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Determinants of Physical Activity Behaviour Change in a
Community-Based Sample of Middle-Aged Women:
Integrating Concepts from the Theory of Planned Behaviour and Self-Determination Theory

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**Determinants of Physical Activity Behaviour Change in a
Community-Based Sample of Middle-Aged Women: Integrating Concepts
from the Theory of Planned Behaviour and Self-Determination Theory**

by

John Kowal

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the Faculty of Graduate and Postdoctoral Studies

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A marathon is an endurance event requiring stamina, perseverance, and a capacity to tolerate discomfort. There is an inherent satisfaction in completing a marathon, especially in the moment one crosses the finish line filled with the experiential knowledge that the goal has been attained. In many ways, this is akin to the process of undertaking and completing a doctoral dissertation.

Any research project of this magnitude would not be realizable without the significant contributions of numerous individuals. First and foremost, I thank my thesis supervisor, Dr. Michelle Fortier, for her mentorship and friendship throughout this process. You have taught me a great deal, and this has nurtured my development, both professionally and personally.

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It is often said that a doctoral thesis is like a mistress in a relationship. In my case, it was merely a "big sea."

ABSTRACT

Despite numerous benefits associated with regular physical activity, the majority of North American women remain insufficiently active. Accordingly, researchers have examined a multitude of variables associated with women's physical activity participation. Two theoretical frameworks that may be extended to predict women's physical activity behaviour are the Theory of Planned Behaviour and Self-Determination Theory. This thesis examined physical activity behaviour change in a community based-sample of middle-aged women by integrating concepts from these two conceptual frameworks. Specific objectives were 1) to examine the relative influence of social support, TPB variables, and SDT variables on intentions to increase physical activity; 2) to assess the relative influence of intentions and motivation on physical activity behaviour change over time by testing mediating and moderating models; and 3) to examine relationships among barriers, environmental characteristics, and change in physical activity behavior. To these ends, two empirical investigations were conducted. In the first study, French-speaking women ($n=109$) completed a questionnaire package assessing the aforementioned variables. In the second study, English-speaking women ($n=149$) complete similar questionnaire packages at baseline and at six months follow-up. All women were recruited from community-based facilities, including community centres and fitness clubs. Overall, results demonstrated that attitudes, perceived behavioural control, subjective norms, and autonomous motivation were associated with intentions to increase physical activity. Intentions were also related to reported physical activity behaviour change over time. Among the most commonly reported barriers to physical activity

increase were daily activities and fatigue. Inactive women reported higher levels of barriers than women who remained active or increased their physical activity level over time. Environmental characteristics (e.g., enjoyable scenery and the presence of others exercising) were also associated with change in physical activity behaviour. Collectively, results support the utility of integrating concepts from different theoretical frameworks as a means of understanding physical activity behaviour change and physical activity behaviour change intentions. Findings also suggest a number of ways in which physical activity behaviour change could be fostered in middle-aged women.

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CHAPTER I

INTRODUCTION

Over the past several decades, there has been a preponderance of published research on a wide range of health behaviours, both of a health comprising and health promoting nature. One health behaviour that has been of particular interest is physical activity. Indeed, the positive impact of physical activity on a variety of chronic health conditions has been well documented (Bouchard, Shepard, & Stephens, 1994; Dunn & Blair, 2002; Hardman & Stensel, 2003; Pate et al., 1995). Specifically, numerous investigations have demonstrated that physical activity is associated with a decrease in the incidence of cardiovascular and coronary heart disease (Blair, 1996; Colditz & Coakley, 1997; Cox, 1997; Folsom, Arnett, Hutchinson, Liao, Clegg, & Cooper, 1997) as well as osteoporosis, diabetes, and different forms of cancer (Drinkwater, Grimston, Raab-Cullen, & Snow-Harter, 1995; Pate et al., 1995; Swain, 1995; Wood, 1994).

Participation in physical activity has also been linked to a number of mental health benefits, including decreased levels of depressive symptomatology (Morgan, 1994), improved mood (Yeung, 1996), and physical and psychological well-being (Courneya, Keats, & Turner, 2000a). This has implications not only for individuals, but for society as a whole in terms of consequences associated with physical inactivity, such as increased risk of chronic diseases (Epstein, 1998; World Health Organization, 1997, 2003) and health care costs (Katzmarzyk, Gledhill, & Shephard, 2000).

Despite the link between physical activity and physical and mental health, recent

population-based data indicates that over half of adult women in North America are insufficiently active (Cameron, Craig, Stephens, & Ready, 2002; U.S. Department of Health and Human Services, 1996). Among middle-age and older Canadian women, it is estimated that only about fifteen percent are currently meeting physical activity recommendations (Craig & Cameron, 2004). This is of particular concern because of the physical activity benefits for women's health (Jones, Franks, Manson, Hoffman-Goetz, & Otis, 1998; Kramer & Wells, 1996; Manson et al., 1999). There is also consensus that women are largely understudied and at risk for developing a wide range of health problems (Ainsworth, 2000; Brownson, Eyler, King, Brown, Shyu, & Sallis, 2000; Merrill & Weed, 2001; U.S. Department of Health and Human Services, 1996).

Determinants of Physical Activity

To address this important social issue, researchers have examined *determinants* of physical activity behaviour (Glanz, Lewis, & Rimer, 1997; Marcus & Sallis, 1997). This line of inquiry has revealed that a wide range of variables, including those of a socio-demographic, physiologic, individual, interpersonal, and contextual nature, are important in this regard (see Sallis & Owen, 1999, 2002; Stokols, 1992; Trost, Owen, Bauman, Sallis, & Brown, 2002 for reviews), particularly among adult women (see Speck & Harrell, 2003 for a review). Specifically, from a physiological perspective, obesity has been consistently linked to physical inactivity (Brownson et al., 2000; King, Castro, Wilcox, Eyler, Sallis, & Brownson, 2000; Martinez-Gonzalez, Martinez, Hu, Gibney, & Kearney, 1999). Physical activity has been inversely related to demographic variables such as age, and women tend to be less active than men (King et al., 2000; Ruchlin &

Lachs, 1999; Scharff, Homan, Kreuter, & Brennan, 1999). Socioeconomic status (Ford et al., 1991; Lantz, House, Lepkowski, Williams, Mero, & Chen, 1998), education level (Steptoe et al., 2000), and ethnic background/culture appear particularly important for women's physical activity participation (Crespo, Smit, & Anderson, 2000; Sternfeld, Ainsworth, & Quesenberry, 1999). At an individual level, self-efficacy, barriers, and expected benefits are key psychological correlates of physical activity (Brownson et al., 2000; Sternfeld et al., 1999; Wilcox, Castro, King, Houseman, & Brownson, 2000).

Interpersonally, physical activity behaviour has been similarly related to physician influence, social support from peers, and social support from one's partner or family (Brownson et al., 2000; Chogahara, O'Brien Cousins, & Wankel, 1998; Sternfeld et al., 1999; Wilcox et al., 2000). Regarding the physical environment, location of residence, climate, and access to physical activity programs and facilities have been further associated with adults' physical activity participation (Bauman, Smith, Stoker, Bellew, and Booth, 1999; Booth, Owen, Bauman, Clavisi, & Leslie, 2000). A growing number of studies have also demonstrated relationships among these different levels of variables within an ecological framework (see Dzewaltowski, 1997; Sallis & Owen, 2002).

Although research in this area has been instrumental in identifying correlates of physical activity participation, many investigations have conceptualized physical activity as an all-or-nothing phenomenon. That is, they have compared across a variety of measures individuals who engage in physical activity with individuals who do not. In doing so, they fail to fully explicate the process of adopting, maintaining, and/or changing physical activity behaviour over time, and they may mask important individual

differences in this regard (Courneya, 1995). Thus, much remains unknown about how and why individuals and, in particular, middle-aged women, change their physical activity behaviour. Additional empirical work based on sound theoretical underpinnings is needed to advance a coherent understanding of physical activity *behaviour change*.

Some recent work has taken a systematic, theory-based approach to examining change in physical activity behaviour over time. Overall, studies in this area have shown that psychological, social, and environmental variables are associated with physical activity behaviour change (see Bock, Marcus, & Pinto, 2001; Glanz, Lewis, & Rimer, 1997; Sallis & Owen, 2002). Indeed, much of the research in this area stems from the seminal work of Prochaska and DiClemente (1983) in their formulation of the Transtheoretical Model (TTM). In this conceptual framework, an emphasis is placed on the degree to which individuals are prepared to change their health behaviour. It is posited that individuals progress through a series of stages as they contemplate, prepare for, change, and sustain their health behaviour. Moreover, the TTM specifically focuses on the decision-making of the individual, and, as such, it is often referred to as a model of intentional change (for a more comprehensive description of this model, see DiClemente & Prochaska, 1998). Over the past decade, a growing number of investigations have demonstrated the utility of this theoretical model in physical activity and other domains (see Adams & White, 2003; Nigg et al., 1999; Prochaska et al., 1994).

The Theory of Planned Behaviour

Another theoretical framework that has been useful for explaining why people

engage in physical activity, and a model that emphasizes intentional change, is the *Theory of Planned Behaviour* (TPB; Ajzen, 1985, 1991) (Figure 1). The basic premise of this theoretical model is that intention to perform a given behaviour is the primary determinant of that behaviour. Three conceptually distinct variables are posited to directly influence intention, namely *attitudes*, *perceived behavioural control*, and *subjective norms*. Attitudes reflect an individual's positive or negative evaluation of performing an activity. It refers to the degree to which an individual perceives a behaviour as favourable or unfavourable, and is determined by beliefs concerning the consequences of the behaviour as well as an evaluation of those consequences. Perceived behavioural control reflects an individual's perception of the ease or difficulty of performing a behaviour. In the present study, perceived behavioural control refers to the extent to which individuals believe they have control over their participation in physical activity. Subjective norms refer to an individual's perception of the social expectations associated with adopting a particular behaviour, that is, the perceived social pressure to engage or not in that behaviour. In this regard, the social context is posited to play a central role in determining intention to perform activities, such as physical activity. Thus, according to the TPB, intentions to engage in physical activity would be highest when individuals appraise this activity positively, perceive that significant others believe that they should engage in it, and perceive that their participation in physical activity is volitional or under their personal control.

Although attitudes, perceived behavioural control, and subjective norms are posited to directly influence intention which, in turn, is posited to directly influence

behaviour, for behaviours that are perceived as being outside of one's personal control, perceived behavioural control may directly impact behaviour, and not be mediated by intention. Stated differently, perceived behavioural control may directly impact behaviour when individuals do not perceive they have complete control over a given behaviour. This possibility is represented by the dotted arrow in Figure 1.

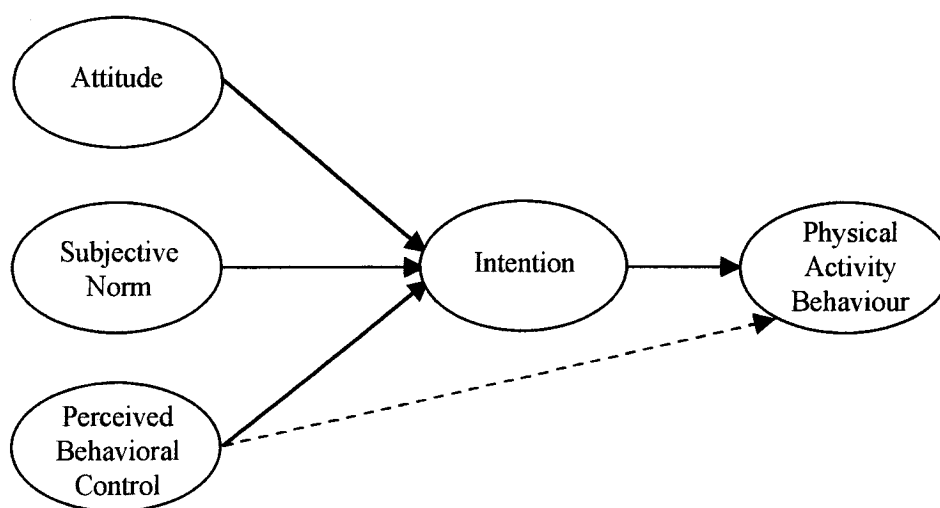


Figure 1. The theory of planned behaviour (Ajzen, 1985, 1991)

Empirical support for the TPB (Ajzen, 1985, 1991) in predicting health behaviour has been demonstrated in scores of investigations (Armitage & Conner, 2001; Blue, 1995; Godin & Kok, 1996; Hausenblas, Carron, & Mack, 1997; Sutton, 1998). Attitudes, perceived behavioural control, and subjective norms have all been significantly linked to intention which, in turn, has been significantly linked to numerous behaviours, including addictive behaviours (Collins & Ellickson, 2004; McMillan & Conner, 2003; Schgel, D'Avernas, Zanna, DeCourville, & Manske, 1992), clinical and screening

behaviours (Drossaert, Beor, & Seydel, 2003; Godin, Boyer, Duval, Fortin, & Nadeau, 1992), workplace health and safety behaviours (Sheeran & Silverman, 2003), eating behaviours (Sparks & Shepherd, 1992), ecological behaviours (Kaiser & Gutscher, 2003), and physical activity behaviour (Ajzen & Driver, 1992; Chatzisarantis & Biddle, 1998; Courneya, 1995; Courneya & Friedenreich, 1999; Courneya, Keats, & Turner, 2000b; Godin, Valois, & Lepage, 1993; Horne, 1994; Kimiecik, 1992; Rhodes & Courneya, 2003; Rhodes, Courneya, & Jones, 2003; Wankel, Mummery, Stephens, & Craig, 1994).

Collectively, these studies have demonstrated that attitudes, perceived behavioural control, and subjective norms account for between 30% and 50% of variance in behavioural intentions (Armitage & Conner, 2001; Godin & Kok, 1996; Sutton, 1998). In terms of effect size (see Cohen, 1992), this translates into a large effect for both attitudes ($ES=1.22$) and perceived behavioural control ($ES=.97$), and, depending on the statistical analysis employed, a medium to large effect for subjective norms ($ES=.56$) (Hausenblas et al., 1997). The proportion of variance in various health behaviours accounted for by intentions is somewhat lower, with estimates ranging between 19% to 38% (Sutton, 1998). In the physical activity literature, intentions have been shown to explain, on average, between 15% and 40% of variance in physical activity behaviour (Godin & Kok, 1996; Hausenblas et al., 1997).

More recently, the TPB (Ajzen, 1985, 1991) has been used to examine physical activity *behaviour change*. This has allowed for a more direct examination of how and why people adopt and maintain their physical activity behaviour. In theory, attitudes,

perceived behavioural control, and subjective norms should predict intentions which should, subsequently, predict behaviour change. Only a limited number of studies, however, have examined this possibility. For example, Courneya (1995) found that attitudes, perceived behavioural control, and subjective norms were significantly associated with physical activity intentions in a cross-sectional study of adult exercisers. Intentions, attitudes, and perceived behavioural control were significantly predictive of stage of readiness for regular physical activity. On a temporal basis, Courneya and colleagues (Courneya, Nigg, & Estabrooks, 2000; Courneya, Plotnikoff, Hotz, & Birkett, 2001) have further supported the utility of the TPB in examining exercise stages and exercise stage progression. In the context of cardiac rehabilitation, intentions have been found to significantly predict exercise adherence over time (Blanchard, Courneya, Rodgers, Daub, & Knapik, 2002).

In a similar vein, Sheeran, Conner, and Norman (2001) examined, on a temporal basis, health screening behaviours in adult men and women. They found that both intention and perceived behavioral control were significant predictors of attendance and frequency of attendance in a health screening clinic, however, they failed to find significant links between TPB variables and pattern of attendance. Based on this latter finding, it was concluded that the TPB is inadequate for explaining speed of initiation of behaviour or the maintenance of behaviour over time. It is important to note that Sheeran and colleagues did not directly assess *behaviour change*, but rather *pattern of attendance* at a health screening clinic. Thus, their conclusion that the TPB cannot explain health behaviour change is somewhat unfounded and appears worthy of further examination.

Moreover, because Sheeran and colleagues conducted their study in the context of health screening behaviour, it is unclear whether their findings apply to the physical activity domain. Past research has consistently shown that the TPB is a salient theoretical framework for examining physical activity behaviour, and it may indeed be germane for examining and understanding physical activity behaviour change.

Self-Determination Theory

Another variable that has been consistently shown to predict a wide range of behaviours, including health behaviours, is motivation. Although numerous motivational theories exist, *Self-Determination Theory* (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000) appears particularly useful for examining health behaviour change, because of its emphasis on human needs, motivational processes (e.g., self-regulation), and the social context. This theoretical framework has been well supported in a variety of contexts and with a wide range of populations (Deci & Ryan, 2002; Sheldon, Williams, & Joiner, 2003; Vallerand, 1997, 2001). According to SDT, there are two main types of motivation: *autonomous* or *self-determined* and *controlled* or *non self-determined*. From this vantage point, motivation refers to the “why?” of human behaviour. Autonomously motivated behaviours are performed out of choice and are regulated by the self. They may also be engaged in for pleasure and/or satisfaction. An example of this type of motivation is exemplified by women who choose to increase their current level of physical activity in order to improve their health or because they value this activity. By way of comparison, behaviours for which motivation is controlled are not performed out of choice, but rather are regulated by internal or introjected pressures and/or by external

forces. Women who attempt to increase their level of physical activity due to pressure from their spouse or physician would be motivated in a controlled fashion. Deci and Ryan predict that whereas autonomous motivation leads to positive outcomes, controlled motivation leads to negative outcomes.

Support for these predictions in the physical activity domain has been obtained in numerous studies (Frederick-Recascino, 2002; Vallerand, 1997, 2001; Vallerand & Losier, 1999). Specifically, autonomous motivation has been positively linked to physical activity persistence (Frederick, Morrison, & Manning, 1996; Pelletier, Fortier, Vallerand, & Brière, 2001; Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002), adherence (Fortier & Grenier, 1999; Ryan, Frederick, Leps, Rubio, & Sheldon, 1997), physical fitness (Wilson, Rodgers, Blanchard, & Gessell, 2003), and involvement (Biddle & Armstrong, 1992), and controlled motivation has been associated with sport dropout (Pelletier et al., 2001). Numerous studies have demonstrated the utility of SDT for understanding a wide range of health behaviours (Sheldon et al., 2003; Williams, 2002; Williams, Deci, & Ryan, 1998). It has also been argued that SDT is a highly relevant organizing framework for specifically examining physical activity in women because its focus on individual and social variables as well as its focus on relatedness (Landry & Solmon, 2002).

Studies examining physical activity behaviour change have demonstrated that elderly individuals in higher stages of change are more autonomously motivated than individuals in lower stages of change (Mullan & Markland, 1997). Individuals in the maintenance stage of change (i.e., who have changed their behaviour for at least six

months) have also reported higher levels of autonomous motivation than individuals in the action stage of change (i.e., who have changed their behaviour for less than six months) (Ingledeu, Markland, & Sheppard, 2003). Controlled motives have been associated with the initial adoption of physical activity, whereas autonomous motives have been associated with stage progression and maintenance of physical activity over time (Ingledeu, Markland, & Medley, 1998). There is additional evidence that autonomous physical activity motives are predictive of physical fitness level, and both of these variables can be enhanced over a 12-week exercise program (Wilson et al., 2003). In health domains, Williams, Grow, Freedman, Ryan, and Deci (1996) used SDT as a conceptual basis for predicting weight-loss and weight-loss maintenance. These researchers found that, over time, autonomous motivation was associated with greater weight loss than controlled motivation. More recently, Williams, McGregor, Zeldman, Freedman, and Deci (2004), in a longitudinal investigation of diabetes patients, revealed that change in autonomous motivation significantly predicted change in diabetes self-care and glycemic control. Similar findings have been obtained in terms of smoking cessation (Williams, Cox, Kouides, & Deci, 1999; Williams, Gagné, Ryan, & Deci, 2002). Collectively, these studies suggest that autonomous motivation plays an important role in promoting health behaviour, such as physically activity.

Deci and Ryan also posit the existence of a third type of motivation known as *amotivation*. According to these authors, amotivation is characterized by an absence of autonomous or controlled motivation, because individuals do not perceive they have control over their behaviour. In many respects, amotivation is conceptually similar to

learned helplessness (Abramson, Seligman, & Teasdale, 1978). More recent work by Pelletier, Dion, Tuson, and Green-Demers (1999) has identified four distinct types of amotivation (these different forms of amotivation will be described in the section on barriers to physical activity behaviour change).

In summary, it would appear that the TPB (Ajzen, 1985, 1991) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000) have the potential to shed light on women's ability to change their physical activity behaviour. In particular, there is initial evidence that intentions from the TPB and autonomous motivation from SDT are important determinants of physical activity behaviour change. Recently, some researchers have integrated concepts from the TPB and SDT to examine physical activity. Collectively, these studies have tested direct and indirect pathways between motivation, intentions, and physical activity behaviour. Consistent with the work of Vallerand (1997, 2001) in his conceptualization of the Hierarchical Model of Intrinsic and Extrinsic Motivation, a theoretical framework based largely on SDT, autonomous motivation has been found to significantly and directly predict physical activity intentions (Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003). Results of a meta-analytic review demonstrated that autonomous and controlled motives mediate the relationship between perceived competence and physical activity intentions (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003). It has also been shown that, over time, the motivation-physical activity behaviour relationship is mediated by intentions (Sarrazin et al., 2002). Specifically, autonomous motives were found to predict intention which, in turn, was found to predict physical activity dropout. Similar findings were obtained in an educational setting, where

low levels of autonomous motivation predicted intentions to drop out of high school, and intentions to drop out of high school predicted actual dropout behaviour (Vallerand, Fortier, & Guay, 1997). Collectively, motivation has been conceptualized in these studies as a predictor or antecedent of intention which, in turn, is conceptualized as a predictor of physical activity behaviour.

Another possibility is that motivation *moderates* the link between intention and physical activity behaviour change. That is, intention and motivation might interact to effect change in physical activity behaviour over time. In theory, it would be expected that individuals who are high in intentions and who are motivated in an autonomous manner would have a greater likelihood of increasing their level of physical activity than individuals who are low in intentions and/or who are motivated in a controlled fashion. A limited number of studies in physical activity settings have assessed this potential moderating effect. Chatzisarantis and Biddle (1998) compared participants motivated in an autonomous versus a controlled manner across TPB variables. Although no overall differences were obtained with regards to intention and attitude, the relationship between subjective norm and intention was positive in the controlled motivation group, whereas it was negative in the autonomous motivation group. Also, the link between perceived behavioural control and intention was significant in the autonomous motivation group only. Similarly, subjective norms were predictive of intentions in individuals motivated in a controlled fashion, but not in an autonomous fashion (Chatzisarantis, Biddle, & Meek, 1997). Further, intentions based on attitudes (a construct similar to autonomous motivation) were shown to be a stronger predictor of behaviour than intentions based on

subjective norms (a similar construct to controlled motivation) (Sheeran, Norman, & Orbell, 1999). In the educational domain, intentions and self-determination were found to interact in the prediction of studying behaviour over a two week period (Orbell, 2003). Thus, there is some preliminary support for the moderating effect of motivation on intentions and other TPB variables. Additional work is needed to further assess mediating versus moderating influences of intentions and motivation on change in physical activity behaviour.

Social Influences and the Theory of Planned Behaviour

As noted, numerous studies conducted in the physical activity realm have confirmed the hypothesized relationships of the TPB, demonstrating the direct impact of attitudes, perceived behavioural, and subjective norms on intention, and the direct influence of intention on behaviour (Armitage & Conner, 2001; Blue, 1995; Godin & Kok, 1996; Hausenblas et al., 1997). A number of investigations, however, have consistently shown that both attitude and perceived behavioural control are more strongly related to intention than subjective norms (Ajzen & Driver, 1992; Courneya, 1995; Dziewaltowski, Nobel, & Shaw, 1990; Godin et al., 1993; Horne, 1994; Kimiecik, 1992; Wankel et al., 1994). Moreover, in a meta-analysis, Hausenblas et al. (1997) revealed that subjective norms had a smaller effect on intention ($ES=.56$) than either attitudes ($ES=1.22$) or perceived behavioral control ($ES=.97$). This basic trend has also been observed in a variety of other health-related domains (Godin & Kok, 1996).

Accordingly, a number of researchers have questioned the salience of subjective norms, and have challenged the operational definition of this variable (Courneya &

McAuley, 1995; Courneya, Plotnikoff, Hotz, & Birkett, 2000; Godin & Kok, 1996; Okun, Karoly, & Lutz, 2002; Rhodes, Jones, & Courneya, 2002). In short, these authors have proposed that the relatively weak link between subjective norms and intention may be attributable to the failure of subjective norm, as a social factor, to account for other important social dimensions, such as the perceived behaviour of significant others, perceived pressure from significant others, and social support. Courneya and McAuley (1995) further proposed that subjective norm may not be the most theoretically relevant social influence in the physical activity domain because it fails to capture the manner in which significant others *assist* in performing physical activity. Thus, to enhance the predictive power of the TPB, especially in terms of behavioural intentions, it would seem important to include other social influences within this theoretical framework.

Interpersonal Style

One variable that appears highly salient in this regard is *interpersonal style*. According to SDT (Deci & Ryan, 1985; Ryan & Deci, 2000), interpersonal style refers to the interpersonal orientation one adopts in interacting with others. This is typically assessed in terms of an individual's perception of the interpersonal style of his or her significant other (e.g., spouse, teacher, etc.). Two basic interpersonal styles have been proposed: *autonomy supportive* and *controlling*. An autonomy supportive interpersonal style is characterized by the provision of choice, the encouragement of initiative, and the support of freedom. By way of contrast, a controlling interpersonal style is characterized by pressure, coercion, and a disregard for the opinions of others.

Research on this social influence has consistently demonstrated that perceptions of

an autonomy supportive interpersonal style are associated with positive outcomes, whereas perceptions of a controlling interpersonal style are related to negative outcomes. Studies in the physical activity domain have shown that perceptions of an autonomy supportive interpersonal style are positively associated with autonomous motivation and persistence (Gagné, Ryan, & Bargmann, 2003; Goudas, Biddle, Fox, & Underwood, 1995; Pelletier et al., see also Mageau & Vallerand, 2003), whereas perceptions of a controlling style are inversely linked to autonomous motivation (Pelletier et al., 2001). There is also evidence that social environments characterized by cooperative learning and improvement are associated with physical activity intentions (Ntoumanis, 2001; Standage et al., 2003).

In the education context, students' perceptions of an autonomy supportive teaching style have been linked to increased levels of autonomous motivation, perceived competence, and academic performance among students (Grolnick & Ryan, 1989; Grolnick, Ryan, & Deci, 1991; Vallerand et al., 1997). By way of comparison, students' perceptions of a teacher's controlling interpersonal style have been linked to students' academic dropout (Vallerand et al., 1997). Moreover, in the health context, it has been found that health care providers' autonomy support is associated with patients' autonomous motivation, medication adherence, smoking cessation, diabetes management, and autonomous learning (Williams & Deci, 1996; Williams et al., 2002; Williams et al., 2004; Williams, Rodin, Ryan, Grolnick, & Deci, 1998). Research on social control—a construct conceptually similar to a controlling interpersonal style—has also shown that interactions characterized by pressure and guilt are positively associated with

psychological distress (Lewis & Rook, 1999), but are unrelated to health behaviour change.

Social Support

Another social influence that has received considerable attention in the physical activity literature is *social support* (Chogahara et al., 1998; Sallis & Owen, 1999). As a construct, social support has been conceptualized in numerous ways (see Sarason, Sarason, & Gurung, 1997). Irrespective of the specific conceptualization of social support, what is common across all definitions is that social support pertains to assistance, help and/or support (Sarafino, 1994). Numerous investigations have demonstrated a positive link between social support and physical activity (Chogahara et al., 1998; Sallis & Owen, 1999; Trost, Owen, Bauman, Sallis, & Brown, 2002). There is also evidence that social support is positively associated with physical activity behaviour change (Calfas, Sallis, Oldenburg, & Ffrench, 1997; Steptoe, Rink, & Kerry, 2000) and physical activity intentions (Horne, 1994; Wankel et al., 1994). More recently, Courneya et al. (2000) examined the relative utility of social support and subjective norm for explaining exercise intention and stage. Results of their investigation demonstrated that social support was a stronger predictor of both intention and stage than subjective norms, and it was concluded that subjective norm should be replaced by social support in order to increase the predictive validity of the TPB. It is important to mention, however, that, in their investigation, Courneya and colleagues assessed social support using a single item, and this has obvious limitations in terms of the reliability and validity of this measure as well as the generalizability of their findings. Notwithstanding

these issues, it appears that integrating social support into the TPB may indeed enhance the explanatory power of this conceptual framework, and this warrants further analysis. Thus, by including interpersonal style and social support in addition to subjective norms, the relative influence of these variables on physical activity intentions can be assessed. The relationship between interpersonal style and motivation can also be examined within the context of change in physical activity behaviour.

Barriers to Physical Activity Behaviour Change

Another line of inquiry in the physical activity literature has examined *barriers* to physical activity involvement. Broadly defined, barriers refer to individual, interpersonal, or contextual factors that prevent individuals from engaging in an activity or hinder their ability to do so (Dishman, 1993; Sallis & Owen, 1999). They may be beliefs concerning physical activity involvement (i.e., psychological barriers). They may also be social factors (e.g., a lack of social support) or environmental factors (e.g., daily activities and limited access to sport/recreational facilities) that preclude individuals from being more active (i.e., contextual barriers).

Past studies have identified numerous barriers to adult women's physical activity participation. Lack of time, lack of energy, fatigue, and health problems are some of the most commonly reported barriers in this population (Booth, Bauman, & Owen, 2002; Canadian Fitness and Lifestyle Research Institute, 1996; Grubbs & Carter, 2002; Jaffe, Lutter, Rex, Hawkes, & Bucaccio, 1999; King et al., 2000; Nies, Vollman, & Cook, 1998; Wilcox et al., 2000). In addition, a lack of social support has been found to undermine women's physical activity participation (Chogahara et al., 1998; O'Brien

Cousins, 2003).

In terms of psychological barriers and within the framework of the SDT, Pelletier and colleagues (1999) identified four types of amotivation beliefs: *capacity*, *strategy*, *effort*, and *global helplessness*. Amotivation due to capacity beliefs is characterized by individuals who do not engage in physical activity because they do not believe they have the ability to do so. Amotivation due to strategy beliefs is exemplified by individuals who fail to participate in physical activity because they believe that their strategy would not be effective in bringing about desired outcomes (e.g., losing weight). Individuals who are amotivated due to effort beliefs would not engage in physical activity because they believe that it requires too much energy or effort. Finally, amotivation due to global helplessness beliefs is a general type of amotivation exemplified by individuals who fail to perceive contingencies between their actions and subsequent outcomes. Past studies have shown that amotivation is negatively related to physical activity participation (see Frederick-Recascino, 2002), and this could generalize to physical activity behaviour change over time.

What has been less studied in the physical activity literature is the prevalence of barriers in different age groups of adult women. There is some evidence to suggest that barriers such as health problems and lacking energy are more commonly reported by older women (Booth et al., 2002; Booth, Bauman, Owen, & Gore, 1997; Chinn, White, Harland, Drinkwater, & Raybould, 1999). Lacking time has also been found to be less of a perceived barrier to physical activity behavior in older women as compared to younger women (Booth et al., 2002; Canadian Fitness and Lifestyle Research Institute, 1996).

These findings are suggestive, however, additional studies in this area are needed, especially with regards to informing age-specific physical activity interventions.

Moving beyond descriptive accounts, a number of investigations have demonstrated that barriers are associated with women's physical activity participation. A consistent finding in this area is that lacking time and fatigue are inversely related to physical activity (Booth et al., 1997, 2002; King et al., 2000; Wilcox et al., 2000). Physical activity and health problems have also been similarly associated (Booth et al., 1997). When examined by age, psychological/health concerns have been negatively associated with vigorous physical activity for older women, but not for younger women (De Bourdeauhuij & Sallis, 2002).

Although several studies have found relationships between barriers and physical activity, there is a paucity of research examining relationships between barriers and physical activity *behavior change* over time. In one of the few studies in this area, a randomized trial of behavioral counseling in primary care, perceived barriers, assessed as a global construct, were predictive of physical activity behavior change at one year follow-up for individuals receiving a behavioral counseling intervention (Steptoe et al., 2000). Taken together, these results suggest that barriers are not only associated with physical activity, but may hinder physical activity behavior change over time.

In line with ecological approaches that integrate individual, interpersonal, and environmental variables (Sallis, Bauman, & Pratt, 1998; Sallis & Owen, 2002), researchers have recently examined the manner in which environmental characteristics influence physical activity involvement. Environmental characteristics refer to physical

attributes of the environment (e.g., neighbourhoods), such as the presence of hills, street lights, walking trails, and enjoyable scenery. Although certain researchers have conceptualized neighbourhood characteristics as physical activity hindering (e.g., Cameron et al., 2002), it is important to note that certain variables (e.g., the presence of sidewalks) may actually promote physical activity.

From a descriptive vantage point, researchers such as King et al. (2000) have found that the most commonly reported environmental characteristics of middle- and older-aged American women are enjoyable scenery, frequently seeing others exercise, and streetlights. For middle-age Canadian women, the most commonly reported environmental characteristics perceived to undermine physical activity participation are cost, safety, and a lack of programs or facilities (Craig, Cameron, Russell, & Beaulieu, 2001; Cameron et al., 2002). Other studies have shown that the physical environment is positively associated with walking to work (Craig, Brownson, Cragg, & Dunn, 2002; see also Saelens, Sallis, & Frank, 2003). More specifically, safe environments, enjoyable scenery, frequently seeing other exercise, and heavy traffic have been correlated with physical activity in adult women (Eyler et al., 2002; King et al., 2000; see also Speck & Harrell, 2003). Despite this pattern of results, other researchers have failed to demonstrate significant relationships between environmental characteristics and participation in physical activity (e.g., Salmon, Owen, Crawford, Bauman, & Sallis, 2003). Given these mixed findings, additional research in this area is needed. In particular, there is a dearth of studies describing environmental characteristics in different age groups of women, and relatively little is known about the relationships

between environmental characteristics and physical activity behavior change over time.

To summarize, research in the physical activity and other health domains suggests that the TPB and SDT are useful theoretical frameworks for understanding how and why individuals engage in a wide range of health behaviours, including physical activity.

Recently, these two theories have been integrated, and this approach holds considerable promise in terms of understanding physical activity behaviour change. Moreover, there is growing evidence that barriers and environmental characteristics are associated with physical activity in adult women. Although relatively few studies have assessed these relationships in the context of physical activity behaviour change, this line of inquiry warrants further examination.

Measuring Physical Activity Behaviour Change

Prior to moving on, it is important to address a number of issues related to the measurement of physical activity, one of the primary outcome variables in this thesis. Assessing physical activity is complex, and researchers have developed numerous means to evaluate this health behaviour (see Haskell & Kiernan, 2000; Mâsse, Dassa, Gauvin, Giles-Corti, & Motl, 2002; National Center for Health Statistics, 1989). Among the most common approaches are self-report measures, which include physical activity logs, diaries, and psychometric questionnaires. Other approaches to assessing physical activity are motion sensors (e.g., pedometers and accelerometers), heart rate monitors, and doubly labeled water (for a description see Haskell & Kiernan, 2000). Self-report measures have been criticized for their reliance on accurate recall, however, numerous measures, such as the Stanford Seven-Day Physical Activity Recall (Sallis et al., 1985),

the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985), and the Community Healthy Activities Model Program for Seniors (Stewart, Mills, King, Haskell, Gillis, & Ritter, 2001), have demonstrated sound psychometric properties. Indeed, the majority of published studies demonstrating associations among physical activity, disease, illness, and morbidity have used self-report measures. Moreover, self-report measures are often the only feasible and/or cost effective measure of physical activity, especially in population-based studies.

The assessment of behaviour change, including physical activity behaviour change, is an even more complex undertaking. From a conceptual vantage point, two basic types of change have been differentiated: change as incremental and change as a process (Francis, Fletcher, Stuebing, Davidon, & Thompson, 1991). When change is conceptualized as *incremental*, the focus is on the quantifiable acquisition (or decrease) in a variable (e.g., increase in physical activity level) over a given period of time. The outcome of interest is the amount of change over time, and the emphasis is on characteristics of groups (i.e., mean change) as opposed to the characteristics of individuals. Critics of this approach argue that incremental change reveals little about the process of individual development over time (Rogosa, Brandt, & Zimowski, 1982; Willett, 1988).

By way of comparison, when change is conceptualized as a *process*, the focus is on individual growth trajectories (i.e., growth curves) that reflect a process of development. Change is conceptualized at an individual level, which allows for an assessment of “interindividual differences in intraindividual change” (Francis et al., 1991,

p. 30). The two key points are that 1) change is assessed at an individual level and 2) change is seen as a process of continuous development. This latter point pertains to different rates of growth, something that is lost when the assessment of change remains at a group level.

From a methodological vantage point, one of the first measures of incremental change was the gain score. In its simplest form, this is the difference between the post-score (follow-up or time 2 score) and the pre-score (baseline or time 1 score). This measure of change has been highly controversial, and critics have demonstrated that gain scores are highly correlated with pre-scores (Cohen & Cohen, 1983). This is problematic because extreme scores (i.e., those farthest from the mean) are more likely to change than scores closer to the mean. Moreover, some researchers have criticized gain scores on the grounds that they are less reliable than actual scores, and they are inversely related to the correlation between pre- and post-scores. These limitations, however, have been questioned (see Willett, 1994).

In response to these criticisms, a second measure of change, the residual change score, was developed. This measure is based on the regression of the post-score on the pre-score. More precisely, it is the difference between the observed (actual) score and the predicted score. Residual change scores adjust for differences in the initial level of a variable and, as such, they give an indication of how much individuals would have changed on a given variable if they had the same initial level of that variable.

Disadvantage of residual change scores are that they require reasonably large samples and they provide little information about *how* individuals change (i.e., the process of

change). Others have argued that inferences about individual change cannot be made based on aggregated data from groups (for a more detailed discussion see Cohen & Cohen, 1983; Francis et al., 1991; Willett, 1994). Nevertheless, numerous studies employing two-wave longitudinal designs have used residual change scores as outcome measures of behaviour change.

Change as a process is typically evaluated by analyzing *growth curves*. This typically occurs within nested or multilevel models (Bryk & Raudenbush, 1992; Hox, 2002). Statistical techniques such as hierarchical linear modeling (HLM), mixed general linear models, or random coefficient regression models allow for an examination of the process of change. Advantages of these approaches are that they are well suited to designs with more than two waves of data. This is because multiple waves of data increase the reliability of growth parameters and individual growth trajectories can be plotted and analyzed. In addition, complete data for each participant is not required in HLM, and predictors of growth can be categorical or continuous. A final advantage is that there is no problem violating the assumption of independence of observations—which can occur in multiple regression analyses—because data can be grouped. Disadvantages of HLM are that data are required at several time points, thus requiring several repeated measures.

In sum, the assessment of physical activity and physical activity behaviour change are complex, posing a number of challenges from conceptual and methodological perspectives. Nevertheless, additional longitudinal research is needed to better understand this complicated phenomenon, and the present thesis attempts to shed light on physical

activity behaviour change in middle-aged women.

Purposes and Hypotheses

Accordingly, the overall purpose of this thesis was to examine physical activity behaviour change in a community based-sample of middle-aged women by integrating concepts from the TPB (Ajzen, 1985, 1991) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). More precisely, the first purpose was to examine the relative contribution of TPB variables (attitudes, perceived behavioural control, and subjective norms) and motivation (autonomous and controlled) to intentions to increase physical activity. Consistent with previous research and theory (Armitage & Conner, 2001; Ajzen, 1991; Chatzisarantis et al., 1997; Courneya, 1995; Godin & Kok, 1996, Ntoumanis, 2001; Sarrazin et al., 2002), it was hypothesized that attitude, perceived behavioural control, and subjective norms would significantly and positively predict physical activity intentions. It was also hypothesized that autonomous motivation would significantly predict intentions beyond and above the three TPB variables.

The second purpose of this study was to examine the relative influence of intentions and motivation on physical activity behaviour change over time. As mentioned, past studies have shown that autonomous motives are predictive of physical activity intentions (Ntoumanis, 2001; Standage et al., 2003) and, in turn, intentions have been shown to predict change in physical activity behaviour (Courneya et al., 2000, 2001; Sarrazin et al., 2002). This supports the mediating influence of intention on the relationship between motivation and physical activity behaviour change. Based on these studies, it was predicted that autonomous motivation would predict intentions which, in

turn, would predict physical activity behaviour change. Other studies have shown that motivation moderates the intention-physical activity behaviour relationship (Chatzisarantis & Biddle, 1998; Chatzisarantis et al., 1997; Orbell, 2003; Sheeran et al., 1999). Thus, the possibility that motivation would moderate the relationship between intentions and physical activity behaviour change was also explored. It was hypothesized that the interaction between intentions and autonomous motivation would significantly predict physical activity behaviour change beyond intentions and autonomous motivation.

The third purpose was to examine the relative influence of social variables on physically activity intentions within the framework of the TPB. In line with previous work in this area (e.g., Courneya et al., 2000; Godin & Kok, 1996; Okun et al., 2002; Rhodes et al., 2002), it was hypothesized that, after controlling for the three TPB variables (attitudes, perceived behavioural control, and subjective norms), social support and interpersonal style would significantly predict physical activity intentions. Autonomy supportive and controlling interpersonal style were also hypothesized to be significantly associated with autonomous and controlled motivation, respectively (Gagné et al., 2003; Goudas et al., 1995; Pelletier et al., 2001).

The fourth and final purpose was to examine barriers and environmental characteristics in the context of physical activity behaviour change. This was accomplished by initially describing barriers to physical activity behaviour change and environmental characteristics present in participants' neighbourhoods, both for the entire sample and for different age groups of women. Relationships among barriers, environmental characteristics, and physical activity behavior change were then assessed.

It was predicted that both barriers and environmental characteristics would be significantly associated with change in physical activity behaviour over time.

Significance of the Thesis

The proposed investigation is of importance for a number of theoretical and practical reasons. From a theoretical perspective, few studies to date have used the TPB (Ajzen, 1985, 1991) to examine health *behaviour change* (e.g., Blanchard et al., 2002; Courneya, 1995; Courneya et al., 2000, 2001). This is noteworthy given the potential of this theoretical framework to forward understanding of focal health behaviours such as physical activity. The current study also aims to test the utility of subjective norms as a predictor of physical activity intentions by integrating other important social influences (viz., interpersonal style and social support) into the TPB. By including these variables, the explanatory power of the TPB might be enhanced (Godin & Kok, 1996), and a more thorough assessment of the relative contribution of subjective norms, interpersonal style, and social support to physical activity intentions will be conducted.

There is a paucity of research examining motivation to change physical activity behaviour. Although a multitude of investigation have assessed motivation towards physical activity using SDT (Frederick-Recascino, 2002; Vallerand 1997, 2001; Vallerand & Losier, 1999), very few have examined motivation towards physical activity *behaviour change*. This is relevant given that numerous authors have posited that the most significant predictor of behaviour is motivation (Deci & Ryan, 1985; Ryan & Deci, 2000). Moreover, there appears to be very little research examining the relationship between intention and motivation (e.g., Chatzisarantis & Biddle, 1998; Chatzisarantis et

al., 1997). By integrating concepts from the TPB (Ajzen, 1985, 1991) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000), this study aims to assess the interaction between these two variables, and it has the potential to shed light on key variables associated with physical activity behaviour change.

The present investigation also contributes to the growing literature on barriers to physical activity involvement and behaviour change. Most notably, this study adds to a growing number of studies examining environmental factors that might influence physical activity change (e.g., Cameron et al., 2002; Craig et al., 2001; King et al., 2000).

Limitations of research in this area are that many studies have not reported barriers on a per item basis or by age group, and many studies have not examined relationships among specific barriers and change in physical activity behaviour over time.

Research on physical activity has traditionally neglected a number of important groups, including adult women (Brownson et al., 2000; King et al., 2000). Even fewer studies having examined physical activity behaviour change in this population (see Courneya, 1995 for an exception). This is cause for concern given that physical inactivity rates among adult women are notably high (Craig & Cameron, 2004; U.S. Department of Health and Human Services, 1996), and because physical inactivity is one of the most prevalent risk factors for chronic illness and disease (World Health Organization, 1997, 2003). By studying Canadian middle-aged women, the present thesis will contribute to our understanding of this understudied population and may ultimately be used in the development of interventions targeting this age cohort.

From a methodological perspective, much of the work in this area has assessed

barriers by asking participants to rate their reasons for not being physically active. In the current thesis, physical activity barriers and environmental characteristics will be *retrospectively* assessed by asking women to rate the extent to which these variables were present over the past six months. Additionally, the proposed longitudinal design allows for behaviour change to be examined on a temporal basis. This design moves beyond cross-sectional studies that examine physical activity behaviour at a single point in time and allows for a more dynamic, prospective assessment of the process of physical activity behaviour change.

Finally, from a practical vantage point, it has been well documented that physical activity leads to numerous mental and physical health benefits. Thus, by better understanding the processes underlying physical activity behaviour change and by examining different factors that facilitate and hinder these processes, more effective interventions aimed at increasing participation in physical activity can be developed and implemented. Results of this study might also be used to inform interventions aimed at increasing physical activity among different age groups of adult women.

Organization of the Remainder of this Thesis

The remainder of this thesis is organized into four chapters. In the next chapter, Chapter II, the first journal article entitled "Psychosocial Correlates of Intentions to Increase Physical Activity in a Community-Based Sample of Adult Women" is presented. The journal articles entitled "Physical Activity Behaviour Change in a Community-Based Sample of Adult Women: Contributions from the Theory of Planned Behaviour and Self-Determination Theory" and "Physical Activity Behavior Change in a Community-Based

Sample of Women: The Role of Barriers and Environmental Characteristics" are then presented in Chapter III and Chapter IV, respectively. The first two articles specifically address purpose one (i.e., to assess the relative contribution of TPB variables and motivation to intentions to increase physical activity), purpose two (i.e., to examine the relative influence of intentions and motivation on physical activity behaviour change over time), and purpose 3 (i.e., to assess the relative influence of social variables on physically activity intentions within the framework of the TPB). The fourth purpose (i.e., to examine barriers and environmental characteristics in the context of physical activity behaviour change) is addressed in the third journal article. All manuscripts have been prepared for submission to scientific journals, and they are formatted accordingly. The only change is that the tables and figures appear in the body of the text instead of at the end of the manuscripts. In Chapter V, the overall findings of this thesis, including the three journal articles and the supplementary statistical analyses, are discussed, and an overall conclusion is presented.

This thesis also includes a number of appendices. Appendix A presents a description of the contributions of the authors listed on the journal articles. Supplementary statistical analyses are presented in Appendix B. In Appendix C, the French questionnaire and the Time 1 and Time 2 English questionnaires are presented. Documentation pertinent to the ethical approval of this study by the Research Ethics Board of the University of Ottawa is included in Appendix D.

CHAPTER II

PSYCHOSOCIAL CORRELATES OF INTENTIONS TO INCREASE PHYSICAL ACTIVITY IN A COMMUNITY-BASED SAMPLE OF ADULT WOMEN

Abstract

Objectives: Numerous studies have examined intentions to engage in physical activity, however, relatively few have assessed intentions to increase physical activity by integrating variables from the Theory of Planned Behaviour (TPB; Ajzen, 1991) and Self-Determination Theory (SDT; Deci & Ryan, 1985, 1991). This study examined psychosocial predictors of intentions to increase physical activity in a community-based sample of adult women.

Design: A cross-sectional, correlational design was used.

Methods: Participants were 109 French-speaking women recruited from a number of community-based facilities. Predictors of intentions to increase physical activity were attitudes, perceived behavioural control, subjective norms, autonomous motivation, controlled motivation, and social support.

Results: Hierarchical multiple regressions and multivariate analysis of variance revealed that, of these variables, attitudes, perceived behavioural control, and autonomous motivation significantly predicted intentions to increase physical activity.

Conclusions: This study demonstrates how concepts from different theoretical frameworks, namely the TPB and SDT, can be integrated to understand important phenomena such as physical activity intentions. Findings indicate that autonomous motivation uniquely contributes to intentions to increase physical activity behaviour beyond and above attitudes, perceived behavioural control, and subjective norms.

Key words: Physical activity, intentions, motivation, social support

The physical and mental health benefits of regular participation in physical activity have been well documented (Bouchard, Shepard, & Stephens, 1994; Pate et al., 1995). Despite this, less than half of adults in developed countries are sufficiently active (Cameron, Craig, Stephens, & Ready, 2002; U.S. Department of Health and Human Services, 1996). To address this important issue, researchers have examined determinants of physical activity behaviour (Sallis & Owen, 1999; Trost, Owen, Bauman, Sallis, & Brown, 2002). This line of inquiry has revealed that a wide range of variables, including those of a psychological, social, and environmental nature, are associated with adults' physical activity participation.

One key theoretical framework that incorporates psychosocial determinants and has been extensively used to examine physical activity is the Theory of Planned Behaviour (TPB; Ajzen, 1991). According to this theory, intention to engage in an activity is the primary determinant of that behaviour. Three conceptually distinct variables are posited to directly influence intention, namely attitudes, perceived behavioural control, and subjective norms. Attitudes refer to the extent to which an individual perceives a behaviour as favourable or unfavourable. Perceived behavioural control refers to the perception of ease or difficulty associated with performing a behaviour. Subjective norms are the perception of the social expectations associated with engaging in a given behaviour.

Empirical support for the TPB in the physical activity domain has been repeatedly demonstrated in numerous studies (Godin & Kok, 1996; Hausenblas, Carron, & Mack, 1997; see also Armitage & Conner, 2001). Specifically, researchers have consistently

shown that attitudes and perceived behavioural control predict intentions which, in turn, predict physical activity. Evidence for the direct influence of subjective norms on intention has been mixed, with relatively fewer studies supporting this hypothesized link. What has not been examined in the literature is the influence of attitudes, perceived behavioural control, and subjective norms on intention to *increase* physical activity involvement. This is theoretically important because it applies the TPB, in a broad sense, to physical activity behaviour change and may ultimately lead to an understanding of the determinants of intentions to increase physical activity as well as how intentions to increase translate into actual physical activity behaviour changes over time.

Another important theoretical framework in this area that has been used to examine intentions as well as a wide range of health behaviours is Self-Determination Theory (SDT; Deci & Ryan, 1985, 1991). According to SDT, there are two broad types of motivation: autonomous and controlled. Individuals who are autonomously motivated engage in physical activity because it is enjoyable, interesting, and/or personally meaningful. By way of contrast, people who are motivated in a controlled manner engage in physical activity through internalized pressure or for external contingencies. The utility of SDT as a conceptual basis for examining motivation in the physical activity domain has been demonstrated in scores of published studies (see Frederick-Recascino, 2002; Vallerand, 1997).

Similar to attitudes, perceived behavioural control, and subjective norms, it is proposed, in the present study, that motivation directly influences physical activity intentions. Support for this link stems from studies in the educational and physical

activity domains. For example, autonomous academic motivation has been shown to positively predict students' intention to persist or drop out of school (Hardre & Reeve, 2003; Vallerand, Fortier, & Guay, 1997). In the context of physical activity, autonomous motives have been shown to predict leisure-time intentions (Chatzisarantis, Biddle, & Meek, 1997; Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003). Global autonomous motives have also been shown to predict physical activity intentions in adolescents (Hagger, Chatzisarantis, & Biddle, 2002). Thus, together, these studies demonstrate that autonomous motives are predictive of physical activity intentions.

Although the TPB posits that subjective norms directly influence intention, numerous studies across health-related domains have shown that subjective norms are a weaker predictor of intentions than either attitudes or perceived behavioural control (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997). Moreover, a growing number of researchers (e.g., Courneya & McAuley, 1995; Courneya, Plotnikoff, Hotz, & Birkett, 2000; Godin & Kok, 1996; Okun, Karoly, & Lutz, 2002; Rhodes, Jones, & Courneya, 2002) have argued that subjective norms fail to capture other important dimensions of the social context, for example, support. Indeed, studies in the physical activity domain have demonstrated that social support influences both intention and behaviour after controlling for other TPB variables (Courneya et al., 2000; Rhodes et al., 2002). This has led researchers such as Courneya et al. (2000) to suggest that future investigations using the TPB replace subjective norms with social support because of the superior predictive ability of this latter variable, especially for behaviours such as physical activity. Prior to modifying the TPB in this way, however, the

superiority of social support as a predictor of intentions beyond and above subjective norms needs to be further established, not only in the physical activity domain, but with different populations (e.g., adult women) and in different settings.

Purposes and Hypotheses

Accordingly, the overall purpose of this study was to examine psychosocial predictors of intention to increase physical activity behaviour using the TPB (Ajzen, 1991) and SDT (Deci & Ryan, 1985, 1991). More specifically, the primary purpose was to examine the influence of attitudes, perceived behavioural control, subjective norms, autonomous motivation, and controlled motivation on intention to increase physical activity in a community-based sample of adult women. In line with past research (Armitage & Conner, 2001; Chatzisarantis et al., 1997; Courneya, 1995; Godin & Kok, 1996) and theory (Ajzen, 1991; Deci & Ryan, 1985, 1991; Vallerand, 1997), it was hypothesized that attitudes, perceived behavioural control, and subjective norms would significantly and positively predict intention to increase physical activity. In addition, it was hypothesized that autonomous motivation would positively influence intentions after controlling for these three TPB variables. The secondary purpose was to examine the relative influence of subjective norms and social support on intention to increase physical activity. Consistent with recent work in this area (e.g., Courneya et al., 2000; Rhodes et al., 2002), social support was hypothesized to significantly and positively predict intention above and beyond subjective norms.

The present study is of importance because relatively few investigations have examined physical activity intentions by integrating variables from the TPB and SDT. As

noted, both of these conceptual frameworks have made important contributions to our present understanding of numerous health behaviours, including physical activity. In addition, to our knowledge, the present study is one of the first to examine intentions to *increase* physical activity, and this may provide insight into how and why people change or increase health-promoting behaviours such as physical activity. Theoretically, this approach applies the TPB to physical activity behaviour change by examining intentions as well as attitudes, perceived behavioural control, and subjective norms (i.e., determinants of intentions) in the context of *increasing* physical activity behaviour. Moreover, this study adds to a growing number of investigations (e.g., Courneya et al., 2000; Okun et al., 2002; Rhodes et al., 2002) examining the relative influence of social variables on physical activity intentions. This not only highlights the importance of the social context in the formation of physical activity intentions, but may ultimately increase the predictive validity of the TPB by integrating dimensions of support, encouragement, and/or assistance with normative beliefs. Finally, because a significant proportion of adult women lead sedentary lifestyles (Brownson, Eyler, King, Brown, Shyu, & Sallis, 2000; U.S. Department of Health and Human Services, 1996), this study adds to a growing number of investigations examining physical activity in this understudied population.

Method

Participants

Participants were 109 French-speaking adult women ranging in age between 36 and 72 years ($M=51.0$, $SD=7.6$). They were recruited from a number of community-

based facilities in the Ottawa, Canada region, including community centres, fitness clubs, and bingo halls. Recruitment took place between May 4, 2001 and June 12, 2001. One hundred and thirty-four women agreed to participate in this study. Twenty-five of these cases were excluded because of missing data ($n=15$) or because women had no intention to increase their level of physical activity ($n=10$) and, subsequently, were unable to complete the questionnaire, leaving a total of 109 cases for analysis. Over ninety-five percent of these women were of Caucasian descent, and over half of the sample was married. Sixty-eight percent of participants had attended college or university (see Table 1 for additional socio-demographic characteristics).

Procedures

Permission to recruit women from fitness classes, bingo halls, and community centres was initially obtained from the respective community-based facilities. Once permission was granted, potential participants were approached by a trained researcher, typically at the beginning of a class or group, and invited to participate in this study. They were informed of the study goals, issues of confidentiality and anonymity, and the voluntary nature of their involvement. All women provided written consent prior to completing the questionnaire. Women were offered the opportunity to complete measures on-site, however, 94 % of the 134 participants opted to complete the questionnaire at home and return it in a postage-paid envelope. The questionnaire required approximately 30 minutes to complete. This study was approved by the research ethics board of the University of Ottawa.

Table 1
Sample socio-demographic characteristics (n = 109).

Variable	
Age - Mean (SD)	51.04 (7.62)
Marital status	
Married	56%
Common-law	13%
Single	6%
Separated	18%
Widowed	6%
Children	86%
Modal number of children	2
Education	
Primary	3%
Secondary	29%
College	19%
University-undergraduate	28%
University-graduate	15%
Employment	
Worked in past year	73%
Household income (CDN)	
< \$20,000	4%
\$20,000-\$39,999	19%
\$40,000-\$59,999	17%
\$60,000-\$79,999	18%
> \$80,000	43%

Measures

Measures included TPB variables (attitudes, perceived behavioural control, subjective norms, and intentions), SDT variables (autonomous and controlled motivation), and social support. Of particular note, participants were asked to respond to items in light of physical activities they *intended to increase* over the next six months. All variables were assessed using self-report measures, and responses were recorded on 7-point Likert type scales (see Appendix C for a copy of the questionnaire).

TPB variables. The TPB variables were measured using previously validated and

reliable scales (Ajzen & Madden, 1986; Courneya, 1995; Courneya et al., 2000; Dziewaltowski, Noble, & Shaw, 1990). Items were slightly adapted to pertain to physical activity behaviour *increase*. For example, instead of asking participants about their attitudes towards physical activity involvement, participants were asked about attitudes towards *increasing* their level of physical activity over the next six months.

Attitudes were measured by asking participants to respond to the general statement: "For me, *increasing* my level of physical activity over the next six months would be..." Examples of the six bipolar adjectives used were: "good-bad," "useful-useless," and "beneficial-harmful." Perceived behavioural control was measured with three items (e.g., "Over the next six months, I have control over whether or not I *increase* my level of physical activity"). An example item from the two-item subjective norms scale was: "People who are close to me think I should *increase* my level of physical activity over the next six months." Finally, intention to *increase* physical activity was assessed with three items (e.g., "I intend to *increase* my physical activity level over the next six months"). Coefficient alpha for these scales ranged between .81 and .97.

Motivation. Autonomous and controlled motivation were assessed using a slightly adapted version of the Treatment Self-Regulation Questionnaire (TSRQ; Ryan & Connell, 1989). Participants were asked to rate items based on the following general statement: "Why do you want to *increase* your physical activity involvement over the next six months?" An example item from the four-item autonomous motivation scale was: "Because I want to take responsibility for my health." Controlled motivation was also measured using four items (e.g., "Because I would feel guilty if I did not"). These two

scales yielded coefficient alphas of .91 and .73, respectively. The validity and reliability of these scales has been demonstrated in several studies (e.g., Ryan & Connell, 1989; Williams, Grow, Freedman, Ryan, & Deci, 1996; Williams, Rodin, Ryan, Grolnick, & Deci, 1998).

Social support. Social support was measured using six items based on previously published research demonstrating acceptable levels of validity and reliability (e.g., Courneya et al., 2000; Courneya, Plotnikoff, Hotz, Birkett, & Nicholas, 2001; Cutrona & Russell, 1987; Duncan & McAuley, 1993). Example items were: "How much support do you receive from those closest to you to *increase* your current level of physical activity" and "My significant others encourage me to *increase* my level of physical activity." This scale yielded a coefficient alpha of .82.

Results

All analyses were performed using the SPSS, version 10 statistical software package. Initial data screening (Tabachnik & Fidell, 2001) did not reveal any univariate or multivariate outliers, and all variables approximated normal distributions. An examination of bivariate scatter plots revealed linear relationships among variables. Basic descriptive statistics and correlations among variables are presented in Table 2.

To examine the influence of attitudes, perceived behavioural control, subjective norms, autonomous motivation, and controlled motivation on intention to increase physical activity behaviour, a hierarchical multiple regression was conducted. In the first step, attitudes, perceived behavioural control, and subjective norms were used to predict intention to increase physical activity. In the second step, autonomous motivation and

Table 2

Descriptive statistics for and correlations among TPB variables, motivation, and social support (n=109).

Variable	Mean (SD)	1	2	3	4	5	6	7
1. Attitudes	5.62 (1.51)	--						
2. Perceived behavioral control	4.56 (1.48)	.20*	--					
3. Subjective norms	3.72 (1.85)	.12	.26**	--				
4. Autonomous motivation	5.49 (1.32)	.31***	.22*	.09	--			
5. Controlled motivation	2.73 (1.33)	.03	.12	.23*	.29**	--		
6. Social support	4.29 (1.38)	.11	.27**	.30**	.28**	.12	--	
7. Intention to increase PA	4.47 (1.93)	.40***	.52***	.22*	.51***	.25**	.19*	--

Note. All variables were assessed on 7-point Likert-type scales, with higher values indicative of higher levels of each variable. PA=physical activity. * $p < .05$. ** $p < .01$. *** $p < .001$.

controlled motivation were entered as predictors of intentions to ascertain whether these two types of motivation significantly predicted intentions after controlling for the TPB variables (attitudes, perceived behavioural control, and subjective norms).

On the first step, attitudes, perceived behavioural control, and subjective norms explained 37% of the variance in intention to increase physical activity (F -change=20.51, $p < .001$) (Table 3). Of these three variables, attitudes ($p < .001$) and perceived behavioural control ($p < .001$) were significantly and positively predictive of intentions. Subjective norms, although also positively linked with intentions, were a non-significant predictor ($p = .37$). Autonomous and controlled motivation, when entered on the second step, uniquely accounted for 12% of the variance in intention (F -change=11.74, $p < .001$). Whereas autonomous motivation was a significant positive predictor ($p < .001$), controlled motivation was not ($p = .25$). Collectively, all variables explained 49% of variance in intention to increase physical activity participation.

The sample was then split into high- and low-intention groups based on a tercile

Table 3

Hierarchical multiple regression predicting intention to increase physical activity participation using attitude, perceived behavioral control, subjective norm, autonomous motivation, and controlled motivation (n=109).

Step	Variable Entered	Stand <i>b</i>	<i>t</i> for within step predictors	<i>R</i> ² - change	<i>F</i> - change
1	Attitude	.31	3.84***		
	Perceived beh.control	.44	5.42***		
	Subjective norm	.07	.90	.37	20.51***
2	Autonomous motivation	.33	4.19***		
	Controlled motivation	.09	1.15	.12	11.74***

Note. Stand=standardized. *** $p < .001$.

split of the intention to increase physical activity variable. Only the two extreme groups were included in the ensuing analyses. High intenders ($n=39$) and low intenders ($n=38$) were compared in terms of attitudes, perceived behavioural control, subjective norms, autonomous motivation, controlled motivation, and social support using a multivariate analysis of variance (Table 4). Overall, there was a significant multivariate effect (Hotelling's $T^2=1.04$; $F(6, 70)=12.14$, $p < .001$), with high intenders reporting significantly higher levels of attitudes ($p < .001$), perceived behavioural control ($p < .001$), subjective norms ($p < .05$), autonomous motivation ($p < .001$), and controlled motivation ($p < .05$) than low intenders.

To examine the relative influence of subjective norms and social support on intention to increase physical activity (Purpose 2), a second hierarchical multiple regression was conducted (Table 5). In the first step, attitudes, perceived behavioural control, and subjective norms were entered as predictors of intention (R^2 -change=37%;

Table 4

Means and standard deviations for high- and low-intention to increase physical activity groups in terms of TPB variables, motivation, and social support.

	High intenders		Low intenders		
	(n = 39)		(n = 38)		
Variable ^a	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>
Attitude	6.16	1.48	4.96	1.59	11.84***
Perceived behavioral control	5.36	1.20	3.64	1.28	36.99***
Subjective norm	4.07	1.80	3.11	1.84	5.40*
Autonomous motivation	6.14	.90	4.74	1.59	22.71***
Controlled motivation	3.16	1.37	2.49	1.22	5.08*
Social support	4.55	1.42	4.08	1.50	1.95

^aOverall MANOVA: Hotelling's $T^2=1.04$; $F(6, 70)=12.14$, $p<.001$. * $p < .05$. *** $p < .001$.

F -change=20.51, $p<.001$). Social support was entered in the second step, and although it was positively related to intentions, this variable failed to uniquely explain a significant proportion of variance in this outcome variable (F -change=.08, $p=.77$). When the sample was split into high and low intenders based on the extreme group tercile split (see Table 4), high intenders reported significantly higher levels of subjective norms than low intenders ($p<.05$), however, no significant difference was observed with respect to social support ($p=.17$).

To assess the possible confounding influence of socio-demographic variables, all analyses were re-run after statistically controlling for age, education level, and income. No differences in the pattern of results were obtained. The sample was also split by marital status, and no significant differences were observed between married women ($n=61$) and unmarried women ($n=48$) (see Table 4 in Appendix B).

Table 5

Hierarchical multiple regression predicting intention to increase physical activity involvement using subjective norm and social support (n=109).

Step	Variable Entered	Stand <i>b</i>	<i>t</i> for within step predictors	<i>R</i> ² - change	<i>F</i> - change
1	Attitude	.31	3.84***		
	Perceived beh.control	.44	5.42***		
	Subjective norm	.07	.90	.37	20.51***
2	Social support	.02	.29	.00	.08

Note. Stand=standardized. *** $p < .001$.

Discussion

Overall, this study aimed to predict intentions to increase physical activity in a community-based sample of adult women by integrating psychosocial variables from the TPB (Ajzen, 1991) and SDT (Deci & Ryan, 1985, 1991). The current investigation went beyond past studies, however, in that it specifically addressed intentions as well as determinants of intentions to *increase* physical activity. From a behaviour change perspective, this has implications for helping women become more active by shedding light on variables potentially associated with increased participation in physical activity. This study further demonstrated how concepts from different theoretical frameworks, namely the TPB and SDT, can be integrated to understand important phenomena such as physical activity intentions (e.g., Chatzisarantis & Biddle, 1998; Chatzisarantis et al., 1997; Hagger et al., 2002; Ntoumanis, 2001; Standage et al., 2003). The integration of these theories may ultimately be used to inform and develop theory-based interventions aimed at increasing physical activity levels in adult women.

More specifically, the primary purpose of this study was to examine the influence of attitudes, perceived behavioural control, subjective norms, autonomous motivation, and controlled motivation on intention to increase physical activity. It was found that, of the three TPB variables, attitudes and perceived behavioural control were predictive of physical activity intentions, and this basic finding is in line with past research in this area (see Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997). That attitudes, perceived behavioural control, and subjective norms collectively explained 37% of variance in physical activity intentions is also consistent with previous work in the physical activity and other domains (see Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997).

Findings further demonstrated the unique, significant contribution of autonomous motivation to intention to increase physical activity after controlling for other TPB variables. This latter finding supports past research showing a positive association between autonomous motivation and intentions (Chatzisarantis et al., 1997; Hardre & Reeve, 2003; Ntoumanis, 2001; Standage et al., 2003; Vallerand et al., 1997), and indicates that this form of motivation contributes to intentions above and beyond attitudes, perceived behavioural control, and subjective norms. Of particular note, in the present study, motivation was used as a predictor of intentions. That is, similar to attitudes, perceived behavioural control, and subjective norms, motivation was conceptualized as a determinant of physical activity intentions. Other researchers (e.g., Hagger et al., 2002) have shown that motivation, when assessed at a global level, is predictive of intentions, but only when mediated by attitudes and perceived behavioural

control. What this suggests is that the influence of motivation on intention is dependent on the level of generality at which motivation is assessed. This concurs with the work of Vallerand (1997) who proposed a hierarchical model of motivation in which global motives, determine context-specific motives, which, in turn, determine situation-specific motives. In the present study, however, motivation was not assessed at a global level, but rather at a contextual level (i.e., with respect to why individuals wanted to increase their level of physical activity). It may be that whereas global motives lead to context-specific attitudes and perceived behavioural control which, in turn, lead to behavioural intentions, context-specific motives lead directly to behavioural intentions, and are not mediated by attitudes and perceived behavioural control. Future research could further explore these possibilities by measuring different levels of motivation and testing different theoretical models.

What was not assessed in the present study was the influence of intentions and/or motivation on actual physical activity behaviour or physical activity behaviour change. According to the TPB, the primary determinant of behaviour is intention. By way of comparison, in SDT, behaviour is primarily determined by motivation. It is possible that both intentions and motivation are directly related to physical activity behaviour when assessed at the same level of generality. Another possibility is that, consistent with the current investigation, intentions mediate the relationship between motivation and physical activity behaviour. It is also possible that the relationship between intentions and behaviour is *moderated* by motivation. That is, individuals who are high in both intentions and autonomous motivation would be more likely to engage in physical activity

and/or increase their level of physical activity participation than either individuals who are motivated in a controlled manner or who have low intentions. The current design does not allow for these possibilities to be empirically examined, and this is a limitation of the study as well as an avenue for further investigation. Future studies could test different intention-motivation models (e.g., mediating versus moderating) and, more importantly, how these models translate into actual behaviour and, specifically, behaviour change over time. This could be accomplished by using larger samples, employing prospective research designs, assessing actual behaviour change, and conducting more comprehensive data analytic procedures such as structural equation modeling or hierarchical linear modeling.

The secondary purpose of this investigation was to examine the relative influence of subjective norms and social support on intention to increase physical activity. In line with predictions, subjective norms were positively but weakly associated with physical activity intentions. This result concurs with past studies demonstrating the relatively weaker link between subjective norms and intentions in comparison to both attitudes and perceived behavioural control (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997; Okun et al., 2002). Although in the expected direction, social support failed to significantly predict intentions after controlling for subjective norms. This runs contrary to previous research demonstrating the unique contribution of social support to physical activity intentions beyond and above subjective norms (Courneya et al., 2000; Rhodes et al., 2002). Given the important theoretical link between social support and physical activity participation (see Chogahara, Cousins, & Wankel, 1998;

Sallis & Owen, 1999), future studies could explore how, in addition to perceived pressure to perform a given behaviour (i.e., subjective norms), support in the form of encouragement, assistance, and help contributes not only to physical activity intentions, but to physical activity behaviour and/or physical activity behaviour change within the conceptual framework of the TPB. It may be that, similar to autonomous motivation, social support moderates the relationship between intentions and actual increase in physical activity.

It is important to note that, in the present investigation, social support was included as a means of examining the relative utility of social influences, including subjective norms, to predict physical activity intentions. Other researchers have examined subjective norms in terms of an injunctive component (i.e., the belief that significant others want one to engage in a given behaviour) and a descriptive component (i.e., whether significant others actually perform a given behaviour) (e.g., Okun et al., 2002; Rhodes & Courneya, 2003). Although findings from these studies are inconclusive, there is some evidence to indicate that descriptive norms are a more salient predictor of intentions than injunctive norms (Okun et al., 2002). Future research may do well to combine these approaches by examining the relative contribution of injunctive norms, descriptive norms, and other social/interpersonal variables (e.g., social support, social control, or interpersonal style) to physical activity intentions (e.g., Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003).

Several limitations should be considered when interpreting the findings of this study. The correlational design precludes any conclusions to be drawn about the temporal

associations among variables. Although attitudes, perceived behavioural control, and autonomous motivation were predictive of physical activity intentions, all of these variables were assessed at the same point in time. Accordingly, causal links between variables cannot be inferred. The community-based sample of adult women limits the generalizability of these findings, especially to male populations, across domains, or across age groups. It also has implications in terms of statistical power and the ability to detect statistically significant results. The high socioeconomic status of research participants further limits the external validity of the present findings. Moreover, the sample was comprised of women who intended to increase their level of physical activity over a six month time period. It is uncertain how these results apply to adult women who do not intend to increase their level of physical activity. Thus, results need to be cross-validated with larger and/or more diverse samples.

From an applied vantage point, this study highlights the importance of attitudes, perceived behavioural control, and autonomous motivation to women's intentions to increase physical activity behaviour. Based on these findings, intentions could be fostered by helping women develop more positive attitudes by, among other things, emphasizing the numerous benefits associated with regular physical activity participation and by enhancing perceptions of behavioural control through the development strategies to initiate or maintain a regular exercise regimen and/or to overcome barriers to physical activity. Intentions could also be enhanced by promoting autonomy supportive environments by fostering support, providing choices, and encouraging initiatives thereby enhancing autonomous motivation towards increasing physical activity.

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CHAPTER III

PHYSICAL ACTIVITY BEHAVIOUR CHANGE IN A COMMUNITY-BASED SAMPLE OF MIDDLE-AGED WOMEN: CONTRIBUTIONS FROM THE THEORY OF PLANNED BEHAVIOUR AND SELF-DETERMINATION THEORY

Abstract

This study aimed to assess physical activity behaviour change in a community-based sample of middle-aged women by integrating concepts from the Theory of Planned Behaviour (TPB; Ajzen, 1991) and Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000). Specific objectives were: 1) to examine the relative influence of TPB variables and motivation on intention to increase physical activity participation; 2) to examine the relative influence of intentions and motivation on physical activity behaviour change over time; and 3) to assess the relative influence of social variables on both physical activity motivation and intentions. One hundred and forty-nine Canadian women, ranging in age between 39 and 68, completed a battery of measures at Time 1, including, attitudes, perceived behavioural control, subjective norms, intentions, autonomous and controlled motivation, social support, interpersonal style, and physical activity. At Time 2, six months later, physical activity was re-assessed. Hierarchical multiple regression revealed that attitudes and subjective norms were significantly related to intentions to increase physical activity. Autonomous motivation was also significantly associated with physical activity intentions. Intentions were found to be a significant predictor of change in physical activity behaviour over time. Moreover, autonomy supportive and controlling interpersonal styles were also associated with autonomous and controlled motivation, respectively. Results generally support the theoretical tenets of the TPB and SDT, and they provide preliminary support for the salience of intentions in the prediction of physical activity behaviour change among middle-aged women. Findings are discussed in light of current research and theory, and future research directions are

proposed.

Key words: Physical activity, behaviour change, intentions, self-determination, women

Given the health benefits associated with regular physical activity participation (Bouchard, Shepard, & Stephens, 1994; Dunn & Blair, 2002; Pate et al., 1995) as well as the health consequences and costs associated with sedentary behaviour (Katzmarzyk, Gledhill, & Shephard, 2000; World Health Organization, 1997, 2003), helping individuals become more physically active has become an important public health priority. In recent years, women in particular have been targeted (Brownson, Eyler, King, Brown, Shyu, & Sallis, 2000; Speck & Harrell, 2003). Indeed, population-based data indicates that over half of adult women in North America are insufficiently active (Cameron, Craig, Stephens, & Ready, 2002; U.S. Department of Health and Human Services, 1996) and, among middle-aged and older Canadian women, only about fifteen percent currently meet physical activity recommendations (Craig & Cameron, 2004). This is of particular concern because, in the physical activity and health domains, women in this age group are understudied and at risk for developing a wide range of health problems (Merrill & Weed, 2001; U.S. Department of Health and Human Services, 1996). Accordingly, this study aimed to investigate physical activity behaviour in middle-aged women.

Researchers have recently examined a broad array of variables associated with the adoption and maintenance of physical activity across various groups (see Sallis & Owen, 1999), including middle-aged women (Brownson et al., 2000; King et al., 2000; Speck & Harrell, 2003). One particular line of inquiry has assessed physical activity participation from the vantage point of behaviour change. Past studies have shown that numerous factors, including those of a cognitive, behavioural, social, and environmental

nature are associated with change in physical activity over time (see Bock, Marcus, & Pinto, 2001; Glanz, Lewis, & Rimer, 1997; Sallis & Owen, 2002). Although informative, much is unknown about how and why individuals and, in particular, middle-aged women, change their physical activity behaviour. Thus, additional empirical work based on sound theoretical underpinnings is needed to advance a coherent understanding of important health behaviours, including physical activity behaviour change.

One theoretical framework that has been used to study how and why individuals change their health behaviour is *Self-Determination Theory* (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000; see also Williams, 2002). According to SDT, there are two main types of motivation: *autonomous* and *controlled*. Behaviours for which motivation is autonomous are performed out of choice and are regulated by the self. They may also be engaged in for pleasure and/or satisfaction. An example of this type of motivation is exemplified by women who choose to increase their level of physically activity in order to improve their health or because they value this activity. By way of comparison, behaviours for which motivation is controlled are not performed out of choice, but rather are regulated by introjected pressures and/or external forces. Women who attempt to change their physical activity level due to pressure from significant others would exemplify this type of motivation. Numerous investigations have demonstrated the utility of SDT in the study of physical activity (Frederick-Recascino, 2002; Vallerand, 2001; Vallerand & Losier, 1999) and other health behaviours (Williams, Deci, & Ryan, 1998; Sheldon, Williams, & Joiner, 2003; Williams, 2002). It has also been argued that SDT is a highly relevant organizing framework for examining physical activity in women

(Landry & Solmon, 2002).

In the context of physical activity behaviour change, elderly individuals in higher stages of change were found to be more autonomously motivated than individuals in lower stages of change (Mullan & Markland, 1997). In a similar vein, adults in the maintenance stage of change reported higher levels of autonomous motivation than individuals in the action stage of change (Ingledew, Markland, & Sheppard, 2003). Controlled motives have been associated with the initial adoption of physical activity, whereas autonomous motives have been associated with stage progression and maintenance of physical activity over time (Ingledew, Markland, & Medley, 1998). Further, there is evidence that autonomous physical activity motives are predictive of physical fitness level, and both of these variables can be enhanced over a 12-week exercise program (Wilson, Rodgers, Blanchard, & Gessell, 2003). In the health domain, autonomous motivation has been associated with weight loss (Williams, Grow, Freedman, Ryan, & Deci, 1996) and smoking cessation (Williams, Cox, Kouides, & Deci, 1999; Williams, Gagné, Ryan, & Deci, 2002) on a temporal basis. Change in autonomous motivation has also been found to significantly predict positive changes in diabetes self-care and glycemic control (Williams, McGregor, Zeldman, Freedman, & Deci, 2004). Collectively, these studies suggest that autonomous motivation plays a key role in promoting health behaviours, including physical activity.

Another theoretical framework that has been extensively used to study a wide range of health behaviours is the *Theory Planned Behaviour* (TPB; Ajzen, 1991). Within the TPB, it is postulated that the most salient predictor of behaviour (e.g., physical

activity) is *intention*. It is further postulated that intentions are predicted by three key variables: *attitudes*, *perceived behavioural control*, and *subjective norms*. Attitudes refer to the extent to which physical activity is perceived as favourable or unfavourable; perceived behavioural control pertains to the perceived ease or difficulty of performing physical activity; and subjective norms refer to the perceived social expectations associated with physical activity participation.

The TPB has been well supported in numerous health-related contexts, including physical activity (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas, Carron, & Mack, 1997). What has been less studied is the salience of the purported TPB relationships in the context of physical activity *behaviour change*. Theoretically, attitudes, perceived behavioural control, and subjective norms should predict intention to increase physical activity which, in turn, should predict change in physical activity behaviour over time. This has been supported in a limited number of investigations. For example, Courneya (1995) found that attitudes, perceived behavioural control, and subjective norms were significantly associated with physical activity intentions in a cross-sectional study of adult exercisers. Intentions, attitudes, and perceived behavioural control were also significantly related to stage of readiness for regular physical activity. On a temporal basis, Courneya and colleagues (Courneya, Nigg, & Estabrooks, 2000; Courneya, Plotnikoff, Hotz, Birkett, & Nicholas, 2001) have further supported the utility of the TPB in examining exercise stages and exercise stage progression. In the context of cardiac rehabilitation, intentions have been found to significantly predict exercise adherence over time (Blanchard, Courneya, Rodgers, Daub, & Knapik, 2002).

Recently, some researchers have integrated concepts from the TPB and SDT to examine physical activity. Collectively, these studies have assessed relationships between motivation and intention by testing direct and indirect pathways between motivation, intentions, and physical activity behaviours. For example, autonomous motivation has been found to significantly and directly predict physical activity intentions (Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003). Results of a meta-analytic review demonstrated that autonomous and controlled motives mediate the relationship between perceived competence and physical activity intentions (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003). It has also been shown that, over time, the motivation-physical activity behaviour relationship is mediated by intentions (Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002). Specifically, autonomous motives were found to predict intention which, in turn, was found to predict physical activity persistence. Similar findings have been obtained in educational settings (Vallerand, Fortier, & Guay, 1997). In the context of physical activity behaviour change, autonomous motives significantly contributed to intentions to increase physical activity above and beyond attitudes, perceived behavioural control, and subjective norms (Kowal, Fortier, Orpana, & Lemyre, 2004; see Article 1 of this thesis). In these studies, motivation is conceptualized as a predictor or antecedent of intention which, in turn, is conceptualized as a predictor of physical activity behaviour.

Another possibility is that motivation *moderates* the link between intention and physical activity behaviour change (i.e., intention and motivation interact to effect change in physical activity behaviour over time). From a theoretical vantage point,

individuals who are high in intentions and who are motivated in an autonomous manner should have a greater likelihood of increasing their level of physical activity than individuals who are low in intentions and/or who are motivated in a controlled fashion. A limited number of studies in physical activity settings have assessed this potential moderating effect. Chatzisarantis and Biddle (1998) compared participants motivated in an autonomous versus a controlled manner across TPB variables. Although no overall differences were obtained with regards to intention and attitude, the relationship between subjective norm and intention was positive in the controlled motivation group, whereas it was negative in the autonomous motivation group. Also, the link between perceived behavioural control and intention was significant in the autonomous motivation group only. Further, intentions based on attitudes (a construct similar to autonomous motivation) were shown to be a stronger predictor of behaviour than intentions based on subjective norms (a similar construct to controlled motivation) (Sheeran, Norman, & Orbell, 1999). In the educational domain, intentions and self-determination were found to interact in the prediction of studying behaviour over a two week period (Orbell, 2003). Thus, there is some preliminary support for the moderating effect of motivation on intentions and other TPB variables. Additional research is needed to further assess mediating versus moderating influences of intentions and motivation on physical activity behaviour change.

Social Influences, Physical Activity Intentions, and Motivation

Within the framework of the TPB, past studies have demonstrated that, in comparison to attitudes and perceived behavioural control, subjective norms are the

weakest predictor of intention (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997). Certain researchers have proposed that this may be attributable to the manner in which subjective norms are measured (e.g., Courneya & McAuley, 1995; Courneya et al., 2001; Godin & Kok, 1996; Okun, Karoly, & Lutz, 2002; Rhodes, Jones, & Courneya, 2002). Specifically, it has been argued that subjective norms fail to account for important dimensions of the social environment, such as social support. Indeed, past research in adult populations has demonstrated the positive association between social support and both physical activity (Troost, Owen, Bauman, Sallis, & Brown, 2002) and physical activity behaviour change (Calfas, Sallis, Oldenburg, & Ffrench, 1997; Steptoe, Rink, & Kerry, 2001). There is also some evidence that social support is predictive of physical activity intentions above and beyond attitudes, perceived behavioural control, and subjective norms (Courneya, Plotnikoff, Hotz, & Birkett, 2000).

It is also likely that, in addition to social support, other social variables are predictive of intentions. Within the framework of SDT, one such social variable is *interpersonal style*. Broadly defined, interpersonal style refers to the interpersonal orientation one adopts in interacting with others. It is typically assessed in terms of an individual's perception of the interpersonal style of his or her significant other (e.g., spouse, teacher, etc.). Two basic interpersonal styles have been examined, namely *autonomy supportive* and *controlling*. Whereas the former is characterized by the provision of choice, the encouragement of initiative, and support of freedom, the latter is characterized by pressure, coercion, and authoritarianism (Deci & Ryan, 1985; Ryan &

Deci, 2000).

In the physical activity domain, perceptions of an autonomy supportive interpersonal style have been associated with positive outcomes, such as autonomous motivation and persistence (Gagné, Ryan, & Bargmann, 2003; Pelletier, Fortier, Vallerand, & Brière, 2001; see also Mageau & Vallerand, 2003). By way of comparison, perceptions of a controlling interpersonal style have been shown to undermine autonomous motivation (Pelletier et al., 2001). Research in health settings has further demonstrated that health care professional's autonomy support is positively associated with patients' autonomous motivation, medication adherence, smoking cessation, and diabetes management (Williams & Deci, 1996; Williams et al., 2002; Williams et al., 2004; Williams, Rodin, Ryan, Grolnick, & Deci, 1998). No studies, however, appear to have specifically examined the relationship between interpersonal style and intentions. By including social support and interpersonal style in addition to subjective norms, the relative influence of these social variables on physical activity intentions can be assessed.

Purposes and Hypotheses

The overall purpose of this study was to examine physical activity behaviour change in a community based-sample of middle-aged, women by integrating concepts from the TPB (Ajzen, 1985, 1991) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). More precisely, the first purpose was to examine the relative contribution of TPB variables (attitudes, perceived behavioural control, and subjective norms) and SDT variables (autonomous and controlled motivation) to intentions to increase physical activity. Consistent with research and theory (Ajzen, 1991; Courneya, 1995; Godin &

Kok, 1996; Ntoumanis, 2001; Sarrazin et al., 2002), it was hypothesized that attitude, perceived behavioural control, and subjective norms would significantly and positively predict physical activity intentions. Based on the findings of Kowal et al. (2004) (see Article 1 of this thesis), it was also hypothesized that autonomous motivation would significantly predict intentions beyond and above the three TPB variables.

The second purpose of this study was to examine the relative influence of intentions and motivation on physical activity behaviour change over time. This was accomplished by testing mediating and moderating influences. In line with previous studies (Courneya et al., 2000, 2001; Ntoumanis, 2001; Sarrazin et al., 2002; Standage et al., 2003), it was predicted that autonomous motivation would predict intentions which, in turn, would predict physical activity behaviour change (mediational model). The possibility that motivation would moderate the relationship between intentions and physical activity behaviour change was also explored. Based on past research (Chatzisarantis & Biddle, 1998; Orbell, 2003; Sheeran et al., 1999), we hypothesized that the interaction between intentions and autonomous motivation would significantly predict physical activity behaviour change beyond intentions and autonomous motivation.

The third purpose was to examine the relative influence of social variables (i.e., subjective norms, social support, and interpersonal style) on physical activity intentions and motivation. Congruent with previous work in this area (Courneya et al., 2000; Godin & Kok, 1996; Okun et al., 2002; Rhodes et al., 2002), it was hypothesized that, after controlling for the three TPB variables, social support and interpersonal style would significantly predict physical activity intentions. Autonomy supportive and controlling

interpersonal style were also hypothesized to be significantly associated with autonomous and controlled motivation, respectively (Gagné et al., 2003; Pelletier et al., 2001).

One of the main contributions of this study is the integration of concepts from the TPB and SDT. By integrating concepts from these conceptual frameworks, this study has the potential to shed light on the relationships among motivation, intentions, and physical activity behaviour change by assessing mediating and moderating influences. This study also extends past physical activity research (e.g., Hagger et al., 2003; Ntoumanis, 2001; Sarrazin et al., 2002) by specifically examining *change* over time in this key health behaviour. Indeed, by using a longitudinal design, the current investigation also allows for an examination of the temporal relationships among study variables, including mediating and moderating influences. Furthermore, this study adds to a growing number of investigations that have specifically assessed how social factors (i.e., social support and interpersonal style) are related to intentions within the framework of the TPB (e.g., Courneya et al., 2000; Okun et al., 2002; Rhodes et al., 2002). Practically, results could inform physical activity interventions that aim to increase physical activity participation among middle-aged women (Landry & Solmon, 2002). Finally, this study specifically examines a sample of middle-aged women, an important group that is preponderantly under active and understudied (Ainsworth, 2000; Brownson et al., 2000; U.S. Department of Health and Human Services, 1996).

Method

Participants

Participants were middle-aged, Canadian women enrolled in classes, groups, or programs at community centres, community health centres, and fitness clubs. To examine behaviour change, only women who reported that they wanted to increase their physical activity level were included in this study. Five hundred and nine women were initially approached and invited to participate. Of these women, 237 (46.6%) completed the Time 1 questionnaire. Eight (3.4%) women failed to provide written consent or a return address, thus leaving 229 eligible participants at Time 1. One hundred and seventy-eight women (77.7%) subsequently completed and returned the Time 2 questionnaire. Twenty-nine of these cases (16.3%) were dropped because women indicated that they had no intention to increase their level of physical activity or because of statistical criteria (e.g., missing data or multivariate outliers). The final sample thus consisted of 149 women, ranging in age between 39 and 68 years ($M=51.8$; $SD=6.7$). The majority of these women were of Caucasian descent, married, and had attended college or university (see Table 1 for additional socio-demographic characteristics).

Study Design and Procedures

This study employed a two-wave, longitudinal design. At Time 1 (October), women participating in classes or activities at community-based facilities were recruited by trained researchers. Participants were informed about the study objectives, the voluntary nature of their involvement, and issues of confidentiality. At this point, several women reported that they had no intention to increase their physical activity level and, as

Table 1
Sample socio-demographic characteristics.

Variable	
Age - Mean (<i>SD</i>)	51.8 (6.7)
Marital status	
Married	67%
Common-law	9%
Single	7%
Separated	15%
Widowed	2%
Education	
Primary	1%
Secondary	15%
College	26%
University-undergraduate	34%
University-graduate	24%
Household income (CAD)	
< \$15,000	3%
\$15,000-\$29,999	4%
\$30,000-\$44,999	6%
\$45,000-\$59,999	16%
\$60,000-\$74,999	16%
> \$80,000	55%

$n = 149$.

such, they did not complete the questionnaire. Although women were offered the opportunity to complete the Time 1 questionnaire package on-site, 94 % completed it at home, and returned it in a postage-paid envelope. All women provided written informed consent. The Time 1 questionnaire package assessed current physical activity level, TPB variables, motivation, social support, interpersonal style, and socio-demographic variables. Women were also asked to provide their name and address so a follow-up questionnaire could be sent via postal mail. At Time 2 (May), six months later, physical activity was re-assessed. The questionnaires required approximately 30 minutes to complete.

This design allowed for an examination of change in physical activity over time. Consistent with past research (e.g., Prochaska & DiClemente, 1985; Prochaska et al., 1994), a six month time interval was chosen. The time periods of October (Time 1) and May (Time 2) were chosen because they are similar with respect to climate normals (Environment Canada, 2002). This study was approved by the research ethics board of the University of Ottawa.

Measures

The questionnaire package was composed of previously validated scales that were slightly re-worded to apply to the context of physical activity behaviour change. Participants were asked to identify specific physical activities they intended to increase over the next six months, and to respond to items in light of these activities. All variables were assessed on 7-point Likert type scales (see Appendix C for a copy of the Time 1 and Time 2 questionnaires).

Physical activity. Physical activity at Time 1 and Time 2 was assessed with the the Community Health Activities Model Program for Seniors (CHAMPS; Stewart, Mills, King, Haskell, Gillis, & Ritter, 2001). Participants were presented with a comprehensive list of leisure-time, sports, and home-based activities, and asked to specify the frequency and duration of their participation in each activity during a typical week over the past month. An “other” category was also included for activities not included in this list. Total energy expenditure was calculated by multiplying the frequency, duration (in hours), and estimated metabolic rate (i.e., MET intensity; Ainsworth et al., 2000) for each activity. These totals were then summed across activities and multiplied by self-reported weight.

This yielded a weight-corrected total energy expenditure in $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{week}^{-1}$. The mean total energy expenditures at Time 1 and Time 2 were 2804.6 ($SD=1831.9$) and 3112.2 ($SD=2084.9$), respectively. Previous research has demonstrated the satisfactory levels of discriminant validity, concurrent validity (r s ranged from 0.55 to 0.73), and sensitivity to change (with small to medium effects sizes). Six-month stability ranged between 0.58 and 0.68 across different physical activity groups (see Stewart et al., 2001).

To assess physical activity behaviour change, a standardized residual change score (Cohen & Cohen, 1983) was calculated by regressing the Time 2 total physical activity score on the Time 1 total physical activity score. This approach has been used in previously published work (e.g., Calfas et al., 1997). This resulted in a physical activity behaviour change score with a mean of 0 and a standard deviation of 1.

TPB constructs. All TPB constructs were assessed using previously published measures (Ajzen & Madden, 1986; Courneya, 1995; Courneya et al., 2000; Dzewaltowski, Noble, & Shaw, 1990). To measure attitudes, participants respond to the general stem "For me, *increasing* my level of physical activity over the next six months would be..." Six bipolar adjectives used were, including "good-bad," "useful-useless," and "beneficial-harmful." Perceived behavioural control was assessed using three items. A sample item was "Over the next six months, I have control over whether or not I *increase* my level of physical activity." Two items measured subjective norms (e.g., "People who are close to me think I should *increase* my level of physical activity over the next six months."). Intention to increase physical activity was assessed with three items. An example item from this scale was "I intend to *increase* my physical activity level over

the next six months." Internal consistency of these scales (i.e., coefficient alpha) were satisfactory, ranging between .88 and .89. The validity of these scales (i.e., concurrent, construct, and predictive validities) has been established in numerous studies (Ajzen & Madden, 1986; Courneya, 1995; Courneya et al., 2000), and six-month test-retest reliability was found to range between 0.50 and 0.60 (Courneya et al., 2001).

Autonomous and controlled motivation. The Treatment Self-Regulation Questionnaire (TSRQ; Ryan & Connell, 1989) was used to measure autonomous and controlled motivation. Participants were asked to respond to the general question "Why do you want to increase your physical activity involvement over the next six months?" Six items were used to assess both autonomous motives (e.g., "Because I want to take responsibility for my health") and controlled motives (e.g., "Because I would feel guilty if I did not"). Coefficient alpha for these scales were .89 and .75, respectively. Past research in the areas of achievement-related, prosocial, and health behaviours has demonstrated the sound psychometric properties of this scale, including test-retest reliability ($r=0.70$), construct validity, concurrent validity, and predictive validity (Ryan & Connell, 1989; Williams et al., 1996, 1998, 2004).

Social support. To measure social support, six items were included based on previously published studies that have supported the validity and reliability of these items (e.g., Calfas et al., 1997; Courneya et al., 2000, 2001; Cutrona & Russell, 1987; Duncan & McAuley, 1993). Two examples were: "My significant other encourages me to increase my level of physical activity" and "My significant other supports me when I engage in physical activity." Cronbach's alpha for this scale was .89.

Interpersonal style. Participants were initially asked to identify their "significant other" (i.e., the individual who currently has the greatest influence on their participation in physical activity), and to respond to items in light of this significant other. Two types of interpersonal style, autonomous and controlling, were measured using a slightly adapted version of the Perceived Interpersonal Style Scale developed by Pelletier (1992). An example item assessing autonomous interpersonal style was "My significant other provides me with opportunities to make personal decisions concerning physical activity," whereas an example of an item assessing controlled interpersonal style was "My significant other pressures me to do physical activity." Both of these scales yielded coefficient alphas of .77. Previous studies have demonstrated the satisfactory internal consistency, construct validity, and predictive validity of these measures (e.g., Pelletier, Fortier, Vallerand, Tuson, Brière, & Blais, 1995; Vallerand et al., 1997).

Statistical Analyses

The SPSS, version 11, statistical software package was used for all statistical analyses. Basic univariate and multivariate statistical assumptions were initially evaluated using established data screening techniques (Tabachnik & Fidell, 2001). Univariate outliers were brought in to three standard deviations from the mean. Missing data were imputed using mean replacement. Pearson correlations were calculated to assess bivariate associations among variables. To predict intentions to increase physical activity, hierarchical multiple regressions were used. The relationships among intentions, motivation, and physical activity behaviour change was also assessed using multiple regression and hierarchical multiple regression analyses. Mediating and moderating

influences between intentions, motivation, and physical activity behaviour were tested using procedures outlined by Baron and Kenny (1986) and Holmbeck (1997). Path analysis (Pedhazur, 1982) was used as an alternative means of testing direct and indirect pathways among intentions, motivation, and change in physical activity behaviour.

Statistical significance was set at $p < .05$ for all univariate and multivariate analyses.

Results

Preliminary Analyses

Independent samples *t*-tests and chi-square analysis were used to compare participants who completed the Time 1 questionnaire and those who completed both the Time 1 and Time 2 questionnaires. Women who dropped out of the study after completing the Time 1 questionnaire were less educated than those women completing the study ($p < .05$). No other significant differences were observed. Weather data at Time 1 and Time 2 were obtained from Environment Canada (2002) to examine the possibility that changes in physical activity level were attributable to seasonal effects. Parametric and non-parametric analyses failed to reveal any significant differences with respect to daily average temperature, daily average relative humidity, daily total precipitation, and total number of rainy days.

Predicting Physical Activity Intentions

Table 2 presents descriptive statistics for and Pearson correlations among study variables. Significant correlations were obtained between attitudes, subjective norms, and autonomous motivation and physical activity intentions ($ps < .05$).

To assess the relative influences of TPB variables and motivation on intentions to

Table 2
Descriptive statistics for and Pearson correlations among study variables.

Variable	Mean (SD)	1	2	3	4	5	6	7	8	9	10
1. Attitudes	5.59 (1.19)	--									
2. Perceived beh. control	5.61 (1.41)	.03	--								
3. Subjective norms	3.97 (1.72)	.24**	.10	--							
4. Intention to increase PA	4.66 (1.71)	.23**	.08	.24**	--						
5. Autonomous motivation	6.02 (1.01)	.18*	.22**	.27**	.18*	--					
6. Controlled motivation	2.49 (1.05)	.04	-.07	.29**	.11	.25**	--				
7. Social support	4.50 (1.50)	.00	.13	.25**	.13	.25**	.20*	--			
8. Autonomy supportive IS	4.34 (1.41)	-.06	.13	.02	.01	.16*	.05	.74**	--		
9. Controlling IS	2.14 (1.21)	-.03	-.02	.29**	-.04	-.02	.37**	.21*	.07	--	
10. PA behaviour change	0.00 (1.00)	.11	-.10	-.14	.23**	-.06	.06	.05	-.01	-.05	--

Note. The physical activity behaviour change variables is based on a residual difference score with a mean of 0 and a standard deviation of 1. All other variables were measured on 7-point Likert-type scales. Beh=behavioural.

PA=physical activity. IS=interpersonal style. $n=149$. * $p < .05$. ** $p < .01$.

increase physical activity, hierarchical multiple regression was used (Table 3). Attitudes, perceived behavioural control, and subjective norms were entered on the first step, and together explained 9% of the variance in the criterion variable (F -change=4.97, $p < .01$). Whereas attitudes ($p < .05$) and subjective norms ($p < .05$) were significant predictors of intentions, perceived behavioural control was not. Autonomous motivation and controlled motivation were then entered on the second step. Neither variable uniquely contributed to the prediction of physical activity intentions, explaining only 1% of its variance (F -change=.73, $p = .49$).

Predicting Physical Activity Behaviour Change

Bivariate correlations demonstrated a significant, but modest positive association between intentions to increase physical activity and change in physical activity behaviour over time ($p < .05$) (Table 2). The mediating influence of intentions and motivation on change in physical activity behaviour was tested in a series of three multiple regression analyses (Baron & Kenny, 1986; Holmbeck, 1997).

Table 3
Hierarchical multiple regressions predicting intention to increase physical activity.

Step	Variable Entered	Stand <i>b</i>	<i>t</i> for within step predictors	<i>R</i> ² - change	<i>F</i> - change
1	Attitude	.18	2.21*		
	Perceived beh.control	.06	.69		
	Subjective norm	.20	2.38*	.09	4.97**
2	Autonomous motivation	.09	1.01		
	Controlled motivation	.04	.41	.01	.73

Note. Stand=standardized. * $p < .05$. ** $p < .01$.

Initially, intentions were regressed onto autonomous motivation. Physical activity behaviour change was then regressed onto autonomous motivation. Finally, physical activity behaviour change was regressed on both intentions and autonomous motivation. Autonomous motivation significantly and positively predicted intentions to increase physical activity ($p < .05$), however, it failed to predict change in physical activity behaviour ($p = .50$) (Table 4). When intentions and autonomous motivation were entered together, only intentions significantly contributed to physical activity behaviour change ($p < .01$). Collectively, these two variables accounted for 6% of variance in the criterion variable. To further assess these relationships and consistent with past research in this area (e.g., Ntoumanis, 2001; Sarrazin et al., 2002; Standage et al., 2003), a path analysis was conducted (Pedhazur, 1982). Intention to increase physical activity was initially regressed onto autonomous motivation. Physical activity behaviour change was then regressed onto intentions (Figure 1). Autonomous motivation significantly predicted intention to increase physical activity behaviour change ($p < .05$) which, in turn,

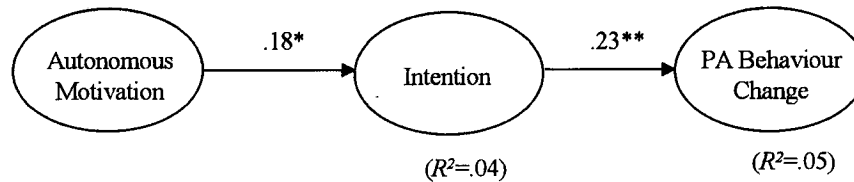


Figure 1. Path model of the relationships among autonomous motivation, intentions, and physical activity behaviour change. PA=physical activity. Regression coefficients are standardized beta weights. * $p < .05$. ** $p < .01$. $n = 149$.

significantly predicted change in physical activity behaviour over time ($p < .01$).

To assess the moderating influence of autonomous motivation and intention on physical activity behaviour change, a hierarchical multiple regression was conducted (Baron & Kenny, 1986; Holmbeck, 1997). Intentions and autonomous motivation were entered in steps 1 and 2, respectively, and the intentions by autonomous motivation interaction term was entered in the third step. To eliminate multicollinearity between first-order terms (intentions and autonomous motivation) and second-order terms (intentions by autonomous motivation interaction), the data were “centered” using procedures outlined by Aiken and West (1991). Intentions significantly predicted physical activity behaviour change ($p < .01$), accounting for only 5% of its variance (F -change=8.31, $p < .01$) (Table 5). Neither autonomous motivation ($p = .21$) nor the interaction term ($p = .20$) were significant predictors of physical activity behaviour change, both accounting for 1% of its variance. This hierarchical multiple regression analysis was repeated for controlled motivation, and neither controlled motivation ($p = .64$) nor the controlled motivation by intention interaction ($p = .58$) were significantly associated with physical activity behaviour change.

Table 4
Mediating influences between intentions and autonomous motivation in the prediction of physical activity behaviour change.

Criterion Variable	Predictor Variable	Stand <i>b</i>	<i>t</i>	R^2	<i>F</i>
Intentions	Autonomous motivation	.18	2.21*	.04	4.90*
PA behaviour change	Autonomous motivation	-.06	-.68	.00	.46
PA behaviour change	Autonomous motivation Intentions	-.10 .25	-1.24 3.06	.06	4.93**

Note. Stand=standardized. PA=physical activity. * $p < .05$. ** $p < .01$.

Influence of Social Variables on Physical Activity Intentions and Motivation

The correlational analyses demonstrated significant associations between subjective norms and intentions, between an autonomy supportive interpersonal style and autonomous motivation, and between a controlling interpersonal style and controlled motivation (all $ps < .05$). Hierarchical multiple regression was used to assess the relative influence of the social variables on physical activity intentions (Table 6). After entering attitudes, perceived behavioural control, and subjective norms in the first step, social support, autonomy supportive interpersonal style, and controlling interpersonal style were entered in the second step, and all were nonsignificant predictors of the criterion variable. Collectively, these three social influences explained 2% of variance above and beyond the three TPB variables (F -change=1.20; $p=.31$).

To assess the potential confounding influence of marital status, the sample was

Table 5
Moderating influences between intentions and autonomous motivation in the prediction of physical activity behaviour change.

Step	Predictor Variable	Stand <i>b</i>	<i>t</i> for within step predictors	<i>R</i> ² - change	<i>F</i> - change
1	Intentions	.23	2.88**	.05	8.31**
2	Autonomous motivation	-.10	-1.24	.01	1.53
3	Intention by autonomous motivation interaction	-.11	-1.28	.01	1.63

Note. Stand = standardized. ** $p < .01$.

split into married ($n=99$) and unmarried women ($n=50$). These two groups were compared across all study variables using a multivariate model. An overall multivariate effect was observed for marital status (Hotelling's $T^2=0.15$; $F(10, 138)=2.00$, $p < .05$), with married women reporting significantly higher levels of controlled motivation ($p < .05$) than unmarried women. Married women also demonstrated significantly greater change in their physical activity behaviour over time than their unmarried counterparts ($p < .01$) (See Table 5 in Appendix B for a summary of these results).

Discussion

Overall, this study aimed to examine change in physical activity behaviour over time in a community-based sample of middle-aged women by integrating concepts from the TPB (Ajzen, 1991) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). This study extends past research in this area by specifically targeting middle-aged women, by assessing change in their physical activity behaviour over time, and by testing mediating and moderating influences between intentions, motivation, and physical activity

Table 6
Hierarchical multiple regression predicting intention to increase physical activity.

Step	Variable Entered	Stand <i>b</i>	<i>t</i> for within step predictors	<i>R</i> ² - change	<i>F</i> - change
1	Attitude	.18	2.21*		
	Perceived beh.control	.06	.69		
	Subjective norm	.20	2.38	.09	4.86**
2	Social support	.19	1.49		
	Autonomy supportive style	-.12	-.99		
	Controlling style	-.12	-1.38	.02	1.20

Note. Stand = standardized. * $p < .05$. ** $p < .01$. Beh. = behavioural.

behaviour change.

With regards to the prediction of intentions to increase physical activity (Purpose 1), in support of the TPB (Ajzen, 1991) and consistent with past research (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997), attitudes and subjective norms were significantly predictive of physical activity intentions. Contrary to previous work, however, perceived behavioural control was not significantly associated with intentions to increase physical activity, although the relationship was in the expected direction. This result is somewhat surprising, and might be attributable to the combination of high levels of perceived behavioural control and elevated levels of physical activity over time. It might also be attributable to the operational definition of perceived behavioural control. A certain number of researchers (e.g., Rhodes & Courneya, 2003; Trafimow, Sheeran, Conner, & Finlay, 2002; see also Ajzen, 2002) have demonstrated that there are multiple components, not only of perceived behavioural control, but of attitudes and subjective norms. Specifically, they have shown that

perceived behavioural control, when assessed in terms of self-efficacy and controllability dimensions, is a superior predictor of intentions than perceived behavioural control when measured as a single construct (as in the current investigation). Although self-efficacy and, specifically, barriers self-efficacy (McAuley, 1992) were not assessed here, future research might include these variables as predictors of intentions in the context of physical activity behaviour change. In a similar vein and from the vantage point of SDT, it would also seem useful to include perceived competence as a predictor of physical activity intentions (as in Chatzisarantis et al., 2003). This would allow for a more complete test of the contribution of SDT in the context of physical activity behaviour change.

Of the three TPB variables, subjective norms emerged as the strongest predictor of physical activity intentions. This runs contrary to the results of numerous studies demonstrating that, relative to attitudes and perceived behavioural control, subjective norms are a weaker predictor of intentions (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997). There is some evidence to suggest that the relationship between subjective norms and intentions is moderated by gender. Specifically, in cancer rehabilitation contexts, the relationship between these variables has been found to be significant in woman (Courneya & Friedenreich, 1999), but not in men (Courneya & Friedenreich, 1997). Although, for obvious reasons, this possibility was not assessed here, it might be that, for middle-aged women, subjective norms are a more salient predictor of intentions than attitudes or perceived behavioural control. Future studies would do well to assess the relative contribution of attitudes, perceived behavioural

control, and subjective norms to intentions in the context of change in physical activity behaviour and, more broadly, in the domain of health behaviour change. This could be done by examining the potential moderating influence of gender.

The relationship between autonomous motivation and intentions to increase physical activity behaviour partially supported predictions. As hypothesized and consistent with past studies (Ntoumanis, 2001; Sarrazin et al., 2002; Standage et al., 2003), these two variables were positively correlated, however, in the hierarchical multiple regression analysis, after controlling for attitudes, perceived behavioural control, and subjective norms, the relationship between autonomous motivation and intentions was no longer significant. This runs contrary to the results of Kowal et al. (2004) (see Article 1 of this thesis), which demonstrated that autonomous motivation was a significant predictor of intentions to increase physical activity above and beyond the three TPB variables. One explanation for this nonsignificant finding is the limited amount of variability in autonomous motivation. Indeed, the descriptive statistics suggest a marked ceiling effect (i.e., a substantial proportion of women felt highly autonomously motivated to increase their level of physical activity over time, with many women scoring at the upper limit of this scale). Another possibility is that, congruent with the findings of Hagger, Chatzisarantis, & Biddle (2002), the relationship between autonomous motivation and intentions to increase physical activity behaviour is *mediated* by attitudes, perceived behavioural control, and subjective norms. This was suggested by a closer inspection of the correlation matrix (Table 2). Specifically, autonomous motives were significantly associated with attitudes, perceived behavioural control, and subjective

norms. As mentioned, attitudes and subjective norms were significant predictors of intentions to increase physical activity which, in turn, was a significant predictor of physical activity behaviour change.

Of note, in the present investigation, motivation was assessed in terms of two basic types: autonomous or controlled. Other researchers (see Frederick-Rescano, 2002; Kowal & Fortier, 2000; Vallerand, 2001; Vallerand & Losier, 1999) have taken a more refined approach, and they have examined different forms of motivation along a self-determination continuum (Deci & Ryan, 1985; Ryan & Deci, 2000). It might be that specific types of autonomous motivation (e.g., intrinsic motivation or identified regulation) are most salient in the prediction of physical activity intentions. Indeed, intrinsic motivation has been positively associated with leisure-time physical activity intentions (Ntoumanis, 2001; Standage et al., 2003). Thus, this possibility could be further assessed in future physical activity and health behaviour research.

With regards to the second purpose of the study, in line with expectations, intentions to increase physical activity were a significant, but modest predictor of physical activity behaviour change over time. This provides some support for the theoretical tenet linking intentions to behaviour (Ajzen, 1991), and it suggests that the TPB has some predictive power for assessing change in physical activity behaviour (Courneya, 1995). This findings also extends the results of past studies demonstrating links between physical activity intentions and behaviour on a cross-sectional basis (Ntoumanis, 2001; Kowal et al., 2004 (see Article 1 of this thesis); Standage et al., 2003), as well as previous work showing that, on a temporal basis, intentions translate

into physical activity and other behaviours, such as persistence (Courneya et al., 2000, 2001; Sarrazin et al., 2002; Vallerand et al., 1997).

Contrary to expectations, autonomous motivation was unrelated to change in physical activity behaviour. Theoretically, autonomous motives are postulated to effect numerous positive outcomes, including behaviour change (Deci & Ryan, 1985; Ryan & Deci, 2000; Vallerand, 2001), and numerous empirical studies have shown that motivation, especially autonomous or self-determined forms of motivation, are an important predictor of physical activity behaviour (see Frederick-Rescano, 2002; Pelletier et al., 2001; Vallerand, 2001; Vallerand & Losier, 1999). A growing number of investigations have further demonstrated the importance of autonomous motivation in the context of health behaviour change (Williams et al., 1996, 1999, 2002, 2004). The nonsignificant relationship between autonomous motivation and change in physical activity behaviour is, again, likely attributable to the limited variability in autonomous motivation (i.e., ceiling effect). Given the strong theoretical and empirical support for the role of autonomous motivation in effecting positive outcomes, additional research is needed to further test the relationship between autonomous forms of motivation and change in physical activity behaviour.

In terms of mediating influences, results partially supported predictions. As mentioned, autonomous motivation was not significantly associated with change in physical activity behaviour over time. Because of this nonsignificant link, the relationship between these two variables could *not* be mediated by intentions to increase physical activity. Nevertheless, results of the path analysis indicated that autonomous motivation

significantly predicted intentions (Ntoumanis, 2001; Standage et al., 2003) which, in turn, significantly predicted change in physical activity behaviour (Sarrazin et al., 2002). Based on the present findings, this suggests that motivation might be a determinant or antecedent of intentions to increase physical activity behaviour. Stated differently, autonomous motivation appears to be indirectly related to physical activity behaviour change through its influence on intentions. As noted above and consistent with the findings of Hagger et al. (2002), it might be that the pathway between autonomous motivation and intentions is mediated by attitudes, perceived behavioural control, and subjective norms.

With regards to moderating influences, no interaction was observed between intentions and either autonomous or controlled motivation in the prediction of physical activity behaviour change over time. Although other studies have failed to demonstrate a moderating influence of motivation on the intention-behaviour change relationship (e.g., Sarrazin et al., 2002), this finding is discordant with past investigations which, to varying degrees, have provided support for the interaction between intentions and motivation in physical activity settings (Chatzisarantis & Biddle, 1998; Sheeran et al., 1999). Because the present study is one of the first to assess this relationship in the context of *behaviour change*, additional studies are needed to further test potential interaction effects. In terms of mediating versus moderating influences, the present data are suggestive of the former, however, this is a very tentative conclusion that warrants further longitudinal research using larger samples and more sophisticated data analytic procedures that allow for alternative models to be tested, such as structural equation

modeling (SEM) and hierarchical linear modeling (HLM).

It is also worth noting that the level of generality at which motivation is assessed likely plays an important role in the link between motivation and intentions. Authors such as Vallerand (2001) have argued that when motivation and motivational consequences (e.g., intentions) are assessed at the same conceptual level, relationships are stronger than when motivation is assessed at one level (e.g., global) and motivational consequences are measured at another (e.g., situational). Empirically, there is some evidence to suggest that global autonomous motives influence situation-specific cognitions (e.g., attitudes and perceived behavioural control) which, subsequently, influence situation-specific intentions (Hagger et al., 2003). Although Hagger and colleagues failed to assess different levels of autonomous and controlled motives, future studies might do so as a means of examining relationships between motivation and physical activity intentions, behaviour, and behaviour change. Theoretical frameworks such as the Hierarchical Model of Intrinsic and Extrinsic Motivation (Vallerand, 2001), which is based largely on SDT, could be highly salient in this regard.

It should be underscored that only 6% of the variance in physical activity behaviour change was explained by intentions in combination with autonomous motivation (Table 4), leaving 95% of variance unaccounted for. Notwithstanding the high levels of physical activity at both Time 1 and Time 2, there are likely other important psychological variables that could further explicate women's ability to increase their physical activity behaviour over time, including barrier self-efficacy, outcome expectations, and value expectancy (McAuley, 1992; Oman & King, 1998; Sternfeld,

Ainsworth, & Quesenberry, 1999; see also Sallis & Owen, 1999). It might also be that transtheoretical processes of change (Prochaska et al., 1994) are central to increasing physical activity behaviour both in the short- and long-term.

There is a growing body of evidence suggesting that, in addition to psychological and social variables, different levels of variables (e.g., physiologic, socio-demographic, cultural, environmental, and political) should be integrated within a coherent, organizing framework to more fully understand the inherently complex process of changing health behaviours (see Sallis & Owen, 2002; Speck & Harrell, 2003). Indeed, in the present study, married women reported significantly greater change in their physical activity behaviour than unmarried women. This results is in line with past studies demonstrating that marital status is associated with physical activity participation (e.g., King, Kiernan, Ahn, & Wilcox, 1998); however, it should be noted that, the influence of marital status on physical activity behaviour is inconsistent across studies (see Trost et al., 2002). Nevertheless, marital status explained additional variance in physical activity behaviour change (approximately 6%) thereby highlighting the utility of integrating different levels of variables. What remains unknown is whether simply having a spouse is beneficial to women's participation in physical activity or whether the *quality* of the marital relationship or partners' interpersonal style are also important in this regard. These possibilities could be conceptualized within ecological models and empirically tested using HLM.

With respect to the relationships between social variables and physical activity intentions (Purpose 3), findings partially supported hypotheses. As predicted, subjective

norms contributed significantly to intentions to increase physical activity over six months, however, there was no support for the unique relative contribution of either social support or interpersonal style to this criterion variable. Although there is evidence that social support is related to physical activity intentions after controlling for the three TPB variables (Courneya et al., 2000), other researchers have failed to support this link in the context of physical activity behaviour change (e.g., Kowal et al., 2004; see Article 1 of this thesis). The present data suggest that social support might be indirectly related to intentions, perhaps through autonomous motivation. An examination of the bivariate correlations (Table 2) supported this contention, indicating that social support was significantly related to autonomous motivation which, as mentioned, was linked with intentions to increase physical activity.

From the vantage point of SDT, both an autonomy supportive and controlling interpersonal style were significantly associated with autonomous and controlled motivation, respectively, supporting past research in this area (Pelletier et al., 2001; Williams et al., 1998, 2002, 2004). More interestingly, this suggests that interpersonal style influences motivation which, subsequently, influences intentions, which, in turn, influences physical activity behaviour change. Theoretically, this generally concurs with the causal sequence postulated in SDT: social factors--> motivational mediators--> motivation--> outcomes (e.g., intentions predicting physical activity behaviour change) (Deci & Ryan, 1985; Ryan & Deci, 2000; Vallerand, 2001). Obviously, motivational mediators (i.e., the needs for autonomy, competence, and relatedness) were not assessed here. There is an extensive body of research demonstrating that the

fundamental needs for autonomy, competence, and relatedness are predicted by social factors (e.g., interpersonal style), and these needs have also been found to directly influence autonomous motivation and indirectly influence motivational outcomes, including health behaviours (see Vallerand, 2001; Ryan & Deci, 2002). Future studies might do well to incorporate additional variables from SDT, namely need satisfaction, in the study of physical activity behaviour change.

From a practical vantage point, results suggest that intentions to increase physical activity translate into physical activity behaviour change over time. Based on the current findings, one way to enhance intentions would be to help women foster more positive attitudes towards increasing their physical activity level. This could be accomplished by helping women focus on physical and mental health benefits of regular physical activity participation. Alternatively, subjective norms were found to predict physical activity intentions, and this social variable could be fostered by encouraging significant others (e.g., spouses, friends, or health care professionals) to voice their positive expectations regarding regular involvement in physical activity. Another means of increasing physical activity intentions would be to enhance autonomous forms of motivation. This could be accomplished by encouraging significant others to act in autonomy supportive ways and to focus on satisfying women's fundamental needs for autonomy, competence, and relatedness (e.g., Williams, 2002; Williams et al., 1998, 2002). Consistent with the findings of Chatzisarantis et al. (2003) and within the framework of the SDT, this might be best accomplished by helping women feel more competent or efficacious. Nevertheless, it should be re-iterated that even though intentions were a significant

predictor of physical activity behaviour change, it only accounted for 5 % of variance.

Thus, these practical suggestions should be considered with this in mind.

A number of limitations of this study are acknowledged. No intervention was implemented to increase women's physical activity participation. As such, the current results are based on naturally occurring change in women's level of physical activity. Experimentally, it would seem useful, for example, to manipulate study variables such as attitudes, autonomous motivation, or intentions as a means of fostering behaviour change. As well, more sophisticated data analytic procedures, such as SEM, would allow for a direct comparison of the relative fit of alternative theoretical models, and future studies would do well to employ this type of data analysis. An additional limitation stems from participants' high levels of physical activity and autonomous motivation. Indeed, the majority of study participants were sufficiently active to meet established recommendations for regular physical activity participation (Task Force on Community Preventive Services, 2002; see also Craig & Cameron, 2004). Thus, an increase in physical activity participation might effect relatively fewer health benefits for highly active women compared to less active or sedentary woman. Because the sample was comprised of women with a high socioeconomic status, the generalizability of the present findings are limited. Finally, as previously noted, the current investigation did not include certain variables from SDT, namely, the needs for autonomy, competence, and relatedness. Future research should include these variables with the present overall framework to ascertain how and where they influence motivation, intentions, and, ultimately, physical activity behaviour change.

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CHAPTER IV

PHYSICAL ACTIVITY BEHAVIOR CHANGE IN A COMMUNITY-BASED SAMPLE OF ADULT WOMEN: THE ROLE OF BARRIERS AND ENVIRONMENTAL CHARACTERISTICS

Abstract

Despite numerous benefits associated with physical activity, over half of North American women are insufficiently active. This study aimed to 1) describe barriers to physical activity behavior change in a community-based sample of women as well as environmental characteristics present in their neighborhoods, and 2) examine relationships among barriers, environmental characteristics, and physical activity behavior change. Participants were 149 women ranging in age between 39 and 68. At Time 1, physical activity was assessed. Six months later, at Time 2, barriers and environmental characteristics were retrospectively measured, and physical activity was re-assessed. The most prevalent barriers were daily activities and fatigue. Women over 60 years reported lower levels of barriers than younger women. Over time, inactive women reported higher levels of barriers (e.g., fatigue and lack of interest) than women who remained active or increased their physical activity level. Environmental characteristics were also associated with physical activity behavior change.

Key words: physical activity, behavior change, barriers, environment, adult women

Despite numerous benefits associated with regular physical activity participation (Pate et al., 1995), recent statistics indicate that the majority of adult women in North America are insufficiently active (Cameron, Craig, Stephens, & Ready, 2002; U.S. Department of Health and Human Services, 1996). This has implications not only for the physical and mental health of individuals, but for society as a whole in terms of consequences associated with physical inactivity, including increased risk of chronic diseases (Epstein, 1998) and health care costs (Katzmarzyk, Gledhill, & Shephard, 2000). Accordingly, researchers have explored a multitude of variables potentially associated with physical activity, and have attempted to use this information to inform intervention-based programs (Sallis & Owen, 1999).

One particular line of inquiry has examined *barriers* to physical activity. Broadly defined, barriers refer to real or perceived individual, interpersonal, or contextual factors that prevent individuals from engaging in an activity or hinder their ability to do so (Sallis & Owen, 1999). They may be beliefs concerning physical activity participation (i.e., psychological barriers). They may also be social factors (e.g., a lack of social support) or environmental factors (e.g., daily activities and limited access to sport/recreational facilities) that preclude individuals from being more physically active (i.e., contextual barriers).

Past studies have identified numerous barriers to adult women's physical activity participation. Lack of time, lack of energy, fatigue, and health problems are some of the most commonly reported barriers in this population (Booth, Bauman, & Owen, 2002; Canadian Fitness and Lifestyle Research Institute, 1996; Grubbs & Carter, 2002; King,

Castro, Wilcox, Eyler, Sallis, & Brownson, 2000; Wilcox, Castro, King, Houseman, & Brownson, 2000). A lack of social support has been found to undermine women's physical activity participation (Chogahara, O'Brien Cousins, & Wankel, 1998; O'Brien Cousins, 2003). What has been less studied is the prevalence of barriers in different age groups of adult women. There is some evidence to suggest that barriers such as health problems and lacking energy are more commonly reported by older women (Booth et al., 2002; Booth, Bauman, Owen, & Gore, 1997; Chinn, White, Harland, Drinkwater, & Raybould, 1999). Lacking time has also been found to be less of a perceived barrier to physical activity behavior in older women as compared to younger women (Booth et al., 2002; Canadian Fitness and Lifestyle Research Institute, 1996). These findings are suggestive, however, additional studies in this area are needed, especially with regards to informing age-specific physical activity interventions.

Moving beyond descriptive accounts, a number of investigations have demonstrated that barriers are associated with women's physical activity participation. A consistent finding in this area is that lacking time and fatigue are inversely related to physical activity (Booth et al., 1997, 2002; King et al., 2000; Wilcox et al., 2000). Physical activity and health problems have been similarly associated (Booth et al., 1997). When examined by age, psychological/health concerns have been negatively associated with vigorous physical activity for older women, but not for younger women (De Bourdeauhuij & Sallis, 2002). Although several studies have found relationships between barriers and physical activity, there is a paucity of research examining relationships between barriers and physical activity behavior change over time. In one of the few

studies in this area, a randomized trial of behavioral counseling in primary care, perceived barriers, assessed as a global construct, were predictive of physical activity behavior change at one year follow-up for both women and men receiving a behavioral counseling intervention (Steptoe, Rink, & Kerry, 2000). Taken together, these results suggest that barriers are not only associated with physical activity, but may hinder physical activity behavior change over time.

In line with ecological approaches that integrate individual, interpersonal, and environmental variables (see Sallis, Bauman, & Pratt, 1998; Sallis & Owen, 2002), researchers have started to examine the manner in which environmental characteristics influence physical activity participation. Environmental characteristics refer to physical attributes of the environment (e.g., neighborhood), such as the presence of hills, street lights, walking trails, and enjoyable scenery. Although certain researchers have conceptualized neighborhood characteristics as physical activity hindering (e.g., Cameron et al., 2002), it is important to note that certain variables (e.g., the presence of sidewalks) may actually promote physical activity.

From a descriptive vantage point, researchers such as King et al. (2000) have found that the most commonly reported environmental characteristics of middle- and older-aged American women are enjoyable scenery, frequently seeing others exercise, and streetlights. For middle-age Canadian women, the most commonly reported environmental characteristics perceived to undermine physical activity participation are cost, safety, and a lack of programs or facilities (Craig, Cameron, Russell, & Beaulieu, 2001).

Other studies have shown that the physical environment is positively associated with walking to work (Craig, Brownson, Cragg, & Dunn, 2002; see also Saelens, Sallis, & Frank, 2003). Safe environments, enjoyable scenery, frequently seeing other exercise, and heavy traffic have also been correlated with physical activity participation (Eyler et al., 2002; King et al., 2000). Despite this pattern of results, other researchers have failed to demonstrate any significant relationships between environmental characteristics and participation in physical activity (e.g., Salmon, Owen, Crawford, Bauman, & Sallis, 2003). Given these mixed findings, additional research in this area seems warranted. In particular, there is a dearth of studies describing environmental characteristics in different age groups of women, and relatively little is known about the relationships between environmental characteristics and physical activity behavior change over time.

In sum, there is growing evidence that barriers are associated with physical activity in adult women. There is also some evidence that environmental characteristics are associated with physical activity participation. What is less established are associations among barriers, environmental characteristics, and physical activity behavior change over time. Accordingly, the overall purpose of this study was to examine barriers and environmental characteristics in the context of physical activity behavior change. More specifically, the first purpose was to describe barriers to physical activity behavior change in a community-based sample of adult women as well as environmental characteristics present in their neighborhoods. This was accomplished by examining these variables for the entire sample and for different age groups of adult women. The second purpose of this study was to examine relationships among barriers, environmental

characteristics, and physical activity behavior change by correlating these variables and by comparing groups of women who increased, decreased, and maintained their level of physical activity over a six month period.

This study is of importance because relatively few investigations have specifically examined barriers to physical activity behavior change in community-based samples of adult women, particularly in Canadian women. As well, many studies in this area have not reported barriers on a per item basis or by age group, and have not examined relationships among specific barriers and change in physical activity behavior over time. From a methodological perspective, the majority of studies in this area have assessed barriers by asking participants to rate their reasons for not being physically active. In the current study, physical activity barriers and environmental characteristics were *retrospectively* assessed by asking women to rate the extent to which these variables were present over the past six months. In terms of practical implications, results of this study may be used to inform interventions aimed at increasing physical activity among adult women.

Method

Study Design

This study employed a two-wave, longitudinal design. At Time 1, in October, 2001, participants were administered a questionnaire assessing their current level of physical activity and a number of psychosocial variables. Six months later, in May, 2002 (Time 2), they were administered a similar battery in which their level of physical activity was re-assessed. This design allowed for an examination of change in physical

activity over time. At Time 2, participants were also asked about barriers they encountered over the past six months, as well as environmental characteristics present in their neighborhoods over this same time period. A six month time interval was chosen based on previous work in this area (e.g., Prochaska & DiClemente, 1985; Prochaska et al., 1994), and because it would allow results of the present study to be compared with those of other investigations employing similar measures and procedures to examine physical activity behavior change. The time periods of October and May were chosen because they are similar with respect to climate normals (Environment Canada, 2002).

Participants and Procedures

The sample was comprised of adult women attending classes, groups, or programs at community-based facilities in the Ottawa, Canada region, including community centres, community health centres, and fitness clubs. Administrative staff from various community-based facilities were initially contacted about participating in this study.

Upon approval from the respective facilities, a total of 509 women were approached by trained researchers and invited to participate. Participants were informed about the study objectives, issues of confidentiality, and the voluntary nature of their involvement. They were given a baseline (Time 1) package containing a questionnaire, an information sheet, two consent forms, and a postage-paid envelope, and instructed to sign and return one of the consent forms along with their completed questionnaire. They were also asked to provide their name and address so a six-month follow-up (Time 2) questionnaire could be sent via postal mail. Two hundred and thirty-seven (46.6%) Time 1 questionnaires were returned. Eight (3.4%) of these questionnaires failed to include either a signed consent

form or return address, leaving 229 eligible participants at Time 1. The follow-up questionnaire package was sent to these 229 women at Time 2, and 178 (77.7%) questionnaires were completed and returned in the postage-paid envelope. Twenty-nine of these 178 (16.3%) cases were subsequently omitted from the data set because of missing data or because women stated that they had no intention to increase their level of physical activity over the past six months and, as a result, could not complete the measures (see Appendix A for a copy of the Time 1 and Time 2 questionnaires).

The final sample was thus comprised of 149 women ranging in age between 39 and 68 years ($M=51.76$, $SD=6.69$). When categorized by age, 23 women (15%) were younger than 45 years, 36 women (24%) were between 45 and 49 years, 39 women (26%) were between 50 and 54 years, 30 women (20%) were between 55 and 59 years, and 21 women (14%) were older than 60 years. The majority of women were of Caucasian descent (93%), married (66%), and had attended college or university (85%). More than half of women (56%) reported a total annual revenue over \$75,000 CDN. Ethical approval for this investigation was obtained from the research ethics board of the University of Ottawa.

Measures

Physical activity behavior change. To assess physical activity behavior change, the Community Health Activities Model Program for Seniors (CHAMPS; Stewart, Mills, King, Haskell, Gillis, & Ritter, 2001) was administered at Time 1 and Time 2. Participants were asked to think about a typical week over the past month and to respond to questions in light of this typical week. They were presented with a comprehensive list

of physical activities, including leisure-time activities (e.g., walking, aerobics, and stretching), sports (e.g., playing basketball or soccer), and home-based activities (e.g., gardening and cleaning) and asked to rate the frequency and duration (in minutes) of their involvement in each activity. For activities not included in this list, an “other” category was included. To arrive at an overall amount of physical activity, frequency was multiplied by duration (converted to hours) per activity. This total amount of time was then multiplied by the estimated metabolic rate of energy expenditure or MET intensity (Ainsworth et al., 2000) to arrive at a per activity total energy expenditure. After summing across activities, this total was multiplied by self-reported weight in kilograms, yielding a weight-corrected total energy expenditure in $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{week}^{-1}$. The psychometric properties of this scale have been established by Stewart et al. (2001), with satisfactory six-month test-retest reliability (intraclass correlations ranged between 0.58 and 0.68 across physical activity groups), concurrent validity, and sensitivity to change (effect sizes were small to medium).

For the purposes of correlational analyses, similar to past studies (e.g., Calfas, Sallis, Oldenburg, & Ffrench, 1997), a standardized residual change score was computed as one measure of physical activity behavior change. This was accomplished by regressing the six month (Time 2) total physical activity score on the baseline (Time 1) total physical activity score (see Cohen & Cohen, 1983). Because of the standardization, this measure had a mean of 0 and a standard deviation of 1. Scores represent the degree of change from the mean change of the entire sample.

In line with previous research (e.g., Bock, Marcus, & Pinto, 2001; Booth et al.,

2002; Booth, Owen, Bauman, Clavisi, & Leslie, 2000) and for the purposes of a group comparison analysis, a second measure of physical activity behavior change was computed. This second measure was based on participants' attainment of a minimal total energy expenditure of 1500 kcal/week at Time 1 and Time 2. The criterion of 1500 kcal/week was founded on international physical activity guidelines (Health Canada & Canadian Society for Exercise Physiology, 1998; U.S. Department of Health and Human Services, 1996) and past physical activity research (Hambrecht et al., 1993). Participants who reported a minimal total energy expenditure of at least 1500 kcal/week were categorized as active, whereas participants expending less than 1500 kcal/week were categorized as inactive. Dichotomizing Time 1 and Time 2 total energy expenditure in this way resulted in the following four groups: *stable inactive* (inactive at both Time 1 and Time 2; $n=16$), *regressed* (active at Time 1 and inactive at Time 2; $n=14$), *progressed* (inactive at Time 1 and active at Time 2; $n=22$), and *stable active* (active at both Time 1 and Time 2; $n=97$). This approach allowed for a direct comparison of women who maintained, increased, or decreased their level of physical activity over time.

Barriers to physical activity. Physical activity barriers were measured at Time 2 by asking participants, on a retrospective basis, their reasons for not doing more physical activity over the past six months. Items were based on previously published work demonstrating acceptable levels of validity and reliability (Booth et al., 2002; De Bourdeauhuij & Sallis, 2002; King et al., 2000; Salmon et al., 2003). All items were assessed on a 7-point Likert-type scale anchored by 1 (*strongly disagree*) and 7 (*strongly*

agree). A total of fourteen items were used, including "Because my daily activities took the majority of my time," "Because I didn't like to exercise alone," "Because I lacked confidence when it came to physical activity," and "Because I was too tired."

Environmental characteristics. Consistent with the work of Sallis et al. (1997), participants were presented with a list of ten environmental characteristics and asked to rate the extent to which each characteristic was present in their neighborhood over the past six months. Items were measured on a 7-point Likert-type scale ranging from 1 (*not at all present*) to 7 (*highly present*). Certain items were physical activity facilitating (e.g., sidewalks, street lights, other people exercising, enjoyable scenery, and walking trails), whereas others were physical activity hindering (e.g., heavy traffic, unattended dogs, and crime). This and similar measures have been used in several recent studies (King et al., 2000; Sallis, Johnson, Calfas, Caparosa, & Nichols, 1997; Salmon et al., 2003) and have yielded satisfactory levels of validity and reliability (e.g., stability = .68).

Statistical Analyses

All statistical analyses were conducted using the SPSS, version 11 statistical software package. Descriptive statistics were used to describe physical activity barriers and environmental characteristics for the entire sample and by age group. Differences among the different age groups were tested using chi-square analyses. To examine bivariate associations among barriers, environmental characteristics, and physical activity behavior change (residual difference score), Pearson correlations were computed. Multivariate analyses of variance (MANOVAs) were conducted to test for differences between women who maintained (*stable active* and *stable inactive* groups), increased

(*progressed* group), or decreased (*regressed* group) their level of physical activity over time. A separate MANOVA was conducted for physical activity barriers and environmental characteristics. Statistical significance was set at .05 for all univariate and multivariate analyses.

Results

Preliminary Analyses

Participants who dropped out of the study after completing the Time 1 questionnaire were initially compared to the final sample of participants who completed both the Time 1 and Time 2 questionnaires using independent samples *t*-tests and chi-square analyses. Participants who completed both questionnaires were more highly educated ($p < .05$) than participants who dropped out of the study after completing the Time 1 questionnaire. No other significant differences were found. To assess the possibility that changes in physical activity were attributable to seasonal effects, weather data at Time 1 and Time 2 were obtained from Environment Canada (2002). Independent samples *t*-tests and chi-square analysis did not reveal any significant differences in terms of the average daily temperature, average daily relative humidity, total daily precipitation, and the total number of rainy days, indicating that the weather at Time 1 and Time 2 was comparable with respect to these meteorologic indices. Finally, after categorizing women by age, analysis of variance (ANOVA) was used to compare these groups in terms of their total energy expenditure at Time 1. No significant differences were obtained. This analysis was repeated at Time 2 and, again, no significant differences were observed.

Description of Physical Activity Barriers and Environmental Characteristics

In line with past research (e.g., Booth et al., 2002), the percentage of women reporting each barrier as the most or second-most important reason for not being more physically active over the past six months are presented in Table 1. The most commonly reported barriers for the entire sample were daily activities (39.6%), being too busy (31.5%), feeling too tired (20.1%), feeling too lazy (19.5%), experiencing health problems (14.8%), having difficulty managing time (14.7%), and not wanting to exercise alone (12.8%). Access to exercise/sport facilities and unsafe environments were only endorsed by 4.0% and 0.7% of the entire sample, respectively.

When the sample was categorized by age group, women over the age of 60 generally reported lower levels of physical activity barriers than women in all other age groups, especially in terms of being too tired ($p < .05$). Of note, only 14.3% of women over 60 reported that being too busy was the most or second-most important barrier to being more physically active compared to 47.8% of women in the under 45 age group ($p < .05$). Proportionately, more women under the age of 45 identified being too tired and having difficulty managing time as important barriers compared to women over the age of 60 ($ps < .05$). As well, no woman over the age of 60 indicated that lacking an interest in physical activity and feeling uncomfortable about her body was an important barrier to physical activity. Conversely, over one quarter of women younger than 55 reported that being too tired was the most or second-most important barrier to doing more physical activity over the past six months. Health problems were most common in women older than 60 years.

Table 1

Percentage of women who reported external and internal barriers to physical activity behavior change as most or second-most important.

Physical Activity Barrier	Entire Sample (n=149)	Age group				
		< 45 years (n=23)	45-49 years (n=36)	50-54 years (n=39)	55-59 years (n=30)	60+ years (n=21)
I didn't like to exercise alone	12.8	17.4	13.9	10.3	16.7	4.8
I didn't have access to an exercise/ sport facility	4.0	4.3	2.8	2.6	6.7	4.8
I was too busy	31.5	47.8	36.1	38.5	16.7	14.3
Health problems	14.8	13.0	16.7	15.4	10.0	19.0
My daily activities took the majority of my time	39.6	47.8	38.9	46.2	36.7	23.8
I didn't have enough money to exercise	6.7	13.0	0.0	10.3	10.0	0.0
I didn't have safe environments in which to engage in physical activity	0.7	4.3	0.0	0.0	0.0	0.0
I lacked confidence when it came to physical activity	4.7	4.3	8.3	2.6	3.3	4.8
I was not interested in physical activity	6.1	13.0	5.6	5.1	6.7	0.0
I didn't think physical activity would benefit me	1.4	4.3	2.8	0.0	0.0	0.0
I was too lazy	19.5	17.4	25.0	20.5	23.3	4.8
I felt uncomfortable about my body	8.1	8.7	5.6	15.4	6.7	0.0
I was too tired	20.1	26.1	25.0	25.6	16.7	0.0
I had difficulty managing my time	14.7	21.7	13.9	20.5	13.3	0.0

In terms of environmental characteristics (Table 2), over half of women indicated that sidewalks, street lights, enjoyable scenery, other people exercising, bicycle paths, and walking trails were highly present in their neighborhoods. Crime, unattended dogs, hills, and heavy traffic were the least present environmental characteristics reported in this sample. When examined by age, women younger than 45 years reported a higher presence of heavy traffic than women in all other age groups ($p < .05$).

Table 2

Percentage of women who reported each environmental characteristic as most or second-most present in their neighborhood.

Environmental Characteristic	Entire Sample (n=149)	Age group				
		< 45 years (n=23)	45-49 years (n=36)	50-54 years (n=39)	55-59 years (n=30)	60+ years (n=21)
Sidewalks	56.4	52.2	58.3	56.4	56.7	57.1
Street lights	54.4	47.8	66.7	53.8	50.0	47.6
Enjoyable scenery	61.1	56.5	61.1	66.7	63.3	52.4
Frequently seeing people walking or exercising	55.0	43.5	52.8	56.4	66.7	52.4
Bicycle paths	50.4	30.4	52.8	56.4	60.0	42.9
Walking trails	50.3	26.1	55.6	61.5	56.7	38.1
Hills	14.1	8.7	16.7	20.5	13.3	4.8
Heavy traffic	16.1	39.1	11.1	15.4	10.0	9.5
Dogs that are unattended	8.1	13.0	0.0	10.3	13.3	4.8
High levels of crime	2.6	8.7	2.8	0.0	3.3	0.0

Relationships among Barriers, Environmental Characteristics, and Physical Activity Behavior Change

Correlations among barriers, environmental characteristics, and physical activity behavior change (residual difference score) were modest. Specifically, physical activity behavior change was negatively associated with feeling too tired ($r = -.21$, $p < .05$), whereas it was positively correlated with the presence of safe environments ($r = .17$, $p < .05$) and enjoyable scenery ($r = .19$, $p < .05$).

When the sample was subdivided into physical activity behavior change groups based on whether or not women met the minimal total energy expenditure of 1500 kcal/day at Time 1 and Time 2 (Table 3), overall, the majority of women (65.1%) were in the stable active group compared to the progressed (14.8%), stable inactive (10.7%),

Table 3

Percentage of women in each physical activity behavior change group for the entire sample and by age group.

Physical Activity Group	Age group					
	Entire Sample (<i>n</i> =149)	< 45 years (<i>n</i> =23)	45-49 years (<i>n</i> =36)	50-54 years (<i>n</i> =39)	55-59 years (<i>n</i> =30)	60+ years (<i>n</i> =21)
Stable inactive	10.7	13.0	19.4	5.1	6.7	9.5
Regressed	9.4	4.3	22.2	5.1	10.0	0.0
Progressed	14.8	8.7	13.9	25.6	13.3	4.8
Stable active	65.1	73.9	44.4	64.1	70.0	85.7

and regressed (9.4%) groups. The greatest proportion of women in all age groups was in the stable active group, with the proportions ranging between 44.4% for women between the ages of 45 and 49 years, and 85.7% for women over the age of 60.

A multivariate comparison of the four physical activity behavior change groups using MANOVAs (Table 4) revealed a significant overall effect for physical activity barriers, $F(14, 132)=2.42, p<.001$. Post hoc ANOVAs showed significant differences in terms of lack of interest $F(3, 145)=8.49, p<.001$, feeling too lazy $F(3, 145)=5.56, p<.001$, feeling too tired, $F(3, 145)=9.34, p<.001$, and the expense associated with physical activity $F(3, 145)=3.56, p<.05$. Specifically, women in the stable inactive group reported significantly lower interest in physical activity than women in either the regressed ($p<.05$) or stable active ($p<.001$) groups. Women in the stable inactive group reported feeling significantly more lazy than women in the stable active group ($p<.01$), and significantly more tired than women in both the progressed ($p<.05$) and stable active ($p<.001$) groups. Women who regressed reported feeling more tired than women in the

Table 4

Differences in external barriers, internal barriers, and environmental characteristics among physical activity behavior change groups.

Variable	Physical Activity Behavior Change Group				
	Stable Inactive (<i>n</i> = 16) <i>M</i> (<i>SD</i>)	Regressed (<i>n</i> = 14) <i>M</i> (<i>SD</i>)	Progressed (<i>n</i> = 22) <i>M</i> (<i>SD</i>)	Stable Active (<i>n</i> = 97) <i>M</i> (<i>SD</i>)	Univariate ANOVA <i>F</i>
Physical activity barriers^a					
I didn't like to exercise alone	3.56 (2.25)	2.36 (1.91)	3.50 (1.97)	2.75 (1.87)	1.90
I didn't have access to an exercise/sport facility	2.31 (1.30)	2.21 (2.19)	1.68 (1.13)	1.88 (1.39)	0.83
I was too busy	5.00 (2.03)	5.21 (1.58)	4.14 (1.88)	3.97 (2.06)	2.49
Health problems	3.69 (2.39)	2.43 (1.79)	2.55 (1.82)	2.61 (2.01)	1.48
My daily activities took the majority of my time	5.31 (1.78)	5.00 (1.41)	4.95 (1.96)	4.18 (2.00)	2.58
I didn't have enough money to exercise	2.38 (1.86)	1.36 (0.93)	2.55 (2.15)	1.61 (1.31)	3.56*
I didn't have safe environments in which to engage in PA	1.50 (0.82)	1.64 (1.28)	1.64 (1.29)	1.53 (1.05)	0.11
I lacked confidence when it came to PA	2.81 (1.94)	2.14 (1.75)	2.32 (1.67)	1.82 (1.29)	2.49
I was not interested in PA	4.00 (2.00)	2.43 (1.79)	2.73 (1.86)	1.92 (1.41)	8.49**
I didn't think PA would benefit me	1.44 (0.51)	1.14 (0.36)	1.27 (0.63)	1.39 (0.97)	0.46
I was too lazy	5.00 (2.00)	4.36 (2.44)	3.82 (2.08)	3.09 (1.86)	5.56**
I felt uncomfortable about my body	2.81 (2.10)	1.79 (1.63)	2.41 (1.74)	2.14 (1.62)	1.13
I was too tired	5.38 (1.36)	4.79 (0.97)	3.55 (2.04)	3.10 (1.94)	9.34**
I had difficulty managing my time	4.00 (2.10)	3.29 (1.98)	3.64 (2.17)	2.88 (1.80)	2.21
Environmental characteristics^b					
Sidewalks	5.06 (2.17)	4.86 (2.68)	5.55 (2.02)	5.06 (2.25)	0.35
Street lights	5.06 (2.26)	4.86 (2.18)	5.18 (2.28)	5.08 (2.00)	0.07
Enjoyable scenery	4.88 (1.45)	5.00 (2.08)	5.50 (1.63)	5.71 (1.48)	1.90
Frequently seeing people walking or exercising	5.06 (1.44)	3.93 (1.54)	5.86 (1.42)	5.41 (1.48)	5.43**
Bicycle paths	5.00 (1.83)	5.00 (1.96)	4.23 (2.18)	4.81 (2.27)	0.57
Walking trails	4.88 (1.93)	4.79 (1.81)	4.68 (2.12)	4.85 (2.20)	0.04
Hills	3.00 (2.07)	3.36 (1.95)	3.82 (1.79)	2.97 (1.77)	1.38
Heavy traffic	3.88 (1.54)	4.00 (1.80)	3.59 (1.87)	3.67 (1.86)	0.21
Dogs that are unattended	2.25 (1.39)	2.57 (1.65)	2.23 (1.77)	2.59 (1.65)	0.44
High levels of crime	2.25 (1.13)	2.36 (1.78)	1.77 (0.87)	2.02 (1.22)	0.82

^aOverall MANOVA: $F(14, 132) = 2.42, p < .001$. ^bOverall MANOVA: $F(10, 136) = 1.37, p = .095$.

* $p < .05$. ** $p < .001$.

stable active group ($p < .01$). Moreover, women in the progressed group reported that physical activity expenses were a significantly greater barrier than women in the stable

active group ($p < .05$). A trend was also observed for daily activities, $F(3, 145) = 2.58$, $p = .056$, with women in the stable inactive group reporting higher levels of this barrier than women in the stable active group. Finally, although no significant multivariate effect was found for environmental characteristics, $F(10, 136) = 1.37$, $p = .095$, a significant univariate effect was obtained for others exercising, $F(3, 145) = 5.43$, $p < .001$. Women in the progressed and stable active groups reported a significantly higher prevalence of others exercising in their neighborhood than women in the regressed group ($ps < .01$).

Finally, *post hoc* analyses were conducted to assess potential associations between marital status and both physical activity barriers and environmental characteristics. To this end, MANOVAs were used. With respect to barriers, a multivariate effect was found (Hotelling's $T^2 = 0.22$; $F(14, 134) = 2.10$, $p < .05$), with married women endorsing the barrier "I was too busy" to a greater degree than unmarried women ($p < .05$) (see Table 6 in Appendix B). A significant overall effect was also observed for environmental characteristics (Hotelling's $T^2 = 0.22$; $F(10, 138) = 2.99$, $p < .01$). Unmarried women reported that sidewalks ($p < .001$), heavy traffic ($p < .05$), street lights ($p < .001$), crime ($p < .01$), the presence of others exercising ($p < .05$), bicycle paths ($p < .001$), and walking trails ($p < .05$) were more present in their neighborhoods than married women (see Table 7 in Appendix B).

Discussion

The current investigation is one of the few examining relationships among barriers, environmental characteristics, and physical activity behavior change over time in a community-based sample of adult women. Results of the descriptive analyses

demonstrated that the most commonly reported barriers for the entire sample (i.e., those barriers reported by over 10% of the sample) were daily activities, being too busy, feeling tired, feeling lazy, health problems, having difficulty managing time, and not wanting to exercise alone. These physical activity barriers are generally consistent with those identified in past studies of adult women, especially daily activities and lacking time (Booth et al., 1997, 2002; Canadian Fitness and Lifestyle Research Institute, 1996; Grubbs & Carter, 2002; King et al., 2000; Wilcox et al., 2000). Of particular note, difficulty managing time was identified as an important barrier in the present sample. It may be that lacking time and daily activities are significant contextual barriers to physical activity, however, it may also be that the ability to manage time is an important variable that precludes women from being more physically active. From an applied perspective, time management strategies is a teachable skill that may help to foster physical activity participation in this population.

When examined by age group, older women (i.e., those over the age of 60 years) reported lower levels of most physical activity barriers than women in all other age groups. One notable exception was found with respect to health problems, a physical activity barrier more prevalent in older women than in younger women, although, with current sample size, this difference was not statistically significant.

This pattern of results generally concurs with past studies (Booth et al., 1997; 2002; Canadian Fitness and Lifestyle Research Institute, 1996; Chinn et al., 1999; De Bourdeauhuij & Sallis, 2002), and may be attributable, in part, to lifestyle changes such as reduced childcare or care giving duties and/or retirement from full-time employment.

Although older adults in the present study were defined as being at least 60 years of age, there is evidence that the degree to which health-related problems, including injury or disability, are perceived as important physical activity barriers continues to increase in individuals over the age of 70 years (Booth et al., 2002). From an applied perspective, physical activity interventions aimed at older women should include activities that are sensitive to their health-related needs and abilities. It also suggests that developing a generic physical activity intervention may not be the most effective approach because it fails to address specific barriers that are most salient to different age groups of women.

The most commonly reported environmental characteristics for the entire sample were enjoyable scenery, sidewalks, seeing others exercising, street lights, bicycle paths, and walking trails. The prevalence of sidewalks, streetlights, and frequently seeing others exercising were comparable to those reported by King et al. (2000) in a study of middle- and older-aged American women. The presence of heavy traffic, unattended dogs, high levels of crime, and enjoyable scenery, however, were lower than those reported by King et al., and this may be attributable to the differences in socio-economic status and differences in geographic location. The prevalence of certain environmental characteristics varied with age, for example, the presence of heavy traffic was highest in women younger than 45 years and lowest in women over the age of 60 years. Although speculative, it may be that, in the current study, younger women (i.e., those younger than 45 years) lived in more densely populated urban areas than older women.

In addition to age group differences, marital status was also significantly related to environmental characteristics and, to a lesser extent, physical activity barriers. Married

participants reported a lower presence of several environmental attributes, including, sidewalks, street lights, bicycle paths, crime, and heavy traffic. Married women also reported that being overly busy was a more important barrier to physical activity behaviour change than unmarried women. To our knowledge, there are very few investigations that have directly examined the link between marital status and either physical activity barriers or environmental characteristics. Nevertheless, it might be that marriage is associated with increased familial responsibilities, and this could partially explain why married women reported that being overly busy was a more important barrier than women who were divorced/separated, single, or widowed.

From the vantage point of physical activity behavior change, results demonstrated that a number of barriers were associated with physical activity increase, decrease, or maintenance over time. Specifically, women who maintained a level of physical inactivity reported feeling more lazy, more tired, and less interested in physical activity than women who increased or maintained their physical activity level. Women who remained physically inactive reported that daily activities were more of a barrier than women who remained physically active, although this was only a trend. With respect to environmental characteristics, enjoyable scenery and the presence of others exercising were both related to physical activity increase. Overall, results are in line with past studies of adult women demonstrating associations between physical activity and both barriers and environmental characteristics (Booth et al., 1997, 2002; Cameron et al., 2002; King et al., 2000; Wilcox et al., 2000; see also Saelens et al., 2003). The importance of the social context (i.e., having others to exercise with and receiving

support) and safety is also consistent with past Canadian research in this area (Craig et al., 2001; O'Brien Cousins, 1993; see also Chogahara et al., 1998).

What is unique about the present study is that it demonstrated relationships between barriers, environmental characteristics, and physical activity behavior change on a temporal basis. Whereas past research has differentiated between active and inactive women, this investigation differentiated among groups of women who maintained, increased, or decreased their level of physical activity. A very limited number of longitudinal studies have shown that barriers, when assessed as a global construct, are predictive of physical activity behavior change over a period of 12 months (Steptoe et al., 2000). What the current investigation contributes is insight into *specific* barriers and environmental characteristics associated with change in physical activity over time.

Practically speaking, the present findings suggest that interventions aimed at increasing physical activity in adult women should address a number of specific barriers. For example, interest in physical activity could be fostered by including intrinsically enjoyable activities and interest-enhancing strategies. Engaging in enjoyable activities would also be expected to foster intrinsic motivation, a variable that has been consistently associated with physical activity participation (see Frederick-Recascino, 2002). Feelings of fatigue could be addressed by educating women about the importance of proper sleep hygiene and adequate nutrition, as well as through the use of strategies such as positive self-talk, imagery, and yoga or meditation. From a social learning perspective (Bandura, 1986), physical activity could also be fostered by encouraging women to exercise in groups, in aesthetically pleasing settings, and/or in settings in which others are engaging

in similar activities.

What is important to underscore is that interventions aimed solely at the individual may not be optimally effective in promoting physical activity behaviour in adult women. Sallis and colleagues (Sallis et al., 1998; Sallis & Owen, 2002) suggest that multilevel interventions (i.e., those targeting the individual, the sociocultural context, the physical environment, and, at a broader level, policy-making) may be most effective in facilitating physical activity behaviour change. This type of multilevel approach may include such factors as social support from family and peers, physician influence, climate and seasonal factors, and the media. Indeed, a growing number of recent studies have supported the effectiveness of multilevel approaches in the context of increasing participation in physical activity (e.g., Bauman, Bellew, Owen, & Vita; 2001; Brownson et al., 2000). Although not exhaustive, the present investigation suggests the individual, social, and environmental variables play an important role in physical activity behaviour change.

Several limitations should be considered when interpreting the results of the current investigation. Many of the women in the present study were already sufficiently active at Time 1, and, as such, were unlikely to increase their level of physical activity by any significant degree. Indeed, the largest proportion of women in this study maintained a sufficient level of physical activity over time. Because this study only included women who intended to increase their physical activity level over time, it is unclear how results generalize to women who do not intend to increase their physical activity level. Also, because the current sample was relatively well-educated and of a

high socio-economic status, the generalizability of these findings to the general population should be made with caution. Moreover, it is unclear how results extend to time frames longer than six months. It is possible that many of the obtained relationships would still apply after at least 12 months, however, it is plausible that the strength of certain relationships may increase or decrease over time. Future studies could examine this possibility.

The current study included a limited number of barriers and environmental characteristics. Numerous other psychological and environmental factors may have been related to physical activity behavior change, including family priorities and socio-economic status (Eyler et al., 2002; Sallis & Owen, 1999). Accordingly, future studies may do well to further investigate other barriers (e.g., caregiving duties and cultural barriers) and environmental characteristics (e.g., weather and pollution). The limited sample size also precluded an analysis of physical activity behavior change for different age groups of women. Based on the results of the descriptive analysis in which certain barriers and environmental characteristics varied across age groups, these differences could translate into physical activity behavior change. Future studies would therefore do well to include larger and more representative samples, especially in terms of the different age groups of women. Finally, it may be that attitudes and beliefs towards barriers are as important to physical activity participation as the perceived presence or absence of barriers (O'Brien Cousins, 2003). Future studies may do well to explore variables associated with women's attitudes and beliefs towards physical activity barriers as well as their ability to surmount these types of barriers over time.

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CHAPTER V

GENERAL DISCUSSION

The overall purpose of this thesis was to examine physical activity behaviour change in a community based-sample of middle-aged women by integrating concepts from the TPB (Ajzen, 1985, 1991) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). This was accomplished by conducting two empirical investigations, one with French-speaking women and one with English-speaking women, the results of which were presented in a series of three journal articles. In the first article, "Psychosocial Correlates of Intentions to Increase Physical Activity in a Community-Based Sample of Adult Women," the objective was to examine psychosocial correlates of intentions to increase physical activity among French-speaking women at one point in time. Results demonstrated that both attitudes and perceived behavioural control significantly predicted intentions to increase physical activity. In addition, autonomous motivation uniquely contributed to physical activity intentions beyond and above the three TPB variables (attitudes, perceived behavioural control, and subjective norms). No significant relationship was observed, however, between social support and intentions to increase physical activity after controlling for the three TPB variables. This study supported the utility of integrating concepts from the TPB and SDT as a means of understanding important health behaviours, such as physical activity.

In the second journal article, "Physical Activity Behaviour Change in a Community-Based Sample of Middle-Age Women: Contributions from the Theory of

Planned Behaviour and Self-Determination Theory," an overarching aim was to replicate the findings of the first study in a English-speaking sample (i.e., to examine psychosocial correlates of intentions to increase physical activity). The second article specifically assessed physical activity *behaviour change* over time by integrating concepts from the TPB and SDT. Attitudes and subjective norms significantly predicted intentions to increase physical activity which, in turn, were significantly predictive of physical activity behaviour change over time. No other variables were significantly associated with physical activity intentions after controlling for the three TPB variables. Based on bivariate correlations, there was modest support for the mediating influence of the three TPB variables on the motivation-intention relationship; however, no moderating influence was observed among intentions, autonomous motivation, and change in physical activity behaviour. Further, a significant association was obtained between interpersonal style and motivation, but neither interpersonal style nor social support was related to intentions. Again, these results support the usefulness of integrating concepts from the TPB and SDT as a means of understanding change in physical activity behaviour.

Although the first two studies yielded some insight into the influence of psychological and social variables on physical activity behaviour change, they did not include environmental variables that might also contribute to women's ability to change their physical activity behaviour. Thus, the third journal article, "Physical Activity Behavior Change in a Community-Based Sample of Women: The Role of Barriers and Environmental Characteristics," aimed to identify barriers to physical activity behaviour

change as well as environmental characteristics present in women's neighbourhoods. An additional objective was to examine relationships among barriers, environmental characteristics, and physical activity behaviour change over time. Among the most commonly reported barriers were daily activities and fatigue, whereas the most prevalent environmental characteristics were enjoyable scenery, sidewalks, and frequently seeing others exercising. Women over the age of sixty reported fewer barriers than all other women. Moreover, inactive women reported higher levels of barriers (e.g., fatigue and lack of interest) than women who remained active or increased their physical activity level over six months. Environmental characteristics (e.g., enjoyable scenery and the presence of others exercising) were also associated with change in physical activity behaviour. Results of this third journal article complement the findings of the first two journal articles by demonstrating that, in addition to psychological variables such as intentions, the physical environment, psychological barriers, and contextual barriers play a relatively small, but important role in physical activity behaviour change among middle-aged women.

Theoretical Implications

Theory of Planned Behaviour

From a theoretical vantage point, the overall results generally supported the purported relationships of the TPB (Ajzen, 1985, 1991). As expected, attitudes were a significant predictor of physical activity intentions in the first two journal articles. Perceived behavioural control was a significant predictor of intentions in the first journal article, but not in the second journal article. Subjective norms were significantly

predictive of intentions in the second journal article only. Collectively, these results are in partial agreement with past physical activity research demonstrating significant links between the three TPB variables and physical activity intentions (Ajzen & Driver, 1992; Chatzisarantis & Biddle, 1998; Courneya, 1995; Courneya & Friedenreich, 1999; Courneya et al., 2000b; Rhodes & Courneya, 2003; Rhodes et al., 2003; Wankel et al., 1994).

The proportion of variance in intentions to increase physical activity accounted for by attitudes, perceived behavioural control, and subjective norms in the first journal article was 37%. This is consistent with past investigations that have explained between 30% and 50% of behavioural intentions across health behaviours (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997; Sutton, 1998). In the second journal article, however, the proportion of explained variance in physical activity intentions was markedly lower (i.e., 9%). This is most likely due to differences between the two samples (which will be specifically addressed later in this chapter). Nevertheless, what is unique about the present thesis is that it assessed intentions *to increase* physical activity both cross-sectionally and on a longitudinal basis. This extends the wealth of investigations examining intentions to engage in a multitude of health behaviours at a single point in time.

More interestingly, intentions to increase physical activity translated into behaviour change over time, although this relationship was relatively weak (i.e., the effect was small to medium; Cohen, 1992). Past studies have repeatedly shown that, in physical activity and other settings, intentions are predictive of behaviour (Chatzisarantis

& Biddle, 1998; Collins & Ellickson, 2004; Courneya et al., 2000b; Drossaert et al., 2003; Kaiser & Gutscher, 2003; McMillan & Conner, 2003; Sheeran & Silverman, 2003; Rhodes & Courneya, 2003; Sarrazin et al., 2002; Vallerand et al., 1997). What the current thesis contributes to the extant literature is an application of the TPB to physical activity *behaviour change*. Despite the fact that authors such as Sheeran et al. (2001) have questioned the validity of the TPB for examining behaviour change, results of this thesis concur with the findings of a growing number of investigations (e.g., Courneya et al., 2000, 2001; Sarrazin et al. 2002), demonstrating that intentions may play a modest, but determining role in effecting change in physical activity behaviour.

The five percent of variability in physical activity behaviour change explained by intentions to increase physical activity is lower than the 15% to 40% of variance in physical activity behaviour that has been consistently reported across studies (Godin & Kok, 1996; Hausenblas et al., 1997). Longitudinal investigations testing the TPB have explained somewhat less variance in physical activity behaviour, with estimates ranging between 8% and 31% (Blanchard et al., 2002; Lowe, Eves, & Carroll, 2002; Sarrazin et al., 2002). It is worth noting, however, that none of these studies directly examined *change* in physical activity behaviour over time. Obviously, accounting for five percent of variance in physical activity behaviour change means that ninety-five of variance was unexplained. Indeed, researchers such as Gollwitzer (1999) have differentiated between different types of intentions. One specific type is *goal intentions*, that is, the intention to

attain a specific outcome or goal¹. A second type of intentions, *implementation intentions*, refers to *how* a specific outcome or goal is to be attained given specific environmental conditions. There is some empirical evidence supporting the premise that goals are more likely to be realized when individuals have high implementation intentions, that is, they are not only able to initiate goal-directed behaviours, but they are able to anticipate and plan for potential problems, including barriers, distractions, and competing goals (Gollwitzer & Brandstätter, 1997; Orbell, Hodgkins, & Sheeran, 1997; see also Sheeran, Milne, Webb, & Gollwitzer, in press). Recent findings from a study of job-seeking behaviour suggest that implementation intentions might mediate the goal intentions-behaviour relationship (van Hooft, Born, Taris, van der Flier, & Blonk, in press). Future studies could therefore benefit from assessing both goal intentions and implementation intentions as a means of further examining physical activity and health behaviour change.

It is also likely that numerous other variables that could potentially explain how and why women changed their physical activity behaviour above and beyond the TPB variables. From a psychological perspective, these include task self-efficacy (Bandura, 1986; Oman & King, 1998; Sternfeld et al., 1999), barrier self-efficacy (McAuley, 1992), and transtheoretical processes of change (Adams & White, 2003; DiClemente & Prochaska, 1998; Prochaska & DiClemente, 1983, 1985; Prochaska et al., 1994;

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Intention to increase physical activity as assessed in this thesis is a type of goal intentions.

Prochaska, Norcross, & DiClemente, 1995). Additional determinants of physical activity behaviour change could be multilevel in nature (i.e., physiological, interpersonal, cultural, environmental, and political) (Sallis & Owen, 2002; Speck & Harrell, 2003; Trost et al., 2002). What remains clear is that behaviour change is a complex process, and obtaining relationships of even modest strength is informative with respect to explaining why and how women increase their physical activity level (Rosnow & Rosenthal, 1989).

Self-Determination Theory

From the vantage point of SDT, results partially supported predictions. In the first journal article, autonomous motivation emerged as a significant predictor of intentions to increase physical activity beyond and above the three TPB variables. This finding is consistent with the general theoretical postulate that autonomous motivation leads to positive outcomes (Deci & Ryan, 1985; Ryan & Deci, 2000; Vallerand, 2001). It also concurs with previous investigations demonstrating significant links between autonomous motives and physical activity intentions (Ntoumanis, 2001; Sarrazin et al., 2002; Standage et al., 2003), however, the current thesis provides a more stringent test of the autonomous motivation-intention relationship by employing a hierarchical regression model. Findings from the first journal article highlight the *unique*, relative contribution of autonomous motivation to intentions to increase physical activity beyond attitudes, perceived behavioural control, and subjective norms.

Results of the second journal article failed to replicate this basic finding, and this was most likely attributable to the limited amount of variance in autonomous motivation

(i.e., ceiling effect). Indeed, *post hoc* analyses demonstrated that the English-speaking women in the second journal article had significantly higher levels of autonomous motivation than the French-speaking women in the first journal article (see Appendix B). This suggests that these mixed findings might stem, at least in part, from differences between the English- and French-speaking samples. Whereas the former sample was recruited from community health centres, community centres, and fitness clubs, the latter sample was recruited from bingo halls, community centres, and fitness facilities. A further comparison of these two samples indicated that the English-speaking women reported significantly higher levels of perceived behavioural control ($p < .001$) and education ($p < .01$). There was also a trend for English-speaking women being more physically active than French-speaking women ($p = .07$). Nevertheless, consistent with previous research (Ntoumanis, 2001; Standage et al., 2003), a relatively weak, but significant bivariate correlation was observed between autonomous motives and intentions in the second journal article. Accordingly, the overall results of this thesis indicate that intentions and motivation are significantly associated, however, the nature of the relationship between these variables remains somewhat equivocal.

To specifically address this issue, a particular aim of the second journal article was to assess mediating and moderating influences among motivation, intentions, and physical activity behaviour change. Consistent with previous work in this area (e.g., Sarrazin et al., 2002), there was no evidence of an interaction between autonomous motivation and intentions in the prediction of change in physical activity behaviour, despite the fact that other researchers have demonstrated, to varying degrees, moderating

influences between intentions and motivation (Chatzisarantis & Biddle, 1998; Chatzisarantis et al., 1997; Orbell, 2003; Sheeran et al., 1999). By way of comparison, based on the overall results of this thesis, there was some evidence to support a mediating influence between motivation and intentions to increase physical activity. Because there was no significant relationship between autonomous motives and change in physical activity over time, the intention-behaviour change relationship could not be mediated by autonomous motivation (Baron & Kenny, 1986; Holmbeck, 1997). The supplementary statistical analyses (Appendix B) suggest that the relationship between autonomous motivation and intentions might be mediated by attitudes and subjective norms.

Specifically, results demonstrated that autonomous motivation was predictive of the three TPB variables, and, in turn, attitudes and subjective norms were predictive of intentions to increase physical activity (which subsequently predicted physical activity behaviour change). This sequence of direct and indirect pathways concurs with the findings of Hagger et al. (2003), which indicated that global motives influenced attitudes, perceived behavioural control, and subjective norms, all of which influenced physical activity intentions. Given the wealth of research demonstrating that autonomous motivation plays a key role in numerous health behaviour and health behaviour change (Williams et al., 1996, 1998, 2002, 2004), future studies of physical activity *behaviour change* are needed to further assess these purported relationship (i.e., mediating versus moderating influences). Larger and more heterogeneous samples, especially in terms of intentions, would be germane in this regard. In a similar vein, experimental and/or longitudinal research designs would allow for a more direct assessment of causal relationships among

these variables.

With regards to social variables, no significant association was observed between significant others' interpersonal style and physical activity intentions. This ran contrary to expectations, and it could be attributable to the manner in which interpersonal style was assessed. In the current thesis, participants were asked to identify the individual who has the greatest impact on their physical activity participation. Indeed, a wide range of "significant others" were identified by study participants, including children, siblings, spouses/partners, and health care professionals. It is unclear whether children or health care professionals, for example, provide autonomy support in the same manner as a spouse.

Another possibility is that, consistent with SDT (Deci & Ryan, 1985; Ryan & Deci, 2000; see also Vallerand, 1997, 2001), social influences are indirectly related to intentions through their influence on motivation. As expected, significant associations were obtained between an autonomy supportive interpersonal style and autonomous motivation, as well as between a controlling interpersonal style and controlling motivation. The bivariate correlation matrices presented in the first two journal articles also demonstrated significant associations between social support and autonomous motivation.

According to SDT (Deci & Ryan, 1985; Ryan & Deci, 2000), social variables, including, among others, interpersonal style and social support, should influence motivation through their direct impact on the three fundamental needs for autonomy, competence, and relatedness. These three basic needs should then directly influence

autonomous and controlled motives and, in turn, autonomous and controlled motives should predict a wide range of motivational consequences or outcomes. In terms of a causal sequence, this is visually depicted in Figure 2.

Relationships among the needs for autonomy, competence, and relatedness and autonomous and controlled motives were not examined here, because these three fundamental needs were not assessed. This is both a limitation of the present thesis and a potentially fruitful avenue of future study. Nevertheless, based on the findings from the first two journal articles as well as the supplementary statistical analyses presented in Appendix B, there was some support for the sequential relationships delineated in Figure 2. Specifically, social factors (i.e., interpersonal style and social support) were significantly associated with motivation. Autonomous motives were also significantly associated with physical activity intentions—although, based on supplementary analyses, this relationship might be mediated by attitudes, perceived behavioural control, and subjective norms. In turn, as noted above, intentions to increase physical activity (a motivational consequence) translated into physical activity behaviour change over time (a second motivational consequence). The observed relationships among these variables is visually depicted in Figure 3².

Empirically, the direct and indirect pathways among social factors, need satisfaction, motivation, and motivational consequences have been well supported in

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The needs for autonomy, competence, and relatedness were not measured in the present thesis. They have been included in this model to demonstrate their theoretical relationships with social factors and motivation.



Figure 2. Proposed causal sequence underlying human motivation based on SDT.

physical activity (see Frederick-Recascino, 2002; Vallerand & Losier, 1999; Vallerand, 1997, 2001; Wilson et al., 2003) and other settings (Deci & Ryan, 2002; Sheldon et al., 2003). Moreover, these relationships have also been observed in studies specifically, including physical activity intentions as a motivational outcome (e.g., Ntoumanis, 2001; Sarrazin et al., 2002; Standage et al., 2003). Additional support for this causal sequence stems from a recent meta-analysis conducted by Chatzisarantis and colleagues (2003).

These researchers demonstrated that autonomous and controlled motives mediate the relationship between perceptions of competence and physical activity intentions. Thus, future studies would do well to directly test the relationships delineated in Figure 3 in the context of physical activity behaviour *change* and, in particular, among middle-aged women. The Hierarchical Model of Intrinsic and Extrinsic Motivation (Vallerand, 1997, 2001) would seem particularly salient in this regard.

What remains unclear based on the results of the first two journal articles and the supplementary statistical analyses (Appendix B) is the influence of motivation and TPB variables (attitudes, perceived behavioural control, and subjective norms) on physical activity intentions and behaviour. One possibility is that, consistent with the mediational

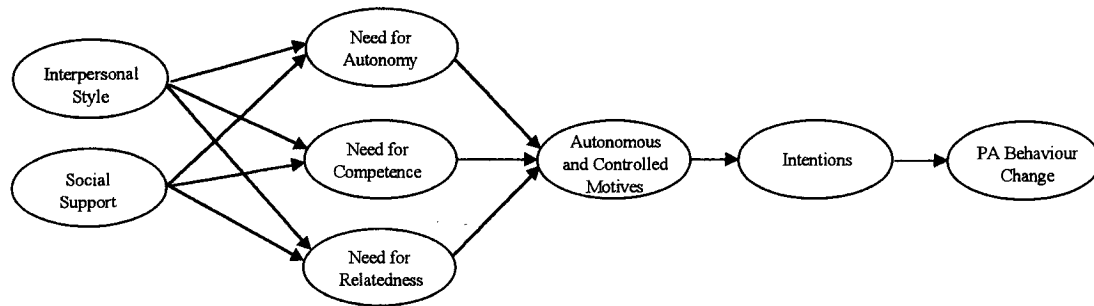


Figure 3. Theoretical model of the relationships among social factors, need satisfaction, motivation, and motivational consequences.

model tested in Appendix B, autonomous motivation influences the three TPB variables which, in turn, influence intentions. This sequence of relationships is depicted in Figure 4. Another possibility is that, consistent with the findings of the first article, motivation is at the same level as the three TPB variables. That is, attitudes, perceived behavioural control, subjective norms, *and* autonomous motivation are directly related to intentions (Figure 5). What seems clear is that additional research is needed to further test these possibilities. This could be done with both physical activity and other behaviours (e.g., addictive behaviours, clinical and screening behaviours, and ecological behaviours).

In terms of theory integration, there is also some question as to where subjective norms should be situated in Figures 3 through 5. Within the framework of the TPB, subjective norms are posited to directly influence intentions (as depicted in Figures 4 and 5). This runs contrary to SDT, which, as previously noted, posits that social factors should directly influence the needs for autonomy, competence, and relatedness which, in

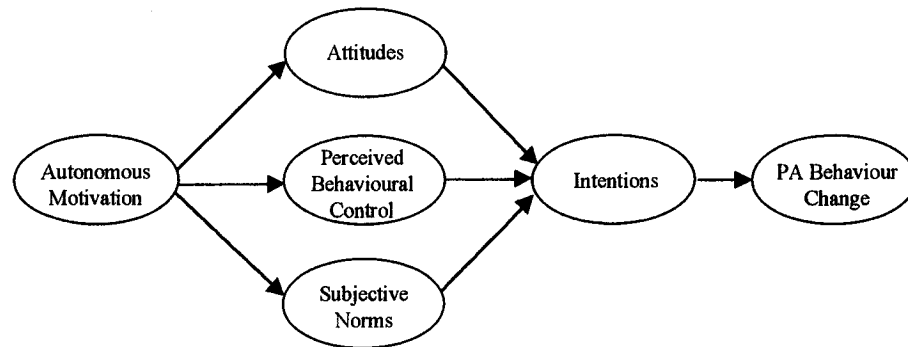


Figure 4. Theoretical model of the mediating influence of attitudes, perceived behavioural control, and subjective norms on the motivation-intentions relationship.

turn, should influence motivation which, subsequently, should effect motivational consequences (including intentions and behaviour change) (as in Figures 2 and 3).

What would seem plausible based on SDT is that subjective norms are at the same conceptual level as the other social factors (i.e., interpersonal style and social support). In other words, interpersonal style, social support, *and* subjective norms could directly predict the needs for autonomy, competence, and relatedness. That subjective norms might be a distal determinant of intentions rather than a proximal determinant (as in the TPB) could also explain why, in comparison to attitudes and perceived behavioural control, subjective norms tend to be a weaker predictor of intentions (Armitage & Conner, 2001; Godin & Kok, 1996; Hausenblas et al., 1997). A closer inspection of the bivariate correlations presented in the first two articles indicated that the association between subjective norms and controlled motivation was slightly stronger than the correlation between subjective norms and intentions. Although this evidence is relatively weak, in terms of integrating concepts from the TPB and SDT, it suggests that additional

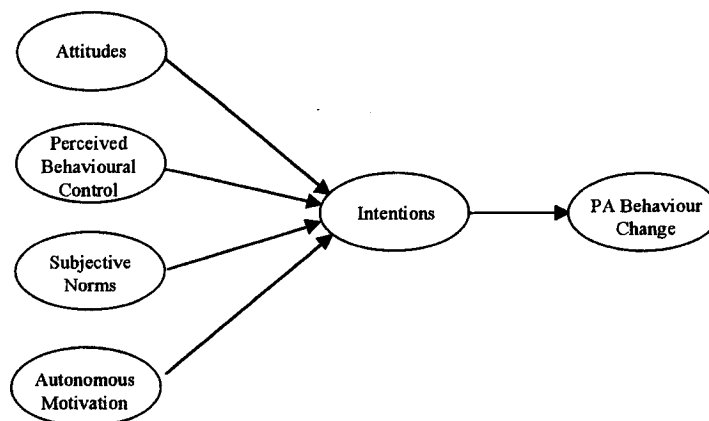


Figure 5. Theoretical model of direct influences between attitudes, perceived behavioural control, subjective norms, and autonomous motivation on intentions.

research is needed to further examine relationships among subjective norms, the needs for autonomy, competence, and relatedness, motivation, and intentions.

Conceptual models such as the TPB and SDT have potential for understanding relationships among psychological variables, social variables, and behaviour (see Conner & Norman, in press; Deci & Ryan, 2002); however, they do not typically include variables of a physiological, demographic, or policy-based nature. An increasing number of studies have collectively demonstrated that physiological, sociodemographic, social/cultural, environmental, and political variables play important roles in physical activity behaviour (Sallis & Owen, 2002; Trost et al., 2002), particularly among adult women (Speck & Harrell, 2003).

In the context of the present thesis, significant differences were observed between married and unmarried English-speaking women (in the second and third journal articles) in terms of physical activity behaviour change, environmental characteristics, and, to a

lesser degree, physical activity barriers. This is in line with previous physical activity research demonstrating a positive association between marital status and physical activity participation (King, Kiernan, Ahn, & Wilcox, 1998), although this basic finding has been inconsistent across studies (Trost et al., 2002). One issue that remains unclear is whether simply having a spouse is sufficient to foster women's physical activity participation—presumably through various forms of support (e.g., emotional, instrumental, and autonomy supportive). It may be that the *quality* of the marital relationship (i.e., marital satisfaction) is at least as important as simply having a spouse, and this could be further explored in future studies. Regardless, marital status contributed six percent of variance to change in physical activity in the second journal article. The inclusion of this sociodemographic variable explained the same amount of variance in physical activity behaviour change as that accounted for by the TPB and SDT variables. Thus, future research would do well to include marital status as a determinant of physical activity behaviour change in adult women.

From a theoretical vantage point, an increasing number of investigations have integrated multiple levels of variables within ecological frameworks (Sallis & Owen, 1997, 2002; Stokols, 1992). Other conceptual models such as Behavioral Choice Theory (Vuchinich & Tucker, 1983, 1988) similarly incorporate individual-level variables with environmental factors, and recent data support the usefulness of this approach (e.g., Salmon, Owen, Crawford, Bauman, & Sallis, 2003). Notwithstanding methodological challenges inherent in conducting research investigations of this magnitude, future studies in physical activity setting would do well to integrate a broader array of variables to

complement the psychological and social measures that are typically included in mainstream theoretical models, such as the TPB and SDT.

Fostering Physical Activity in Middle-Aged Women

From an applied perspective, the overall results of this thesis suggest a number of ways in which physical activity could be fostered in middle-aged women. In term of the first two journal articles, attitudes, perceived behavioural control, subjective norms, and autonomous motivation were, to various degrees, associated with intentions to increase physical activity behaviour which, in turn, were predictive of change in physical activity over time. Accordingly, physical activity intentions could be fostered by helping women develop more positive attitudes (e.g., by focusing on physical and mental health benefits of regular physical activity participation) and perceptions of behavioural control (e.g., by focusing on strategies to increase physical activity levels, such as goal setting). By encouraging significant others to vocalize positive expectations regarding regular involvement in physical activity, subjective norms could be enhanced. Additionally, autonomous motivation could be fostered by addressing the fundamental needs for autonomy, competence, and relatedness and/or encouraging significant others to act in autonomy supportive ways (e.g., providing choices and support). In the context of the present thesis, given the limited amount of variance in physical activity behaviour change accounted for by intentions and motivation, as well as participants' high levels of physical activity over time, these practical suggestions might effect a relatively small change in physical activity behaviour. Nevertheless, as noted previously, behaviour change is a complex process, and even a small increase can bring about positive changes

in terms of physical and mental health (Bouchard et al., 1994; Dunn & Blair, 2002; Pate et al., 1995).

In terms of the third article, results indicated that, consistent with past research (e.g., Booth et al., 1997, 2002; Canadian Fitness and Lifestyle Research Institute, 1996; Grubbs & Carter, 2002; King et al., 2000; Wilcox et al., 2000), several barriers and environmental characteristics are associated with physical activity behaviour change. For example, a lack of interest could be addressed by helping women choose intrinsically appealing physical activities that combine enjoyment with physical health benefits. Fatigue and lack of energy could be targeted by helping women develop better sleep hygiene and/or nutritional habits. Positive self-talk, imagery, and yoga or meditation could also be useful in this regard. Given that the presence of others exercising was associated with change in physical activity over time, encouraging women to exercise in groups, especially in aesthetically pleasing settings, could also foster physical activity involvement.

Overcoming Physical Activity Barriers

What were not assessed in any of the articles comprising this thesis were strategies to overcome barriers to physical activity behaviour change. In addition to the aforementioned suggestions for enhancing physical activity in middle-aged women, a growing number of investigations have shown that variables such as barriers self-efficacy, outcome expectations, and value expectancy (Fleury, 1992; McAuley, 1992; Sternfeld et al., 1999; see also Sallis & Owen, 1999) are important to overcoming physical activity barriers and, ultimately, becoming more active. Ideally, a more

comprehensive investigation would include not only determinants of and barriers to physical activity behaviour change, but a systematic examination of strategies that might facilitate or hinder women's ability to overcome these barriers. This could potentially shed light on strategies that are most salient to effect an increase in physical activity levels of middle-aged women. Again, using an ecological framework (Sallis & Owen, 2002) or a similar conceptual model (Stokols, 1992) could be useful in this regard. Qualitative methodologies could also be used as an alternative approach to understanding women's ability to overcome physical activity barriers. O'Brien Cousins (2003) has made important contributions to our understanding of women's physical activity barriers and benefits by using a grounded theory approach. Other researchers (e.g., Fleury, 1992) have argued that models of physical activity behaviour change should include an assessment of the meaning women assign to changing their health behaviour.

Limitations

One of the main limitations of this thesis pertains to the physical activity level of study participants. Indeed, the majority of French- and English-speaking women were highly active (i.e., they met established population-based recommendations for regular physical activity participation) (Task Force on Community Preventive Services, 2002; U.S. Department of Health and Human Services, 1996; see also Blair et al., 2004; Craig & Cameron, 2004). Because most women were already highly active, despite their self-reported intentions, there was a limit with respect to the extent to which they could have increased their physical activity behaviour. The high physical activity levels could be attributable to actual physical activity levels and/or to a social desirability bias.

Regardless, it would have been useful to have examined the relative contribution of SDT and TPB variables to physical activity behaviour change among sedentary women and/or by comparing groups of inactive versus active women. Barriers to physical activity increase and environmental characteristics might also differ between active and inactive women, and this information could be used to develop interventions specifically targeting different populations.

The majority of women who participated in this research were of a high socioeconomic status, and this limits the extent to which the present findings could be generalized to other populations. As well, given the limited socioeconomic diversity within and between the French- and English-speaking samples, an interesting avenue for future research would be to assess the purported relationships among TPB and SDT variables and physical activity behaviour across divergent subpopulations (e.g., ethnic and socioeconomic groups).

Another limitation pertains to the small proportion of explained variance in physical activity behaviour change. As noted throughout this chapter, only six percent of change in physical activity behaviour was accounted for by the combination of intentions and motivation, although this was approximately doubled by the inclusion of marital status. Again, this likely stems from participants' high levels of physical activity at Time 1 and Time 2. It might also be attributable to the limited capacity of variables such as intentions and autonomous motivation (notwithstanding the ceiling effect of autonomous motivation in the second journal article) to fully explicate change in physical activity behaviour. Additional variables such as task self-efficacy, barrier self-efficacy,

implementation intentions, transtheoretical processes of change, and a broad array of physiological, social/cultural, environmental, and policy-level variables would likely have enhanced the explained variance in women's physical activity behaviour change over time.

Since the current data were collected, there have been a number of published studies questioning the operational definitions of the TPB variables (Rhodes & Courneya, 2003; Trafimow et al., 2002; see also Ajzen, 2002). Specifically, it has been demonstrated that when multiple dimensions of attitudes, perceived behavioural control, and subjective norms are assessed, they increase the explanatory power of the TPB. It has also been argued that, in addition to goal intentions (as assessed in the present thesis), implementation intentions should be routinely assessed as a determinant of goal-directed behaviour (Gollwitzer & Brandstätter, 1997). There is some emerging evidence to support this contention (Orbell et al., 1997; Sheeran et al., in press; van Hooft et al., in press). Accordingly, future research could extend the present research by including more encompassing measures of attitudes, perceived behavioural control, subjective norms, and intentions in the study of women's physical activity behaviour.

A further limitation of this thesis is that no data were obtained on the women who declined participation in this study. The response rate in the second journal article was 47%, indicating that just under half of all women approached actually participated in this research. Nothing is known about the 53% of women who declined participation due to lack of interest, lack of time, or because they had no intention of increasing their level of physical activity. There was also a significant number of English- and French-speaking

participants who, after the study was explained during initial recruitment, agreed to participate in this study. These same women later indicated on their questionnaire that they could not respond to items because they did not intend to increase their physical activity level. Although this has obvious implications in terms of sample size and statistical power, there was likely a self-selection bias for those women who actually agreed to participate in this study. For example, it is possible that women agreeing to participate were more autonomously motivated to increase their physical activity level and/or had higher perceptions of control over becoming more physically active than study decliners. The high levels of autonomous motivation observed in the second article gives some credence to this possibility.

A final limitation pertains to the design of the research. By using a non-experimental design, what was effectively studied in the two studies comprising this thesis was *naturally occurring* change in physical activity behaviour. This could have further contributed to the limited amount of variability in actual physical activity increase over six months, thereby attenuating relationships among change in physical activity behaviour, intentions, and motivation. Future research could benefit from using an experimental or quasi-experimental design to enhance intentions to increase physical activity behaviour change (e.g., by targeting attitudes or autonomous motivation) and/or physical activity behaviour. On a related methodological note, the relatively small sample size has implications in terms of the statistical analyses employed. Indeed, as mentioned previously, this thesis would have benefitted from using SEM as a data analytic strategy instead of multiple regression and path analysis. This is especially pertinent with regards

to testing alternative theoretical models (e.g., Figure 4 versus Figure 5 in this chapter), because SEM allows for a direct comparison of the fit of different theoretical models. The limited number of study participants in combination with their already high levels of physical activity also limits the external validity of the current research findings.

The two-wave longitudinal design has limits in terms of the assessment of behaviour change. This design allowed for an aggregate measure of physical activity behaviour at two time points, six months apart. This sheds light on change in physical activity between these two time points, but it reveals little in terms of individual rates of change or growth trajectories over time. Moreover, there is some controversy regarding the use of residual change scores as a measure of behaviour change (see Francis et al., 1991). To address this issue, a second, criterion-based measure of physical activity behaviour change was calculated in the third journal article. This second measure allowed for a more comprehensive assessment of behaviour change over time. Nevertheless, future research would do well to examine the *process* of behaviour change (e.g., rates of change) using multilevel models and data analytic procedures such as HLM. This could be accomplished by having multiple waves of data and by extending the study time frame from six months to one or more years.

Conclusion

In conclusion, this thesis examined physical activity behaviour change in a community-based sample of middle-aged women. Results demonstrated that intentions to increase physical activity were modestly associated with change in physical activity behaviour over six months. A number of variables were also associated with intentions to

increase physical activity, including attitudes, perceived behavioural control, subjective norms, and autonomous motivation. Results shed light on the relationships among intentions, autonomous motives, and change in physical activity behaviour; however, additional research is needed to further test mediating and moderating influences among these variables. Moreover, this research demonstrated that barriers (e.g., lack of interest, lack of time, and daily activities), environmental characteristics (e.g., enjoyable scenery and frequently seeing others exercising), and marital status were associated with change in physical activity over time. Future research would do well to extend the current findings by integrating variables from the TPB and SDT into broader, more encompassing ecological frameworks.

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APPENDIX A
CONTRIBUTIONS OF THE COLLABORATORS

This thesis was conducted within the scope of a broader research project entitled, "Multilevel Determinants of Health Behaviours in Perimenopausal Women: Integrating Psychology and Population Health Paradigms." This broader project was a collaborative effort between two professors Dr. Michelle Fortier (School of Human Kinetics and School of Psychology) and Dr. Louise Lemyre (School of Psychology), and two doctoral students, John Kowal and Heather Orpana. It was funded through the *Interfaculty Collaborative Research Initiatives* of the University of Ottawa. Dr. Fortier and Mr. Kowal combined their experience and expertise in the area of physical activity, motivation, and behaviour change with the experience and expertise of Dr. Lemyre and Ms. Orpana in the areas of stress, population health, and multilevel models.

The conceptualization of the study, including the research design and methodology, was a collaborative effort among the above mentioned parties. Mr. Kowal and Dr. Fortier selected all measures pertinent to the physical activity portion of the study (e.g., SDT variables, TPB variables, social variables, and physical activity measures). The data collection was conducted by Mr. Kowal and Ms. Orpana, with the assistance of a number undergraduate and graduate students. Initially, the overall project targeted French-speaking women only. This particular population was chosen based on a general paucity of research on women and, in particular, French-speaking women. Because of the limited number of French-speaking women actually recruited at Time 1 ($n=109$) and Time 2 ($n=60$), many of the proposed statistical analyses, especially the longitudinal analyses, could not be adequately conducted without violating fundamental statistical assumptions. Accordingly, a second, independent study was conducted by Mr.

Kowal and Dr. Fortier. The second study used the same methodology as in the first investigation, however, the sample was comprised of English-speaking women. Mr. Kowal was responsible for all aspects of this second study, including participant recruitment, data collection, data entry, data analysis, and manuscript preparation. Supervision of all aspects was provided by Dr. Fortier.

In terms of the three articles comprising this thesis, the names of Mr. Kowal, Dr. Fortier, Ms. Orpana, and Dr. Lemyre appear on the first article, "Psychosocial Predictors of Intentions to Increase Physical Activity in a Community-Based Sample of Adult Women." These four authors were included because of their substantive contributions to the study conceptualization and methodology (see above). It should be noted, however, that Mr. Kowal and Dr. Fortier were responsible for the statistical analyses and the writing of this article. Again, Dr. Fortier provided guidance in this regard.

In the second article, "Physical Activity Behaviour Change in a Community-Based Sample of Adult Women: Contributions from the Theory of Planned Behaviour and Self-Determination Theory," and the third article, "Physical Activity Behavior Change in a Community-Based Sample of Women: The Role of Barriers and Environmental Characteristics," only the names of Mr. Kowal and Dr. Fortier appear, because they were based solely on the second investigation conducted with English-speaking women. As mentioned, Mr. Kowal was responsible for all work presented in these articles, and Dr. Fortier was responsible for overseeing all aspects of this project.

APPENDIX B
SUPPLEMENTARY STATISTICAL ANALYSES

Comparison of French- and English-Speaking Participants

As previously noted, the three journal articles comprising this thesis were based on two empirical investigations, one with French-speaking women and one with English-speaking women. Given potential differences between these two samples as well as differences in participant recruitment between the two studies (French-speaking women were recruited from bingo halls, community centres, and fitness facilities, whereas English-speaking women were recruited from community health centres, community centres, and fitness facilities), these two samples were compared across all common variables (i.e., TPB variables, motivation, social support, and total energy expenditure). To this end, a multivariate analysis of variance (MANOVA) was used (Table 1).

French-speaking woman reported significantly lower levels of perceived behavioural control and autonomous motivation than English-speaking women ($ps < .001$). There was also a trend for French-speaking women having lower physical activity scores than English-speaking women ($p = .07$). These two groups did not significantly differ across any other measures.

A further comparison between the French- and English-speaking participants was conducted across socio-demographic variables using an independent samples *t*-test and chi-square analyses. Results of this comparison are presented in Table 2. French-speaking women were less educated than their English-speaking counterparts ($p < .01$). No other differences were observed between these two samples.

Mediating Influences among TPB variables, Motivation, and Intentions

Based on the pattern of correlations observed in the second journal article, as well

Table 1
Comparison of French- and English-speaking samples across study variables.

Variable	French-speaking sample (<i>n</i> =109) Mean (<i>SD</i>)	English-speaking sample (<i>n</i> =149) Mean (<i>SD</i>)	<i>F</i>
Attitudes	5.62 (1.51)	5.59 (1.19)	0.02
Perceived behavioral control	4.56 (1.48)	5.61 (1.41)	33.28***
Subjective norms	3.72 (1.85)	3.97 (1.72)	1.28
Autonomous motivation	5.49 (1.32)	6.02 (1.01)	12.78***
Controlled motivation	2.73 (1.33)	2.49 (1.05)	2.56
Social support	4.29 (1.38)	4.50 (1.50)	1.35
Intentions	4.47 (1.93)	4.66 (1.71)	0.73
Physical activity	2387.83 (1769.27)	2804.6 (1831.9)	3.35

Note. All variables except physical activity were assessed on 7-point Likert-type scales, with higher values indicative of higher levels of each variable. Physical activity was calculated based on a weight-corrected total energy expenditure in $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{week}^{-1}$. Overall MANOVA: Hotelling's $T^2=0.19$; $F(8, 249)=6.02$, $p < .001$. $n=258$. *** $p < .001$.

as past physical activity research (e.g., Hagger et al., 2002), the possibility that the three TPB variables (attitudes, perceived behavioural control, and subjective norms) mediated the relationship between autonomous motivation and intention to increase physical activity was assessed. This was accomplished in a series of three multiple regression analyses (Baron & Kenny, 1986; Holmbeck, 1997). In the first regression analyses, the three TPB variables were independently regressed onto autonomous motivation. Intentions to increase physical activity were then regressed onto autonomous motivation in the second regression. Finally, intentions to increase physical activity were regressed onto attitudes, perceived behavioural control, subjective norms, and autonomous motivation in the third multiple regression analysis (see Table 3).

Table 2

Comparison of French- and English-speaking samples across socio-demographic variables.

Variable	French-speaking sample (<i>n</i> = 109)	English-speaking sample (<i>n</i> = 149)	<i>t</i> or χ^2 ^a
Age; Mean (<i>SD</i>)	51.04 (7.62)	51.80 (6.70)	-0.85
Marital Status (%)			
Married/common-law	56%	67%	
Common-law	13%	9%	
Single	6%	7%	
Separated	18%	15%	
Widowed	6%	2%	5.93
Education			
Primary or secondary	32%	16%	
College	19%	26%	
University undergraduate	28%	34%	
University graduate	15%	24%	11.69**
Annual Household Income ^b			
< \$60,000	40%	29%	
\$60,000-\$79,999	18%	16%	
> \$80,000	43%	55%	4.27

Note. Percentages may not sum to 100 due to rounding errors. ^aMean age was compared using an independent samples *t*-test, whereas all other variables were compared using chi-square analyses.

^bThe annual household income categories in this table have been slightly modified because of differences between the French and English questionnaires with respect to the individual annual household items. ***p* < .01.

Autonomous motivation was significantly associated with each of the three TPB variables (*ps* < .05). As well, autonomous motives was significantly related to physical activity intentions (*ps* < .05). When the three TPB variables and autonomous motivation were concurrently entered as predictors of intention to increase physical activity, only attitudes and subjective norms were significantly associated with this criterion variable

Table 3

Mediating influences between autonomous motivation and TPB variables in the prediction of intentions in the English-speaking sample.

Predictor Variables	Criterion Variable	Stand <i>b</i>	<i>t</i>	R^2	<i>F</i>
Autonomous motivation	Attitudes	.18	2.18*	.03	4.73*
Autonomous motivation	Perceived behavioural control	.22	2.69**	.05	7.23**
Autonomous motivation	Subjective norms	.27	3.41***	.07	11.63***
Autonomous motivation	Intentions	.18	2.21*	.04	4.90*
Autonomous motivation	Intentions	.10	1.14	.10	4.06**
Attitudes		.17	2.07*		
Perceived behavioural control		.04	.45		
Subjective norms		.17	2.07*		

Note. Stand = standardized. * $p < .05$. ** $p < .01$. *** $p < .001$. $n = 149$.

($p < .05$). Of note, the relationship between autonomous motivation and intentions was no longer significant in this third multiple regression analysis, supporting the mediating role of attitudes and subjective norms in the autonomous motivation-intention relationship.

Covariation of Physical Activity Level from Article 1 Analyses

To assess the possibility that women's total energy expenditure (i.e., physical activity level) was a confounding factor in the analyses conducted in the first journal article, all statistical tests were re-run using physical activity level as a covariate. In the first hierarchical multiple regression analysis, total energy expenditure was independently entered on the first step. Attitudes, perceived behavioural control, and subjective norms

were then entered on the second step. Autonomous and controlled motivation were entered on the third step. Total expenditure was not significantly associated with intentions to increase physical activity (R^2 -change=2%; F -change=2.41, $p = .124$), and its inclusion in this analysis did not alter any of the other relationships. That is, as presented in the first journal article, attitudes and perceived behavioural control were significantly associated with physical activity intentions ($ps < .001$), and, autonomous motivation, when entered in a subsequent step with controlling motivation, was also significantly related to intentions to increase physical activity behaviour ($p < .001$).

In the second hierarchical multiple regression analysis, total energy expenditure was entered on the first step, the three TPB variables were entered on the second step, and social support was entered on the third step. Again, total energy expenditure was not significantly related to women's physical activity intentions (R^2 -change=2%; F -change=2.41, $p = .124$). As observed in the first journal article, attitudes and perceived behavioural control were significantly related to intentions to increase physical activity ($ps < .001$), and social support was unrelated to this outcome variable ($p = .82$).

Finally, in the comparison between high- and low-intenders using a multivariate model, after statistically controlling for total energy expenditure, a significant multivariate effect was found for the intention factor (Hotelling's $T^2 = .99$; $F(6, 69) = 11.38$, $p < .001$). Similar to the hierarchical multiple regression results, no changes in the overall pattern of results were observed. Specifically, high-intenders ($n = 39$) reported significantly higher levels of attitudes ($p < .01$), perceived behavioural control ($p < .001$), subjective norms ($p < .05$), autonomous motivation ($p < .001$), and controlled

motivation ($p < .05$) than low-intenders ($n=38$). Thus, the results obtained after controlling for total energy expenditure were the same as the results obtained in the first journal article.

Comparison of Married and Unmarried French- and English-Speaking Participants

To test for the potential moderating influence of marital status, the French-speaking participants in the first journal article were compared across all study variables (from that article) (Table 4). No overall multivariate effect was obtained (Hotelling's $T^2 = .12$; $F(8, 100) = 1.45$, $p = .185$), and no significant differences were observed between married and unmarried participants on any study variable.

The same type of analysis was repeated for the English-speaking women in the second journal article. A significant multivariate effect was observed (Hotelling's $T^2 = 0.15$; $F(10, 138) = 2.00$, $p < .05$), with married women ($n=99$) reporting significantly higher levels of controlled motivation ($p < .05$) and physical activity behaviour change ($p < .01$) than unmarried women ($n=50$). These data are presented in Table 5.

The relationship between marital status and both physical activity barriers and environmental characteristics was assessed for the English-speaking women in the third journal article. Again, MANOVAs were used to this end. In the first MANOVA comparing married and unmarried women across physical activity barriers, an overall multivariate effect was found (Hotelling's $T^2 = 0.22$; $F(14, 134) = 2.10$, $p < .05$). The only significant difference was observed with respect to being too busy, with married women reporting higher levels of this barrier than unmarried women ($p < .05$) (Table 6).

Table 4
Comparison of Married and Unmarried French-Speaking Women across Article 1 Variables.

Variable	Married (<i>n</i> =61) Mean (<i>SD</i>)	Unmarried (<i>n</i> =48) Mean (<i>SD</i>)	<i>F</i>
Attitudes	5.85 (1.36)	5.33 (1.64)	0.29
Perceived behavioural control	4.41 (1.54)	4.75 (1.39)	3.30
Subjective norms	3.63 (1.75)	3.83 (1.98)	1.38
Autonomous motivation	5.45 (1.40)	5.54 (1.22)	0.33
Controlled motivation	2.66 (1.31)	2.81 (1.36)	0.18
Social support	4.34 (1.34)	4.23 (1.44)	0.13
Intentions to increase PA	4.56 (1.88)	4.35 (2.01)	0.35
Physical activity	2742.58 (2179.14)	2112.43 (1888.39)	2.52

Note. All variables except physical activity were assessed on 7-point Likert-type scales, with higher values indicative of higher levels of each variable. Physical activity was calculated based on a weight-corrected total energy expenditure in $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{week}^{-1}$. PA=physical activity. Overall MANOVA: Hotelling's $T^2=0.12$; $F(8, 100)=1.45$, $p=.185$. $n=109$.

Table 5
Comparison of Married and Unmarried English-Speaking Women across Article 2 Variables.

Variable	Married (<i>n</i> =99) Mean (<i>SD</i>)	Unmarried (<i>n</i> =50) Mean (<i>SD</i>)	<i>F</i>
Attitudes	5.60 (1.18)	5.58 (1.22)	0.00
Perceived behavioural control	5.54 (1.47)	5.73 (1.28)	0.59
Subjective norms	3.97 (1.66)	3.96 (1.83)	0.00
Autonomous motivation	6.01 (1.01)	6.05 (1.02)	0.06
Controlled motivation	2.64 (1.09)	2.18 (0.90)	6.57*
Social support	4.54 (1.55)	4.44 (1.43)	0.12
Autonomy supportive IS	4.43 (1.44)	4.17 (1.35)	1.12
Controlling IS	2.16 (1.27)	2.11 (1.11)	0.04
Intentions to increase PA	4.76 (1.64)	4.46 (1.85)	1.02
PA behaviour change	0.17 (1.00)	-0.34 (0.92)	9.16**

Note. All variables except physical activity behaviour change were assessed on 7-point Likert-type scales, with higher values indicative of higher levels of each variable. Physical activity behaviour change variables is based on a standardized residual difference score with a mean of 0 and a standard deviation of 1. IS=interpersonal style. PA=physical activity. Overall MANOVA: Hotelling's $T^2=0.15$; $F(10, 138)=2.00$, $p<.05$. * $p<.05$. ** $p<.01$. $n=149$.

Table 6
Comparison of Married and Unmarried English-Speaking Women across Article 3 Physical Activity Barriers.

Physical activity barrier	Married (<i>n</i> =99) Mean (<i>SD</i>)	Unmarried (<i>n</i> =50) Mean (<i>SD</i>)	<i>F</i>
I didn't like to exercise alone	2.99 (1.88)	2.76 (2.09)	0.47
I didn't have access to an exercise/sport facility	1.86 (1.46)	2.08 (1.37)	0.80
I was too busy	4.46 (1.99)	3.76 (2.03)	3.97*
Health problems	2.54 (1.81)	3.01 (2.37)	1.85
My daily activities took the majority of my time	4.66 (1.92)	4.15 (2.01)	2.28
I didn't have enough money to exercise	1.67 (1.44)	2.07 (1.69)	2.32
I didn't have safe environments in which to engage in physical activity	1.62 (1.18)	1.41 (0.83)	1.29
I lacked confidence when it came to physical activity	1.97 (1.43)	2.14 (1.63)	0.43
I was not interested in physical activity	2.31 (1.69)	2.33 (1.75)	0.01
I didn't think physical activity would benefit me	1.42 (0.97)	1.23 (0.46)	1.70
I was too lazy	3.47 (2.06)	3.63 (2.07)	0.20
I felt uncomfortable about my body	2.30 (1.62)	2.06 (1.85)	0.61
I was too tired	3.37 (1.90)	3.96 (2.10)	3.00
I had difficulty managing my time	3.26 (1.84)	2.94 (2.09)	0.87

Note. All physical activity barriers were assessed on 7-point Likert-type scales. Overall MANOVA: Hotelling's $T^2=0.22$; $F(14, 134)=2.10$, $p<.05$). * $p<.05$. ** $p<.01$. $n=149$.

Finally, a second MANOVA for environmental characteristics also revealed a significant overall effect (Hotelling's $T^2=0.22$; $F(10, 138)=2.99$, $p<.01$.). Unmarried women reported a higher presence of sidewalks ($p<.001$), heavy traffic ($p<.05$), street lights ($p<.001$), crime ($p<.01$), the presence of others exercising ($p<.05$), bicycle paths ($p<.001$), and walking trails ($p<.05$) than married women (Table 7).

Table 7
Comparison of Married and Unmarried English-Speaking Women across Article 3 Environmental Characteristics.

Environmental characteristic	Married (<i>n</i> =99)	Unmarried (<i>n</i> =50)	<i>F</i>
	Mean (<i>SD</i>)	Mean (<i>SD</i>)	
Sidewalks	4.61 (2.38)	6.10 (1.52)	16.21***
Street lights	4.67 (2.12)	5.88 (1.71)	12.27***
Enjoyable scenery	5.53 (1.57)	5.50 (1.59)	0.01
Frequently seeing people walking or exercising	5.11 (1.63)	5.68 (1.28)	4.67*
Bicycle paths	4.35 (2.27)	5.58 (1.73)	11.46***
Walking trails	4.55 (2.13)	5.36 (1.99)	5.02*
Hills	3.04 (1.70)	3.34 (2.07)	0.92
Heavy traffic	3.46 (1.78)	4.22 (1.78)	6.11*
Dogs that are unattended	2.36 (1.52)	2.77 (1.82)	2.07
High levels of crime	1.83 (1.00)	2.46 (1.51)	9.25**

Note. All physical activity barriers were assessed on 7-point Likert-type scales. Overall MANOVA: Hotelling's $T^2=0.22$; $F(10, 138)=2.99$, $p<.01$). * $p<.05$. ** $p<.01$. *** $p<.001$. $n=149$.

APPENDIX C
QUESTIONNAIRES

Comportements de santé chez les femmes

Université d'Ottawa

**Louise Lemyre, PhD, Michelle Fortier, PhD,
John Kowal, MA, & Heather Orpana, BA**

Pour le/la chercheur(e)

Endroit: _____

Date: _____

Chercheur(e): _____

L'activité physique

On aimerait vous poser des questions sur votre participation à des activités physiques au cours d'une SEMAINE TYPIQUE durant le dernier mois. Les questions sont similaires à l'exemple ci-dessous. Si vous avez fait une de ces activités au cours d'une semaine typique durant le dernier mois:

Étape 1. Cochez la boîte OUI. Si vous n'avez pas fait l'activité, passez à l'étape 5.

Étape 2. Indiquez combien de FOIS par semaine vous l'avez faite.

Étape 3. Indiquez la DURÉE de votre participation chaque fois que vous l'avez faite.

Étape 4. Indiquez le niveau d'INTENSITÉ de votre participation chaque fois que vous l'avez faite.

1 = légère - effort minimal

2 = modérée - active le coeur mais pas trop fatiguant, la respiration s'accélère un peu

3 = forte - activité vigoureuse, le coeur bat rapidement, la respiration est forte, vous suez

Étape 5. Indiquez votre INTENTION d'augmenter votre participation dans cette activité au cours des six prochains mois.

Voici un exemple de la manière dont Mme. Beaulieu aurait répondu à cette question. Elle a fait deux fois une promenade pour le plaisir pendant une demi-heure (chaque fois) au cours de la dernière semaine. Quand elle marche, son coeur bat un peu plus vite et sa respiration s'augmente un peu. Elle n'a pas l'intention d'augmenter son niveau de participation dans cette activité au cours des six prochains mois.

Durant une semaine typique au cours du dernier mois, avez vous :	Environ combien de TEMPS chaque fois	Environ quelle INTENSITÉ	INTENTION d'augmenter au cours des six prochains mois
Marché pour le plaisir ou l'exercice (inclure l'utilisation d'un tapis roulant)? ☒ Oui Combien de FOIS par semaine? <u>2</u> ☐ Non	<u>30</u> minutes	☐ légère ☒ modérée ☐ forte	☒ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup

Durant une semaine typique au cours du dernier mois, avez vous :	Environ combien de TEMPS chaque fois	Environ quelle INTENSITÉ	INTENTION d'augmenter au cours des six prochains mois
Dansé (carré, folklorique, sociale) (ne pas inclure danse aérobique)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☒ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup

Durant une semaine typique au cours du dernier mois, avez vous :	Environ combien de TEMPS chaque fois	Environ quelle INTENSITÉ	INTENTION d'augmenter au cours des six prochains mois
Joué au golf, en transportant votre équipement (calculez seulement le temps de marche)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Joué au golf, avec une voiturette (calculez seulement le temps de marche)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Joué au billiards? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Joué au tennis? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Patiné (patins de glace, patins à roues alignées)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait du grand ménage (tel que laver les fenêtres, nettoyer les gouttières)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait du ménage léger (tel que passer l'aspirateur ou l'époussetage)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup

Durant une semaine typique au cours du dernier mois, avez vous :	Environ combien de TEMPS chaque fois	Environ quelle INTENSITÉ	INTENTION d'augmenter au cours des six prochains mois
Fait du grand jardinage (tel que tondre le gazon ou ramasser les feuilles)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait du jardinage léger (tel qu'arroser les plantes)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait du jogging ou course à pied (inclure l'utilisation d'un tapis roulant)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Marché pour le plaisir ou l'exercice (inclure l'utilisation d'un tapis roulant)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Marché comme moyen de transport (tel que marcher au magasin)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait de la bicyclette (ou vélo) pour le plaisir ou l'exercice (inclure bicyclette stationnaire)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait de la bicyclette (ou vélo) comme moyen de transport? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup

Durant une semaine typique au cours du dernier mois, avez vous :	Environ combien de TEMPS chaque fois	Environ quelle INTENSITÉ	INTENTION d'augmenter au cours des six prochains mois
Utilisé d'autres machines aérobiques (telles que machine à ramer et «step »; ne pas inclure tapis roulant et bicyclette stationnaire)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait de l'aquaforme ou autres exercices dans l'eau (ne pas inclure la natation)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Nagé? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait des exercices d'étirement ou de flexibilité (ne pas inclure le yoga ou le Tai-chi)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait du yoga ou du Tai-chi? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait de l'aérobic ou de la danse aérobique? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait des poids et haltères (tels que les poids libres, bandes élastiques ou push-up)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup

Durant une semaine typique au cours du dernier mois, avez vous :	Environ combien de TEMPS chaque fois	Environ quelle INTENSITÉ	INTENTION d'augmenter au cours des six prochains mois
Fait du conditionnement physique (tels que les calisthenics)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Joué aux quilles? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Joué au basket-ball, soccer ou raquet-ball (ne pas calculer le temps au banc)? ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup
Fait d'autres activités physiques qui n'ont pas été mentionnées ci-haut (spécifiez)? ____ ☐ Oui Combien de FOIS par semaine? ____ ☐ Non	____ minutes	☐ légère ☐ modérée ☐ forte	☐ Non ☐ Augmentez un peu ☐ Augmentez moyennement ☐ Augmentez beaucoup

LES PROCHAINES QUESTIONS S'APPLIQUENT AUX ACTIVITÉS PHYSIQUES QUE VOUS AVEZ L'INTENTION D'AUGMENTER AU COURS DES SIX PROCHAINS MOIS, C'EST-À-DIRE LES ACTIVITÉS QUE VOUS AVEZ MENTIONNÉES DANS LA SECTION PRÉCÉDENTE. CES ACTIVITÉS SERONT DÉSIGNÉES COMME «LES ACTIVITÉS PHYSIQUES QUE VOUS AVEZ MENTIONNÉES AUPARAVANT».

Pour chacune des questions ci-dessous, indiquez votre opinion.

1. J'ai l'intention d'augmenter les activités que j'ai mentionnées auparavant au cours des trois prochains mois.
 Très en désaccord 1 2 3 4 5 6 7 Très en accord

2. J'ai l'intention d'augmenter les activités que j'ai mentionnées auparavant au cours des six prochains mois.
 Très en désaccord 1 2 3 4 5 6 7 Très en accord

3. Sur l'échelle suivante, indiquez à quel point vous êtes **motivée** à augmenter les activités que vous avez mentionné auparavant.
 Pas du tout motivée 0 20 40 60 80 100% Très motivée

4. Sur une échelle de 0 à 100%, indiquez à quel point vous êtes **confiante** de pouvoir augmenter les activités que vous avez mentionnées auparavant.
 Pas du tout confiante 0 20 40 60 80 100% Très confiante

Pour moi, augmenter les activités que j'ai mentionnées auparavant au cours des six prochains mois, serait...

- | | | |
|----------------|---------------|---------------|
| 5. Agréable | 1 2 3 4 5 6 7 | Désagréable |
| 6. Stimulant | 1 2 3 4 5 6 7 | Épuisant |
| 7. Plaisant | 1 2 3 4 5 6 7 | Déplaisant |
| 8. Bon | 1 2 3 4 5 6 7 | Mauvais |
| 9. Utile | 1 2 3 4 5 6 7 | Inutile |
| 10. Avantageux | 1 2 3 4 5 6 7 | Désavantageux |

11. Pour moi, ce serait facile d'augmenter les activités physiques que j'ai mentionnées auparavant au cours des six prochains mois?
- Très en désaccord 1 2 3 4 5 6 7 Très en accord
12. Si je voulais, je pourrais facilement augmenter les activités physiques que j'ai mentionnées auparavant au cours des six prochains mois.
- Très en désaccord 1 2 3 4 5 6 7 Très en accord
13. Au cours des six prochains mois, c'est moi qui contrôle si j'augmente ou non les activités physiques que j'ai mentionnées auparavant.
- Très en désaccord 1 2 3 4 5 6 7 Très en accord
14. La plupart des personnes qui sont importantes pour moi (mes proches) me suggéreraient d'augmenter les activités physiques que j'ai mentionnées auparavant au cours des six prochains mois.
- Très en désaccord 1 2 3 4 5 6 7 Très en accord
15. Dans mon milieu social, les personnes qui sont importantes pour moi (mes proches) pensent que je devrais augmenter les activités physiques que j'ai mentionnées auparavant au cours des six prochains mois.
- Très en désaccord 1 2 3 4 5 6 7 Très en accord
16. Combien de support est-ce que vous recevez des gens qui sont les plus proches de vous pour augmenter votre niveau d'activité physique.
- Pas de support 1 2 3 4 5 6 7 Beaucoup de support

17. Qui est l'adulte qui vous influence le plus à cette période de votre vie?
- ____ Conjoint(e) ____ Membre de ma famille (précisez _____)
- ____ Ami(e) ____ Autre (précisez _____)

POUR LES QUESTIONS SUIVANTES, CET ADULTE SERA DÉSIGNÉ COMME VOTRE « PROCHE »

Pour les questions suivantes, indiquez à quel point ces énoncés correspondent à vos opinions en encerclant le chiffre le plus approprié.

Très en désaccord			Modérément en accord			Très en accord	
1	2	3	4	5	6	7	

Mon proche...

1. me donne l'opportunité de prendre mes propres décisions concernant l'activité physique.	1	2	3	4	5	6	7
2. me met de la pression pour augmenter mon niveau d'activité physique.	1	2	3	4	5	6	7
3. considère ouvertement mes opinions et mes sentiments vis-à-vis l'activité physique.	1	2	3	4	5	6	7
4. me pousse à augmenter mon niveau d'activité physique.	1	2	3	4	5	6	7
5. me demande des suggestions et/ou mes opinions en ce qui a trait à l'activité physique.	1	2	3	4	5	6	7
6. me critique lorsque je fais de l'activité physique.	1	2	3	4	5	6	7
7. tente de me faire sentir coupable lorsque je ne fais pas de l'activité physique.	1	2	3	4	5	6	7
8. me donne des choix en ce qui a trait à l'activité physique.	1	2	3	4	5	6	7
9. m'encourage à augmenter mon niveau d'activité physique.	1	2	3	4	5	6	7
10. me supporte quand je fais de l'activité physique.	1	2	3	4	5	6	7
11. fait de l'activité avec moi.	1	2	3	4	5	6	7
12. me félicite quand je fais de l'activité physique.	1	2	3	4	5	6	7
13. m'aide à faire de l'activité physique.	1	2	3	4	5	6	7

À l'aide de l'échelle ci-dessous, indiquez dans quelle mesure chacun des énoncés suivants correspond présentement à l'une des raisons pour lesquelles vous voulez augmenter le niveau des activités physiques que vous avez mentionnées auparavant.

Ne correspond pas du tout			Correspond modérément			Correspond exactement	
1	2	3	4	5	6	7	

POURQUOI voulez-vous augmenter les activités physiques que vous avez mentionnées auparavant au cours des six prochains mois?

1. Parce que je veux prendre la responsabilité pour ma santé.	1	2	3	4	5	6	7
2. Parce que je crois personnellement que c'est la meilleure chose pour ma santé.	1	2	3	4	5	6	7
3. Parce que j'y ai beaucoup pensé et je crois que c'est important pour plusieurs aspects de ma vie.	1	2	3	4	5	6	7
4. Parce que c'est un choix important que je veux vraiment faire.	1	2	3	4	5	6	7
5. Parce que c'est en accord avec mes objectifs de vie.	1	2	3	4	5	6	7
6. Parce que c'est très important pour être en meilleure santé.	1	2	3	4	5	6	7
7. Parce que ça me permet d'atteindre un équilibre dans ma vie.	1	2	3	4	5	6	7
8. Parce que je choisis moi-même de le faire pour mon bien.	1	2	3	4	5	6	7
9. Parce que je me sentirais coupable si je ne le faisais pas.	1	2	3	4	5	6	7
10. Parce que je ressens de la pression de mes proches pour le faire.	1	2	3	4	5	6	7
11. Parce que j'aurais honte si je ne le faisais pas.	1	2	3	4	5	6	7
12. Parce que je veux que les autres m'acceptent.	1	2	3	4	5	6	7

13. Parce que mes proches seraient mécontents si je ne le faisais pas.	1	2	3	4	5	6	7
14. Parce que je veux que les autres voient que je suis capable de le faire.	1	2	3	4	5	6	7
15. Parce que je devrais le faire.	1	2	3	4	5	6	7
16. Parce que je me sentrais mal si je ne le faisais pas.	1	2	3	4	5	6	7
17. Parce que je sens qu'il faut que je le fasse.	1	2	3	4	5	6	7

Indiquez à quel point ces énoncés correspondent aux raisons pour lesquelles vous NE FAITES PAS plus d'activité physique en encerclant le chiffre le plus approprié.

Très en désaccord			Modérément en accord			Très en accord	
1	2	3	4	5	6	7	

Pourquoi ne faites vous pas plus d'activité physique présentement?

1. Parce que je n'aime pas faire de l'activité physique seule.	1	2	3	4	5	6	7
2. Parce que je manque de confiance en ce qui a trait à l'activité physique.	1	2	3	4	5	6	7
3. Parce que l'activité physique ne m'intéresse pas.	1	2	3	4	5	6	7
4. Parce que je ne crois pas que faire de l'activité physique puisse m'aider.	1	2	3	4	5	6	7
5. Parce que je n'ai pas accès à des installations sportives.	1	2	3	4	5	6	7
6. Parce que je suis trop occupée.	1	2	3	4	5	6	7
7. Parce que j'ai des problèmes de santé.	1	2	3	4	5	6	7
8. Parce que je suis trop paresseuse.	1	2	3	4	5	6	7
9. Parce que je me sens inconfortable vis-à-vis mon corps.	1	2	3	4	5	6	7
10. Parce que mes responsabilités quotidiennes prennent la majorité de mon temps.	1	2	3	4	5	6	7
11. Parce que c'est trop cher.	1	2	3	4	5	6	7
12. Parce que je me sens trop fatiguée.	1	2	3	4	5	6	7
13. Parce que je manque d'endroits sécuritaires pour faire de l'activité physique.	1	2	3	4	5	6	7
14. Parce que j'ai de la difficulté à gérer mon temps.	1	2	3	4	5	6	7

À quel point les conditions suivantes sont-elles présentes dans votre quartier?

Pas du tout présent			Modérément présent			Très présent	
1	2	3	4	5	6	7	

1. Trottoirs.	1	2	3	4	5	6	7
2. Circulation dense.	1	2	3	4	5	6	7
3. Collines.	1	2	3	4	5	6	7
4. Lampadaires.	1	2	3	4	5	6	7
5. Chiens sans laisse.	1	2	3	4	5	6	7
6. Paysages agréables.	1	2	3	4	5	6	7
7. Haut taux de criminalité.	1	2	3	4	5	6	7
8. Personnes faisant de l'activité physique.	1	2	3	4	5	6	7
9. Pistes cyclables	1	2	3	4	5	6	7
10. Sentiers pédestres.	1	2	3	4	5	6	7

Questions sociodémographiques

1. Quel est votre statut civil actuel?
☐ Mariée ☐ Séparée/divorcée
☐ Vit avec conjoint(e) de fait ☐ Veuve
☐ Célibataire jamais mariée
2. Quel âge avez-vous? _____
3. Avez-vous des enfants? ☐ Oui – Combien d'enfants? _____
☐ Non
4. Êtes-vous, ou un membre de votre ménage est-il, propriétaire de votre logement?
☐ Oui
☐ Non
5. Quel est le plus haut niveau de scolarité que vous avez atteint?
☐ Pas d'étude ☐ Études collégiales non-terminées
☐ Études primaires ☐ Diplôme d'études professionnelles, collégiales ou CEGEP
☐ Études secondaires non-terminées ☐ Études universitaires non-terminées
☐ Diplôme d'études secondaires ☐ Baccalauréat (y compris LL.B.)
☐ ☐ Maîtrise, Baccalauréat en médecine, Doctorat
6. Combien d'années de scolarité avez-vous complétées?
 _____ (Nombre)
7. Qu'est-ce que vous considérez, en ce moment, être votre principale occupation?
 Cochez tout ce qui s'applique.
☐ Soins à la famille ☐ Recherche d'un emploi
☐ Travail rémunéré ☐ Retraite
☐ Études ☐ Autre (précisez _____)
☐ Convalescence/état d'invalidité
8. Avez-vous effectué un travail rémunéré au cours des 12 derniers mois?
☐ Oui - Combien d'heures par semaine? _____
☐ Non
9. Quel est le titre de votre emploi principal? (p.e.: superviseure, assistante administrative)

10. Si vous ne travaillez plus, mais vous avez déjà travaillé, quel était le titre de votre emploi principal?

11. Quel a été le revenu total approximatif avant impôts et retenues de tous les membres du ménage au cours des 12 derniers mois? (Inclure toutes les sources de revenus)

☐	Aucun revenu	☐	\$30,000-39,999
☐	\$1-9,999	☐	\$40,000- 59,999
☐	\$10,000-14,999	☐	\$60,000-79,999
☐	\$15,000- 19,999	☐	\$80,000 et plus
☐	\$20,000-29,999		

12. Quel a été votre revenu total *personnel* approximatif avant impôts et retenues au cours des 12 derniers mois? (Inclure toutes les sources de revenus)

☐	Aucun revenu	☐	\$30,000-39,999
☐	\$1-9,999	☐	\$40,000- 59,999
☐	\$10,000-14,999	☐	\$60,000-79,999
☐	\$15,000- 19,999	☐	\$80,000 et plus
☐	\$20,000-29,999		

MERCI BEAUCOUP POUR VOTRE PARTICIPATION!

**Factors Associated with Physical Activity
Behaviour Change in Middle-Age Women**

Time 1 Questionnaire

University of Ottawa

Michelle Fortier, PhD & John Kowal, MA

For Research Purposes Only

Setting:

Date:

Physical Activity

This questionnaire is about physical activities you may have engaged in during a typical week over the past month. The questions on the following pages are similar to the example shown below. If you engaged in the activity during a typical week over the past month:

Step 1. Check the YES box (if you have not engaged in the activity, skip to Step 5).

Step 2. Indicate the number of TIMES per week you usually did it.

Step 3. Indicate the DURATION of your participation in this activity in minutes.

Step 4. Indicate the level of INTENSITY of your participation in this activity.

1 = Low - minimal effort

2 = Medium - increased heart rate and breathing; perspiring lightly

3 = High - heart beating rapidly, breathing is rapid, perspiring

Step 5. Indicate your INTENTION to increase your participation in this activity over the next six months.

Here is an example of how Mrs. Jones would answer Question 1: In a typical week over the past month, Mrs. Jones walked to see her friends on two separate occasions. She walked for 30 minutes per time. Her heart was beating faster, her breathing increased, and she was perspiring lightly. Over the next six months, she intends to walk more frequently and at a slightly higher intensity.

During a typical week over the past month, have you:		DURATION	INTENSITY	INTENTION to increase
Walked for pleasure or exercise (include use of a treadmill)?			☐ low ☒ medium ☐ high	☐ None ☐ Increase a little ☒ Increase moderately ☐ Increase a lot
☒ Yes ☐ No	How many TIMES per week? <u>2</u>	<u>30</u> min.		

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Danced (square, folk, ballroom, etc.; do not include aerobic dance here)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played golf, carrying or pulling your equipment (count walking time only)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played golf, riding a cart (count walking time only)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played pool or billiards? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played tennis? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Skated (ice, roller, in-line)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Done heavy work around the house (e.g., washing windows, cleaning gutters)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done light work around the house (e.g., sweeping or vacuuming)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done heavy gardening (e.g., digging, raking)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done light gardening (e.g., watering plants)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Jogged or ran (including use of a treadmill)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Walked for pleasure or exercise (include use of a treadmill)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Walked as a means of transportation (e.g., walking to the store)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Rode a bicycle for pleasure or exercise (include use of a stationary bicycle)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Rode a bicycle as a means of transportation? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Used other aerobic machines such as rowing or step machines (do not count treadmill or stationary bicycle)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Engaged in aquafitness, aquaform, or water exercises other than swimming? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Swam? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Done stretching or flexibility exercises (do not count yoga or Tai-chi)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Engaged in yoga or Tai-chi? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done aerobics or aerobic dance? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done strength training (e.g., hand held weights, weight machines, or elastic bands)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done general conditioning exercises such as calisthenics or chair exercises? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Bowled? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you: .	DURATION	INTENSITY	INTENTION to increase
Played basketball, soccer or racketball (do not count time on sidelines)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done other types of physical activity not previously mentioned (please specify)? ____ ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

THE FOLLOWING QUESTIONS REFER TO THE PHYSICAL ACTIVITIES YOU INTEND TO INCREASE OVER THE NEXT SIX MONTHS (I.E., THOSE ACTIVITIES YOU IDENTIFIED IN THE PREVIOUS SECTION). THESE ACTIVITIES WILL BE REFERRED TO AS "THE PHYSICAL ACTIVITIES I PREVIOUSLY MENTIONED."

For each of the following questions, please indicate your opinion.

1. I intend to increase my participation in the physical activities I previously mentioned over the next three months.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2. I intend to increase my participation in the physical activities I previously mentioned over the next six months.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. Over the next six months, on a scale from 0% to 100%, how **motivated** are you to increase your participation in the physical activities you previously mentioned?

Not at all motivated 0 20 40 60 80 100% Very motivated

4. Over the next six months, on a scale from 0% to 100%, how **confident** are you of increasing your participation in the physical activities you previously mentioned?

Not at all confident 0 20 40 60 80 100% Very confident

For me, to increase my participation in the physical activities I previously mentioned over the next six months would be...

- | | | | |
|-----|-----------|---------------|-------------|
| 5. | Useful | 1 2 3 4 5 6 7 | Useless |
| 6. | Enjoyable | 1 2 3 4 5 6 7 | Unenjoyable |
| 7. | Harmful | 1 2 3 4 5 6 7 | Beneficial |
| 8. | Pleasant | 1 2 3 4 5 6 7 | Unpleasant |
| 9. | Good | 1 2 3 4 5 6 7 | Bad |
| 10. | Stressful | 1 2 3 4 5 6 7 | Relaxing |

11. How much control do you have over whether or not you increase your participation in the physical activities you previously mentioned over the next six months?

No control 1 2 3 4 5 6 7 Complete control

12. If I wanted to, I could easily increase my participation in the physical activities I previously mentioned over the next six months.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

13. Over the next six months, I have control over whether or not I increase my involvement in the physical activities I previously mentioned.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

14. Most people who are important to me believe I should increase my level of participation in the physical activities I previously mentioned over the next six months.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

15. In my social environment, people who are important to me think that I should increase my participation in the physical activities I previously mentioned over the next six months.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

16. How much support do you receive from those close to you to increase your physical activity level?

No support 1 2 3 4 5 6 7 Complete support

17. Who is the adult who influences you the most at this point in your life?

☐ Spouse ☐ Family member (specify _____)
☐ Friend ☐ Other (specify _____)

PLEASE NOTE THAT IN THE NEXT SECTION, THIS PERSON WILL BE REFERRED TO AS YOUR "SIGNIFICANT OTHER."

Please indicate to what extent the following items correspond to your opinions by circling the most appropriate number.

<i>Strongly disagree</i>			<i>Moderately agree</i>			<i>Strongly agree</i>	
1	2	3	4	5	6	7	

My significant other...

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. provides me with opportunities to make personal decisions concerning physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. pressures me to increase my level of physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. openly acknowledges my thoughts and feelings regarding physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. pushes me to increase my level of physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. asks about my opinions regarding physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. criticizes me when I engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. tries to make me feel guilty when I do not engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. provides me with choices when it comes to physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. encourages me to increase my level of physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. supports me when I engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. engages in physical activity with me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. praises me when I participate in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. helps me engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Using the following scale, indicate to what extent you agree with each reason for wanting to increase your level of participation in the physical activities you previously mentioned.

<i>Strongly disagree</i>			<i>Moderately agree</i>			<i>Strongly agree</i>	
1	2	3	4	5	6	7	

Over the next six months, WHY do you want to increase your level of participation in the physical activities you previously mentioned?

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. Because I feel that I want to take responsibility for my own health. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Because I would feel guilty or ashamed of myself if I did not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Because I personally believe it is the best thing for my health. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Because others would be upset with me if I did not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Because I have carefully thought about it and believe it is very important for many aspects of my life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Because I would feel bad about myself if I did not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Because it is an important choice I really want to make. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Because I feel pressure from others to do so. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Because it is consistent with my life goals. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 10. Because I want others to approve of me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Because it is very important for being as healthy as possible. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Because I want others to see I can do it. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
-

Indicate to what extent the following items correspond to your reasons for not doing more physical activity by circling the most appropriate number.

<i>Strongly disagree</i>			<i>Moderately agree</i>			<i>Strongly agree</i>	
1	2	3	4	5	6	7	

At present, why don't you do more physical activity?

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. Because I don't like to exercise alone. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Because I lack confidence when it comes to physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Because I am not interested in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Because I don't think physical activity will benefit me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Because I don't have access to an exercise/sport facility. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Because I am too busy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Because of health problems. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Because I am too lazy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Because I feel uncomfortable about my body. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Because my daily activities take the majority of my time. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Because I don't have enough money to exercise. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Because I am too tired. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. Because I do not have safe environments in which to engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. Because I have difficulty managing my time. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
-

To what extent are the following conditions present in your neighbourhood?

<i>Not at all present</i>			<i>Somewhat present</i>			<i>Very present</i>	
1	2	3	4	5	6	7	

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. Sidewalks. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Heavy traffic. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Hills. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Street lights. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Dogs that are unattended. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Enjoyable scenery. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. High levels of crime. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Frequently seeing people walking or exercising. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Bicycle paths. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Walking trails. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
-

Sociodemographic Questions

1. What is your marital status?

- ☐ Married
 ☐ Separated/Divorced
☐ Living with common-law partner
 ☐ Widowed
☐ Single (never married)

2. How old are you? ____

3. What is your height and weight? ____ ft or m ____ lbs or kg

4. What is your ethnic background?

- ☐ White
 ☐ Asian
☐ African American
 ☐ Other (Please specify _____)
☐ Hispanic

5. Do you currently have any health problems? Yes No (Circle one)

Please list your health problems:

6. Are you currently taking any medication? Yes No (Circle one)

Please list your medication:

7. What is your highest level of education completed or in progress?

- ☐ Primary school
 ☐ University (Undergraduate program)
☐ Secondary school
 ☐ University (Graduate program)
☐ College

8. Over the past year, what is the total revenue (before taxes) earned by people living in your household?

- ☐ \$0-14,999
 ☐ \$45,000-59,999
☐ \$15,000-29,999
 ☐ \$60,000- 74,999
☐ \$30,000- 44,999
 ☐ \$75,000 and above

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

**Factors Associated with Physical Activity
Behaviour Change in Middle-Age Women**

Time 2 Follow-up Questionnaire

University of Ottawa

Michelle Fortier, PhD & John Kowal, MA

Physical Activity I

In the first questionnaire, you were asked about a number of physical activities in which you may have engaged and whether you intended to increase your participation in each of these activities. The following questions pertain to these same activities. Please indicate whether you intended to increase your participation in each of the following activities over the past six months and whether you were successfully able to do so.

Physical Activity	Did you intend to increase your participation in this activity over the past 6 months?	Were you successfully able to do so?
Dancing (square, folk, ballroom, etc.)	☐ Yes ☐ No	☐ Yes ☐ No
Playing golf carrying or pulling equipment	☐ Yes ☐ No	☐ Yes ☐ No
Playing golf riding a cart	☐ Yes ☐ No	☐ Yes ☐ No
Playing pool or billiards	☐ Yes ☐ No	☐ Yes ☐ No
Playing tennis	☐ Yes ☐ No	☐ Yes ☐ No
Skating (ice, roller, in-line)	☐ Yes ☐ No	☐ Yes ☐ No
Doing heavy work around the house	☐ Yes ☐ No	☐ Yes ☐ No
Doing light work around the house	☐ Yes ☐ No	☐ Yes ☐ No
Doing heavy gardening	☐ Yes ☐ No	☐ Yes ☐ No
Doing light gardening	☐ Yes ☐ No	☐ Yes ☐ No
Jogging or running	☐ Yes ☐ No	☐ Yes ☐ No
Walking for pleasure or exercise	☐ Yes ☐ No	☐ Yes ☐ No
Walking as a means of transportation	☐ Yes ☐ No	☐ Yes ☐ No
Cycling for pleasure or exercise	☐ Yes ☐ No	☐ Yes ☐ No
Cycling as a means of transportation	☐ Yes ☐ No	☐ Yes ☐ No
Using aerobic machines (rowing, step, etc.)	☐ Yes ☐ No	☐ Yes ☐ No
Aquafitness or aquaform	☐ Yes ☐ No	☐ Yes ☐ No
Swimming	☐ Yes ☐ No	☐ Yes ☐ No
Stretching or flexibility exercises	☐ Yes ☐ No	☐ Yes ☐ No
Yoga or Tai-chi	☐ Yes ☐ No	☐ Yes ☐ No
Aerobics or aerobic dance	☐ Yes ☐ No	☐ Yes ☐ No
Strength training (weights, elastic bands)	☐ Yes ☐ No	☐ Yes ☐ No
General condition exercises (calisthenics)	☐ Yes ☐ No	☐ Yes ☐ No
Bowling	☐ Yes ☐ No	☐ Yes ☐ No
Basketball, soccer, or racketball	☐ Yes ☐ No	☐ Yes ☐ No
Other (specify _____)	☐ Yes ☐ No	☐ Yes ☐ No

**THE FOLLOWING QUESTIONS REFER TO THE
PHYSICAL ACTIVITIES IN WHICH YOU ENGAGED OVER
THE PAST SIX MONTHS.**

For each of the following questions, please indicate your opinion.

1. How much control did you have over whether or not you increased your participation in physical activity over the past six months?

No control 1 2 3 4 5 6 7 Complete control

2. Over the past six months, I had control over whether or not I increased my involvement in physical activity.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. How much support did you receive from those close to you to increase your physical activity level over the past six months?

No support 1 2 3 4 5 6 7 Complete support

-
4. Who is the adult who influenced you the most over the past six months?

☐ Spouse ☐ Family member (specify _____)
☐ Friend ☐ Other (specify _____)

**PLEASE NOTE THAT IN THE NEXT SECTION, THIS PERSON WILL BE REFERRED
TO AS YOUR "SIGNIFICANT OTHER."**

Please indicate to what extent the following items correspond to your opinions by circling the most appropriate number.

<i>Strongly disagree</i>			<i>Moderately agree</i>			<i>Strongly agree</i>	
1	2	3	4	5	6	7	

Over the past six months, my significant other...

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. provided me with opportunities to make personal decisions concerning physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. pressured me to increase my level of physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. openly acknowledged my thoughts and feelings regarding physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. pushed me to increase my level of physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. asked about my opinions regarding physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. criticized me when I engaged in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. tried to make me feel guilty when I did not engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. provided me with choices regarding physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. encouraged me to increase my level of physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. supported me when I engaged in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. engaged in physical activity with me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. praised me when I participated in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. helped me engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Using the following scale, indicate to what extent you agree with each reason for wanting to increase your level of participation in the physical activities over the past six months.

<i>Strongly disagree</i>			<i>Moderately agree</i>			<i>Strongly agree</i>	
1	2	3	4	5	6	7	

Over the past six months, WHY did you want to increase your level of participation in physical activity?

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. Because I wanted to take responsibility for my own health. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Because I would have felt guilty or ashamed of myself if I did not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Because I personally believed it was the best thing for my health. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Because others would have been upset with me if I did not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Because I have carefully thought about it and believed it was very important for many aspects of my life. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Because I would have felt bad about myself if I did not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Because it was an important choice I really wanted to make. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Because I felt pressured by others to do so. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9. Because it was consistent with my life goals. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Because I wanted others to approve of me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Because it was very important to be as healthy as possible. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Because I wanted others to see I could do it. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Indicate to what extent the following items correspond to your reasons for not doing more physical activity over the past six months by circling the most appropriate number.

<i>Strongly disagree</i>			<i>Moderately agree</i>			<i>Strongly agree</i>	
1	2	3	4	5	6	7	

Why didn't you do more physical activity over the past six months?

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. Because I didn't like to exercise alone. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Because I lacked confidence when it came to physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Because I was not interested in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Because I didn't think physical activity would benefit me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Because I didn't have access to an exercise/sport facility. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Because I was too busy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Because of health problems. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Because I was too lazy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Because I felt uncomfortable about my body. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Because my daily activities took the majority of my time. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Because I didn't have enough money to exercise. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Because I was too tired. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13. Because I didn't have safe environments in which to engage in physical activity. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. Because I had difficulty managing my time. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

To what extent were the following conditions present in your neighbourhood over the past six months?

<i>Not at all present</i>			<i>Somewhat present</i>			<i>Very present</i>	
1	2	3	4	5	6	7	

- | | | | | | | | |
|--|---|---|---|---|---|---|---|
| 1. Sidewalks. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Heavy traffic. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. Hills. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Street lights. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Dogs that are unattended. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Enjoyable scenery. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. High levels of crime. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Frequently seeing people walking or exercising. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Bicycle paths. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Walking trails. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Physical Activity II

This questionnaire is about physical activities you may have engaged in during a typical week over the past month. The questions on the following pages are similar to the example shown below. If you engaged in the activity during a typical week over the past month:

Step 1. Check the YES box (if you have not engaged in the activity, skip to Step 5).

Step 2. Indicate the number of TIMES per week you usually did it.

Step 3. Indicate the DURATION of your participation in this activity in minutes.

Step 4. Indicate the level of INTENSITY of your participation in this activity.

1 = Low - minimal effort

2 = Medium - increased heart rate and breathing; perspiring lightly

3 = High - heart beating rapidly, breathing is rapid, perspiring

Step 5. Indicate your INTENTION to increase your participation in this activity over the next six months.

Here is an example of how Mrs. Jones would answer Question 1: In a typical week over the past month, Mrs. Jones walked to see her friends on two separate occasions. She walked for 30 minutes per time. Her heart was beating faster, her breathing increased, and she was perspiring lightly. Over the next six months, she intends to walk more frequently and at a slightly higher intensity.

During a typical week over the past month, have you:		DURATION	INTENSITY	INTENTION to increase
Walked for pleasure or exercise (include use of a treadmill)?			☐ low ☒ medium ☐ high	☐ None ☐ Increase a little ☒ Increase moderately ☐ Increase a lot
☒ Yes ☐ No	How many TIMES per week? <u>2</u>	<u>30</u> min.		

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Danced (square, folk, ballroom, etc.; do not include aerobic dance here)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played golf, carrying or pulling your equipment (count walking time only)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played golf, riding a cart (count walking time only)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played pool or billiards? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Played tennis? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Skated (ice, roller, in-line)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Done heavy work around the house (e.g., washing windows, cleaning gutters)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done light work around the house (e.g., sweeping or vacuuming)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done heavy gardening (e.g., digging, raking)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done light gardening (e.g., watering plants)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Jogged or ran (including use of a treadmill)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Walked for pleasure or exercise (include use of a treadmill)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Walked as a means of transportation (e.g., walking to the store)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Rode a bicycle for pleasure or exercise (include use of a stationary bicycle)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Rode a bicycle as a means of transportation? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Used other aerobic machines such as rowing or step machines (do not count treadmill or stationary bicycle)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Engaged in aquafitness, aquaform, or water exercises other than swimming? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Swam? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Done stretching or flexibility exercises (do not count yoga or Tai-chi)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Engaged in yoga or Tai-chi? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done aerobics or aerobic dance? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done strength training (e.g., hand held weights, weight machines, or elastic bands)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done general conditioning exercises such as calisthenics or chair exercises? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Bowled? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

During a typical week over the past month, have you:	DURATION	INTENSITY	INTENTION to increase
Played basketball, soccer or racketball (do not count time on sidelines)? ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot
Done other types of physical activity not previously mentioned (please specify)? ____ ☐ Yes How many TIMES per week? ____ ☐ No	____ min.	☐ low ☐ medium ☐ high	☐ None ☐ Increase a little ☐ Increase moderately ☐ Increase a lot

The following questions refer to the physical activities you intend to increase over the next six months (i.e., those activities you identified in the previous section, PHYSICAL ACTIVITY II). These activities will be referred to as “the physical activities I previously mentioned.”

1. I intend to increase my participation in the physical activities I previously mentioned over the next three months.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2. I intend to increase my participation in the physical activities I previously mentioned over the **next six months**.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. Over the next six months, on a scale from 0% to 100%, how **motivated** are you to increase your participation in the physical activities you previously mentioned?

Not at all motivated 0 20 40 60 80 100% Very motivated

4. Over the next six months, on a scale from 0% to 100%, how **confident** are you of increasing your participation in the physical activities you previously mentioned?

Not at all confident 0 20 40 60 80 100% Very confident

Sociodemographic Questions

- 1. What is your marital status?**

☐ Married ☐ Separated/Divorced
☐ Living with common-law partner ☐ Widowed
☐ Single (never married)

2. How old are you? _____

3. What is your height and weight? _____ ft or m _____ lbs or kg

- 4. What is your ethnic background?**

☐ White
 ☐ Asian
☐ African American
 ☐ Other (Please specify _____)
☐ Hispanic

5. Do you currently have any health problems? Yes No (Circle one)
Please list your health problems: _____

6. Are you currently taking any medication? Yes No (Circle one)
Please list your medication: _____

7. What is your highest level of education completed or in progress?

____ Primary school
____ Secondary school
____ College

____ University (Undergraduate program)
____ University (Graduate program)

8. Over the past year, what is the total revenue (before taxes) earned by people living in your household?

____ \$0-14,999
____ \$15,000-29,999
____ \$30,000- 44,999

____ \$45,000-59,999
____ \$60,000- 74,999
____ \$75,000 and above

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!!!

If you are interested in participating in a follow-up study of physical activity, please write your name and telephone number below.

Name: _____

Telephone number: _____

APPENDIX D
ETHICAL APPROVAL FORMS