | | |
| Perceived Competence (PC) | IAS | .37*** (.08) | .20 | .98 | .04 | .96 |
| Autonomous Regulation of PA (ARPA) | GA | .14*** (.04) | .12 | .71 | .50 | .50 |
| | IAS | 1.03*** (.18) | .21 | | | |
| | PC | 1.60*** (.08) | .61 | | | |
| Controlled Regulation of PA (CRPA) | GC | .25*** (.04) | .31 | .95 | .10 | .90 |
| | IAS | -.02 (.15) | -.01 | | | |
| | PC | .02 (.08) | .01 | | | |
| Self-Efficacy for PA (SE) | PC | .56*** (.03) | .57 | .46 | .78 | .22 |
| | ARPA | .15*** (.01) | .40 | | | |
| | CRPA | -.07*** (.01) | -.12 | | | |
| Planning (PL) | SE | .22*** (.04) | .28 | .77 | .41 | .59 |
| | ARPA | .12*** (.02) | .40 | | | |
| | CRPA | .02 (.02) | .05 | | | |
| PA Behaviour at 6 Months (PAB-6) | PAB-B | .17** (.06) | .31 | .86 | .26 | .74 |
| | PL | .42** (.14) | .27 | | | |
| | ARPA | .08* (.04) | .18 | | | |
| | CRPA | -.05 (.04) | -.07 | | | |

Note. [α]Values in parentheses are standard errors. D, disturbance term associated with endogenous variable. *p< .05; **p<.01.

Table 13b

Maximum Likelihood Estimates for the Structural Portion of the Final Motivational Model of Physical Activity Behaviour (Study 2)

| Variable | | Regression coefficients | | | | |
|---|---|---|---|---|---|---|
| Endogenous | Predictor | Unstandardized[α] | Standardized | D | $R^2$ | $1-R^2$ |
| Interpersonal Autonomy Support (IAS) | General Autonomy (GA) | .07** (.01) | .29 | .97 | .07 | .93 |
| | General Control (GC) | -.03* (.01) | -.14 | | | |
| Perceived Competence (PC) | IAS | .37** (.08) | .20 | .98 | .04 | .96 |
| Autonomous Regulation of PA (ARPA) | GA | .14** (.04) | .12 | .71 | .50 | .50 |
| | IAS | 1.03** (.17) | .21 | | | |
| | PC | 1.60** (.08) | .61 | | | |
| Controlled Regulation of PA (CRPA) | GC | .25** (.04) | .31 | .95 | .10 | .90 |
| Self-Efficacy for PA (SE) | PC | .56** (.03) | .57 | .46 | .78 | .22 |
| | ARPA | .15** (.01) | .40 | | | |
| | CRPA | -.06** (.01) | -.12 | | | |
| Planning (PL) | SE | .20** (.04) | .25 | .77 | .41 | .59 |
| | ARPA | .12** (.02) | .42 | | | |
| PA Behaviour at 6 Months (PAB-6) | PAB-B | .18* (.06) | .32 | .86 | .26 | .74 |
| | PL | .42* (.14) | .26 | | | |
| | ARPA | .08* (.04) | .18 | | | |

Note. [α]Values in parentheses are standard errors. D, disturbance term associated with endogenous variable. *p< .01; **p<.001.

Table 14

Direct, Indirect and Total Effects of Causal Constructs on Endogenous Constructs of the Final Motivational Model of Physical Activity Behaviour (Study 2)

| Causal Construct | Endogenous Construct | | | | | | |
|---|---|---|---|---|---|---|---|
| | IAS | PC | ARPA | CRPA | SE | PL | PAB-6 |
| General Autonomy (GA) | | | | | | | |
| Direct Effect | .29*** | | .12*** | | | | |
| Indirect Effect | | .06*** | .10*** | | .12*** | .12*** | .07*** |
| Total Effect | .29*** | .06*** | .22*** | | .12*** | .12*** | .07*** |
| General Control (GC) | | | | | | | |
| Direct Effect | -.14** | | | .31*** | | | |
| Indirect Effect | | -.03* | -.05** | | -.07*** | -.04** | -.02* |
| Total Effect | -.14** | -.03* | -.05** | .31*** | -.07*** | -.04** | -.02* |
| Interpersonal Autonomy Support (IAS) | | | | | | | |
| Direct Effect | | .20*** | .21*** | | | | |
| Indirect Effect | | | .12*** | | .25*** | .21*** | .11*** |
| Total Effect | | .20*** | .34*** | | .25*** | .21*** | .11*** |
| Perceived Competence (PC) | | | | | | | |
| Direct Effect | | | .61*** | | .57*** | | |
| Indirect Effect | | | | | .24*** | .46*** | .23*** |
| Total Effect | | | .61*** | | .81*** | .46*** | .23*** |
| Autonomous Regulation of PA (ARPA) | | | | | | | |
| Direct Effect | | | | | .40*** | .42*** | .18* |
| Indirect Effect | | | | | | .10** | .14** |
| Total Effect | | | | | .40*** | .52*** | .31*** |

(table continues)

Table 14 (cont'd)

| Causal Construct | Endogenous Construct | | | | | | |
|---|---|---|---|---|---|---|---|
| | IAS | PC | ARPA | CRPA | SE | PL | PAB-6 |
| Controlled Regulation of PA (CRPA) | | | | | | | |
| Direct Effect | | | | | -.12*** | | |
| Indirect Effect | | | | | | -.03*** | -.01* |
| Total Effect | | | | | -.12*** | -.03*** | -.01* |
| Self-Efficacy for PA (SE) | | | | | | | |
| Direct Effect | | | | | | .25*** | |
| Indirect Effect | | | | | | | .07* |
| Total Effect | | | | | | .25*** | .07* |
| Planning (PL) | | | | | | | |
| Direct Effect | | | | | | | .26** |
| Indirect Effect | | | | | | | |
| Total Effect | | | | | | | .26** |
| PA Behaviour at Baseline (PAB-B) | | | | | | | |
| Direct Effect | | | | | | | .32** |
| Indirect Effect | | | | | | | |
| Total Effect | | | | | | | .32** |

Note. The total effect is not always the exact sum of the direct plus indirect effects due to rounding-off to two decimal places.
N=768. *p< .05; **p<.01; ***p<.001.

Figure Captions

Figure 1. Conceptual model of physical activity regulation. This model depicts the hypothesized antecedents and consequences of self-determined versus non-self-determined motivations to be physically active; it draws relationships among general motivation, interpersonal support of autonomy, perceived competence, contextual motivation style (regulatory style), self-efficacy beliefs, planning, past physical activity habits, and regulation of physical activity behaviour.

Figure 2. Hypothesized model of physical activity intentions (Study 1). This model depicts the predicted relationships between general motivational orientation, interpersonal support of autonomy, perceived competence, regulatory style, self-efficacy beliefs, planning, and past physical activity habits in the prediction of physical activity intentions.

Figure 3. Test of the hypothesized model of physical activity intentions (Study 1). Estimates for paths with a full line are significant at the .05 or lower level; a dashed line specifies non-significant paths.

Figure 4. Final model of physical activity intentions (Study 1). All estimates are significant at the .05 or lower level.

Figure 5. Hypothesized model of physical activity behaviour (Study 2). This model depicts the predicted relationships between general motivational orientation, interpersonal support of autonomy, perceived competence, regulatory style, self-efficacy beliefs, planning, and past physical activity habits in the prediction of physical activity behaviour. Superscripts 1, 2, and 3 denote the respective time of assessment.

Figure 6: Participant flow and follow-up.

Figure 7. Test of the hypothesized model of physical activity behaviour (Study 2). Estimates for paths with a full line are significant at the .05 or lower level; a dashed line specifies non-significant paths. Superscripts 1, 2, and 3 denote the respective time of assessment.

Figure 8. Final model of physical activity behaviour (Study 2). All estimates are significant at the .05 or lower level. Superscripts 1, 2, and 3 denote the respective time of assessment.

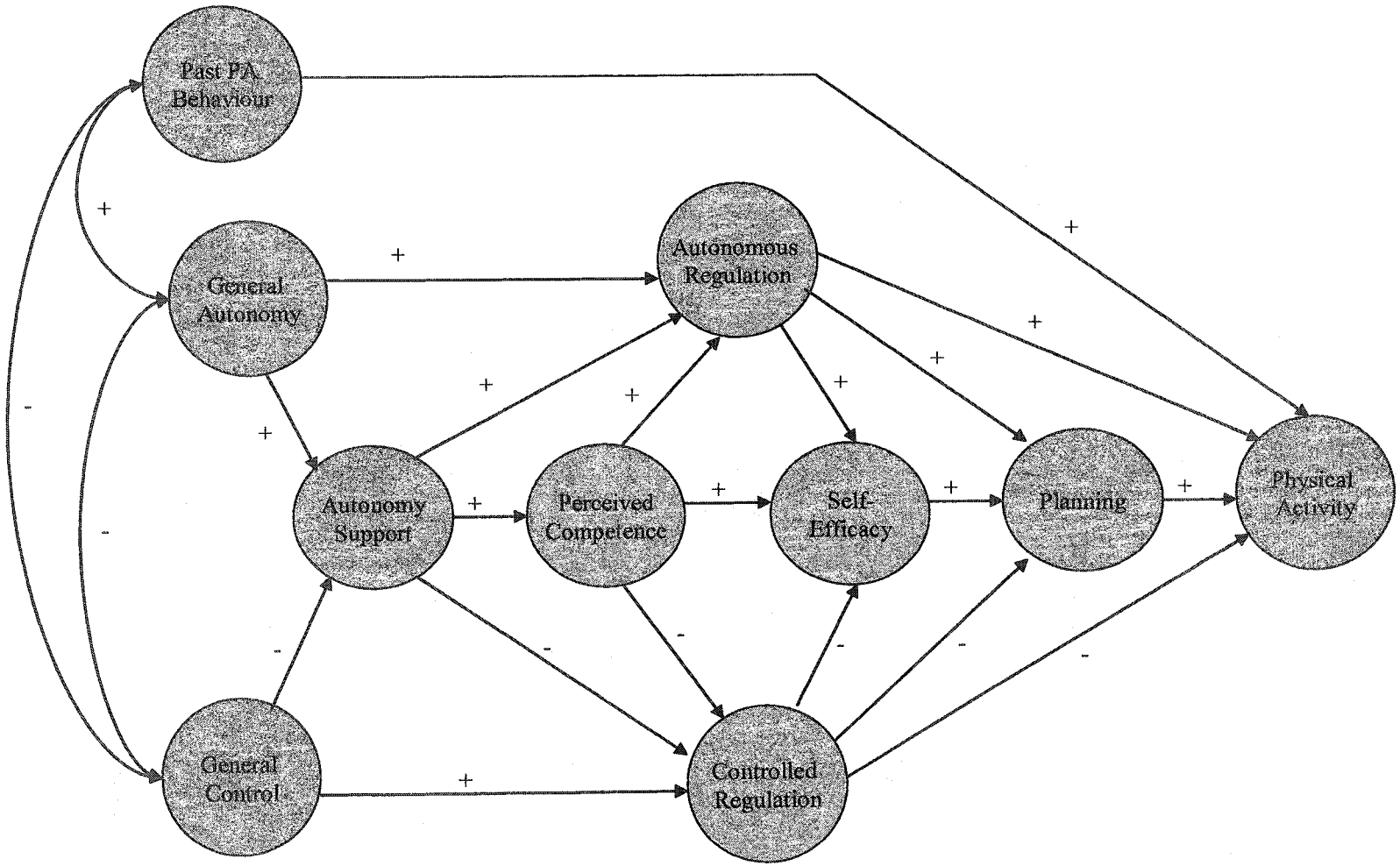
Past PA Behaviour
General Autonomy
Autonomous Regulation
Autonomy Support
Perceived Competence
Self-Efficacy
Planning
Physical Activity
General Control
Controlled Regulation
+
-

Figure 1.

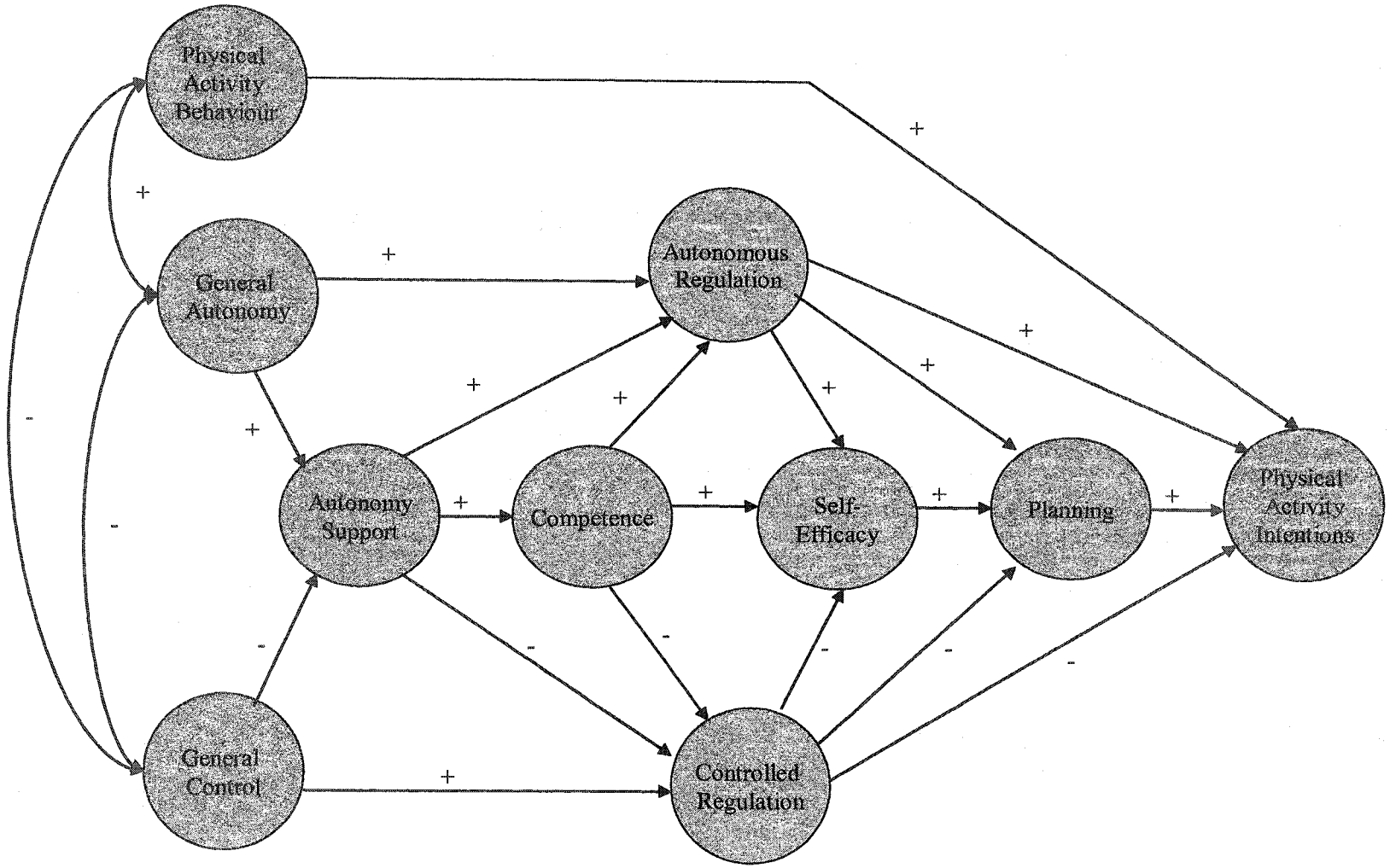
Physical Activity Behaviour
General Autonomy
Autonomous Regulation
Autonomy Support
Competence
Self-Efficacy
Planning
Physical Activity Intentions
General Control
Controlled Regulation
+
-

Figure 2.

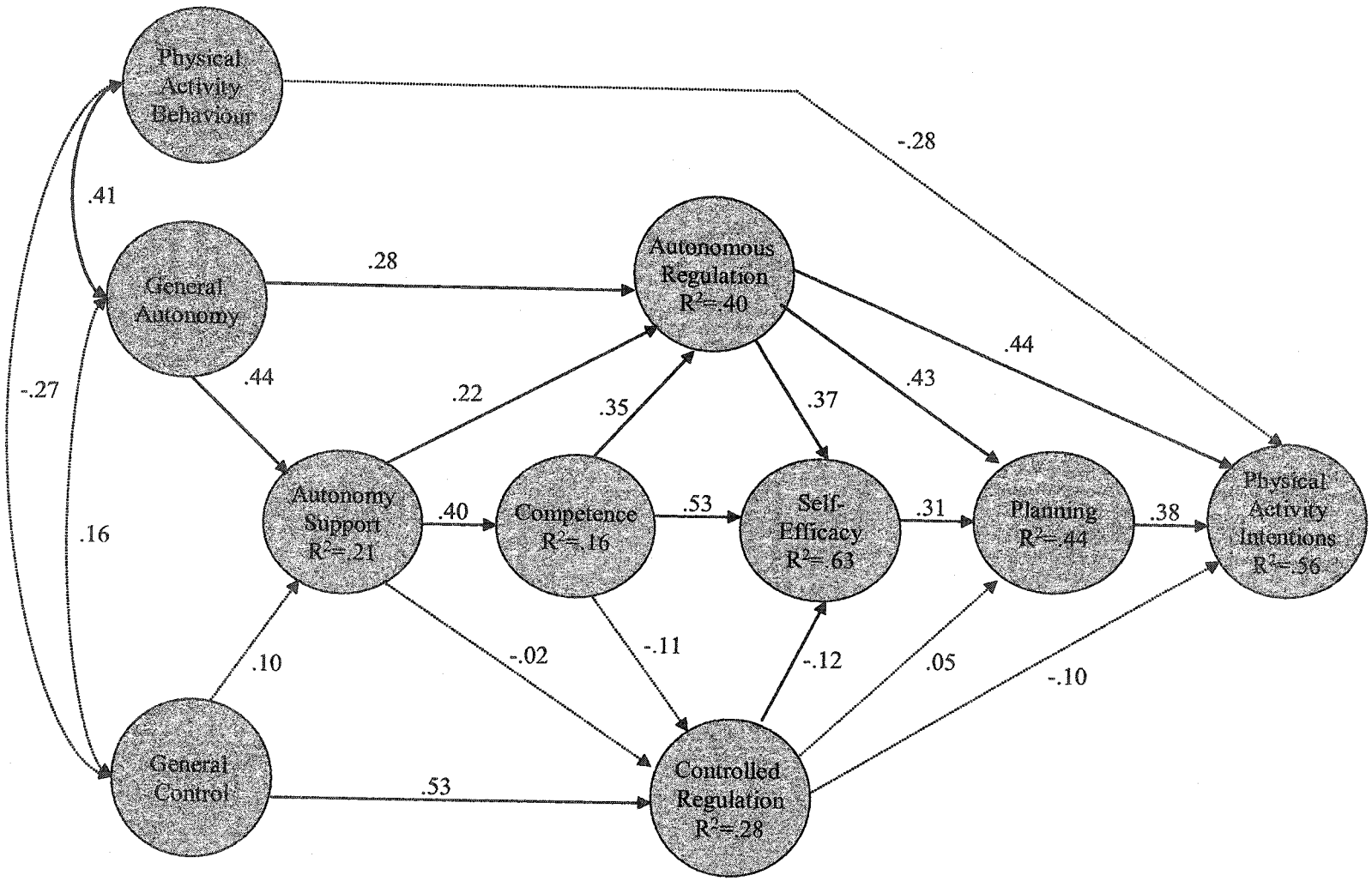
Physical Activity Behaviour
General Autonomy
Autonomous Regulation R²=.40
Autonomy Support R²=.21
Competence R²=.16
Self-Efficacy R²=.63
Planning R²=.44
Physical Activity Intentions R²=.56
General Control
Controlled Regulation R²=.28
-.28
.41
.28
-.27
.44
.22
.35
.37
.43
.44
.16
.40
.53
.31
.38
.10
-.02
-.11
-.12
.05
-.10
.53

Figure 3.

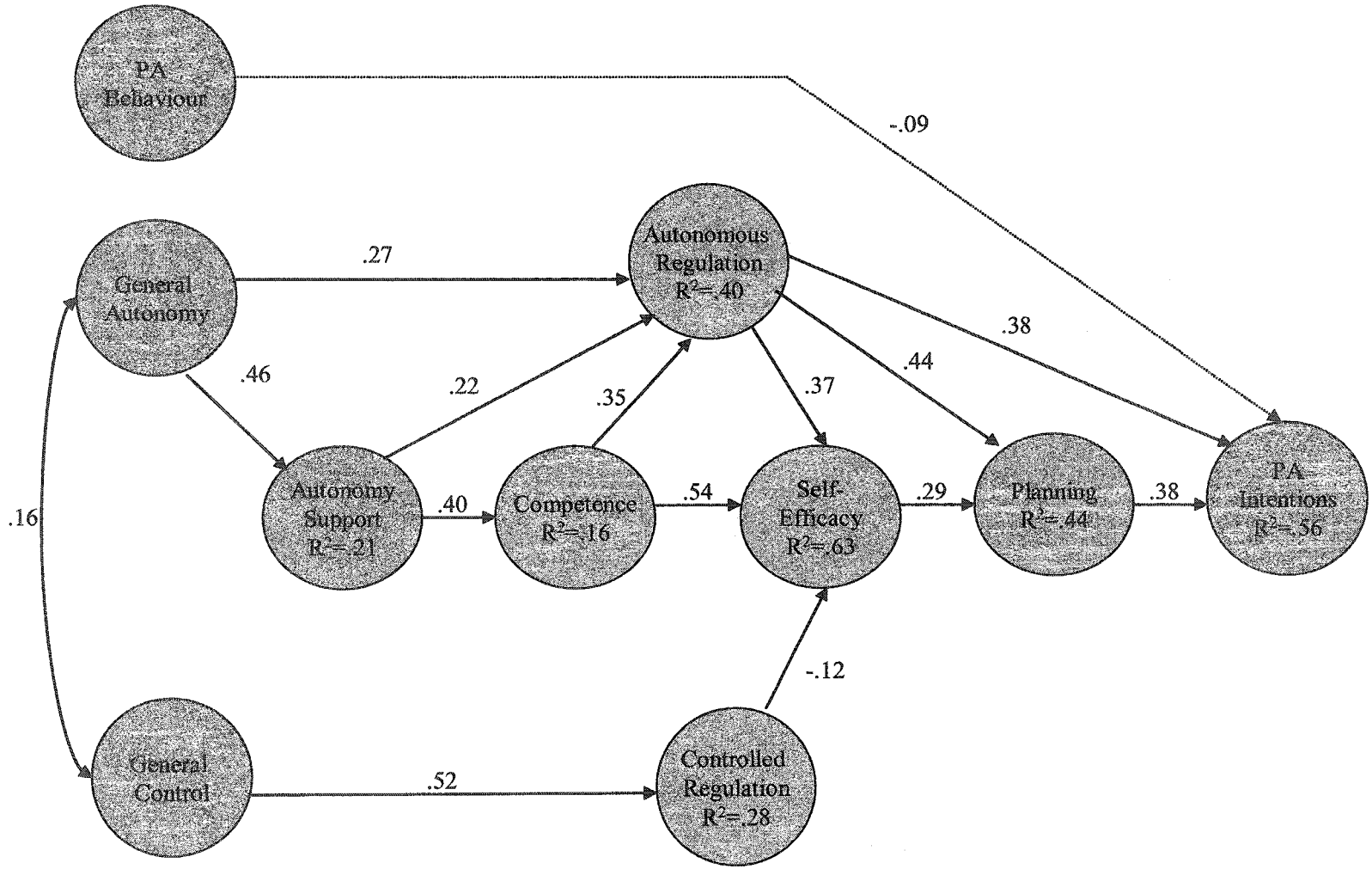
PA Behaviour
-.09
General Autonomy
.27
Autonomous Regulation $R^2$=.40
.38
.46
.22
.35
.44
.37
Autonomy Support $R^2$=.21
.40
Competence $R^2$=.16
.54
Self-Efficacy $R^2$=.63
.29
Planning $R^2$=.44
.38
PA Intentions $R^2$=.56
.16
-.12
General Control
.52
Controlled Regulation $R^2$=.28

Figure 4.

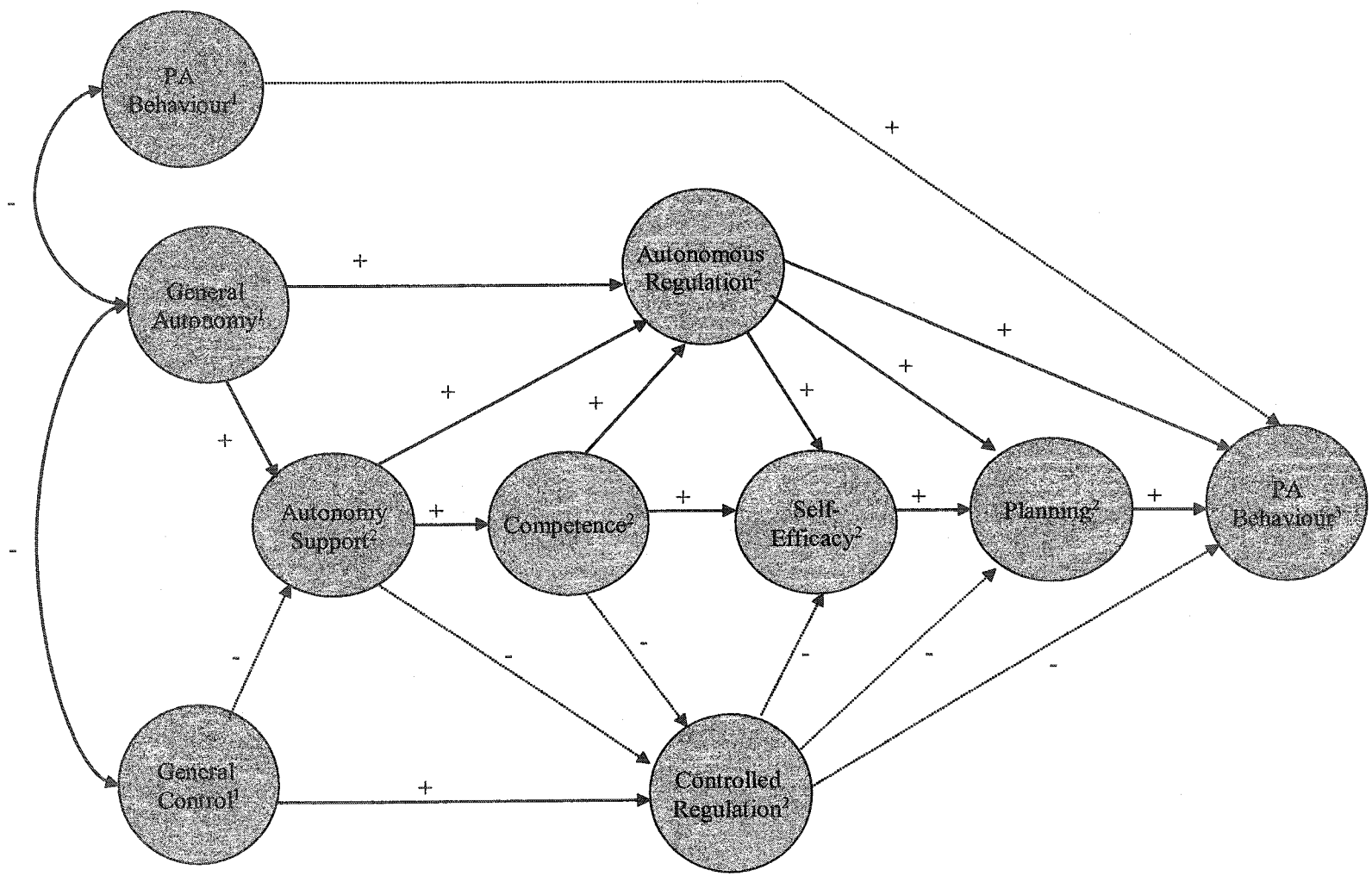
PA Behaviour1
General Autonomy1
Autonomous Regulation2
Autonomy Support2
Competence2
Self-Efficacy2
Planning2
PA Behaviour3
General Control1
Controlled Regulation2
+
-

Figure 5.

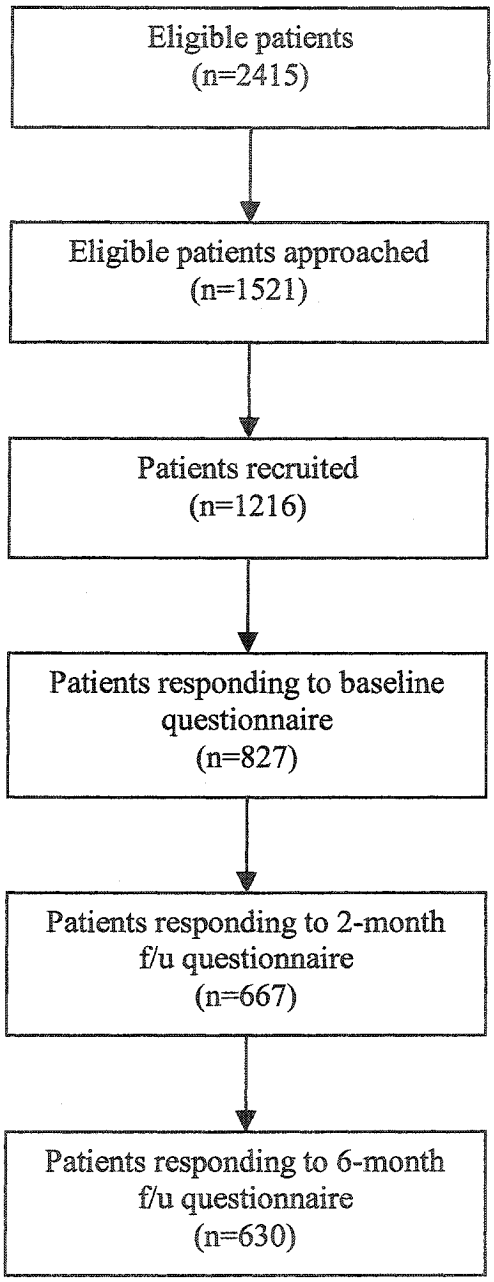
Eligible patients
(n=2415)
Eligible patients approached
(n=1521)
Patients recruited
(n=1216)
Patients responding to baseline
questionnaire
(n=827)
Patients responding to 2-month
f/u questionnaire
(n=667)
Patients responding to 6-month
f/u questionnaire
(n=630)

Figure 6.

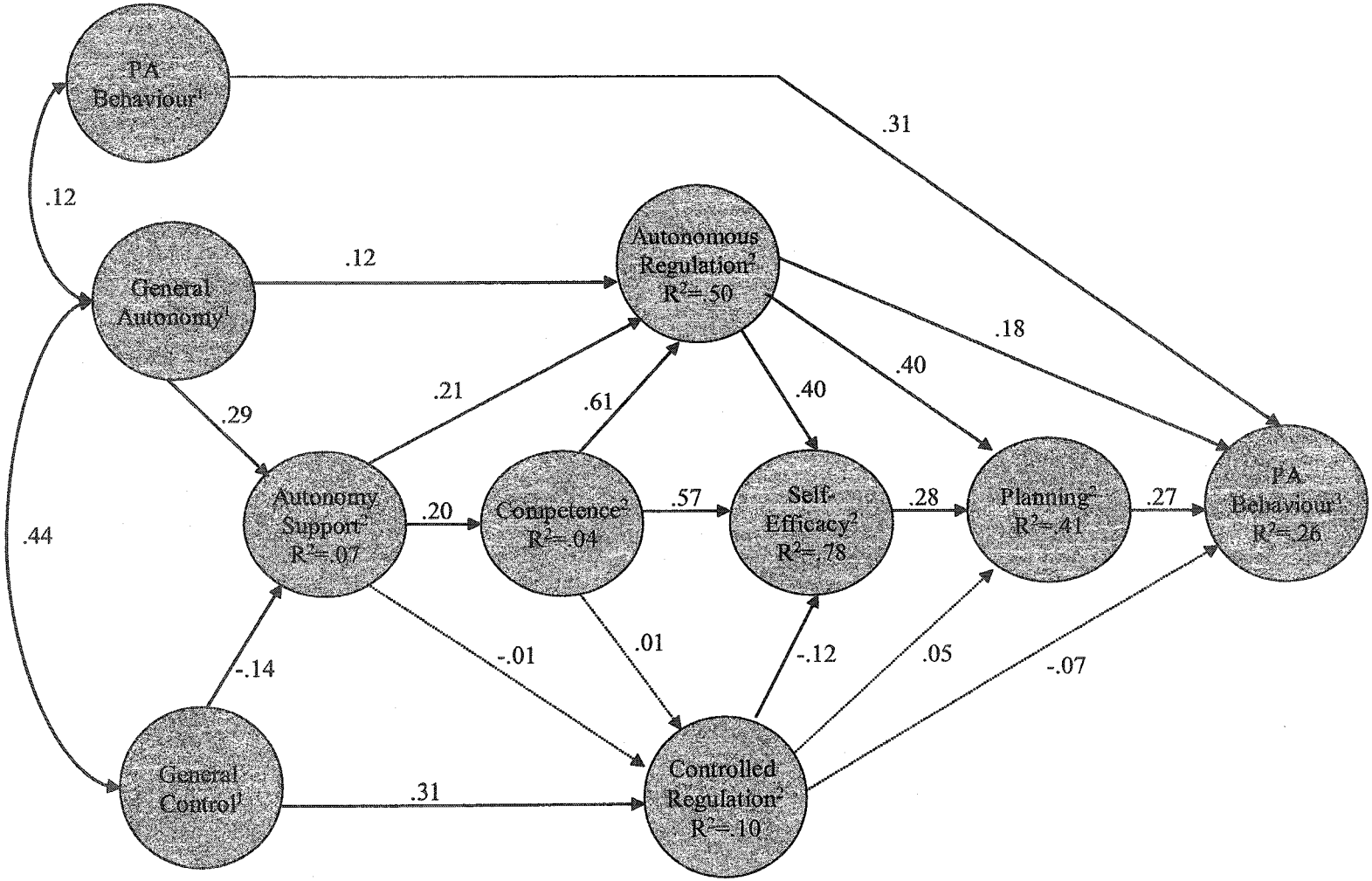
PA Behaviour[1]
General Autonomy[1]
General Control[1]
Autonomous Regulation[2] R²=.50
Autonomy Support[2] R²=.07
Competence[2] R²=.04
Self-Efficacy[2] R²=.78
Planning[2] R²=.41
PA Behaviour[3] R²=.26
Controlled Regulation[2] R²=.10
.31
.12
.12
.18
.40
.21
.61
.40
.29
.44
.20
.57
.28
.27
-.14
-.01
.01
-.12
.05
-.07
.31

Figure 7.

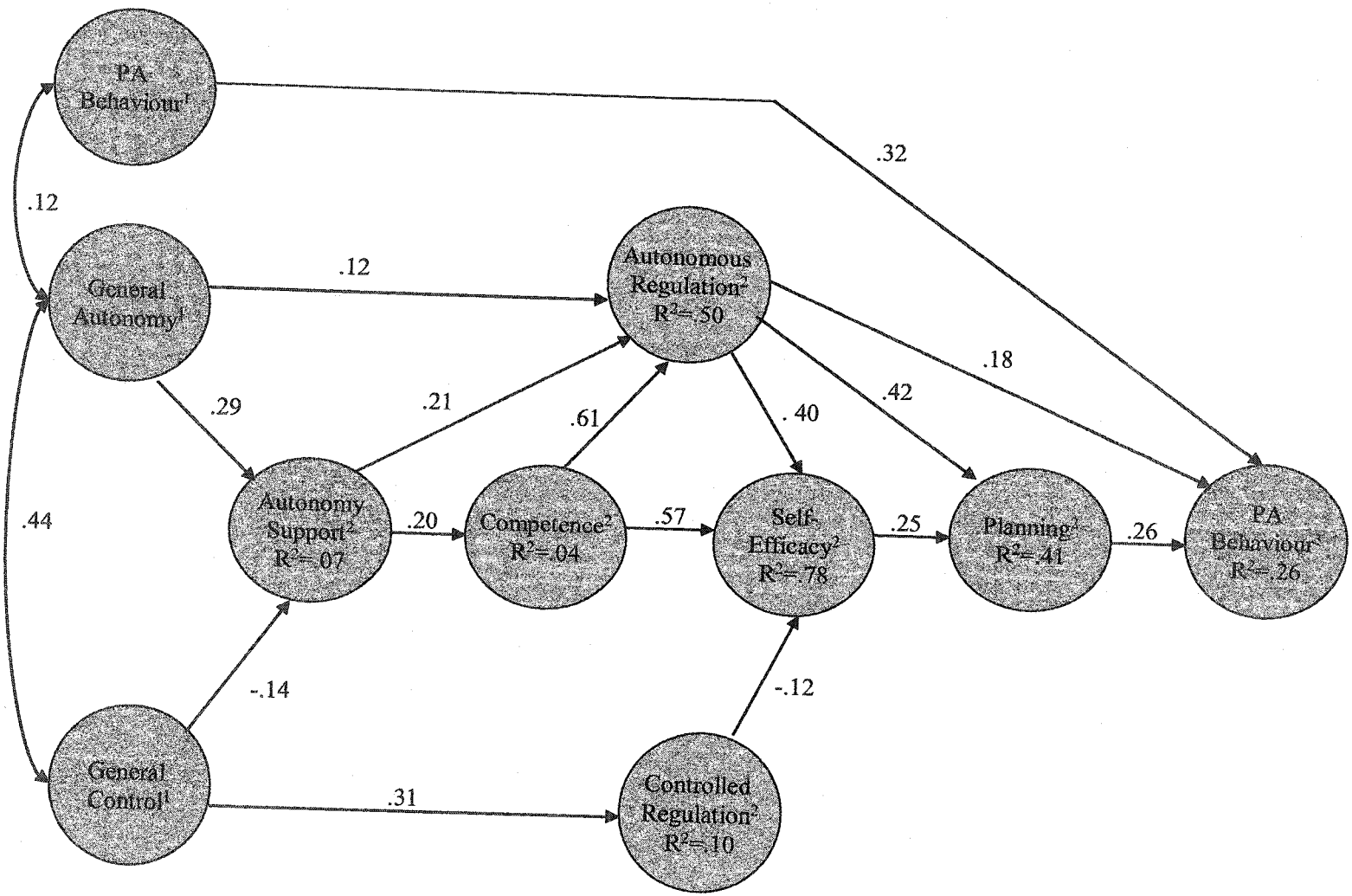
PA Behaviour¹
General Autonomy¹
General Control¹
Autonomous Regulation² R²=.50
Autonomy Support² R²=.07
Competence² R²=.04
Self-Efficacy² R²=.78
Planning² R²=.41
PA Behaviour² R²=.26
Controlled Regulation² R²=.10
.12
.32
.12
.29
.21
.61
.40
.42
.18
.44
.20
.57
.25
.26
-.14
-.12
.31

Figure 8.

# APPENDIX A
# QUESTIONNAIRE USED IN STUDIES 1 AND 2

PHYSICAL ACTIVITY HISTORY PRIOR TO HOSPITALIZATION

**This section asks about your physical activity level during the 6-MONTHS prior to your most recent hospitalization.**

**Considering a typical week in the last six months, how many times on average do you do the following kinds of leisure time physical activity for more than 15 minutes during your free time? Please write on each line the appropriate number of times you engaged in the different kinds of leisure time physical activity described in the table below. If you have not participated in any leisure time physical activity, please indicate this with a 0.**

| Intensity of Physical Activity | TIMES PER WEEK |
|---|---|
| ***Mild Exercise*** ➔<br>(Minimal effort, no perspiration)<br><br>**Examples:** yoga, easy walking, golf, etc. | _____ |
| ***Moderate Exercise*** ➔<br>(not exhausting, light perspiration)<br><br>**Examples:** brisk walking, leisure or recreational sports, etc. | _____ |
| ***Strenuous Exercise*** ➔<br>(heart beats rapidly, sweating)<br><br>**Examples:** running, jogging, aerobic dance, competitive sports (soccer, basketball, swimming, etc.). | _____ |

## GENERAL MOTIVATION

**Please indicate to what extent each of the following statements corresponds generally to the reasons why you do different things.**

| Not agree at all 1 | Very slightly agree 2 | Slightly agree 3 | Moderately agree 4 | Mostly agree 5 | Strongly agree 6 | Completely agree 7 |
|---|---|---|---|---|---|---|

*IN GENERAL, I DO THINGS . . .*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. ... because I do not want to disappoint certain people. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. ... in order to help myself become the person I aim to be. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. ... because they represent who I am. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. ... even though I do not see the benefit in what I am doing. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. ... because I want other people to see me in a positive way. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. ... because I chose them as a way to reach my goals. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. ... for the pleasure of learning something new. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. ... because otherwise I would feel guilty for not doing them. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9.... because they are in line with my main beliefs. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10.... even though it does not make a difference whether I do them or not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. ... for the pleasant feelings I get while I am doing them. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. ... to show others what I am capable of. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. ... because I force myself to do them. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14.... because of the satisfaction I feel in trying to excel in what I do. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. ... even though I do not have a good reason for doing them. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. ... because I choose to make a commitment to what is important to me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17. ... because I would be upset with myself if I did not do them. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18. ... because they reflect what I value most in life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**REASONS FOR BEING PHYSICALLY ACTIVE**

**Please indicate the extent to which each of the following reasons for doing physical activity applies to you using the scale below.**

**I am trying to be physically active (or would start to be) because...**

| | Not at all True | | | Somewhat True | | | Completely True |
|---|---|---|---|---|---|---|---|
| 1. I enjoy my exercise sessions. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. I feel guilty when I don't exercise. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Other people say I should. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Healthy activity is part of my life goals. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. I am not even trying because I feel that I would be wasting my time. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Exercising is fun. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I value the benefits of exercise. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Honestly, I don't know why I bother. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. I feel ashamed when I miss an exercise session. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Others will not be pleased with me if I don't. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Regular physical activity is very important for many aspects of my life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. I really don't think about being or becoming physically active. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. I feel under pressure from my friends/family to exercise. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. It makes sense to me to exercise regularly. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. Regular physical activity is part of the way I have chosen to live my life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16. I find exercise a pleasurable activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17. I feel bad about myself when I haven't exercised in a while. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18. It is a good way to improve my health. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**Interpersonal Autonomy Support**

To what extent do each of the following statements correspond to your interactions with the people in your life (e.g., partner/spouse, children, parents, friends, health professionals, work colleagues) regarding your **health behaviours**.

***People in my life...***

| | ***Never*** | | | | | | ***Always*** |
|---|---|---|---|---|---|---|---|
| 1. Provide me with lots of opportunities to make my own decisions in what I do. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Openly respect my thoughts and feelings although theirs may be different. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Encourage me to be myself. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Ask me what I think before giving me their opinion when I ask them to help me with problem | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**GENERAL CONFIDENCE IN PHYSICAL ACTIVITY ABILITIES (STUDY 1)**
*(Items used to assess perceived competence in Study 1)*

**Please use the 7-point scale provided to respond to each question.**

**a) How much control do you have over whether you engage in regular physical activity?**

No control at all — Complete Control

| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**b) If I wanted to, I could easily engage in regular physical activity.**

Strongly disagree — Strongly agree

| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**c) For me to engage in regular physical activity is….**

Extremely Difficult — Extremely Easy

| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**GENERAL CONFIDENCE IN PHYSICAL ACTIVITY ABILITIES (STUDY 2)**
*(Perceived competence scale used in Study 2)*

**The following questions ask about how competent you feel about doing physical activity?**

**a) I feel competent in my ability to successfully complete an exercise session.**

| Do Not Agree at all | | | Moderately Agree | | | Completely Agree |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**b) I feel capable of engaging in regular physical activity.**

| Do Not Agree at all | | | Moderately Agree | | | Completely Agree |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**c) I feel capable of completing challenging exercises.**

| Do Not Agree at all | | | Moderately Agree | | | Completely Agree |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**d) I feel competent in the exercises I attempt.**

| Do Not Agree at all | | | Moderately Agree | | | Completely Agree |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## BELIEFS ABOUT BEING PHYSICALLY ACTIVE

**The following questions ask about your confidence in being physically active under various circumstances.**

**Please indicate how confident you are that you will be able to engage in regular physical activity over the next 4 weeks even ...**

**a. When you have many demands at work or many home duties.**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**b. When you are feeling depressed?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**c. When you are feeling anxious or stressed?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**d. When you become bored with the activities?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**e. If you cannot notice improvements in your fitness?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**f. When you feel a little tired?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**g. After recovering from illness (e.g., flu, heart condition) or injury that caused you to stop exercising?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**h. When you feel physical discomfort when you exercise?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**i. During bad/uncomfortable weather (e.g., rain, snow, humidity)?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**j. If you have to do it by yourself?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**k. When there are other more interesting things to do?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**l. Without support from family or friends?**

| Not at all Confident | | | Moderately Confident | | | Completely Confident |
|---|---|---|---|---|---|---|
| O | O | O | O | O | O | O |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**PLANNING**

1. **Do you tend to follow a regular physical activity routine (e.g., exercise at the same time of day) or do your physical activity habits tend to differ from week to week?**
   - ❍ Never follow routine (differs from day to day)
   - ❍ Seldom follow a routine
   - ❍ Sometimes follow a routine
   - ❍ Most of the time I follow a routine
   - ❍ Always follow a regular routine (same time everyday)

2. **To what extent do you make specific plans to be physically active (i.e. when, where, how)?**
   - ❍ Never plan my physical activity
   - ❍ Seldom plan my physical activity
   - ❍ Sometimes plan my physical activity
   - ❍ Most of the time I plan my physical activity
   - ❍ Always plan my physical activity

**INTENTIONS TO BE PHYSICALLY ACTIVE**

**1. Please state how much you agree with the following statements.**

**a) I intend to exercise regularly over the next month**

| Do not Agree At All | | | | | | Completely Agree |
|---|---|---|---|---|---|---|
| 1O | 2O | 3O | 4O | 5 O | 6 O | 7O |

***b) I intend to exercise regularly over the next six months***

| Do not Agree At All | | | | | | Completely Agree |
|---|---|---|---|---|---|---|
| 1O | 2O | 3O | 4O | 5 O | 6 O | 7O |

**CURRENT PHYSICAL ACTIVITY HABITS**
*(Instrument used to assess physical activity behaviour at 6 months)*

**Considering a typical week in the last six months, how many times on average do you do the following kinds of leisure time physical activity for more than 15 minutes during your free time? Please write on each line the appropriate number of times you engaged in the different kinds of leisure time physical activity described in the table below. If you have not participated in any leisure time physical activity, please indicate this with a 0.**

| Intensity of Physical Activity | TIMES PER WEEK |
|---|---|
| ***Mild Exercise*** ➔<br>(Minimal effort, no perspiration)<br><br>**Examples:** yoga, easy walking, golf, etc. | _____ |
| ***Moderate Exercise*** ➔<br>(not exhausting, light perspiration)<br><br>**Examples:** brisk walking, leisure or recreational sports, etc. | _____ |
| ***Strenuous Exercise*** ➔<br>(heart beats rapidly, sweating)<br><br>**Examples:** running, jogging, aerobic dance, competitive sports (soccer, basketball, swimming, etc.). | _____ |