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**FACULTÉ DES ÉTUDES SUPÉRIEURES
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**FACULTY OF GRADUATE AND
POSTDOCTORAL STUDIES**

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GRADE / DEGREE

School of Human Kinetics

FACULTÉ, ÉCOLE, DÉPARTEMENT / FACULTY, SCHOOL, DEPARTMENT

**Social Cognitive Theory Correlates of Physical Activity for Women Approaching Menopause: A
MONET study**

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Social Cognitive Theory Correlates of Physical Activity for Women

Approaching Menopause:

A MONET study

by

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These submitted to the

Faculty of Graduate and Postdoctoral Studies

in partial fulfilment of the requirements for the degree of

Master's of Science in Human Kinetics

School of Human Kinetics

University of Ottawa

November 2006



Library and
Archives Canada

Bibliothèque et
Archives Canada

Published Heritage
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Direction du
Patrimoine de l'édition

395 Wellington Street
Ottawa ON K1A 0N4
Canada

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

ISBN: 978-0-494-32473-8

Our file Notre référence

ISBN: 978-0-494-32473-8

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ACKNOWLEDGEMENTS

I believe that relationships with people are by far the most important part of life. In fact, the hardest component of doing a Masters was that I had to give up time spent with important people in my life. Along this journey, there were many people who supported me and people who patiently waited for me to have more time for them. This acknowledgement section might be a bit long ... but quite valuable to me.

Dr. Chris M. Blanchard is the first person to whom I want to express my gratitude for the support he gave. I was very privileged to have a thesis director who was brilliant, hard working, knowledgeable, kind, and who had a great ability to listen and understand. His solidness was easily seen in his remarkable ability to give without concern for his personal needs. I truly appreciated him as a leader, a guide and a colleague.

I also want to express my gratitude for the involvement of Dr. Diane Ste-Marie and Dr. Michelle Fortier as thesis committee members. I feel that the comments, the suggestions and the corrections they made were a strong asset to the quality of my thesis.

I want to acknowledge the presence and support of my husband Mark and my kids, Jonathan and Michelle, during the climb of this mountain. The struggles of the climb were often felt by all of us. I was certainly not alone in bearing it. However, it is my hope that my children have developed an awareness that education is an opportunity to contribute to the world through passion and knowledge. I want to thank Mark for his support, for the long hours he spent proof reading my thesis, for his clever advice and for rescuing me from my computer problems with his sharp brain.

There were some health problems along the way. During my struggle with cancer, my amazing mother who gives with passion and my super friend Michelle came to help with

my data entry, so that I could proceed with the analysis before the departure of my thesis director from the University. My parents-in-law, Carole and Phil, were there physically and emotionally every step of the way and were immensely helpful to our family. The spirit of my father was also present, since it is his courage to take and overcome challenges that lift me within. I also want to thank my siblings and friends who were there during this time.

I owe a huge thank you to my work colleagues at the Shirley E. Greenberg Women's Health Centre, as well as to Dr. Elaine E. Jolly, Dr. Claire Laflèche and Dr. Mark Hardy, who made a significant difference to my "after thesis" life expectancy. They gave me back my chance to complete the project of my soul, the raising of my kids.

I want to thank my work colleague Elizabeth Contestabile, a strong specialist on menopause, who frequently gave me the most up to date articles for my literature review. Thanks to the MONET team, they were great company during these hours at the lab and answered kindly my numerous questions.

Finally, I want to extend my gratitude to my exercise buddies for sharing good health, mood and spirit (Michelle, Catherine, France, Genevieve, the lady's night group, the people who share my passion for skiing and the Strong Women Program participants). No "woman" is an island!

ABSTRACT

Menopause marks the beginning of a period of life transition involving important health changes (North American Menopause Society [NAMS], 2004). It has been demonstrated that physical activity can partly compensate for some of the negative effects of estrogen deficiency (Kemmler et al., 2002). Unfortunately the majority of Canadian middle-aged women are inactive (Craig & Cameron, 2004). The years prior to the onset of the menopausal transition are an important time to modify activity levels, but very few studies have looked at the determinants of physical activity for women at this stage of their life. The purpose of this study was to investigate social cognitive theory correlates of physical activity for women that are approaching menopause. The initial methodology was based on a prospective research design. However, based on the decision to rely on a different measure of physical activity behaviour, the research design was modified to that of a cross sectional design. Within the cross sectional research design, 76 participants, enrolled in the MONET longitudinal study, completed measures of barrier self-efficacy, social support, environmental factors, moods, and exercise behaviour. Results showed that physical activity behaviour was significantly correlated to barrier self-efficacy ($r = .33, p < .01$) and anxiety ($r = -.27, p < .05$). In the light of these results, consideration should be given to the roles of self-efficacy and anxiety in the development of strategies to increase physical activity for women approaching the menopausal transition.

LIST OF ABBREVIATIONS

AEE	Activity Energy Expenditure
BMD	Bone Mineral Density
BMI	Body Mass Index
HRT	Hormone Replacement Therapy
IPAQ	International Physical Activity Questionnaire
MET	Metabolic Equivalent
PA	Physical Activity
PAL	Physical Activity Level
POMS	Profile of Mood Scale
SCT	Social Cognitive Theory
SE	Self-efficacy
SS	Social Support
SSES	Social Support and Exercise Survey
TDEE	Total Daily Energy Expenditure
RMR	Resting Metabolic Rate

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Chapter 1. Introduction

Menopause marks the end of a woman's reproductive life and the beginning of a period of life transition involving physical and possible psychological changes (North American Menopause Society [NAMS], 2004). This period of hormonal change has been identified as a possible period of body weight dysregulation (Milewicz, Tworowska, & Demissie, 2001), reduced physical fitness (Teoman, Ozcann, & Acar, 2004), and health impairment (Kemmler et al., 2002). All of these changes may have a negative effect on quality of life (Teoman et al., 2004). It is important that this period of life be taken into consideration. Menopause may be a natural process, however, since life expectancy has changed greatly, and the average age to enter the menopausal transition is only 47.5 years old (McKinlay, Brambilla, & Posner, 1992), a woman can expect to live with the health changes she is exposed to in the postmenopausal period for a substantial amount of time. In fact, this is estimated to be a third of the average woman's life (Samsioe, Doren, & Lobo, 2003). In addition, there is an unprecedented number of postmenopausal women, since the general population is increasing. According to the World Health Organisation, by 2030, there will be 1.2 billion women over the age of 49 (Teoman et al., 2004).

In the early 1990's, it was believed that hormone replacement therapy (HRT) was beneficial to prevent health deterioration related to menopause (Légaré, Godin, Dodin, Turcot, & Laperrière, 2003). Therefore, HRT has been advocated frequently by physicians in the past. However, over the last few years, some contrary evidence to the benefits of HRT has surfaced from the Women's Health Initiative study, which demonstrated a negative overall risk-benefit ratio of HRT in healthy postmenopausal women (Kemmler et al., 2002), with risks such as increasing breast cancer, heart disease

and stroke (Rossouw et al., 2002). In light of these results, the popularity of this option has decreased significantly and many women are now reluctant to use HRT to replace their natural hormones (Légaré et al., 2003).

Involvement in regular physical activity (PA) is an important alternative (Kemmler et al., 2002). More and more physicians are turning towards PA for the short-term goal of minimizing menopause symptoms as well as for the long-term goal of helping women to remain independent (Shangold, 1996) through the prevention of health complications. In fact, it has been demonstrated that an active lifestyle that includes regular PA compensates, at least partially, for some of the negative effects of estrogen deficiency in areas such as body composition, coronary heart disease, diabetes and quality of life (Kemmler et al., 2002). However, the benefits and therapeutic effect of PA may not be reaching its maximum potential in this population. According to the 2000/01 Canadian Community Health Survey, 59% of women between the ages of 45 to 64 are inactive (Craig & Cameron, 2004). For this large group of inactive women, the years prior to the onset of the menopausal transition might be an important and optimal time to modify this level of inactivity for the following reasons. First, in order to maximize health, it might be preferable to use the preventative effect of PA before the menopause health changes start to occur. Second, some of these health changes could be perceived as added barriers to PA. Therefore, trying to adhere to an active lifestyle before their occurrence might be easier. It would be hoped that the lifestyle change would be carried on throughout the hormonal change and beyond. In light of this, the target population of this research was the population of women who are very close to the beginning of the menopausal transition or who have just entered its initial stage.

The high percentage of middle-aged women who are inactive may be an indication that PA involvement is a challenge for the group of women approaching the menopausal transition. Therefore, it is crucial to design PA programs that are effective at addressing this issue. According to Trost, Owen, Bauman, Sallis and Brown (2002), “Interventions are most effective when they alter the underlying variables that influence physical activity” (p.1996). Thus, acquiring a better knowledge of the correlates of PA specific to the population of interest has the potential to serve as an important prerequisite for designing useful interventions (Trost et al., 2002).

The incorporation of theoretical perspectives facilitates the understanding of PA behaviour and allows for an examination of the roles that determinants play on behaviour (Hall, 1998). The theoretical perspective that was chosen for the present research was the Social Cognitive Theory (SCT). Social Cognitive Theory was chosen because it is one of the most frequently used theories for increasing PA (Ransdell, Oakland, & Taylor, 2003) and because this theory has been shown to successfully explain PA in several different populations including middle-aged adults (Marcus & Forsyth, 2003; McAuley, 1992a; Wallace, Buckworth, Kirby, & Sherman, 2000; Winters, Petosa, & Charlton, 2003).

The correlates of PA for middle-aged women have only been explored by a limited number of studies and no study has looked at these correlates specifically for women that are very close to the initiation of the hormonal changes that occur at perimenopause. As such, the purpose of this study was to identify the most reliable correlates of PA behaviour for this target group. The reason for identifying such correlates is to understand which factors might influence the PA level of this population. These factors

could then be integrated in PA interventions aimed at changing the pattern of PA for these women.

The following chapter provides up to date information from the literature on topics, which are fundamental for this study. As a first step, the different phases of the hormonal transition are explained. Secondly, the menopause health effects and the benefits of PA for such effects are brought to light, followed by information about the prevalence of PA for women approaching the menopausal transition. Then, the SCT framework is presented, followed by the purpose, the objectives and the hypotheses of the present study.

Chapter II. Literature Review

Phases of the Hormonal Transition

Menopause:

Menopause is the actual point in time that a women is considered to have a permanent cessation of menstruation following the loss of ovarian activity (Speroff, Glass, & Kase, 1999) (see Figure 1). In medical terms, there is permanent cessation after 12 months without a menstrual period (Treloar, Boyton, Behn, & Brown, 1967). It is a normal condition that all women experience as they age (Rosenthal, 1999). The mean age for its occurrence is estimated to be 51 years (Samsioe et al., 2003). Though it naturally emerges with the aging process, menopause may also come on suddenly as a result of a surgical procedure, treatment of a disease, or illness. In these cases, it is referred to as induced menopause (Rosenthal, 1999).

Perimenopause / Menopausal Transition:

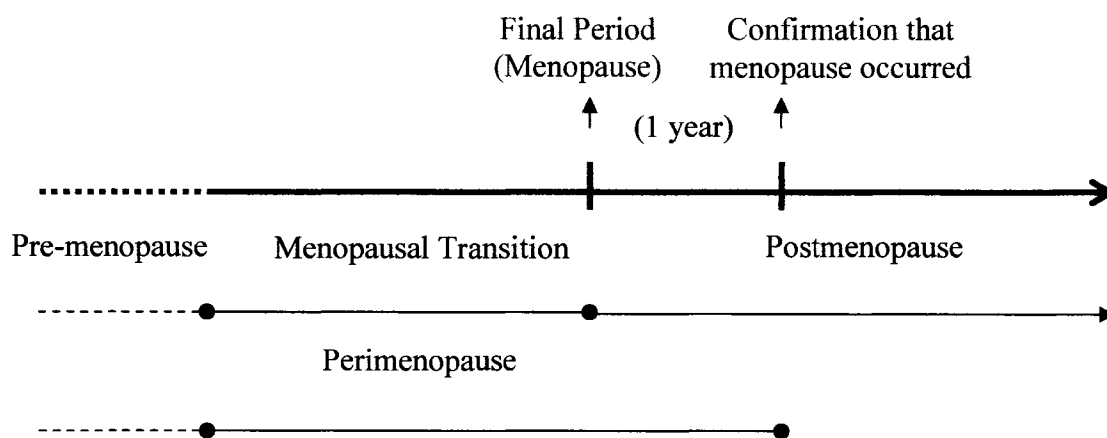
Prior to menopause, there is a decrease in ovarian function (Sarrel, 1997). The years preceding the onset of menopause, with associated symptoms reflecting the hormonal changes, define *perimenopause* (Speroff et al., 1999). The term perimenopause is used interchangeably with *menopausal transition*, however, there is a slight difference (see Figure 1). The term menopausal transition only includes the portion of perimenopause before the final menstrual period (World Health Organization [WHO], 1996) while the perimenopause period also includes the year following the final menstruation (McKinlay et al., 1992; Nachtigall, 1998; Prior, 1998). It has been suggested that perimenopause usually ranges from 2 to 8 years with a mean of 4 years (McKinlay et al., 1992; Treloar, 1981). The age of onset for 90% of women is between 39 and 51 (Treloar, 1981) with a

median age of inception estimated to be 47.5 years (McKinlay et al., 1992). This period is characterized by erratic hormone secretion leading to menstrual cycle irregularity and then complete cessation of menstruation (NAMS, 2004). The beginning of perimenopause is identified when a woman reports at least three, but less than 12 consecutive months of amenorrhea (i.e. no periods) or a self report of increased menstrual irregularity (Brambilla, McKinlay, & Johannes, 1994). If there is a report of changes in cycle regularity at only isolated times, the women are not considered in their perimenopause yet, but rather still in their premenopause phase (i.e., the years from birth to the beginning of perimenopause, as indicated in Figure 1) (McKinlay et al., 1992).

Postmenopause:

The *postmenopause* period refers to approximately the last third of a woman's life, dating from the final menstrual period (NAMS, 2004). Therefore, it is the period once the menopausal transition has passed.

Figure 1. Phases of the hormonal transition



Menopause Health Effects

As women move from the menopausal transition and beyond, a wide variety of physical and psychological changes may appear (NAMS, 2004). Some of these changes are acute symptoms of menopause, often more prominent during the menopausal transition (Li, Lanuza, Gulanick, Penckofer, & Holm, 1996). Their frequency and intensity is a highly individual process (Speroff et al., 1999), but overall these symptoms are quite considerable, since up to 40% of women will seek medical attention to try to alleviate them (McMillian & Mark, 2004). Other menopause-related changes are permanent and have longer-term health implications (Samsioe et al., 2003). It is important to note that some of these changes may also be a manifestation of aging and that their onset may not always be directly associated with menopause (NAMS, 2004). The following section describes these symptoms and long-term health effects with consideration of their association to menopause.

Uterine Bleeding Changes:

The most common symptom of the menopausal transition is a change in menstrual pattern prior to the permanent cessation of menstruation. This is experienced by 90% of women (Nachtigall, 1998). The change is characterized by decreased or increased flow, irregular frequency of menstruation, and ultimately, amenorrhoea (Speroff et al., 1999).

Vasomotor Symptoms:

Vasomotor disturbances are the second most common symptom of the menopausal transition, which are experienced by 85% of women. They cause hot flashes and night sweats (Santoro, Brown, Adel, & Skurnich, 1996). Hot flashes are perceived as a sudden onrush of fever-like heat. They may last for a few seconds or several minutes. When hot

flashes occur at night, there is usually an outbreak of perspiration that appears, commonly called “night sweats”, which can awaken a person abruptly and lead to insomnia (Lambert-Lagacé, 1999). Despite a skin temperature that often rises between 4 to 8 degrees Fahrenheit, the internal body temperature drops, which is perceived as an odd sensation (Rosenthal, 1999). Up to 15% of women experience very frequent and / or severe hot flashes (NAMS, 2004). Some may experience up to 40 hot flashes per day and intense night sweats (Santoro et al., 1996). Several studies have indicated that having a BMI higher than 26 kg / m² is associated with a higher frequency of hot flashes (NAMS, 2004). Vasomotor symptoms will start to emerge when estrogen levels are starting to be erratic in early perimenopause (Prior, 1998). Their frequency accelerates during the menopausal transition to reach a peak in the surrounding time of the final menstrual period (Guthrie, Dennerstein, Hopper, & Burger, 1996) and will usually terminate one to two years after the final menstrual period (Rosenthal, 1999).

Sleep Disturbances:

Up to half of the women between 40 to 54 years old report sleep problems. When the menopausal status is taken into consideration, sleeping difficulties are more prevalent for the group of women who are in their menopausal transition and beyond (NAMS, 2004). Sleep disturbances associated with menopause include difficulty falling asleep and awakening during the night or early-morning with trouble resuming sleep (Nachtigall, 1994). According to most studies, night time hot flashes would be the causing factor of sleep disturbances around menopause (NAMS, 2004).

Central Nervous System and Emotional Changes:

Headaches, mood and cognitive disturbances are common complaints of the menopausal transition and early postmenopause (NAMS, 2004). The most prevalent mood symptoms are anxiety, depressed/labile mood, tearfulness, irritability, lack of motivation/energy (Prior, 1998) and fatigue (Neugarten & Kraines, 1965; Studd, Watson, & Henderson, 1990). Reported cognitive disturbances are difficulty concentrating (Bromberger et al., 2001; Prior, 1998; WHO, 1996) and memory impairment (Vilet & Davis, 1991).

It is known that estrogen has an effect on the neurotransmitter system and that estrogen's receptors are present in the central nervous system, however, it is not known if the above mood and cognitive disturbances are directly linked with estrogen deficiency (NAMS, 2004; Samsioe et al., 2003). Another belief is that these symptoms could emerge from sleep deprivation caused by night time hot flashes (NAMS, 2004; Speroff et al., 1999).

Body Weight Dysregulation:

Menopause has been identified as a possible critical period of body weight dysregulation in women, which could lead to a cluster of risk factors such as an increased risk of cardiovascular disease and metabolic disease (Gordon, Kannel, Hjortland, & McNamara, 1978; Kannel, 1987; NAMS, 2003; Tchernof, Calles-Escandon, Sites, & Poehlman, 1998). During the menopausal transition, the average weight gain ranges between 2.25 kg and 4.19 kg (Wing, Matthews, Kuller, Meilahn, & Plantinga, 1991). However, the direct association of weight gain with menopause is not well supported by scientific evidence and is still under investigation. More evidence is pointing to the fact

that menopause would be associated with a shift of fat distribution to the abdominal region (NAMS, 2004; Tchernof et al., 1998), which carries increased risk for cardiovascular disease (Colombel & Charbonnel, 1997).

Cardiovascular System Effects:

Heart disease is the first cause of death for women over 55 years old in Canada (NAMS, 2003). The loss of estrogen is identified as a potential contributing factor of cardiovascular disease for postmenopausal women. In fact, it was identified that the rate of heart disease is 2 to 3 times higher for postmenopausal women than premenopausal women independently of age (NAMS, 2003). Various causing factors have been identified. The most prevalent finding is a change in cholesterol levels after menopause where low density lipoprotein cholesterol increases (NAMS, 2004) at a significant rate within three years of natural menopause (Peters et al., 1999). Endothelial dysfunction of the arteries also becomes more important with conditions such as increased prevalence of plaque and intima-media thickening (Sutton-Tyrell et al., 1998).

Skeletal and Muscular Systems Effects:

Osteoporosis, a disease in which the bone becomes very fragile, is strongly associated with the loss of estrogen. Bone mineral density (BMD) reaches its peak by early adulthood (Samsioe et al., 2003) and as women approach menopause, about one year before the final menstrual period, the process of demineralisation begins. From menopause to age 80, the loss of BMD is estimated to be one-third and the predominant factor influencing this loss is the decline in estrogen (NAMS, 2004). It is reported that out of all postmenopausal women, 30% have osteoporosis and 54% have osteopenia or low bone mass (Beck & Shoemaker, 2000). These conditions increase the risk of

fracture, and in turn, the decreased mobility can lead eventually to long-term care and mortality (NAMS, 2003). In fact, almost one quarter of women over 50 years who suffer a hip fracture die within the following year (NAMS, 2003).

Sarcopenia is the reduction or wasting away of muscle mass with aging (Marks, 2002). Between the second and the seventh decades, it is approximated that the decline of muscle strength is about 30% and the actual muscle loss is about 40% (Rogers & Evans, 1993). This phenomena contributes to a decreased ability to function with daily life activities and increased risk of falls (Marks, 2002). Very little information is available on the role of menopause in sarcopenia and it is possible that this role could be marginal (Volpi, Nazemi, & Fujita, 2004). However, some evidence that this phenomenon could be accelerated at menopause has been reported (Kurina et al., 2004; Wang, Hassager, Ravin, & Wang, 1994).

Other Menopause Related Health Changes:

The basal metabolism rate decreases by almost 15% between the third and the eighth decade of life (Evans, 1999). After the age of 48, for each decade, women experience a 4% to 5% decline. The loss of fat free mass associated with aging is an important causing factor (Gilliat-Wimberly, Manore, Woolf, Swan, & Carroll, 2001). The menopausal status (independent of age) has also been considered a responsible factor involved in its decline (Poehlman et al., 1995).

The VO_{2max} declines significantly for middle-aged adults who are not undertaking regular aerobic PA. Its decline will be at a rate of 9% to 15% between the ages of 45 to 55 (Spirduso, 1995) and approximately 40% between the ages of 25 to 65 (Spina, 1999). The loss of VO_{2max} is slightly greater in women than in men, and it is believed that the

hormonal deficiencies in menopause could be a cause (Spina, 1999). In fact, Lynch, Ryan, Berman, Sorkin and Nicklas (2002) have demonstrated that VO_{2max} is negatively influenced by the menopausal status for women of similar age and adiposity.

Other menopause-related health changes that have been linked to estrogen deficiency are: urinary frequency (Neugarten & Kraines, 1965; Studd et al., 1990), heart palpitations, decline in skin collagen and skin thickness, ocular changes, dental / oral cavity changes, genital changes such as vaginal dryness and vaginal atrophy, as well as sexual function and sexual drive changes (NAMS, 2004).

In summary, menopause is associated with a number of symptoms and health changes. Some of these changes can have long-term health implications that can create a dramatic impact on the postmenopausal years. The following section describes how PA may be beneficial in helping women to face the health challenge imposed by menopause.

Benefit of P.A. for Menopause Health Effects

Involvement in regular PA is a powerful remedy for some of the health changes that are associated with menopause and midlife (NAMS, 2003; Shangold, Sherman, & DiNubile, 1998). A basic prescription of moderate aerobic PA for 30 to 60 minutes (which can be broken into 10-minute sessions) on most days, strength training exercises two to three days per week, and flexibility training is strongly recommended in order to face the health changes associated with menopause and the surrounding years (Public Health Agency of Canada, 2005; Rowe, Blake, & Belisle, 2006; Shangold et al., 1998). The following section will highlight some of the benefits associated with PA.

Benefits of PA for Vasomotor Symptoms:

Intense PA can negatively influence vasomotor symptoms for symptomatic women who are not physically conditioned (NAMS, 2004). However, when practised regularly, PA might be beneficial for hot flash frequency (Elavsky & McAuley, 2004; NAMS, 2004; Northrup, 2001) and intensity (Elavsky & McAuley, 2004; Ivarsson, Spetz, & Hammar, 1998) based on observational studies of active women. Such effects could be possible via a positive effect from regular PA on the neurotransmitters that regulate central thermoregulation (Ivarsson et al., 1998).

Benefits of PA for Sleep, Central Nervous System and Emotional Disturbances:

It is well known that the production of endorphins resulting from PA has positive benefits on a person's psychological health (Kirkcaldy & Shephard, 1991; NAMS, 2003). It has been identified that PA has the capability to reduce anxiety, stress and depressive symptoms (International Society of Sport Psychology [ISSP], 1992). In addition, an active lifestyle can result in better self-esteem (Kull, 2002), more positive thoughts and a more restorative sleep (NAMS, 2003). It can be questioned if these benefits apply to menopausal women; but the following studies have demonstrated the integrity of most of these benefits regardless of the menopausal status. Slaven and Lee (1994) concluded from their study that PA contributes significantly to improved mood for non menopausal as well as menopausal women. A study from Kemmler et al.(2005) revealed that PA significantly improves insomnia, mood changes and migraines for early postmenopausal women. Also, Elavsky and McAuley (2004) reported that women of varying menopausal status who are more active have higher levels of physical self-esteem and quality of life.

Benefits of PA for Weight Gain, Metabolic and Cardiovascular Diseases:

In a review of menopause and age-related concerns, Desindes, Bélisle, and Graves (2006) stated that: “The most powerful modifier of weight gain in menopausal women is physical activity” (p. S27). It is indicated in the literature that for middle-aged premenopausal as well as postmenopausal women, PA is associated with lower weight, less central adiposity and lower insulin level, leading to strong benefits in relation to diabetes risk (Owens, Matthews, Raikonen, & Kuller, 2003). As well, regardless of the menopausal status, increased PA has the potential to reduce blood pressure (Marks, 2002; Owens et al., 2003) and improve blood lipid profile (Kemmler et al., 2005; Owens et al., 2003), which are two important factors contributing to cardiovascular disease (Owens et al., 2003). In addition, the benefit of PA on endothelial functions of the vascular system, for postmenopausal women, has been demonstrated (Hagmar, Erikson, Lindholm, Schenck-Gustafsson, & Hirschberg, 2006).

Benefits of PA for the Skeletal and Muscular Systems:

Regular weight-bearing and high-impact exercises are reported to be beneficial for menopausal women, in order to maintain bone density. Such effects are particularly important for the prevention of fractures (Samsioe et al., 2003). According to Dr. Miriam E. Nelson who researches the benefit of PA, the years surrounding menopause are a critical time for prevention measures because of the associated dramatic change in bone mass. In one of her studies exploring the benefit of strength training for postmenopausal women, she demonstrated an average gain of 1 % in bone density after one year of strength training twice a week as opposed to an average loss of 2 % for the control group. In addition, the group who exercised improved their balance of 14 % (Nelson & Wernick,

2001). In terms of the muscular system, the North American Menopause Society indicated that PA seems to have the most beneficial effect for maintaining muscle mass of menopausal women (NAMS, 2003).

Benefits of PA for Other Menopause Health Effects:

Habitual PA favourably influences the resting metabolic rate since it affects total daily energy expenditure by maintaining fat free mass and by increasing the amount of energy expended daily (Gilliat-Wimberly et al., 2001). Also, regular participation in aerobic PA can slow down or even reverse VO_{2max} decline to the point that it can be elevated by 10% to 25% for older individuals (Spiriduso, 1995).

In summary, PA has the potential to alleviate the adverse health effects associated with menopause. It is therefore an important strategy to use in preparation for the perimenopausal and postmenopausal years. However, are women approaching the menopausal transition using this strategy? The next section will address this question.

Prevalence of PA for Women Approaching Menopause

The magnitude of the health decline related to aging and the loss of estrogen protection is at least partially dependent on the level of PA. To acquire health benefits, PA maintenance is necessary (Marcus et al., 2000). Unfortunately, women's activity levels are low (Martin, Morrow, Jackson, & Dunn, 2000) and even decrease with age (Caspersen & Merritt, 1995). It is reported that 85% to 90% of Canadians are not sufficiently active for optimal health benefits (Canadian Fitness and Lifestyle Research Institute, 1996a). Furthermore, the U.S. Department of Health and Human Services indicates that 60% of adults are not sufficiently active to alleviate the high incidence of cardiovascular disease, obesity and other chronic disorders (Dacey, Baltzell, &

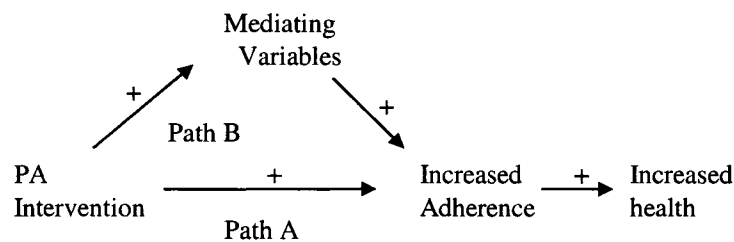
Zaichkowsky, 2003). Although there are no available statistics for the population of middle-aged women that are close to the onset of the menopausal transition, according to the 2000/01 Canadian Community Health Survey, 59% of the women between the ages of 45 to 64 are inactive, 24% are moderately active, and only 17% are active (Craig & Cameron, 2004). While these statistics do not take into consideration the menopausal status, they do provide a very good indication that the PA level of our population of interest is low. It is unclear how menopause affects free-living PA; it appears to be a relatively unexplored area of research. It is quite possible that the various menopause-related health effects negatively influence PA levels and vice versa. For example, it is interesting to note that in a study from Wing and Matthews (1991), the only factor predictive of weight gain at menopause was the level of PA.

The Need for Theory and the Importance of Mediating Variables

Considering that PA levels are a problem for middle-aged women, it is imperative to understand how to help them increase their PA levels in order to be better equipped to face the health consequences attributed to the hormonal changes. Baranowski, Anderson, and Carmack (1998) indicated that it is highly valuable to identify important correlates of PA and to incorporate these variables into a PA intervention in order to maximize the intervention's efficiency. Therefore, rather than focusing only on the outcome (i.e., PA adherence), an additional focus on mediating variables should be highly considered. For example (see Figure 2), if self-efficacy was identified as a strong correlate of PA behaviour for women in their late reproductive years, a PA program could be developed such that PA would be recommended (path A) and would be supplemented with

interventions to strengthen self-efficacy as the mediating variable (path B).

Figure 2. Mediation model



Hypothetically, the increase in self-efficacy would contribute to a better adherence to PA, and subsequently to a better physical and mental health status for these women. The important question becomes, what theoretical mediating variables should be used for women in their late reproductive years?

Correlates of Physical Activity for Middle-Aged Women

Physical activity correlates specific to women were rarely included in PA research up to the late 1990's (Im, 2001). However, in an attempt to increase the effectiveness of PA interventions, a shift was made in order to understand PA behaviour of more sedentary sub-groups of our population (Seefeldt, Malina, & Michael, 2002). Middle-aged women were considered as one of these more sedentary sub-groups (Brownson et al., 2000). Recent research has identified environmental, interpersonal and intrapersonal factors associated with PA specific to them.

Environmental factors found to be positively associated with PA are: living in urban rather than rural areas (Brownson et al., 2000), enjoyable scenery, presence of others exercising (King et al., 2000; Kowal & Fortier, 2005) and, interestingly, the presence of hills and unattended dogs (King et al., 2000). In terms of interpersonal factors, social support from family and friends was found to be associated with the accumulation of

enough PA to be considered minimally active (Eyler et al., 1999). The desire for social networking and support from others was identified as important to PA commitment (Poole, 2001). Intrapersonal factors found to have an association with PA level were: level of education, self-consciousness of physical appearance (King et al., 2000), past lifestyle, number of medical conditions, perceived health (Aubertin-Leheudre, Carbonneau, Melancon, & Dionne, 2005), smoker or non-smoker status, consumption of a certain amount of fruits and vegetables per day, and body weight (Brownson et al., 2000). Self-efficacy was identified as an important PA correlate for middle-aged adults (McAuley, Courneya, Rudolph, & Lox, 1994). Identified PA barriers for middle-aged women were: feeling too tired, not being in good health and lacking energy (King et al., 2000).

The above information provided valuable information with respect to the general knowledge of PA correlates for middle-aged women. However, the studied variables were context specific and the menopausal status was not taken into account in each of the studies. In order to understand further which variables were potentially important to explore for the population of interest for this study, it was decided to rely on valuable information provided by an independent qualitative MONET study. The data of this research served in some respects as a pilot project for the present study. This pilot project is described in the following section.

Pilot Project “PA Correlates for Women Approaching Menopause”

A sample of 10 participants from the MONET study took part individually in interviews of 45 to 60 minutes on PA and food habits. These interviews were part of an independent qualitative study intended to explore weight management. It consisted of an

informal conversation with a health professional to explore PA and food habits. The first section of the interviews was largely related to PA correlates (see Appendix A). The investigator of the present study conducted these qualitative interviews as well as their transcriptions in the course of a research assistantship. The subjective appraisal of the information by the interviewer served as a pilot project for the current study.

To date, there is no research that has explored the correlation between theoretical variables (e.g., self-efficacy) and PA specifically for women that are very close to or just starting the onset of perimenopause. The experience from the pilot project helped to identify which of these theoretical variables were more frequently reported. Such knowledge helped to choose the SCT framework used for this study and to identify which variables would be studied within this framework. The following section describes the reasons SCT was chosen and includes the identification of the variables that were frequently reported during the pilot study.

Reasons to choose Social Cognitive Theory

Social Cognitive Theory (Bandura, 1986) has been chosen to guide the present study for five main reasons. The first reason is related to the mood component. From the interviews conducted in the pilot project, mood was mentioned as a barrier to PA for the women who had just started to have hot flushes and difficulty sleeping. As discussed previously, a relationship has been drawn between hormonal changes and mood changes. Because some women in the study had just started to experience mood difficulties, it was important to choose a theory that would present a clear path relationship between mood and PA adherence in the way that SCT does. Other important theories such as Stages of Change Theory and the Theory of Planned Behaviour do not have mood as a key

variable. The second reason to choose SCT originated from the fact that social support was often mentioned as a key variable for PA adherence in the pilot project interviews. This variable plays an important role in SCT and is viewed more broadly in SCT than in the other theories, which consider social support to be related to more specific attributes. The Theory of Planned Behaviour includes subjective norms (i.e. the perceived social pressure to perform or not to perform a behaviour) in its model, however, meta-analyses have demonstrated that subjective norms do not perform well in predicting PA (Hagger, Chatzisarantis, & Biddle, 2002).

Third, the difficulty in overcoming barriers to PA (i.e., not enough time, lack of energy, health problem) was often discussed at length in the qualitative interviews. The confidence that one has to engage in PA (self-efficacy) is a main construct of the SCT framework. The evidence from the literature that shows this main construct as a key correlate of PA is impressive (Courneya & McAuley, 1994; Feltz & Lirgg, 2001; Hofstetter, Hovell, & Sallis, 1990; McAuley, 1992a; McAuley et al., 1994; Netz & Raviv, 2004; Sallis, Hovell, & Hofstetter, 1992). In fact, in their review and update of the literature, Trost et al. (2002) have concluded that self-efficacy was the most consistent correlate of PA behaviour. In addition, the pivotal role of self efficacy as a PA correlate has been demonstrated to be beyond short-term PA participation (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003).

The fourth reason to choose SCT was based on the fact that the literature highly supports this theoretical model to explain behaviour (Feltz, 1992; McAuley, 1992b). From their analysis regarding the use of a mediating variable framework for PA interventions, Baranowski, Anderson, and Carmack (1998) have recommended that when

choosing such a framework, it should account for at least 30% of the variance in PA. The SCT framework exceeds this recommendation since it has been demonstrated to account for up to 60% of the PA variance (Conn, 1998; Conn, Burks, Pomeroy, Ulbrich, & Cochran, 2003; McAuley et al., 2003).

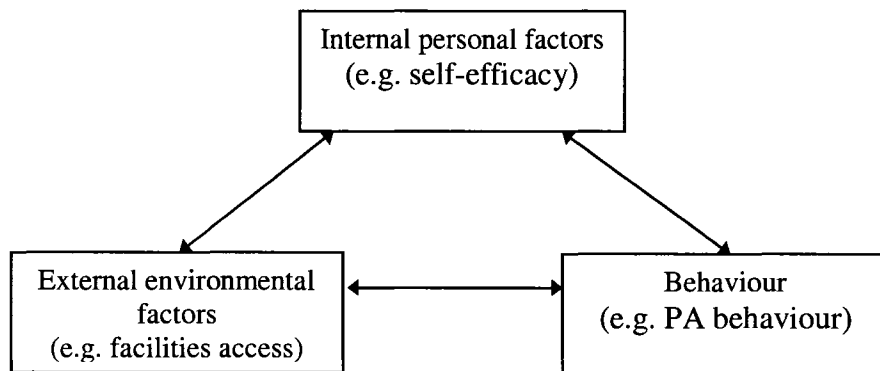
Finally, the fifth reason to choose SCT was based on the fact that the environmental, interpersonal, and intrapersonal PA correlates of middle-aged women that emerged from the literature were largely encompassed within SCT. In light of the above five reasons, the use of SCT appears warranted for the current population of interest and will be outlined in the next section.

Social Cognitive Theory

Social cognitive theory was developed by Albert Bandura to present a useful framework to understand human behaviour. The roots of his theory come from the field of operant conditioning, social psychology, and cognitive psychology (King et al., 1998). Figure 3 presents an illustration of the main constructs of SCT and their inter-relationships. Internal personal factors (ex: self-efficacy), external environmental factors (ex: equipment, facilities) and behaviour (ex: PA participation) are the three main constructs and they reciprocally influence each other (King et al., 1998).

One of the most important internal personal factors is self-efficacy (SE). It is a primary construct of interest within Bandura's theory since it is claimed to be the most powerful mediator of behavioural performance (Bandura, 1986). For this reason, self-efficacy will be explained in detail as a first step, followed by a detailed presentation of the theory web of determinants, referred to as the triadic reciprocal causation (McAuley & Mihalko, 1998).

Figure 3. SCT, Triadic reciprocal causation (adapted from Bandura 1997)



Self-Efficacy:

Self-efficacy is defined as the belief that a person has of his or her capabilities to carry out the necessary courses of action to reach a desired goal, or an expected outcome. It is theorized that self-efficacy will influence the activities a person chooses to engage in, the level of effort that will be expended in the activity, and the level of persistence present to face obstacles or adversities (Bandura, 1986). Self-efficacy belief is therefore an important base for action. When self-efficacy is stronger, more challenging tasks are approached, greater efforts are expended on the task and more persistence is present in the face of difficulties (McAuley & Mihalko, 1998).

Recently, some precision has been brought to the definition of self-efficacy. Specifically, Maddux (1995) explored existing definitions from main authors and clarified the distinction between task self-efficacy and barrier self-efficacy. According to Maddux, task self-efficacy refers to the belief of a person's own capabilities to perform a behaviour (e.g. running a certain distance) while barrier efficacy (or coping self-efficacy) refers to the belief of a person's own capacity to overcome social, personal, or

environmental obstacles (e.g. going for a run despite family demands, fatigue or bad weather).

Maddux (1995) also qualified barrier self-efficacy as more crucial than task self-efficacy in daily life, particularly because it relates to “complex adaptation” as opposed to “elemental acts”. He indicated, “Most of our valued life goals and successes do not require the performance of physically difficult tasks (e.g., lifting heavy objects, returning a 120 mph tennis serve). Instead, the major obstacles to success in our personal strivings are more similar to those involved in abstaining from smoking and using condoms regularly during sex, dealing with emotional and / or physical discomfort, coping with social disapproval, and so on.” (Maddux, 1995, p. 382). In addition, it is noted that barrier self-efficacy has been correlated to a higher frequency of PA for previously sedentary middle-aged adults compared to task self-efficacy (McAuley & Mihalko, 1998). Therefore, barrier self-efficacy was the variable of interest for the present project.

Environmental Factors:

Environmental factors are part of the SCT triadic reciprocation (Figure 3). They are defined as the conditions, influences or the forces surrounding a person (Carron, Hausenblas, & Estabrooks, 2003). It is believed that a supportive environment will positively influence PA involvement (Carron et al., 2003) while a non-supportive one can make it more difficult (Bandura, 1997). Environmental factors related to PA cover attributes such as accessibility of facilities, opportunities for activities, weather, safety, and aesthetic attributes (Humpel, Owen, & Leslie, 2002). The manipulation of such factors may allow for opportunity to increase PA participation (Bandura, 1997). Environmental factors have recently received more and more attention from researchers

who have started to include such variables in their studies (Troost et al., 2002). As a result, positive associations with PA were revealed (Atkinson, Sallis, Saelens, Cain, & Black, 2005; Blanchard et al., 2005; De Bourdeaudhuij, Sallis, & Saelens, 2003; Rutt, 2004). Specific environmental correlates of PA have been identified and it is suggested that access to facilities, satisfaction with facilities, neighbourhood safety, and access to PA equipment at home are important factors of PA participation (Troost et al., 2002). As an example, a running program, which takes place in a safe and pleasant neighbourhood with lots of designated running paths, would be more likely to be successful than in an environment without a designated running path, in a high traffic area.

Supportive behaviours from others are viewed as environmental factors by some authors such as Sallis and Owen (1999). However, based on Bandura (1997), environmental factors include the physical/social environment (e.g. observation of an aerobics class in the neighbourhood), rather than the social support from others (e.g. receiving positive feedback from a spouse for being physically active). Within the context of the theoretical framework used for this study, social support was not studied as an environmental factor, but rather as one of Bandura's five sources of self-efficacy beliefs, described in a later section.

Some research indicates that the relationship between environmental factors and PA could be influenced by variables such as age (Carron et al., 2003). This highlights the fact that particular environmental factors can be specific for middle-aged women approaching menopause. As discussed previously, few environment correlates have been identified for middle-aged women (King et al., 2000), and it is believed that none of this research has taken into consideration the hormonal status. Since it is desirable to identify

which environmental factors are specific to our population of interest and since environmental influences are considered a predominant class of determinants within Bandura's social cognitive model (Bandura, 1986), this variable was included in the present study.

Triadic Reciprocal Causation:

The triadic reciprocal causation (Figure 3) represents an interdependent causal structure between three classes of determinants: behaviour (e.g., type, duration, frequency), internal personal factors (e.g., emotional, biological, cognitive aspects) and external environmental factors (e.g. physical/social environment). These three classes of determinants influence one another in a bi-directional way; however, their relative influence is not equal in strength and will vary depending upon the different activities and circumstances (Bandura, 1997). The following example describes the interacting influence of these three classes of determinants. A woman's self-efficacy (internal personal factors) would influence her decision to attend a walking group (behaviour) offered in her work place by a Menopause Health Centre. In turn, the improvement of her fitness level that she would observe from her involvement with the walking program (behaviour) would influence her self-efficacy (internal personal factors). The convenience of having the program offered in her workplace (environmental factors) would also influence her to participate (behaviour).

Outcome expectations:

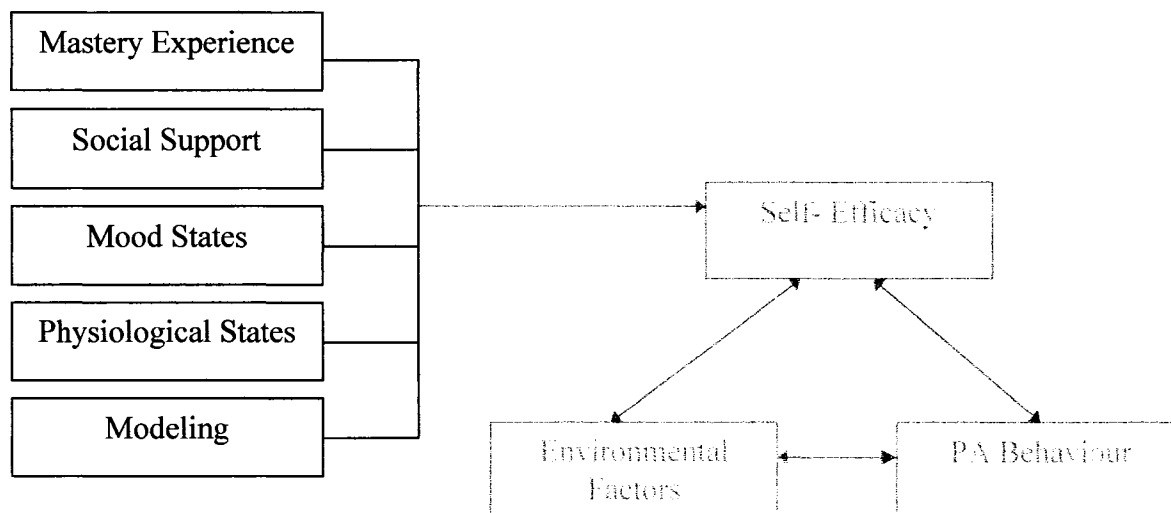
Within Social Cognitive Theory, outcome expectations fall under the category "internal personal factors" (Figure 3). This variable is largely discussed within Bandura's SCT. In the context of PA, it refers to the belief that a person has about the

gain resulting from engaging in PA. If a person believes that the gain resulting from PA adherence (e.g., reduction of cardiovascular risks factors or osteoporosis) outweigh the negative attributes of engaging in PA (e.g., feeling uncomfortable when out of breath), this person might be more likely to engage in PA (Marcus & Forsyth, 2003). However, unlike self-efficacy, outcome expectation is not reported as a key predictor of PA (Trost et al., 2002). In a study from Conn (1998), results demonstrated that outcome expectation contributed little to PA in the SCT model they used. Therefore, this variable was not included in the present study.

Sources of Self-Efficacy Beliefs:

Within the triadic reciprocal causation, self-efficacy is situated in the intrapersonal classes of determinants. As discussed earlier, self-efficacy has a primary role in influencing behaviour and therefore is a main component of this class of determinants. It is of interest to understand what other factors outside of the triadic reciprocal causation might influence self-efficacy. Bandura (1986) has outlined that self-efficacy is influenced by five determinants (Figure 4), which he refers to as self-efficacy sources. These are: mastery experiences, social support, emotional states, physiological arousal and modeling (Bandura, 1986).

Figure 4. Sources of self-efficacy (adapted from Bandura 1997)



Mastery experience (past behaviour).

Mastery experience is related to the experience that a person has gained from a previous course of action. This type of experience serves as a strong indicator of capability because of the authentic evidence it carries about whether or not one masters what is needed to succeed (Bandura, 1997). In fact, mastery experience has been categorized as the most influential source of self-efficacy (Carron et al., 2003). When a task is accomplished with success, a person will perceive a stronger sense of capability for that task. This perception will be even stronger if obstacles and adversity were present and overcome (Carron et al., 2003). For example, a woman who engaged in regular PA prior to menopause is more likely to be confident that she can engage in regular PA during the menopausal transition compared to a woman who was previously sedentary. Since mastery experience is an important source of self-efficacy and since the literature strongly supports its association as a correlate of PA (McAuley, 1992a; Trost et al., 2002), this variable was included in the present study.

Social support (verbal persuasion).

Social support (SS), as described by Bandura, is related to the feedback received from others expressing messages of encouragement. Such feedback has the potential of strengthening one's belief of having the capabilities to achieve a desired outcome (Bandura, 1997). Three factors play a role in the influential effect of social support: the knowledge / credibility of the persuader, the way the feedback is framed, and the degree of appraisal disparity.

Feedback will be more influential if it is received from an individual who is perceived to be knowledgeable and credible. Feedback promotes self-efficacy when it is framed in a positive manner, when it is realistic rather than inflated, and when it focuses on the present rather than distant past or future. The recipient of the feedback is more likely to be influenced when the difference between self-appraisal and the appraisal of the persuaders is not too large (Bandura, 1997). For example, a PA trainer for a group of women approaching menopause will be more likely to enhance their self-efficacy, if this person: (1) is a qualified fitness instructor as well as a health care practitioner, (2) encourages PA involvement by focusing on benefits like decreased daily anxiety rather than more distant ones like increased life expectancy, (3) makes movement corrections that are built upon attainments rather than focusing on the fault, and (4) guides the participants towards a program with an intensity that is not too weak or too high for their capacities.

As discussed previously, social support was often mentioned in the qualitative interviews as an important variable to positively influence PA levels. In addition, the literature shows that social support is a significant correlate to PA adoption and

maintenance (Blanchard et al., 2005; Eyler et al., 2002; Kaplan, Newsom, McFarland, & Lu, 2001; Sallis et al., 1992; Sallis & Owen, 2002; Trost et al., 2002), and particularly for women (Eyler et al., 2002; Lit, Kleppinger, & Judge, 2002; Plonczynski, 2003). Therefore, this variable was included in the study. As discussed above, from Bandura's perspective, social influence is related to the feedback received from others, which express messages of encouragement. Based on previous research (McAuley et al., 2003) that has studied social support more broadly within the SCT framework, this study explored social support slightly beyond the perspective of the original SCT author. More specifically, based on a definition stated by Eyler et al. (1999), social support was studied in terms of the tasks or steps that significant others (family and friends) took to facilitate PA behaviour. As discussed previously, social support is considered distinct from social environment.

Mood states.

Mood states influence self-efficacy because they can alter how events are interpreted, organized cognitively, and retrieved from memory (Bandura, 1997). The influence of mood on self-efficacy can be either through affective or cognitive priming. According to the affective priming theory, previous successes and failures are stored in memory along with their associated mood states. The experience of success is most likely stored in memory along with positive feelings such as joy or vigour while failure is stored with negative feelings such as frustration and sadness (Carron et al., 2003). When the same mood states are experienced in the future via other circumstances, they would reactivate these memories. For example, feeling vigorous again could reactivate the memories of an intense and complete workout on a treadmill and therefore would enhance self-

efficacy while feeling frustrated again could bring back the memory of giving up on a treadmill workout, which would serve to diminish self-efficacy.

In the cognitive priming view, the previous successes and failures are stored in memories along with the thought content that accompanied the experience. Associated mood states might also be stored, but according to this view, the emphasis is more on the associated thought content. As an example, if the memory of the failure to attend a PA class one day is stored in memory with an accompanying cognitive attribution of having a disorganized day, then in the future, awareness of the presence of the causal event (having a disorganized day) would bring back both the emotion that was present (e.g., feeling stressed) and the memory of failing to attend the PA class. This mechanism would serve to decrease self-efficacy (Carron et al., 2003) and decrease the chance of being successful with adherence to the exercise class.

Various levels of mood and mood intensity present during the experience of success or failure can bias self-efficacy perception. Even when mood mismatches the performance, the bias created by mood is still present. As such, the experience of failure under happy mood can lead to overestimation of capacities while the experience of success under sad mood can lead to underestimation of capacities (Bandura, 1997).

Various studies have demonstrated the positive association of mood with PA (Hugo, 1986; Kaplan et al., 2001; McAuley, Bane, & Mihalko, 1995) and with self-efficacy (Hugo, 1986; McAuley, Elavsky, Jerome, Konopack, & Marquez, 2005). Mood is also associated with menopause; therefore, it was decided to include this variable in the study and to assess three different types of mood (i.e., anxiety, depression and vigour), which are highly associated with middle age hormonal change, as discussed previously.

Physiological state.

In sports and PA, the interpretation of somatic indicators can influence personal efficacy positively or negatively (Bandura, 1997). For example, bodily states such as increased heart rate, respiratory rate, or sweating can be interpreted as a sign of a health hazard, or they can be interpreted as a sign of an energizing facilitator to develop fitness. When bodily states are misinterpreted, the correction of their interpretation can positively influence self-efficacy. Physiological arousal was not mentioned as a strong PA predictor in an important review and update of the literature on PA correlates for adults (Trost et al., 2002). Also, its weak effect as a source of self-efficacy was documented by Williams (1995). In addition, during the qualitative interviews, none of the women mentioned this variable as a factor linked to their level of PA; therefore, it was decided to not include it in the present study.

Modeling (observational learning).

When trying to reach a goal, there are often no absolute measures of adequacy. The success or failure of others in circumstances that are similar to ours can provide us with an appraisal of our potential. Modeling refers to this comparison that we make of ourselves to others. However modeling is a weaker source of self-efficacy (Bandura, 1997). Because of this and the fact that this variable was rarely mentioned during the qualitative interviews, it was decided not to include it in the present study.

In summary, at the heart of the SCT, three main constructs coexist within the triadic reciprocal causation: behaviour, external environmental factors and internal personal factors. In the context of initiation and maintenance of PA behaviour, self-efficacy is one of the most important internal personal factors. This construct is also

influenced by a variety of factors outside of the triadic reciprocal causation: mastery experiences, social support, mood states, physiological states and modeling. The present study used selected social cognitive predictors within the SCT framework.

Purpose and Objectives of the Study

We know that the majority of Canadian middle-aged women are inactive (Craig & Cameron, 2004). This is an indication that most women enter the menopausal transition without the benefit of PA. The time prior to the onset of the menopausal transition and the associated health changes is a good period to modify this level of inactivity, but very few studies have looked at the PA correlates for women at this stage of their lives. The identification of such correlates would provide information needed to develop effective interventions aimed at increasing PA. Therefore, the main objective of this study was to investigate the PA correlates of women approaching menopause, using variables within SCT. To achieve this objective, a sample of women approaching the menopausal transition were asked to complete a battery of tests, which involve selected variables from SCT. These variables were analyzed in association with measures of PA behaviour.

Hypotheses

Based on Social Cognitive Theory:

- 1) Barrier self-efficacy would be correlated to PA.
- 2) Environment (home equipment, neighbourhood facilities), mastery experience, social support (SS- family, SS-friends) and mood (anxiety, depression, vigour) would be correlated to PA.
- 3) Barrier self-efficacy would mediate the environment, mastery experience, social support, and mood / PA relationships.

MONET Research Project

This research took place within the structure of the Montreal-Ottawa New Emerging Team (MONET) 5-year longitudinal research project. This research team unites two universities and four faculties (nutrition, medicine, kinesiology and health sciences). The main goal of this longitudinal study is to understand the factors that regulate body weight in women during the peri and postmenopausal years.

Delimitations

The sample for the present study was delimited to women aged 47 years and older, who had not yet fully entered the menopausal transition, but who were expected to enter it shortly, since the median age of inception for this transition is estimated to be 47.5 years. The initial sample was composed of participants enrolled in the MONET research project. In addition, because of the overall requirements of the MONET project, this sample was delimited to women that were generally healthy, non-smokers and not taking any hormone replacement therapy or oral contraceptives. These women also had a stable body weight for the 6 months prior to recruitment and a waist circumference that did not exceed 90 cm.

The selection of the variables to be measured for the present study was delimited to the SCT framework. Only the data collected during the first year of the MONET longitudinal study were used. In addition, the measure of the PA variable was limited to a period of 7 days.

Chapter III. Methodology

Sample

The final sample of the study was composed of 76 women enrolled in the MONET research project. The participants were healthy premenopausal or just barely perimenopausal women greater than 47 years old. Their menopausal status was confirmed first, upon their verbal report of having a regular menstrual cycle. The criterion set by the MONET group was that they had at least two periods over the last 3 months prior to recruitment. Second, a blood test confirmed that their serum level of follicle-stimulating hormone (FHS) was lower or equal to 30 IU/L. The serum concentration of this hormone rises when the ovaries cease to function. It is considered that the level associated with middle-aged ovarian failure is between 20 and 120 IU/L. Therefore, the value of 30 IU/L or lower set by the MONET research group confirmed that the participants had not yet reached the menopausal transition or have reached it, but only at a very early stage. To ensure a natural course of events for the menopause transition, these women did not have a hysterectomy and were not taking any hormone replacement therapy or oral contraceptives.

To satisfy other specific needs of the MONET project, other criteria of inclusion were that the participants were non-smokers, generally healthy, had a stable body weight for the 6 months prior to recruitment, a body mass index (BMI) of less than $35.0 \text{ kg} / \text{m}^2$ and a waist circumference that did not exceed 90 cm. Such admission criteria were important to the MONET study for a number of reasons. For example, a healthy status would minimize the risk of health complications resulting from the maximal aerobic power test performed on the treadmill. As for the other criteria related to anthropometrical

measures, controlling for weight, BMI and waist circumference was important because the main goal of this longitudinal study involved an exploration of the association of weight gain with menopause (including a close examination of the accumulation of fat at the waist level). In addition, participants using any types of medication that had the potential to affect body weight were also excluded (ex: antidepressant).

As indicated in Table 1.1 and 1.2, the participants were on average 50.9 years old ($SD=2.0$), with an average BMI of 23.18 ($SD=2.3$). Most of the participants were married (77%). The mean number of other adult(s) (includes grown up children) living at home with them was 1.39 ($SD=0.8$), and the mean number of children less than 18 years of age at home was 0.63 ($SD=1.1$). To represent the family situation from another angle, children under the age of 18 years were present in the household of more than a third of the women (37.3 %). In terms of the presence of other people over the age of 18 years, the household included more than two adults for a third of them (33.3 %), and two adults for over half of them (58.8%). About half of them (57.3%) had a university degree. Most of them were employed (93.3%), with a permanent full time position (62.7%), for more than a year (82.7%) and working no more than 41 hours per week (69.3%). For almost half of the participants (42.7%), the type of position occupied was a management or a professional position. A good proportion of them considered themselves to be financially comfortable (66.7%) with a good financial evolution (46.7%), and more than half of the respondents (58.7%) indicated to have a family income equal or higher than 50,000 dollars. Half of the participants (50.7%) had more than 30 minutes of leisure time per day.

Table 1.1

Descriptive statistics of continuous socio-demographic variables

Socio-demographics	N	Mean	SD
Age	76	50.90	1.95
BMI	76	23.18	2.27
Number of other adult(s) at home (≥ 18 years old)	76	1.39	0.84
Number of children at home (< 18 years old)	76	0.63	1.124

Note. SD = standard deviation; BMI = body mass index.

Table 1.2

Descriptive statistics of categorical socio-demographic variables

	Frequency	Percentage
<u>Marital status</u>		
Married	58	77.3
not married	17	22.7
living with children under 18 years old	28	37.3
not living with children under 18 years old	47	62.7
household includes more than two adults	25	33.3
household includes two adults	44	58.8
household includes only one adult	6	8
<u>Education</u>		
university degree	43	57.3
no university degree	32	42.7

Table 1.2 (*continued*)

	Frequency	Percentage
<u>Employment</u>		
Employed	70	93.3
Unemployed	3	4.0
<u>Time since employed</u>		
employed for more than a year	62	82.7
employed since less than a year	8	10.7
<u>Job status</u>		
permanent full time	47	62.7
not permanent full time	21	28.0
<u>Type of employment</u>		
management or professional	32	42.7
other than management or professional	42	56.0
<u>Job hours</u>		
41 hours and up	21	28
0 to 40 hours	52	69.3
<u>Income</u>		
≥ \$50,000	44	58.7
< \$50,000	27	36
<u>Perception of the financial situation</u>		
financially comfortable	50	66.7
sufficient income or poorer	24	32.0

Table 1.2 (*continued*)

	Frequency	Percentage
<u>Financial evolution</u>		
more at ease than in the past	35	46.7
same as before or less	39	52.0
<u>Available time for leisure</u>		
more than 30 minutes	38	50.7
less than 30 minutes	34	45.3

Measures

Socio-demographics:

Demographics were self-reported using a questionnaire to gather the following information: age, marital status, number of children or teenager living at home, education, employment status, type of employment, time since employed, hours of work per week, means of transportation, time spent on transportation, time spent doing leisure activities, family income, perception of financial situation, evolution of the financial situation (see Appendix D). Such information was used to identify any possible confounders with PA level, for this specific population.

Anthropometric Data:

To measure body mass index (BMI), the participant's weight was measured after removal of shoes and heavy clothing, with a calibrated digital scale (TANITA, BWB-800) to the nearest 0.1 kg. Then height was measured to the nearest 0.1cm, using a wall-mounted measurement device, with the participant in a standing position with no shoes.

Body mass index was then calculated using the formula: body mass (kg) divided by height (m) squared. This measure was used in order to identify if BMI was a confounder within the study.

Mastery Experience:

International Physical Activity Questionnaire (IPAQ).

The IPAQ (see Appendix E) was developed in 1998-1999 in order to provide a common instrument, which would serve as an international measure of health-related PA for middle-aged adults primarily (Craig et al., 2003). Using this instrument, the participants are asked to report their PA over the last 7 days in regards to frequency (days per week) and duration (hours or minutes per day) of vigorous activity, moderate activity, and walking. Vigorous PA refers to activities that take hard physical effort and make the participant breathe much harder than normal. Moderate PA refers to activities that take moderate physical effort and make the participant breathe somewhat harder than normal. In regards to walking, only bouts of 10 minutes duration or more are recorded. The set timeframe, which did not exceed 7 days, helped to minimize difficulty of recall with this subjective method of measurement.

The criterion validity of this measure ($r_s=0.30$) is reported to be comparable to most other self-report questionnaires. Spearman's correlation coefficient of the short form ($r_s=0.67$) is comparable to the long form ($r_s=0.80$). Repeatability is also at an acceptable level with 75% of the correlation coefficients observed above 0.65 (Craig et al., 2003).

In the current study, the IPAQ (short form) data were summarized first by calculating individual scores for the number of METs (metabolic equivalent) minute per week for each of the following categories: vigorous intensity activities, moderate intensity

activities and walking. The following formula was used: duration (in minutes) $\times$ frequency (number of days) $\times$ intensity for each category (8 METs for vigorous-intensity activity, 4 METs for moderate-intensity activities, 3.3 METs for walking). Then, the computation of the total physical activity METs per minute per week was done with the sum of the METs per minute per week scores of all three intensity categories. This calculation is in accordance with the latest version of the guidelines for data processing and analysis of the International Physical Activity Questionnaire group (International Physical Activity Questionnaire [IPAQ], 2005) where the suggested METs value in the above formulas were derived from the IPAQ validity and reliability study (Craig et al., 2003).

Social Support:

Social Support and Exercise Survey (SSES).

The SSES (Sallis, 1986) involves 20 questions to measure the frequency of social support received for PA involvement (see Appendix F). From the 20 questions, 10 relate to family members and 10 identical questions relate to friends, acquaintances or coworkers. Participants are asked, “Under FAMILY, rate how often anyone living in your household has said or done what is described during the last month. Under FRIENDS, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.” One example of a description is: “Engaged in physical activity with me”. The perceived frequency of occurrence related to each description is rated on a 5-point scale ranging from 1(none) to 5 (very often). For each scale, the score is the sum of points for the 10 items. As demonstrated in the appendix E, these 10 items are questions number 1 to 13, minus questions number 7, 8

and 9. These last three questions are part of an optional subscale related to reward and punishment and were not included in this study. This instrument has been demonstrated to be valid and to have acceptable internal reliability for the family scale ($\alpha = 0.91$) and for the friend scale ($\alpha = 0.84$) (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). As well, internal reliability was assessed to be very good in the present study with Cronbach's alphas of .88 and .92 respectively.

Mood:

Profile of Mood States (POMS).

Anxiety, depression and vigour are measured using the abbreviated subscales of the Profile of Mood States (see Appendix G) developed by Grove and Prapavessis (1992). It consists of a total of 18 mood-related adjectives (ex: tense, sad, energetic) preceded by the statement "Over the past week, I have felt..." that participants are instructed to rate on a 5-point scale ranging from 0 (not at all) to 4 (extremely). The score is the mean from the 5-point scale, for each of 6 sub-scale items (anxiety, depression and vigour subscales). Higher scores for anxiety and depression are indicative of disturbed mood, while a higher score for vigour indicates better mood. The instrument has acceptable psychometric properties. Validity has been demonstrated and the Cronbach's alphas for all subscales ranged from .66 to .95 with a mean of .80 (Grove & Prapavessis, 1992). Within the present study, this value was assessed to be .89 (anxiety scale), .82 (depression scale) and .90 (vigour scale).

Environmental Factors:

Home Environment & Neighborhood Convenient Facilities Scales.

The goal of these scales is to evaluate the influence of the environment on PA. They originate from the original version of Sallis, Johnson, Calfas, Caparosa and Nichols (1997) and were modified to the context of the current study (see Appendix H). The Home Environment Scale involves a list of 13 supplies or common pieces of equipment available at the place of residence that can be used for PA. Participants are asked, “Please indicate which items you have access to in your home, yard, or apartment complex”. Examples of supplies or pieces of equipment are: bicycle, weight lifting equipment, skates, and swimming pool. The answers are based on a yes or no dichotomous rating. The “yes” responses for all 13 items were summed to obtain an overall score.

For the Neighborhood Convenient Facilities Scale, it involves a list of 9 common facilities for PA within the neighbourhood. Participants are asked, “Please indicate which items you have access to in your neighborhood”. Examples of facilities are: bike paths, public recreation centre, and health club. The answers are also based on a yes or no dichotomous rating. The score is the sum of “yes” responses for all 9 items. Both scales were demonstrated to be valid and have a test-retest intra-class correlation of 0.89 and 0.80 respectively (Blanchard et al., 2005; Sallis et al., 1997).

Barrier Self-Efficacy:

Barrier Efficacy Scale.

The Barrier Efficacy Scale (see Appendix I) is an 11-item scale designed to evaluate the confidence that a person has to overcome commonly identified barriers to engage in

PA on a regular basis. The scale was taken from the original version of McAuley (1991) and was modified to the context of the current study. With no time frame suggested, the participants were asked, “How confident are you that you will engage in regular physical activity EVEN IF...” and one example of a suggested barrier is: “you are too tired / lacked energy”. The degree of confidence in overcoming each barrier is answered based on a 7-point Likert scale ranging from 1 (extremely unconfident) to 7 (extremely confident). The total score for this scale is the mean from the 7-point scale for all items. It has been demonstrated that this scale is valid and has good reliability ($\alpha = 0.93$) (Blanchard et al., 2005; McAuley, 1992a, 1993). Its internal reliability was also very good within the present study ($\alpha = 0.88$).

PA Behaviour:

Physical activity behaviour was measured using the physical activity level value (PAL). This value is obtained via the formula: total daily energy expenditure (TDEE) divided by resting metabolic rate (RMR). In this equation, TDEE is equal to the average activity energy expenditure (AEE) per day plus RMR (Hoos, Gerver, & Westerterp, 2003; Puyau, Adolph, Vohra, Zakeri, & Butte, 2004). The AEE and RMR measures were respectively obtained with an accelerometer and a ventilated hood indirect calorimeter, described below.

The following explanation helps to understand why it is important to consider AEE in combination with individual RMR in the above equation. Physical activities have a metabolic cost (or rate of oxygen use), which is expressed in METs. More precisely, the metabolic cost of any activity is a multiple of the RMR (or the calories required by the body at rest for a 24 hours period). This metabolic cost is a consequence of body

movement and therefore is related to body size (Carron et al., 2003). For example, the energy expenditure will be higher for a woman with a higher body weight, especially for weight bearing activities (Westerterp & Plasqui, 2004).

Accelerometer (See Appendix J).

The accelerometer model Actical® (Mini Mitter Co., Inc.) was used to measure intensity and frequency of body movement in free living condition during a period of 7 days in order to obtain an objective AEE value. It consists of a device that measures 28 x 27 x 10 mm and weighs 17.5 grams. It is worn on a Velcro belt around the waist. It is waterproof and can be worn while showering or swimming. Two Velcro bands are available for water activities. The digital integration signal processing of the instrument reports both the intensity and the range of motion in all planes. The motion acting on the sensor produces a variable voltage output signal, which will identify a number of activity counts per minute, with a sensitivity of 0.05 grams (Bio-Lynx Scientific Equipment inc., 2005), these unit of counts roughly represents changes in PA energy expenditure (Heil, 2006). This raw data is downloaded into a computer using a serial port computer interface, which allows the exportation of data as text files (Heil, 2006). Minute-by-minute activity energy expenditure is reduced to an average per day in the provided output. This instrument has been proven to be valid to measure AEE and to measure and discriminate sedentary, light, moderate, and vigorous levels of PA in children (Puyau et al., 2004). In terms of the adult population, another study related to its validity, demonstrating that the Actical® accurately predicted accumulated AEE as well as the time variables within all activity intensity categories (Heil, 2006). The inter-instrument

reliability of this instrument was also reported ($R=0.92$) (Pfeiffer, McIver, Dowda, Almeida, & Pate, 2006).

The Actical® accelerometer computer program allows for a calculation of RMR, however, such output is only generated from the participant's characteristics such as body mass, age, sex, and height. Therefore, using a RMR value from a more precise instrument such as the ventilated hood indirect calorimeter was preferable.

Ventilated hood indirect calorimeter (See Appendix K).

Resting metabolic rate (RMR) was measured via an analysis of oxygen consumption and carbon dioxide production with an open circuit, ventilated hood indirect calorimeter (Deltatrac II™, SensorMedics). This instrument is stated to be the most accurate of its kind and has been validated in various situations (Da Rocha, Alves, & Da Fonseca, 2006; Stewart, Goody, & Branson, 2005). Its reliability has also been previously established (Alam et al., 2005). The coefficients of variation and correlation were calculated to be 2.3 % and .98 respectively, as determined on 12 MONET research participants, in laboratory condition.

Procedures

This next section describes the entire procedure of the first year MONET study. Within this description, the specific procedures that were directly related to the present study were: Recruitment (i.e., publicity, telephone screening, group meeting, verification of admission criteria), Body Composition Session (i.e., administration of the “Physical Activity During the Late Reproductive Years” questionnaire, measure of body weight and height), Food Intake Session (i.e., measure of the resting metabolic rate), 7-day Follow up (i.e., measure of PA with the accelerometer).

Recruitment:

A variety of strategies were used for the recruitment of the MONET participants: word of mouth; newspaper advertisements; pamphlet distribution at various locations (doctors' offices, massage therapy centres, stores, etc...); advertisements posted on information boards of various establishments (education and community centres, government offices, sports facilities, etc...). A phone number was provided for women who were interested in participating in the project. Those who called to express interest were asked a series of questions over the phone to verify that they met the inclusion criteria for the study (see Appendix B). The incentives presented to the participants were the administration of tests related to their health status and receiving \$300 dollars at the end of the MONET longitudinal study.

Screening #1- Group meeting (see Appendix C).

Women meeting the criteria based on the initial call were invited to take part in an information meeting. Information meetings, for groups of 4 to 10 candidates, occurred every few weeks during the recruitment period, between May 2004 and August 2005. These sessions lasted about 80 minutes and served to welcome the participants, to explain the objectives of the MONET study, and to provide details of the annual testing sessions and procedures. Participants were given the opportunity to ask questions, and then were invited to complete a consent form, a socio-demographics questionnaire and some additional questionnaires specific to the requirements of the MONET study. At the end of the session, participants interested in the study were met individually to have their waist circumference measured and to make appointments for the next two testing sessions (screening #2-Medical Evaluation and screening #3-Glucose Tolerance Test), which took

place during the following months in accordance with the availability of testing and their own personal schedules. These two sessions were considered two of the regular annual testing sessions, but also served as a screening to complete the verification of the inclusion criteria of the MONET study.

Screening #2- Medical evaluation (see Appendix C).

This second testing session consisted of a 2-hour evaluation including a medical examination by a physician, measures of body weight and height, as well as heart rate and blood pressure, and an electrocardiogram at rest. Results of these tests served in part to confirm the health status of the participants.

Screening #3- Glucose tolerance test (see Appendix C).

The third testing session was approximately 3 hours. An oral glucose tolerance test was performed. Following the insertion of a catheter in the antecubital vein of the forearm, a fasting blood sample was taken to measure lipoproteins, insulin, glucose and FHS serum level. Following this procedure, a glucose solution was ingested, and then glucose and insulin were measured through blood sampling for three hours thereafter (one sample every 30 minutes). The analyses of these measurements completed the verification that the participants complied entirely with the inclusion criteria of the MONET study. In particular, for the interest of the present study, the result of the FHS serum level confirmed that the participants were still in premenopause or only at a very early stage of perimenopause. Participants who corresponded to all criteria were officially part of the MONET study and were asked to come to two more sessions of measurements during the year (i.e., Body Composition Session and Food Intake Session) and to participate in a 7-day PA and food intake follow-up.

Body Composition Session:

This session was approximately 2 to 3 hours. It involved a series of events (see Appendix C), which took place in the order described below:

Physical activity questionnaire.

Participants were asked to complete the questionnaire that was used for the present study. This questionnaire was entitled “Physical Activity During the Late Reproductive Years”. It consisted of a battery of tests including measures of self-reported weekly exercise behaviour (International Physical Activity Questionnaire), social support (Social Support and Exercise Survey), vigour/anxiety/depression (Profile of Mood States), environmental factors (Home Environment Scale & Neighborhood Convenient Facilities Scales), and barrier self-efficacy (Barrier Efficacy Scale). It was expected that it would take 25 to 35 minutes to complete. If the participants had any questions or difficulties with the questionnaire, the investigator of the present study was there to provide them with assistance.

Body composition.

A method called dual energy x-ray absorptiometry (DEXA) was used to measure bone density, body fat percentage and lean mass. Body weight and height were measured, and then the participants lay down on an examination table while low-intensity x-rays scanned the entire body.

Maximal aerobic power (VO_2max).

This test was used to measure cardiovascular fitness. It consisted of evaluating the maximal aerobic capacity during exercise to exhaustion. The test was performed on a treadmill; exercise intensity was increased every three minutes until exhaustion was

reached. The participants breathed through a rubber mouthpiece and oxygen consumption was measured. The output generated was the maximal oxygen volume used during one unity of time and for one unity of body weight (ml/min/kg). It represented the highest peak of oxygen uptake that can be obtained during an aerobic exercise.

Computerized tomography.

A computerized tomography (CT) scan was performed to measure abdominal fat. For this procedure, the participants lay down on an examination table while multiple 2-second sectional images of the abdomen were taken at the level of the navel by an x-ray machine.

Food Intake Session:

The Food Intake Session was longer and lasted 5 to 6 hours (see Appendix C). This session had to be done when the estrogen and progesterone levels of the participants were at their lowest levels, which corresponds to the follicular phase of the menstrual cycle (i.e. the first 5 days of menstruation). Due to this constraint, the MONET group decided that it was acceptable for the Food Intake Session to be completed ahead of the Body Composition Session for some participants. During this session, various parameters were measured as follows:

Resting metabolic rate.

Resting metabolic rate was measured with the ventilated hood indirect calorimeter (Deltatrac TM II, SensorMedics). The test was performed early in the morning in a thermoneutral environment with low light, when the participant had been fasting for a period of 8 hours. First, the participant rested in supine position for 20 minutes, then a canopy was placed over the head of the participant for an additional period of 30 minutes.

The instrument brought fresh air to the participant and the amount of oxygen used as well as the production of carbon dioxide were analysed every minute. The instrument was calibrated before each measurement session. For increased precision, the first and the last 5 minutes of measurement were not entered in the finale respiratory quotient result. Finally, resting metabolic rate output was calculated using the Weir's equation (Weir, 1949).

Thermic effect of a meal.

This measure was taken via a series of procedures including measures of oxygen consumption and carbon dioxide production, the ingestion of a standardized breakfast and a lunch meal, nine blood samples, as well as the analysis of a urine sample to verify nitrogen content (an indicator of the rate of protein oxidation to provide energy).

Food intake and appetite.

Food intake and appetite were measured via the ingestion of a buffet-style meal until satiety was reached. Caloric intake as well as composition of food intake was then calculated.

Psychosocial status.

The administration of a questionnaire measured self-esteem, body self-esteem, quality of life, stress, perception of benefits and dietary habits. It is important to note that this questionnaire was different than the one used for the present study and none of its result was integrated to the present study.

7-day Follow up:

The participants were instructed to complete a food journal and to wear an accelerometer (see Appendix C) for the subsequent 7 days of the last testing session (i.e.

the Food Intake Session or the Body Composition Session). For consistency, it was indicated to the participants to wear the accelerometer on the right iliac crest in line with the right knee, with the arrow (printed on the instrument) pointing upward. Placement on the hip is considered one of the best placements for an accelerometer (Trost, McIver, & Pate, 2005). The participants were asked to wear it from the time they woke up, to the time they went to bed (including the time spent showering or bathing). After the 7-day period, they returned the food journal and the accelerometer to the Research Unit. Data from the accelerometer were downloaded into the Actical Analysis Software (version 2.0)

The data from the accelerometer was to serve as an objective measure of PA for the present study. The entire procedure around this measure was under the control of the MONET study and occurred up to 207 days after the administration of the questionnaire “Physical activity during the late reproductive years”. A variety of reasons explain this inconsistent delay, but the most frequent one was the difficulty for the MONET group to schedule the Food Intake Session of the participants, which needed to coincide with the follicular phase of their menstrual cycle. This 7-day follow up procedure completed the entire series of testing for the first year of the MONET study, which is the year that was targeted for the present study.

Note: Procedures section partly adapted from the MONET Consent Form by Prud’homme et al. (Montreal Ottawa New Emerging Team).

Chapter IV. Analysis & Results (Prospective Research Design)

Sample Available for Data Analysis

Initially, 120 women were recruited to enter the MONET study. After a few participants abandoned the study in the early stage and others were excluded by the MONET group, 103 participants reached the first step of the present study. This first step consisted of the completion of the questionnaire “Physical Activity During the Late Reproductive Years”, at the Body Composition Session of year one. From this initial sample of 103 participants, 22 were removed for incomplete accelerometry data. More specifically, (1) two participants were excluded from the MONET study for medical reasons, (2) one participant moved away, (3) another one abandoned the study before completing the 7-day follow up with the accelerometer, (4) the accelerometer failed to work properly for 7 participants, (5) an additional 7 participants had asked to do the 7-day follow up at a later date, but failed to follow through on their commitment, (6) two participants took part in the doubly labelled water test of the MONET study (a specialized test only performed on a few participants) and had their accelerometry measure performed before their Body Composition Session rather than after, and (7) two participants forgot to wear their accelerometer on days that were included in the measure of PA for this study. With the subtraction of these 22 participants, a total of 81 completed both the “Physical Activity During the Late Reproductive Years” questionnaire and the PA measure along with the accelerometer data. From these 81, additional participants had to be removed from the study for the following reasons; (1) four participants had missing data from the IPAQ (which measured mastery experience) because they answered, “I don’t know” for the question about the times that they had

walked for bouts of more than 10 minutes. Such an exclusion procedure is part of the IPAQ guideline for data processing and analysis (IPAQ, 2005), (2) and finally, one more participant was removed from the study because the lapse of time between the completion of the “Physical Activity during the Late Reproductive Years” questionnaire and the accelerometer measure exceeded the acceptable limit of 160 days. As a result, the data of 76 participants were available for statistical analysis.

Basic Information Related to the Statistical Analyses

The SPSS statistical software (SPSS Inc, Chicago, IL, USA), version 12 was used for all data analysis. Descriptive statistics were included to summarize socio-demographic characteristics of the sample and the studied variables. A normal distribution assumption was reached with the removal of outliers using established techniques (Tabachnick & Fidell, 2005). For the main analysis, correlation and regression analyses were considered significant if p values were less than 0.05.

Preliminary Analysis

Normal Distribution of the Data

The basic statistical assumption of a normal distribution of the variables was established. To do so, the variables with skewness and kurtosis values higher than an acceptable range of ± 1.96 (George & Mallery, 2003) were identified: depression (kurtosis 3.07), IPAQ vigorous PA (kurtosis 3.62), IPAQ moderate PA (skewness 3.73, kurtosis 16.49), IPAQ walking activity (skewness 2.57, kurtosis 6.53), accelerometer activity energy expenditure (AEE) day 4 (kurtosis 3.41), accelerometer AEE day 6 (kurtosis 4.17), accelerometer AEE day 7 (skewness 2.63, kurtosis 10.85). The values of the above variables were transformed into Z-scores in order to find and delete the ones with a

Z-score outside of an acceptable range considered to be ± 3.29 range (Tabachnick & Fidell, 2005). The following data points were removed: IPAQ vigorous PA (1570); IPAQ moderate PA (5040, 4800); IPAQ walking activity (6930, 6930, 6930); accelerometer day 4 (2079); accelerometer day 6 (2524); accelerometer day 7 (3617); depression (2.33). After deletion of these data, skewness and kurtosis were now within an acceptable range of ± 1.96 for all variables with the exception for these variables: IPAQ walking activity (kurtosis 5.28) and accelerometer day 7 (kurtosis 2.96). However, no additional data were deleted to respect the Z-score transformation procedure (Tabachnick & Fidell, 2005). Therefore, all remaining data were included in the statistical analysis.

Socio-Demographic and Anthropometrical Confounders

It is possible that one or more of the socio-demographic and anthropometrical variables had a relationship with the participants PAL value. Since it is important to explore if any of these variables acted as a confounder in the study, zero-order (bivariate) correlations were performed between each socio-demographic and anthropometrical variable (independent variables) and the PAL (dependent variable). If such confounders would be identified, they would be controlled for in the main analysis.

The socio-demographic questionnaire presented multiple-choice answers with breakdown categories, while only few variables were continuous. Therefore, before proceeding to the correlation analysis, it was necessary to dichotomize some of the variables by recoding them, as follows: civil status (0 = married, 1 = not married), education (0 = university degree, 1 = no university degree), employment (0 = unemployed, 1 = employed or self-employed), time since employed (0 = employed since

less than a year, 1 = employed for more than a year), job status (0 = not permanent full time, 1 = permanent full time), profession (0 = other than management or professional, 1 = management or professional), job hours (0 = 0 to 40 hours, 1 = 41 hours and up), income (0 = < \$50,000, 1 = ≥ \$50,000), perception of the financial situation (0 = comfortable, 1 = just sufficient, poor or very poor), financial evolution compared with past years (0 = more at ease, 1 = same as before or less at ease), transportation (0 = other mean of transportation than car only, 1 = car only), time spent in transportation to work (0 = <30 minutes, 1 = >30 minutes).

Secondly, zero-order (bivariate) correlations analysis between all recoded demographic variables and PAL was done. Due to numerous demographic comparisons with the PAL, rather than using a Bonferroni correction to avoid making type 1 error, a cut-point of $p = .01$ was used. Results showed that none of these socio-demographic variables were significantly correlated to PAL, and therefore no confounds were detected (see Table 2 below).

Table 2

Zero-order Correlations between Socio-Demographic Variables and PA

Socio-demographic	PAL
Age	.178 ($p=.126$)
BMI	.009 ($p=.938$)
Number of other adult(s) at home (≥ 18 years old)	-.018 ($p=.876$)
Number of children living at home (< 18 years old)	.159 ($p=.173$)
Marital status	.031 ($p=.794$)
Education	.112 ($p=.339$)
Employment	-.033 ($p=.781$)
Time since employed	-.154 ($p=.202$)
Job status	-.135 ($p=.273$)
Type of employment	.143 ($p=.223$)
Job hours	-.016 ($p=.894$)
Income	-.048 ($p=.666$)
Perception of the financial situation	.046 ($p=.697$)
Financial evolution	.022 ($p=.849$)
Available time for leisure	-.035 ($p=.773$)
Mean of transportation	.038 ($p=.746$)
Time spent in transportation to work	.164 ($p=.172$)

Note. PAL = physical activity level; BMI = body mass index.

Other Possible Confounders

Despite the fact that the socio-demographic and anthropometrical variables were not confounders, one possible confounder remained. As discussed earlier, the number of days between the administration of the questionnaire and the completion of the PA measure with the accelerometer varied between 8 and 160. In order to control for these different lapses of time between the participants, a time variable called “time questionnaire-accelerometer” was created and was included in the main analysis as a covariate (see Table 4).

In addition, for more insurance that the inconsistent delay between the administration of the questionnaire and the completion of the accelerometry measure was not a confounder in the study, a split of two groups was created between the participants who completed the PA measure with the accelerometer within 16 days of the questionnaire completion (N= 40) and the participants who completed it after 16 days (N=35). Then, a one-way ANOVA was run between these two groups (independent variables) and PA (dependent variable). The result of this procedure showed that there was no significant difference of PA level between the two groups. Nonetheless, given the variation in time between questionnaire completion and wearing of the accelerometer, the time questionnaire-accelerometer covariate was still controlled for in the main analyses.

Physical Activity Level Data Summary

As discussed in the measures section, PAL values were summarized using the following formula: $(\text{average AEE per day} + \text{RMR}) / \text{RMR}$. To calculate the average AEE per day, it was decided to remove the first two days that the accelerometer was worn by the participants to allow for a run-in period of the instrument. The decision to use this

approach was based on the statement of a previous study indicating that participants tend to increase their PA levels at the beginning of an accelerometer measurement period (Ayabe et al., 2004). Therefore, only the sum of the AEE results from the third to the seventh accelerometer day period was used. The literature indicates that using between 3 and 5 days of monitoring is an adequate period of time required for a reliable estimate of the accelerometer outcome (Trost et al., 2005).

Descriptive Statistics of all studied variables

The next table presents the descriptives of all the studied variables, as well as the “time questionnaire-accelerometer” variable, discussed above.

Table 3

Descriptive statistics of all studied variables

	Scale range	Mean	SD
Mastery experience (MET-min/week)	-	2054.05	1535.47
Social support (SS-family)	10 to 50	23.49	8.49
Social support (SS-friends)	10 to 50	22.22	9.65
Mood states (anxiety)	0 to 4	0.92	0.75
Mood states (depression)	0 to 4	0.39	0.50
Mood states (vigour)	0 to 4	2.39	0.68
Environment (home equipment)	0 to 13	6.53	1.90
Environment (neighbourhood facilities)	0 to 9	7.21	1.83
Barrier self-efficacy	1 to 7	5.14	1.08
PA (PAL value)	-	1.65	0.18
Time questionnaire-accelerometer (days)	-	33.81	38.65

Note. SD = standard deviation; SS = social support; PA = physical activity; PAL= physical activity level.

According to the results from Table 3 and the norms of the IPAQ questionnaire, the average level of mastery experience in PA of the participants of this sample was considered to be between the “moderate” (achieving a minimum of at least 600 MET-min/week) and “high” (achieving a minimum of at least 3000 MET-min/week) levels of PA. Individuals in the first category would be defined as achieving a minimum level of PA for health benefit, while individuals in the latter category are defined as accumulating enough activity for a healthy lifestyle, such as walking about 12,500 steps per day or the equivalent in a combination of activities to reach at least 3000 MET-minutes/week (IPAQ, 2005). However, according to the results of Table 3, there was a very large variation of PA level among the participants.

From the social support scales, a score of 10 would be indicative of receiving no support at all from family or friends while a score of 50 would indicate the maximal level of social support. According to the results from Table 3, it is considered that the level of social support from family and friends that this sample received to engage in PA was somewhere between a low to a moderate level, with a small level of variation.

According to Table 3 and the range of the scale used to measure mood, it is considered that on average, the sample had low levels of anxiety and depression, while vigour was moderate. The level of variation was small to moderate for the three mood components.

From the Home Environmental Scale, a total of 13 PA supplies or common pieces of equipment available at the place of residence were suggested. The mean value from Table 3 indicates that on average, half of the home supplies or equipment was available to this sample. In terms of the Neighbourhood Convenient Facilities Scale, the mean

value of 7.21 out of 9 common facilities for PA suggested that this sample had 80% of the suggested common facilities.

The maximal value that could have been obtained from the Barrier Efficacy Scale was 7. The mean value of 5.14 found in Table 3 corresponds on the Barrier Efficacy Scale to feeling “slightly confident” to overcome barriers to PA. The variation level among the participants was small to moderate.

Regarding the average PAL value of this sample, the value of 1.65 places them in the higher end of the sedentary lifestyle category, which ranges between 1.55 and 1.65. To place this category in perspective, sustainable lifestyle PAL values range between 1.2 and 2.5. The lower value is associated with a non-ambulant lifestyle while the higher value is indicative of a very physically active lifestyle (Shetty, 2005).

Main Analysis

Partial Correlation Analysis

To verify the first and second hypotheses about potential correlates of PA, partial correlations were performed between PA and each of the studied variables: mastery experience, social support (SS-family, SS-friends), mood states (anxiety, depression, vigour), environment (home equipment, neighbourhood facilities), and barrier self-efficacy controlling for the “time questionnaire-accelerometer” variable, which expresses the lapse of time between the measures of these variables with the measure of PA. Details of the results are found in Table 4.

Table 4

*Partial Correlations Between Social Cognitive Variables and PA
(controlling for “time questionnaire-accelerometer”)*

	PAL
Mastery experience	-.099
Social support (SS-family)	-.243*
Social support (SS-friends)	-.208
Mood states (anxiety)	.050
Mood states (depression)	.039
Mood states (vigour)	.118
Environment (home equipment)	-.163
Environment (neighbourhood facilities)	.103
Barrier self-efficacy	-.277*

Note. PAL = physical activity level; SS = social support.

* $p < .05$.

As can be seen in Table 4, results demonstrate that barrier self-efficacy ($r = -.27$, $p < .05$) and social support from family ($r = -.24$, $p < .05$) were significantly correlated to PA. However, quite surprisingly, both of these correlations were negative.

The unexpected direction of the above correlations from this prospective research design poses strong challenges for interpretations of the results. Based a re-examination of the Actical® accelerometer to measure PA (discussed over the next section) it was decided to modify the research design to a cross sectional one, where the IPAQ data that was used to measure “mastery experience” would yield its place to be used for the PA

variable. Before further presentation of this re-modeled design and its results, a discussion related to the prospective design that was initially proposed for this study is presented in the next section.

Chapter V. Discussion (Prospective Research Design)

As discussed above, the results from this prospective research design (that used the accelerometer as the PA measure) are quite surprising since they do not seem to fit well the SCT framework given the inverse correlations. In fact, other than the two variables that were significantly correlated to PA (barrier self-efficacy and SS from family), inverse correlations with PA were also revealed with mastery experience, SS from friends, anxiety, depression and availability of home equipment. In order to find an explanation for these results, different approaches were experimented with. Data entry, computations of all variables and the mathematical formula to calculate the PAL value were all re-verified in depth. Other methods to quantify PA from the accelerometer output were tried: using the total amount of minutes spent in vigorous and moderate PA, using the single value of AEE or TEE rather than a calculated PAL value. Other ways of removing outliers were also explored. As a consequence, none of the above approaches led to any significant difference from the initial results. Inverse correlations were still present.

One aspect of the methodology where some questions were raised was the use of the Actical® (Mini Mitter Co., Inc.) accelerometer. Two main issues were considered. The first one pertained to some concerns with the use of this instrument to measure the targeted PA behaviour of the present study. The second issue was related to the amount of research to support the psychometric properties of this particular accelerometer model. The following two paragraphs address these issues.

The measure of PA that is of interest when measuring PA correlates is the one related to PA behaviour that optimizes health benefit. However, the understanding of the

association between PA and health outcomes is still under investigation (Carron et al., 2003). There is a possibility that PA measured via the accelerometer did not correspond to the targeted PA measure for the present study. The objectivity provided by accelerometers have the advantage of reducing bias and inaccuracies of recall (Sallis & Owen, 1999). However, there seems to be three main concerns with the use of accelerometers. First, hip-mounted accelerometers might not detect properly PA that combine dynamic and static movements (Matthews, 2005). Second, the activity energy expenditure output takes into account PA of all intensities, therefore, giving an important role to PA of light intensity performed over an extended period of time. Third, the instrument does not provide an output related to the duration of a continuous PA session (i.e., temporal length of PA bouts). According to Ward, Everson, Vaughn, Rodgers, and Troiano (2005), the issue about a minimum PA bout length for health benefit is not yet settled. Some of the present guidelines for health benefits don't take into consideration bouts of PA, but rather an accumulation over the course of the day, while other recommendations give consideration to this factor (Ward et al., 2005). Within the present study, it was observed that the amount of time spent in moderate PA, for several of the participants, was summed to be higher than 300 minutes on some days. This is equivalent to spending about 5 hours in moderate PA in a single day. Interestingly, verbal report from some of these participants indicated no recall of engaging in bouts of more than 30 minutes of moderate PA. This illustrated to which extent the temporal length of a PA bout was not taken into account from the accelerometer measure. The above three concerns related to the use of accelerometers might explain why the obtained results did not fit the proposed framework. However, since there is an absence of

consensus in relation to the quantification of PA for maximal health benefit (IPAQ, 2005), this point remains only in the hypothesis domain.

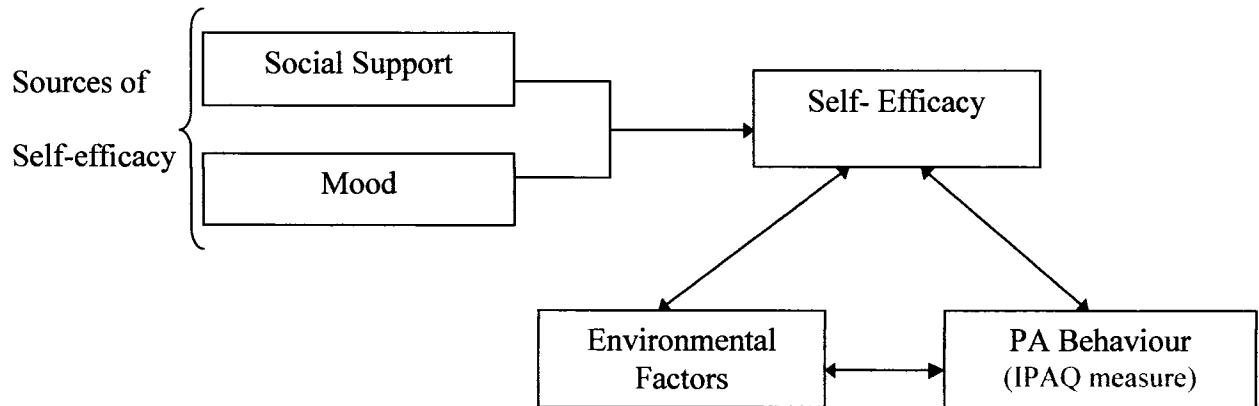
Research supporting the psychometric properties of the Actical® (Mini Mitter Co., Inc.) accelerometer was reconsidered. To date, very few studies have examined these properties for this specific accelerometer model. Of the few studies that explored its reliability, one study from Welk, Schaben, and Morrow (2004) compared the inter-instrument reliability of four different makes and models of accelerometers and concluded that the Actical® accelerometer had the lowest intraclass reliability coefficients (0.62) of the four models during three PA trials. As well, research related to its validity with the adult population is very rare.

In light of all above considerations, it was decided to modify the research design to a cross sectional one, which relied on a different instrument to measure PA. Previous research supports the fact that this modification is an appropriate option. From their study evaluating the utility of a concurrent PA measure within a cross-sectional design, Rhodes and Plotnikoff (2005) have concluded the following: “It appears that a measure of concurrent physical activity included in a cross-sectional design can act as a reasonable proxy measure of future behaviour measured in a passive prospective / longitudinal design. These findings support the use of cross-sectional designs when researchers seek a standard correlation investigation of physical activity and social cognitive constructs with the possibility that coefficients may be slightly biased upwards”(p. 547).

Figure 5 below is a representation of the remodelled research design, excluding the “mastery experience” variable and considering the data from the IPAQ as the “PA

behaviour” variable. The following two chapters will present the results and discussion of this cross-sectional research design, which was adopted as the main design of this thesis.

Figure 5. Cross-sectional research design



Chapter VI. Analysis & Results (Cross-Sectional Research Design)

Sample for Data Analysis

For this cross-sectional design, it could have been possible to enter the 22 participants who were lacking accelerometry data and whom were removed from the first design study. However, in order to allow for possible comparisons between the two research designs, the subsequent set of analysis used exactly the same sample as the one that was used for the prospective design analysis (chapter IV).

Preliminary Analysis

Normal Distribution of the Data

As described in the preliminary analysis presented in chapter IV, the assumption of the data normal distribution was established with outliers' removal. Since the sample remains the same, no additional changes were required.

Socio-Demographic and anthropometrical Confounders

To explore if any of the socio-demographic or anthropometrical variables acted as a confounder in the study, zero-order (bivariate) correlations were performed between each of these variables (independent variables) and the PA measure (dependent variable). A cut-point of $p = .01$ was used to avoid making type 1 error. Result showed than none of these socio-demographic variables were significantly correlated to PA (see Table below), and therefore no confounds were detected.

Table 5

Zero-order Correlations between Socio-Demographic Variables and PA

Socio-demographic	PA (MET-min/week)
Age	-.011 ($p=.926$)
BMI	-.184 ($p=.114$)
Number of other adult(s) at home (≥ 18 years old)	.073 ($p=.535$)
Number of children living at home (< 18 years old)	.167 ($p=.152$)
Marital status	-.060 ($p=.612$)
Education	.030 ($p=.799$)
Employment	-.107 ($p=.369$)
Time since employed	-.055 ($p=.648$)
Job status	-.161 ($p=.190$)
Type of employment	.024 ($p=.841$)
Job hours	.112 ($p=.345$)
Income	-.023 ($p=.849$)
Perception of the financial situation	.140 ($p=.235$)
Financial evolution	.008 ($p=.944$)
Available time for leisure	-.061 ($p=.610$)
Mean of transportation	-.144 ($p=.220$)
Time spent in transportation to work	-.069 ($p=.565$)

Note. PA = physical activity; BMI = body mass index.

Main Analysis

Zero-order Correlation Analysis

To verify the first and second hypotheses about potential correlates of PA, zero-order (bivariate) correlations were performed between PA and each of the studied variables: social support (SS-family, SS-friends), mood states (anxiety, depression, vigour), environment (home equipment, neighbourhood facilities), and barrier self-efficacy. Details of the result are found in Table 6.

Table 6

Zero-order Correlations between Social Cognitive Variables and PA

	PA (MET-min/week)
Social support (SS-family)	.117
Social support (SS-friends)	.125
Mood states (anxiety)	-.267*
Mood states (depression)	-.212
Mood states (vigour)	.213
Environment (home equipment)	.037
Environment (neighbourhood facilities)	-.110
Barrier self-efficacy	.327**

Note. PA = physical activity; SS = social support.

* $p < .05$. ** $p < .01$.

As can be seen in Table 6, results demonstrated that barrier self-efficacy ($r = .33$, $p < .01$) was significantly and positively correlated to PA. Anxiety ($r = -.27$, $p < .05$) was also significantly correlated to PA, however the correlation was negative.

Mediation Analysis

Since barrier self-efficacy and anxiety were correlated to PA, the Baron & Kenny (1986) regression procedure was performed to explore if barrier self-efficacy was a mediator of the relationship between anxiety and PA. The steps for the regression procedure were done as follows:

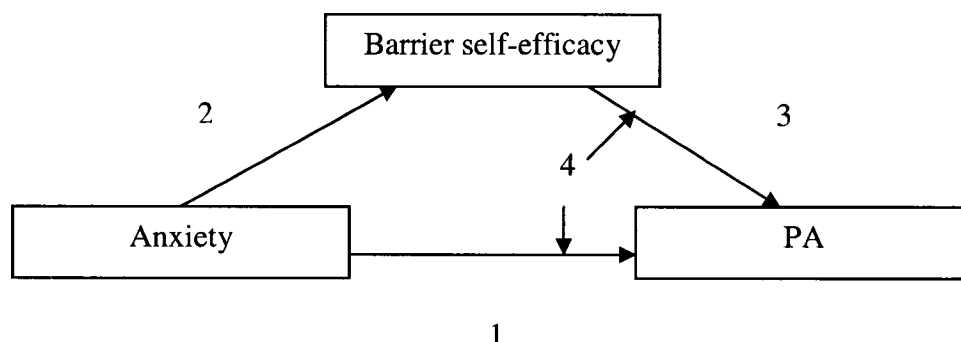
Step 1: PA was regressed onto anxiety

Step 2: Barrier self-efficacy was regressed onto anxiety

Step 3: PA was regressed onto barrier self-efficacy

Step 4: PA was regressed onto barrier self-efficacy and anxiety

Figure 5. Barron and Kenny regression procedure



Using this procedure, step 4 only occurs if the values from step 1 to 3 are all significant. In order for mediation to occur, the standardized beta for the Anxiety / PA relationship in regression # 4 should be smaller than the standardized beta in regression # 1. Results are described in Table 7.

Table 7

Mediation Analysis for Anxiety, Barrier Self-Efficacy and PA

		Barrier SE	PA
Step 1	Anxiety		-.269*
Step 2	Anxiety	-.206 (p = .07)	
Step 3	Barrier SE		.323 *
Step 4	Anxiety		-.212
	Barrier SE		.280 *

Note. SE = self-efficacy; PA = physical activity.

*p < .05.

As seen from Table 7, results from the mediation regression analyses showed that women who have less anxiety engage in significantly more PA than women with a higher level of anxiety ($\beta = -.27$, $p < .05$). As well, women with higher barrier SE engage in significantly more PA than those with lower barrier SE ($\beta = .32$, $p < .05$). However, women with lower levels of anxiety do not have a significantly higher level of barrier self-efficacy than women with more anxiety. In theory, this would confirm that mediation did not occur. However, given that the anxiety / barrier self-efficacy was almost significant, and in order to explore further the influence of barrier self-efficacy, we proceeded with the analysis, which showed that despite a lack of statistical significance, barrier self-efficacy had a very small mediating effect on the anxiety / PA relationship.

Follow Up Analyses

For the purpose of exploring some of the results obtained, which will serve as a base for additional information included in the following discussion section (chapter VI), two

follow up analyses were conducted. These two analysis involved zero-order (bivariate) correlation analysis, the first one between PA and each individual barrier to PA from the Barrier Efficacy Scale (Table 8), the second one between PA and each individual item of the SSES family and friends scales (Table 9). It is important to note that the basic statistical assumption of a normal distribution of all involved variables was verified. Skewness and kurtosis values were all within the acceptable range of ± 2.00 (George & Mallery, 2003).

Table 8

Zero-order Correlations Between each barrier of the Barrier Efficacy Scale and PA

	PA (MET-min/week)
Being too tired / lacking energy	.213
Not having time because of work	.225
Feeling under the weather	.206
Not feeling like doing PA	.308**
Having family commitments	.269*
Weather is bad (hot, humid, rainy, cold)	.361**
Having to exercise alone	.183
Being under personal stress of some kind	.169
Feeling self-conscious about own appearance	.074
Cost too much	.207
Not having access to facilities	.182

Note. PA = physical activity.

* $p < .05$. ** $p < .01$.

Result from Table 8 revealed that the self-efficacy to overcome three specific barriers to engage in PA was significantly related to the PA level for the studied sample: the self-efficacy to overcome “not feeling like doing PA” ($r = .31, p < .01$), to overcome “family commitments” ($r = .27, p < .05$) and to overcome “bad weather” ($r = .36, p < .01$).

Table 9

Zero-order Correlations Between each item from the SSES scales and PA

	family scale	friends scale
	PA (MET-min/week)	PA (MET-min/week)
Engaged in PA with me	.295*	.201
Offered to engage in PA with me	.216	.126
Gave me helpful reminders to engage in PA	-.156	.128
Gave me encouragement to stick to my PA program	-.084	-.044
Changed their schedule to engage in PA together	.038	.159
Discussed PA with me	.138	-.038
Planned for PA on recreational outings	.141	.125
Helped plan activities around my PA	.105	.129
Asked me for ideas on how they can get more PA	.058	.115
Talk about how much they like to engage in PA	.093	.073

Note. PA = physical activity.

* $p < .05$. ** $p < .01$.

Results from Table 9 revealed that only the first item of the SSES family scale was significantly related to the PA level for the studied sample: “engage in PA with me” ($r = .30, p < .05$).

The following chapter involves a discussion of the results from the main and the follow up analyses related to the cross sectional study design (chapter VI). Being that this study design is the central one adopted for this thesis, the following discussion is more elaborated than the previous discussion (chapter V) related to the prospective research design.

Chapter VII. Discussion (Cross-Sectional Research Design)

The purpose of this research was to identify reliable social cognitive correlates of PA for women that are very close to the beginning of the hormonal changes surrounding menopause. The desire to identify such correlates was supported by a need to better understand which factors act as possible facilitators to PA level for this population of women. It was decided to explore these correlates within the context of SCT, in large part, because it is a theory that is well supported by the literature. Based on this theory, three hypotheses were proposed. The first hypothesis was that barrier self-efficacy would be correlated to PA. The second one was that the environment (home equipment, neighbourhood facilities), social support (SS- family, SS-friends) and mood (anxiety, depression, vigour) would also be correlated to PA. The third hypothesis was that barrier self-efficacy would mediate the environment, social support, and mood / PA relationships. No other research has tested these hypotheses for the specific population targeted by this study.

The Relationship of Barrier Self-efficacy with PA

The first hypothesis was supported as barrier self-efficacy was correlated to PA in the studied sample. This indicates that women with stronger confidence in overcoming PA barriers (or obstacles) are engaged in significantly more PA. This is in line with previous research that has identified barrier self-efficacy to be correlated to PA for middle-aged adults (McAuley, 1992a; McAuley et al., 1994), and for a variety of populations (Marcus, Selby, Niaura, & Rossi, 1992; McAuley & Blissmer, 2000; Rogers et al., 2005)

The follow up analysis demonstrated that the ability to overcome three specific barriers (i.e., not feeling like doing PA, having family commitments and the presence of

bad weather) made a significant difference in the PA level of the studied sample. These barriers are not quite the same as the ones that were previously identified for the female population: fatigue, ill health, lack of energy, lack of time and self-consciousness about appearance (Booth, Bauman, & Owen, 2002; Brownson et al., 2000; Eyster et al., 1999; King et al., 2000; Trost et al., 2002; Wilcox, Castro, King, Housemann, & Brownson, 2000). The difference in these results could partly be attributed to the fact that older women were included in the sample of most of these studies, while the present study only included women between the ages of 47 to 55 years. In fact, it is not surprising that the ability to overcome family commitment is a significant factor for women of this age group. From the studied sample, we know that a little more than a third of the women lived with children under 18 years old, and we also have a good indication that about a third of them have grown up children present in their households. In addition, since the demographic data did not capture the total number of children the participants had, it is quite possible that a certain amount of these women had additional children to care for, such as university students, coming back during summer and holiday periods. An additional family commitment that might be considered for this population of women is often the care of their aging parents and/or parents-in-law.

The above findings demonstrate the importance of considering PA barriers in the design of PA programs. In fact, it is particularly important considering that, on average, this sample reported being only “slightly confident” of overcoming PA barriers. Interventions could involve the removal of barriers whenever possible, and/or the provision of strategies to increase the confidence of women approaching menopause in overcoming PA barriers. Considering the specific barriers of this group of women, the

following strategies could be used: to include activities perceived as enjoyable for them (e.g., walking group), keeping family commitments in mind when proposing activities (e.g., jogging from the arena while a teenager is at hockey practice), providing the exposure to various weather conditions (e.g., a walking group that ends at a nice warm coffee shop on cold days).

The Relationship of Environment, Social Support and Mood with PA

The second hypothesis to be tested was to verify the correlation of the environment and the barrier self-efficacy sources (i.e., social support and mood) with PA.

The Relationship of Environment with PA

Recent studies have demonstrated some evidence that environmental factors are positively associated with PA (Atkinson et al., 2005; Blanchard et al., 2005; De Bourdeaudhuij et al., 2003; Rutt, 2004). Environmental factors that may allow for the opportunity to increase PA participation include attributes such as the accessibility of facilities, opportunities for activities, weather, safety, and aesthetic attributes (Humpel et al., 2002). In this study, the accessibility of home equipment and supplies, and community facilities was assessed. Contrary to the positive results of the researchers stated above, the results of this study indicated that there was no significant relationship between the studied environmental attributes and the level of PA of the participants.

The fact that this study did not assess the whole range of environmental attributes described above could explain why this relationship did not register as significant. It is reported in the literature that satisfaction with facilities, neighbourhood safety, (Troost et al., 2002), the aesthetic nature of the local environment, and a good walking area are important correlates to PA (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). Therefore,

including more than one type of environmental attribute might have been more beneficial. Furthermore, most of the participants were employed. As such, the failure to consider the worksite or traveled routes could have lead to an underestimation of the true environment of these women and therefore would also contribute to an assessment scope that was too narrow to fully represent the environment of these women.

Another factor to consider is the fact that the measure of the environment was solely based on a subjective assessment. It is possible that performing objective assessments of the participant's home and community environment could have led to different results, with the elimination of the women's own perception. In fact, Caron et al. (2003) have stated: "Perceptions of one's environment and one's actual environment can be quite different. You may perceive a walking path to be quite safe; your friend may not. In many cases, personal perceptions are a stronger determinant of behavior than the actual environment is. However, a number of objective environment criteria could potentially influence behavior." (p. 125). Subjectivity did not seem to underscore the environment of the studied sample since on average they reported having fairly good accessibility to home equipment and neighbourhood facilities. However, there is no certainty as to the direction of influence from subjectivity. The addition of an objective measure is certainly not as easily feasible, but it is noteworthy to mention that it could have provided further insight as to the role of this variable on PA behaviour.

A supportive environment is believed to facilitate PA behaviour (Carron et al., 2003); however, the definition of a supportive environment might need to be further developed. For this study, according to the scale used, it was the quantity of PA equipment and facilities that was used to measure a supportive environment. However, this way of

measuring a supportive environment might not have been a true reflection of reality. For example, a woman might need only one piece of equipment or one neighborhood facility available to her to be physically active (e.g., having a stationary bicycle or having a fitness center close by). To consider the value of the items proposed in the scale, it might have been helpful to add another scale, which identified the participant's PA interests, in order to consider only the corresponding items from the Home Environment & Neighborhood Convenient Facilities Scale. Another option could have been to use a scale that corresponds better to the type of PA practiced by middle-aged women, if such a scale exists. For example, the neighbourhood scale included items such as public parks with playing fields, basketball/tennis courts, and swimming pools. However, in the literature, swimming and water exercise is only reported to be practiced by 1.6% of women 40 years and older (Brownson et al., 2000).

The reported environmental characteristics of the sample were the following. All of the participants had some access to home equipment for PA, ranging from one to 11 items, with a mean value of 6.5 items. The most frequent piece of equipment reported were: running shoes (96 %), bicycle (89 %), skates (75%), skis (73%), sports equipment such as balls and racquets (65%), weight lifting equipment (63%), and aerobic video & audio (54.7%). It has been reported that walking is by far the most common type of PA for women 40 years and older (Brownson et al., 2000). The fact that home equipment did not result as being significantly related to PA in the study, could be indicative of this preference that women have for walking rather than using additional home equipment. In regards to the accessibility of facilities within the neighbourhood, 100% of the sample had some access, ranging from 2 to 9 facilities, with a mean value of 7.2 facilities. Each

of the nine facilities included in the scale were reported to be present for more than 61% of the women. Being surrounded by family members can be a strong factor for women approaching menopause. Knowing that, in the studied sample, no more than 8 % of the participants lived alone, it is possible that the high level of PA equipment and facilities in the environment of this sample might have been more related to the PA level of their children or husband rather than their own level of PA.

In support of the above considerations, it has been reported that environmental attributes are the least understood influential factors of PA behavior and that their definition and measurement are in a new stage of research (Owen, Leslie, Salmon, & Fotheringham, 2000; Sallis, Bauman, & Pratt, 1998). As well, in their review and update of adult PA correlates, Troast and al. (2002) examined this situation and admitted that there are very unique challenges in studying environmental correlates of PA.

The research of environmental influence on PA is a new and promising area of research (Humpel et al., 2002), however, in the same line as the results from this study, not all studies have demonstrated a relationship between environmental variables and PA (Giles-Corti, Timperio, Bull, & Pikora, 2005; Salmon, Owen, Crawford, Bauman, & Sallis, 2003). In fact, in their book, Carron et al. (2003) stated: “The relationship between perceived environments and physical activity participation is far from clear. Some research has shown that it is positively related, whereas other research has shown no relationship”(p. 125). Also, it is important to consider the fact that no other study has explored the environmental correlates of the specific population targeted by this study. It could well be that environmental attributes might not be a supportive factor of PA for these women. To obtain a comprehensive and thorough understanding of the relationship

between the environment and the PA level of this population, more research would be needed. Particularly, further research would benefit from exploring environmental factors beyond the limits of the assessment that was performed for this study. For example, one could assess more environmental attributes (e.g., safety, aesthetic nature of the local environment), a larger environment (e.g. worksite, traveled route), and add an objective measure of the environment attributes.

The Relationship of Social Support with PA

Social support is believed to have the potential to strengthen one's belief of having the capabilities to achieve a desired outcome such as engaging in PA (Bandura, 1997). For the purpose of this study, the perceived social support from family and friends was assessed at the level of emotional support (e.g., encouragement) and instrumental support (e.g., reminders, companionship) to engage in PA.

Contrary to some evidence in the literature that social support is associated with PA for women (Eyler et al., 2002; Hardcastle & Taylor, 2005; Sallis et al., 1992), the findings from this study indicated that social support from both family and friends were not significantly correlated to PA. Overall, the level of social support from family and friends was found to be fairly low in this sample with a small standard deviation. It is particularly surprising that the social support received from family was low and not significant for its relation to PA, considering that 77 % of these women were married and considering the indication that their children tend to be older. At this stage in a women's life, when children are aging and starting to move away, it might have been anticipated that an increased availability of free time as couple might have lead to a stronger social influence from the spouse or significant other.

An important factor that could have lead to the lower level of correlation between social support and PA could be the fact that this variable was assessed at multi levels (e.g., encouragement, reminders, companionship) leading to a possible dilution of particular levels of social support. Because PA was assessed in a free-living condition in the present study, there is a possibility that some of the participants may have been practicing PA on a regular basis for a long time. Such participants whom have adhered to PA may require a very low amount of encouragement and reminders to engage in PA and may benefit more from companionship to maintain their PA level. Therefore, the assessment of items related to reminder and encouragement might have diluted the important role that one of the levels of social support (i.e., companionship) might play. In fact, in the follow up analysis that explored the correlation of PA with individual items of the SSES scale (see Table 9), the first items of the SS-family scale “Engage in physical activity with me”, which is a purely companionship item, came out as significantly related to PA. On the other hand, items related to reminders and encouragement came out as weakly correlated to PA (i.e., “Gave me helpful reminders to engage in physical activity”, “Gave me encouragement to stick to my physical activity program”). A study conducted by Eyler et al. (1999) who used the same social support scale as the current study (i.e., the SSES scale) found that social support was significantly correlated with the accumulation of enough PA to be considered minimally active, however, the correlation was non-significant for the women who practiced PA on a regular basis. The results of their study might give support to the fact that the reminder and the encouragement items in the SSES scale could be responsible for the non-significant correlation between PA and social support in the current study, where PA was assessed in free-living condition.

The Relationship of Mood with PA

The result of this study indicated a strong relationship between mood and PA. More specifically, anxiety was significantly correlated to PA. This correlation was negative, indicating that women who had less anxiety were engaged in significantly more PA than women who had a higher level of anxiety. This result is in line with many studies that have demonstrated an association of mood with PA (Hugo, 1986; Kaplan et al., 2001; McAuley et al., 1995). This correlation is an important finding for the population of women approaching the middle age hormonal change since mood change is one of the most common complaints of the menopausal transition and early postmenopause (NAMS, 2004) and of all mood symptoms, anxiety is one of the most prevalent (Prior, 1998). Considering that the average level of anxiety on the Profile of Mood Scale of this sample was only rated at the level “feeling a little anxious” and considering the progressive change of mood that comes with the menopausal transition, it would be expected that involvement in PA might become an even greater challenge for these women. As such, special consideration to anxiety should be taken in relation to PA intervention for this particular population. Considering the anxiety level of these women could be done first by measuring it, and then by implementing strategies to control or reduce it. Education about stress management techniques, relaxation, imagery, meditation and breathing exercises could be the first focus of a PA program in hope that the alleviated anxiety would facilitate PA involvement.

Mediation Effect of Barrier Self-efficacy

The third and last hypothesis of this study was that barrier self-efficacy would mediate the environment, social support, and mood / PA relationships. The result of the

regression analysis indicated that a mediation effect from barrier self-efficacy was not present within the studied sample. Particularly, this mediation effect was not established because the regression analysis indicated that women with a lower level of anxiety did not have a significantly higher level of barrier self-efficacy than women with more anxiety. This finding is not in line with some indications in the literature about the influence of mood on self-efficacy (Bandura, 1997; Hugo, 1986; McAuley et al., 2005). However, since no studies have explored the relationship of these two variables for a similar population as this study, it is difficult to compare any results. It is still noteworthy to mention that this regression analysis between anxiety (independent variable) and barrier self-efficacy (dependent variable) was very close to being significant, with a p level of .07 (see Table 7). It might be possible that if self-efficacy had been measured more broadly such as adding the measure of task self-efficacy rather than measuring only barrier self-efficacy, this might have led to more positive findings.

Limitations and Future Directions

There are some limitations to the study that need to be considered when interpreting the current results. First, the generalization of the findings to the general population should be made with caution. Being able to study the sample from the MONET project was a good opportunity to capture women at a precise period of their hormonal status. However, some of the selection criteria for the participants of the MONET project (i.e., having a waist circumference that does not exceed 90 cm, being a non-smoker, not taking some types of medication and being aged above 47 years) might have lead to some misrepresentation of the targeted population for this study. Firstly, there could be an association between the restrictive health admission criteria and the PA level of the

sample, which might have been higher than the average population. As discussed previously, the 2000/01 Canadian Community Health Survey reported that 59% of the women between the ages of 45 to 64 are inactive (Craig & Cameron, 2004). This level of PA appears to be lower than the average level of PA of the studied sample who was situated between the “moderate” and the “high” level of PA from the IPAQ guideline (IPAQ, 2005). Secondly, the restricted health parameters might have influenced the relationship among the studied variable. According to a study from Blanchard et al. (2005), having a sample with restricted health parameters, such as weight status, can alter the strength of the relationship of PA with self-efficacy, social support and access to neighbourhood facilities. In fact, for the present study, the highest BMI value of the participants was only 28.8. Thirdly, the restrictive health parameter imposed by the MONET study could have lead to a sample with a better mood profile than the average population, as expressed by the fairly low score of anxiety and depression for the sample. Fourthly, the restricted age range (i.e., being aged above 47 years) may represent the majority of women approaching the menopausal transition, but it does not represent it entirely since a study by Treloar (1981) indicated that the age range of the menopausal transition is between 39 and 51 years, for 90% of women. Additional factors such as the fairly high level of education and socio-economic status of the sample and the small sample size (N=76) could have also limited the generalization of the findings to the general population. The use of larger and more representative samples would benefit future studies.

This study was limited to the SCT framework. As such, it did not provide the perspective of other theories to explore reliable correlates of PA adherence for women

approaching the menopausal transition. Further studies using other frameworks such as the self-determination theory or the theory of planned behaviour could provide further explanations for PA behaviour of this population. Another limitation is that not all of the variables from the SCT framework were included in the study; therefore, the relationship among the variables may have differed if outcome expectation, past experience, modeling and physiological arousal had been included in the statistical analysis. Further studies including more variables from the SCT framework would provide better coverage of the theory. As well, additional studies would help to confirm the results of the present study, since it was the first one of its kind.

Other limitations of the study pertain to the research design. The second research design retained to present the results of the study (i.e., the one using the IPAQ questionnaire for the main PA measure rather than the accelerometer) provided only cross sectional PA data rather than additional prospective measures of PA. As discussed earlier, cross sectional PA data is still very valuable to measure PA correlates, however, a repeated measure of PA would have allowed the inclusion of past PA behaviour (i.e. mastery experience) in the study design. The measure of this variable would have been valuable since past experience has been categorized as the most influential source of self-efficacy (Carron et al., 2003). It would have provided more insight as to the extent to which the SCT framework could explain PA. A cross sectional design does not allow for causal relationships between the studied variables and PA in the same way that a prospective design does (Salmon et al., 2003). Keeping in mind that this study did not aim to use the SCT framework to test the theory, but rather to serve as a guide to explore PA correlates, it is still worth mentioning that future studies of the same kind would

benefit by combining cross sectional and prospective measure of PA. The repeated PA measure should be done using identical instrument(s). As well, the inclusion of both subjective and objective PA measures would be an asset to future study, which would then present stronger methodology and design.

Conclusion

According to a menopause survey from the North American Menopause Society, the menopausal stage increases the readiness to make positive changes in a woman's life (Utian & Boggs, 1999). The approach of this life transition is an opportune time to make lifestyle changes. As described in this paper, the evidence that PA can lead to a better health outcome in relation to this middle age hormonal change is quite strong. The benefits of PA for this population coupled with their high level of inactivity cannot be ignored. Since it is important to find ways to help this group of women to increase their PA level, the purpose of this study was to identify their specific PA correlates within the context of the SCT framework. It is believed that this investigation was the first one of its kind.

The findings from the cross-sectional research design provided some preliminary evidence that SCT is partially successful in helping to understand PA for this population of women and may suggest some ways in which PA could be fostered for these women. As expected, barrier self-efficacy was a strong correlate to their PA level. In addition, feeling less anxious was also a PA correlate for them. This is an important finding considering that the targeted population of this study is at risk for increased anxiety, resulting from anticipated estrogen level reduction. The identification of such PA correlates unique to this cohort has the potential to serve as baseline information

designing interventions to promote PA. The challenge for future research would be to examine which strategies would be most efficient for enhancing barrier self-efficacy and the relaxed state of mind of these women. If these variables could be positively influenced, one would hope to see successful PA behavioural changes that would ultimately reduce or prevent a number of menopause and aging-related health complications.

As a secondary result, this study might also have some implications related to the accurate quantification of PA for studies exploring correlates of healthy PA behaviour. It was not possible to compare accurately the objective (accelerometer) and subjective (IPAQ questionnaire) measures of PA, since both measures were not done concurrently. However, the re-evaluation of the objective measure as well as the large discrepancy in the findings resulting from both research designs might have provided some insight as to the extent to which it is accurate to rely on the single use of accelerometer for this type of research. As the understanding of PA type, frequency, duration and intensity for disease prevention receives further clarification, the knowledge of the best measure to quantify healthy PA behaviour for research concerned with its psychosocial correlates will also increase. At the present time, it is reported that there is no single method of measuring PA that is psychometrically solid (Carron et al., 2003). Until further technology and research advance, concurrent use of objective and subjective PA measures might be the safest approach to acquire the most accurate PA behaviour profile related to health benefit.

In addition to the inclusion of a more comprehensive PA measure, future studies would benefit from increasing the scope (and/or the precision) of the assessment of self-

efficacy, environment, and social support. The inclusion of more SCT variables and having a more representative and larger sample would also result in improvement for similar studies to this one. It is this author's wish that further research advances along the lines of the present study will continue to improve the last third of the average woman's life.

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Appendix A

Pilot Project - Interview Guide (Physical Activity Questions)

1. Tell me about your definition of what being “physically active” means?
Tell me about the meaning of the term “physical activity” for you.
Probes or alternative ways of asking this question: How do you view physical activity? What does the term “physical activity” mean to you?
Follow-up question: Has the meaning of physical activity changed for you over time?
2. Tell me about some of the reasons for why you would want to be physically active.
Follow-Up question: Tell me how these reasons have changed over time for you?
3. Tell me a story or stories that would characterize some of your experiences with physical activity.
4. If you have been physically active in the past few weeks, tell me about what that has been like i.e., what have your experiences been like as you have incorporated physical activity into your life? OR
If you haven’t been physically active in the past few weeks, tell me about what you think the transition into being physically activity would be like if you were to be active; i.e., what do you anticipate your experiences would be like if you started to become physically active?
5. Tell me about the kinds of things that would facilitate or enhance your ability to be physically active.
6. Tell me about the kinds of things that would prevent you from being physically active.
Probe: If you have been able to, tell me about how you have overcome these barriers.
7. Tell me what you think some of the good things/advantages of becoming physically active might be for you.
8. Tell me about what you think some of the disadvantages/difficulties of becoming physically active might be for you.
9. Give me examples of activities that you like to do on a weekly basis outside of physical activity. What are those experiences like for you? Can you think of story about some of those activities?
10. How do you think people close to you feel about you starting (or continuing if the woman is already active) a physical activity program? Can you provide an example of a specific person or persons along with how they might react to you starting a physical activity program (... how they react to you being involved in a physical activity program); i.e., who would be someone close to you and what would be some reactions he/she might to you being involved in this program; reactions can include things they would say or DO?
11. How would you describe yourself right now in relation to physical activity?

Appendix B

PRE-SELECTION QUESTIONNAIRE (telephone screening)

Questions		Inclusion criteria	
		Y	N
➤ Where did you hear about this study?			
➤ What is your age? (over 48 years)		☐	☐
➤ What is your weight?			
➤ What is your height?			
➤ BMI estimation (< 35.0 kg/m ²)		☐	☐
➤ What is your waist circumference (< 90 cm?)		☐	☐
➤ Are you taking oral contraceptive?		☐	☐
➤ Are you on a hormone replacement therapy (HRT)?		☐	☐
➤ Are you taking estrogen supplements?		☐	☐
➤ Have you had a surgery that induced menopause? If so, what surgery?		☐	☐
➤ Are you still menstruating?		☐	☐
-How frequently?	Every__days		
-Have you had your period at least twice in the last three months?		☐	☐
➤ Do you suffer from claustrophobia?			
➤ Do you smoke?		☐	☐
➤ Have you been weight stable (± 2 kg) for the last 6 months?			
➤ Are you pregnant?			
➤ Do you intend on becoming pregnant?			
➤ Are you vegetarian?		☐	☐
➤ Do you have any food allergies?		☐	☐
-If so, which ones?			
➤ Are you presently taking any medications?		☐	☐
-If so, which ones?			
➤ Do you have diabetes? If yes, which type?		☐	☐
➤ Do you have any cardiac problems? If yes, which one?		☐	☐

- Do you have low or high blood pressure? _____
- Do you have asthma or any other respiratory problems? If yes, which one? _____
- Has your doctor ever diagnosed you with thyroid gland abnormalities? _____
- Do you have any other medical problems that have not been previously mentioned? If yes, which one(s)? _____
- Would you accept to come to the Montfort Hospital for some tests, 5 times this year and 4 times for the 4 following years? _____
- Would you accept that we take some blood samples during some of the tests? _____

☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

The candidate meets all of the inclusion criteria:

Yes
☐
 No
☐
 If not,

why? : _____

- If you don't meet the selection criteria for this study, would you still be interested in being informed about the recruitment for any other research projects in the future?

☐	☐
--------------------------	--------------------------

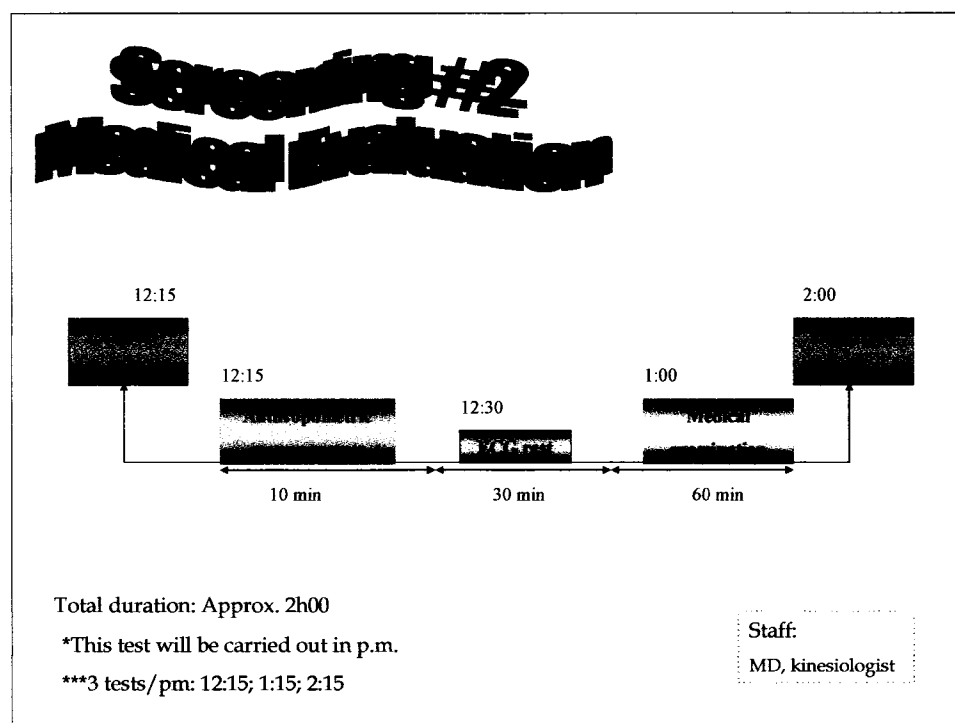
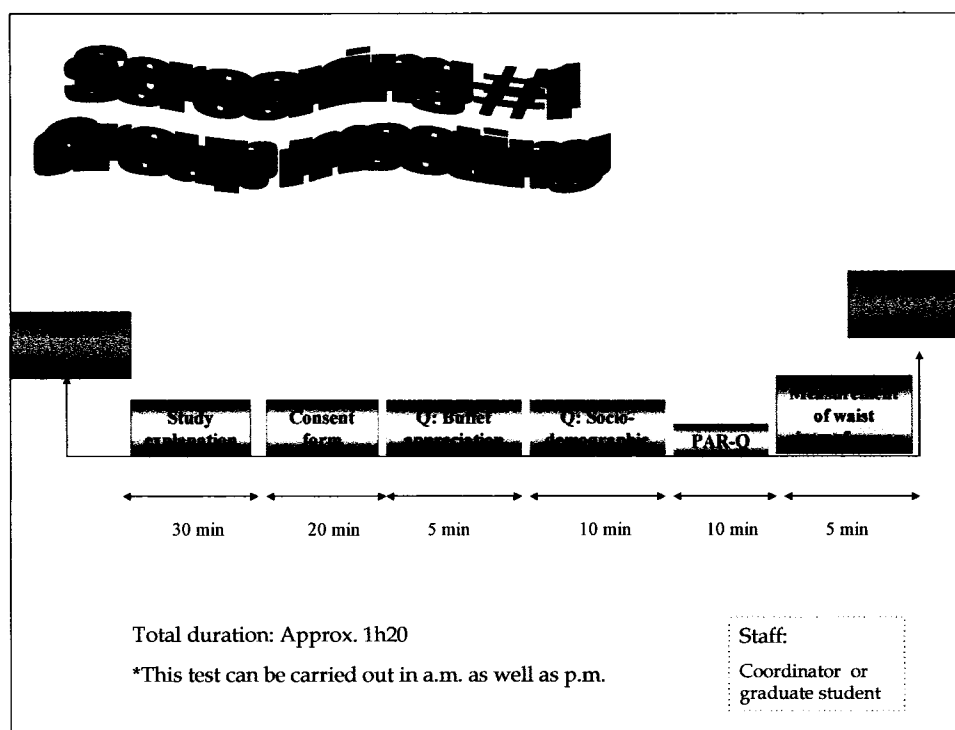
PARTICIPANT INFORMATION

Name :		
Date of birth :	____ / ____ / ____ (day) (month) (year)	
Address :		
Telephone number :	Home: _____	Work: _____
Fax number :		
Email :		

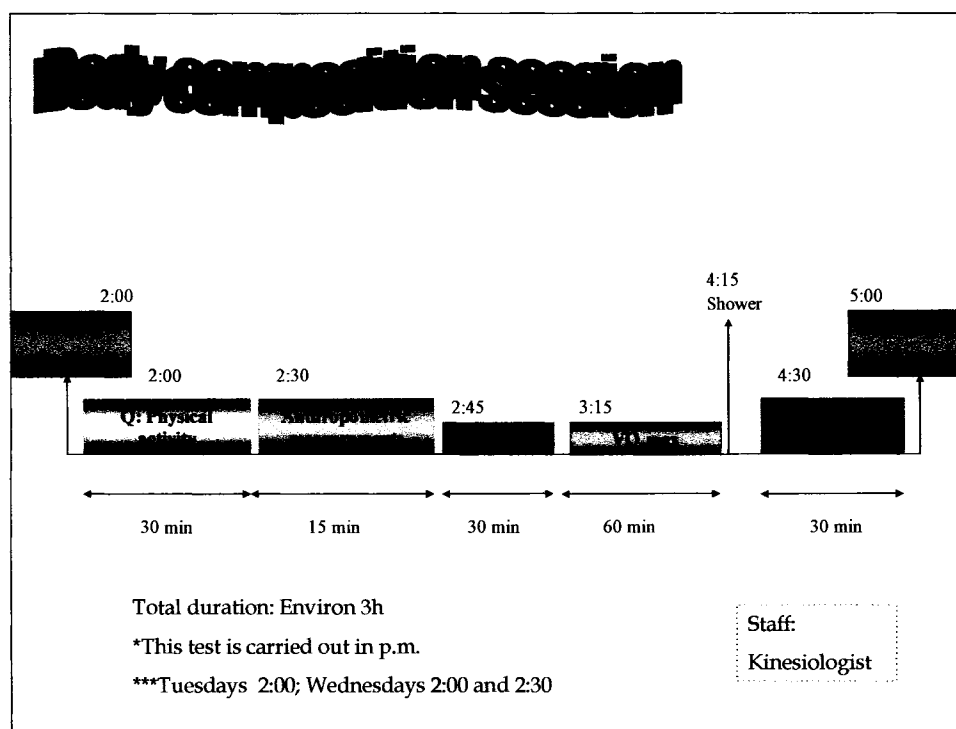
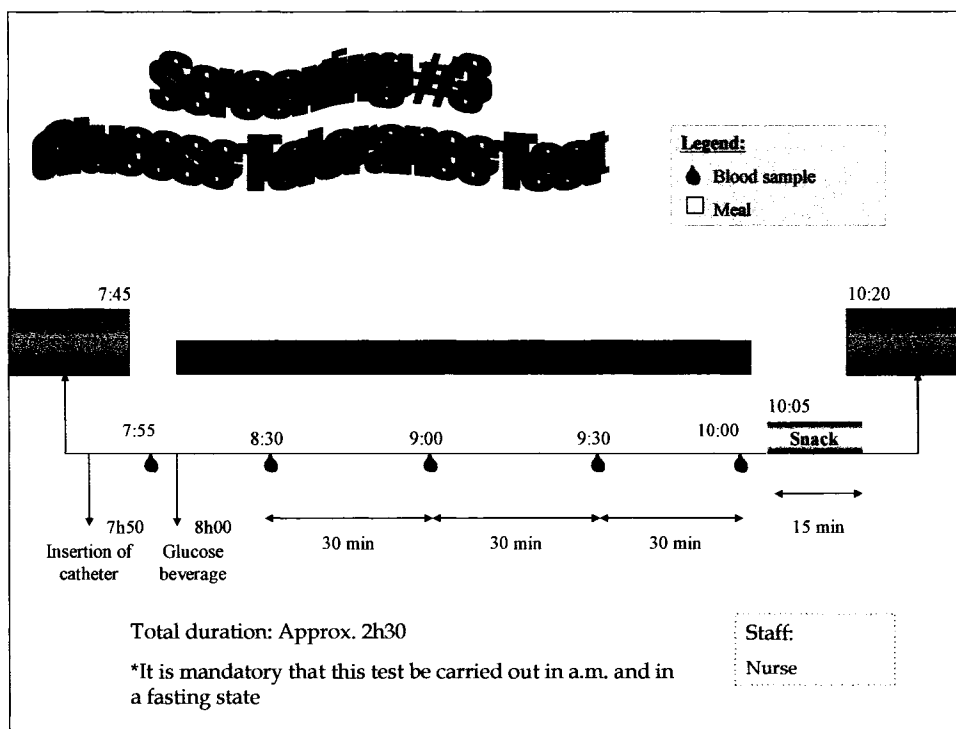
Date of the 1st preliminary visit : _____ **Time :** _____

Appendix C

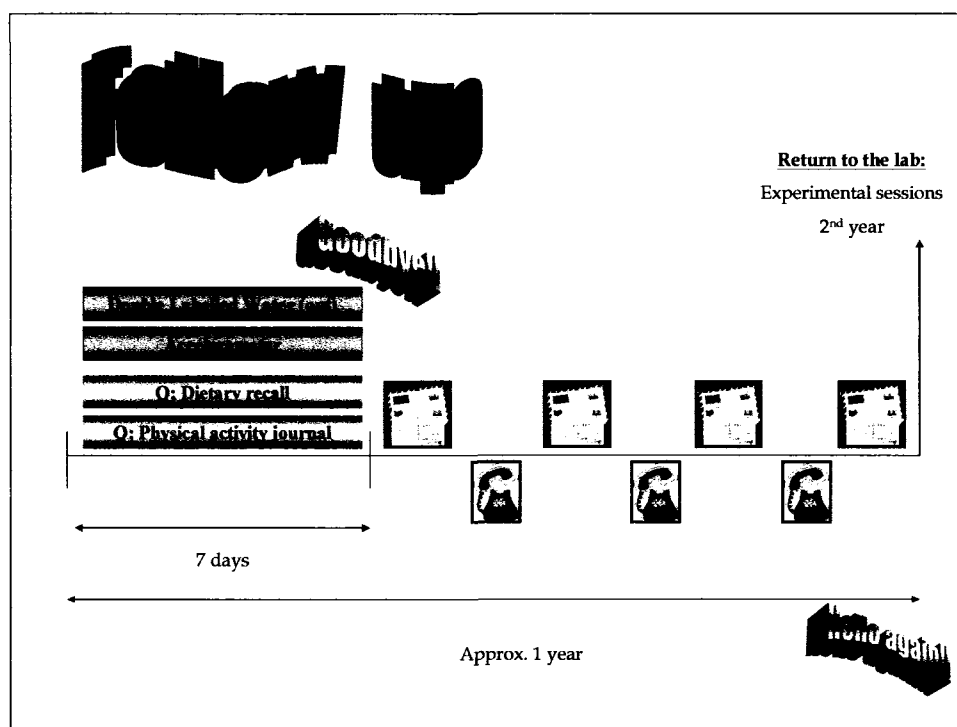
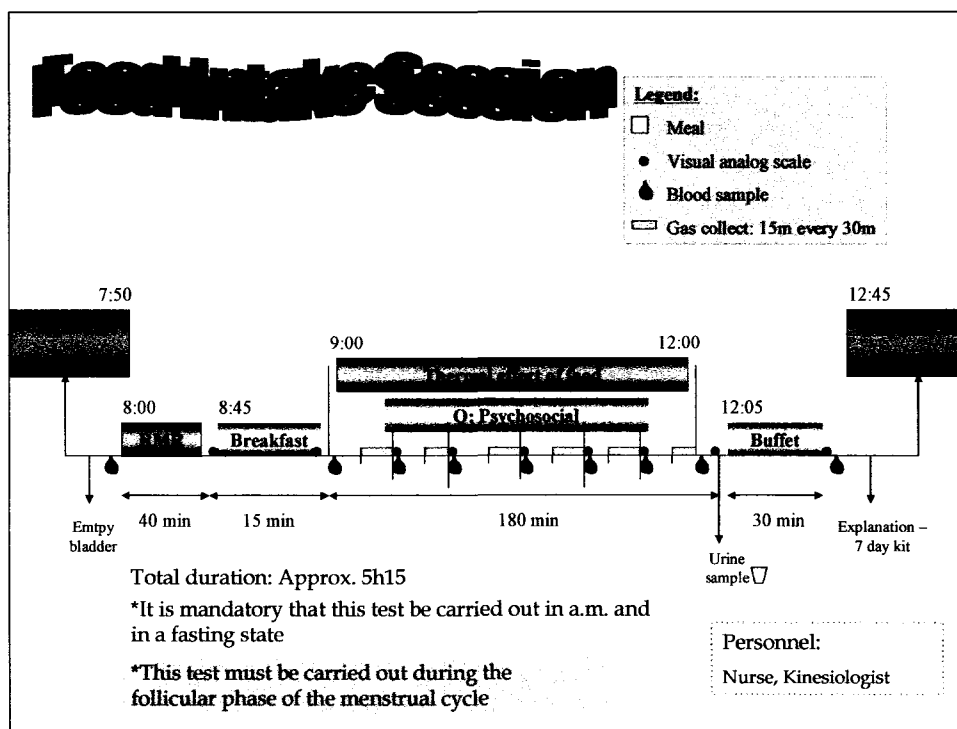
MONET testing sessions and follow up procedure



Appendix C (continued)



Appendix C (continued)



All six slides from Prud'homme et al. (Montreal Ottawa New Emerging Team)

Appendix D

SOCIO-DEMOGRAPHIC INFORMATION

Civil Status:

- | | | |
|--|------------------------------------|---|
| ☐ Married | ☐ Divorced | ☐ Don't know |
| ☐ Living with someone | ☐ Separated | ☐ Refuse to answer |
| ☐ Widowed | ☐ Single | Other _____ |

Education:

Highest level of education obtained?

- | | | |
|------------------------------------|---|-------------|
| ☐ Primary | ☐ University | |
| ☐ Secondary | ☐ Don't know | |
| ☐ College | ☐ Refuse to answer | Other _____ |

Occupation:

Are you presently employed?

- | | | |
|---|---|--|
| ☐ Employed | ☐ Social assistance | ☐ Yes ☐ No |
| ☐ Unemployed | ☐ On strike or lock-out | ☐ Don't know |
| ☐ Student | ☐ Unemployment insurance | ☐ Refuse to answer |
| ☐ Work from home | ☐ Retired | Other _____ |

Employed: Since when have you had that job?

- | | | |
|--|---|---|
| ☐ Less than a week | ☐ More than a year | ☐ Not applicable |
| ☐ Less than a month | ☐ Don't know | Other _____ |
| ☐ Less than a year | ☐ Refuse to answer | |

Unemployed: Since when have you had that occupation?

- | | | |
|--|---|---|
| ☐ Less than a week | ☐ More than a year | ☐ Not applicable |
| ☐ Less than a month | ☐ Don't know | Other _____ |
| ☐ Less than a year | ☐ Refuse to answer | |

Employed: What is the status of your job?

- | | | |
|---|--|---|
| ☐ Permanent: full-time | ☐ Temporary - undetermined duration | ☐ Refuse to answer |
| ☐ Permanent: part-time | ☐ Temporary - determined duration | ☐ Not applicable |
| ☐ Contract work | ☐ Don't know | Other _____ |

Profession:

- | | | |
|---|---|---|
| ☐ Management | ☐ Skilled worker | ☐ Refuse to answer |
| ☐ Professional | ☐ Non-skilled worker | ☐ Not applicable |
| ☐ Technician | ☐ Housekeeper | Other _____ |
| ☐ Office personnel | | |

Hours devoted:

- | | | |
|--|---|---|
| ☐ Less than 20 hours | ☐ More than 60 hours | ☐ Not applicable |
| ☐ Between 20 - 40 hours | ☐ Don't know | |
| ☐ Between 41 - 60 hours | ☐ Refuse to answer | Other _____ |

Transportation:

- | | | |
|---|-------------------------------------|---|
| ☐ Car | ☐ By foot | ☐ Refuse to answer |
| ☐ Public transport | ☐ Bicycle | ☐ Not applicable |
| ☐ Taxi | ☐ Don't know | Other _____ |

Time of transportation:

- | | | |
|--|--|---|
| ☐ Less than 15 minutes | ☐ Between 60 - 90 minutes | ☐ Refuse to answer |
| ☐ Between 15 - 30 minutes | ☐ More than 90 minutes | ☐ Not applicable |
| ☐ Between 30 - 60 minutes | ☐ Don't know | Other _____ |

Leisure Activities:

How much time do you allow for leisure activities each day?

- | | | |
|--|---|---|
| ☐ Between 0 - 30 minutes | ☐ Between 90 - 120 minutes | ☐ Refuse to answer |
| ☐ Between 30 - 60 minutes | ☐ More than 120 minutes | ☐ Not applicable |
| ☐ Between 60 - 90 minutes | ☐ Don't know | Other _____ |

Time of transportation to practice leisure activities per day?

- | | | |
|--|--|---|
| ☐ Less than 15 minutes | ☐ Between 60 - 90 minutes | ☐ Refuse to answer |
| ☐ Between 15 - 30 minutes | ☐ More than 90 minutes | ☐ Not applicable |
| ☐ Between 30 - 60 minutes | ☐ Don't know | Other _____ |

Housing:How many adults (≥ 18 yrs) living with you? _____

How many teenagers (12 to 18 yrs) living with you? _____

How many children (< 12 yrs) living with you? _____**Residence:**

- | | | |
|------------------------------------|--------------------------------------|---|
| ☐ Room | ☐ Condominium | ☐ Refuse to answer |
| ☐ Apartment | ☐ House | ☐ Don't know |
| | | Other _____ |

Property:

- | | | |
|---------------------------------|-------------------------------------|---|
| ☐ Tenant | ☐ Landlord | ☐ Refuse to answer |
| | ☐ Don't know | Other _____ |

Access (outside):

- | | | |
|---------------------------------|-----------------------------------|---|
| ☐ Stairs | ☐ Elevator | ☐ Not applicable |
|---------------------------------|-----------------------------------|---|

Income:

- | | | |
|---|---|---|
| ☐ Less than 20 000\$ | ☐ 30 000\$ to 39 999\$ | ☐ More than 50 000\$ |
| ☐ 20 000\$ to 29 999\$ | ☐ 40 000\$ to 49 999\$ | ☐ Don't know |
| | | ☐ Refuse to answer |

Financial situation:

I consider myself to be...

- | | | |
|--|------------------------------------|---|
| ☐ Financially comfortable | ☐ Poor | ☐ Don't know |
| ☐ Sufficient income | ☐ Very poor | ☐ Refuse to answer |

Economic evolution (compared with past years):

- | | | |
|---------------------------------------|---|---|
| ☐ More at ease | ☐ Not more, not less | ☐ Don't know |
| | ☐ Less as ease | ☐ Refuse to answer |

Television and computer:

How many televisions are there in your home?

Television time/week

- | | | |
|--|--|---|
| ☐ Less than 2 hours | ☐ Between 4 – 6 hours | ☐ Don't know |
| ☐ Between 2 – 4 hours | ☐ More than 6 hours | ☐ Refuse to answer |

Computer time/week (usage other than for internet):

- | | | |
|--|--|---|
| ☐ Less than 2 hours | ☐ Between 4 – 6 hours | ☐ Don't know |
| ☐ Between 2 – 4 hours | ☐ More than 6 hours | ☐ Refuse to answer |

Internet time/week:

- | | | |
|--|--|---|
| ☐ Less than 2 hours | ☐ Between 4 – 6 hours | ☐ Don't know |
| ☐ Between 2 – 4 hours | ☐ More than 6 hours | ☐ Refuse to answer |

Eating habits:

Number of meals per day: _____

Number of snacks per day: _____

Breakfast:

- | | | |
|-------------------------------------|------------------------------------|---|
| ☐ House | ☐ Work | ☐ Don't know |
| ☐ Restaurant | ☐ Cafeteria | ☐ Refuse to answer |
|
☐ House |
☐ Work |
☐ Don't know |
| ☐ Restaurant | ☐ Cafeteria | ☐ Refuse to answer |

Dinner:

- | | | |
|-------------------------------------|------------------------------------|---|
| ☐ House | ☐ Work | ☐ Don't know |
| ☐ Restaurant | ☐ Cafeteria | ☐ Refuse to answer |

Who does the groceries?

- | | | |
|---------------------------------|----------------------------------|---|
| ☐ Me | ☐ Kid(s) | ☐ Employee |
| ☐ Spouse | ☐ Parents | ☐ Don't know |
| | | ☐ Refuse to answer |

Who prepares the meals?

- | | | |
|---------------------------------|----------------------------------|---|
| ☐ Me | ☐ Kid(s) | ☐ Employee |
| ☐ Spouse | ☐ Parents | ☐ Don't know |
| | | ☐ Refuse to answer |

Appendix E

International Physical Activity Questionnaire (IPAQ)

Directions: We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ No vigorous physical activities → *Skip to question 3*

2. How much time did you usually spend doing **vigorous** physical activities on one of those _____ days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

☐ No moderate physical activities → *Skip to question 5*

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → *Skip to question 7*

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Appendix F

Social Support and Exercise Survey (SSES)

Directions: Below is a list of things people might do or say to someone who is trying to engage in regular physical activity. If you are not trying to engage in regular physical activity, then some of the questions may not apply to you, but please read and give an answer to every question. Please rate each question *twice*. Under **FAMILY**, rate how often anyone living in your household has said or done what is described during the last month. Under **FRIENDS**, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

PLEASE WRITE ONE NUMBER FROM THE FOLLOWING RATING SCALE IN EACH SPACE.

None	Rarely	A few times	Often	Very often
1	2	3	4	5

My family (or members of my household) or friends...

	Family	Friends
1. Engaged in physical activity with me.	1. _____	1. _____
2. Offered to engage in physical activity with me.	2. _____	2. _____
3. Gave me helpful reminders to engage in physical activity ('Are you going to engage in physical activity tonight?')	3. _____	3. _____
4. Gave me encouragement to stick to my physical activity program.	4. _____	4. _____
5. Changed their schedule so we could engage in physical activity together.	5. _____	5. _____
6. Discussed physical activity with me.	6. _____	6. _____
7. Complained about the time I spend engaging in physical activity.	7. _____	7. _____
8. Criticized me or made fun of me for engaging in physical activity.	8. _____	8. _____
9. Gave me rewards for engaging in physical activity.	9. _____	9. _____

- 10. Planned for physical activity on recreational outings.** 10. _____ 10. _____
11. Helped plan activities around my physical activity. 11. _____ 11. _____
- 12. Asked me for ideas on how they can get more physical activity** 12. _____ 12. _____
13. Talked about how much they like to engage in physical activity. 13. _____ 13. _____

Appendix G

Profile of Mood States (POMS)

Directions: Below is a list of words that describes feelings people have. Please read each one carefully. Then, circle **ONE** number corresponding to the adjective phrase, that best describes how you have been feeling over the last 7 days.

During the last 7 days, I have been feeling ... (Please answer questions 1 to 18)

		Not at all	A little	Moderately	Quite a bit	Extremely
1.	cheerful	0	1	2	3	4
2.	restless	0	1	2	3	4
3.	hopeless	0	1	2	3	4
4.	vigorous	0	1	2	3	4
5.	nervous	0	1	2	3	4
6.	helpless	0	1	2	3	4
7.	full of pep	0	1	2	3	4
8.	on-edge	0	1	2	3	4
9.	sad	0	1	2	3	4
10.	active	0	1	2	3	4
11.	tense	0	1	2	3	4
12.	worthless	0	1	2	3	4
13.	energetic	0	1	2	3	4
14.	uneasy	0	1	2	3	4
15.	miserable	0	1	2	3	4
16.	lively	0	1	2	3	4
17.	anxious	0	1	2	3	4
18.	discouraged	0	1	2	3	4

Appendix H

Home Environment Scale

Directions: Please indicate which (1) items you have access to in your home, yard, or apartment complex, and (2) whether or not you use them. **Please circle Yes or No for each item in column 1 and column 2.**

	Column 1 Do you have it?		Column 2 Do you use it?	
1. Stationary aerobic equipment	Yes	No	Yes	No
2. Bicycle	Yes	No	Yes	No
3. Trampoline for jogging in place	Yes	No	Yes	No
4. Running shoes	Yes	No	Yes	No
5. Swimming pool	Yes	No	Yes	No
6. Weight lifting equipment (e.g., free weights)	Yes	No	Yes	No
7. Toning devices (e.g., ankle weights)	Yes	No	Yes	No
8. Aerobic workout video or audiotapes	Yes	No	Yes	No
9. Step aerobics, slide aerobics	Yes	No	Yes	No
10. Skates (roller, in line, or ice)	Yes	No	Yes	No
11. Sports equipment (balls, racquets)	Yes	No	Yes	No
12. Canoe, row boat, kayak	Yes	No	Yes	No
13. Skis (snow or water)	Yes	No	Yes	No

Appendix H (continued)

Neighborhood Convenient Facilities Scale

Directions: Please indicate which (1) items you have access to in your neighborhood, and (2) whether or not you use them. Please circle Yes or No for each item in column 1 and column 2.

	Column 1 Do you have it in your neighborhood?		Column 2 Do you use it?	
1. Bike paths	Yes	No	Yes	No
2. Walking paths	Yes	No	Yes	No
3. Public park with playing field	Yes	No	Yes	No
4. Public recreation center	Yes	No	Yes	No
5. Swimming pool, beach, or lake	Yes	No	Yes	No
6. Basketball or tennis courts	Yes	No	Yes	No
7. Health club or gym near your home	Yes	No	Yes	No
8. Hiking trails	Yes	No	Yes	No
9. Organized sports	Yes	No	Yes	No

Appendix I

Barrier Efficacy Scale

Directions: The items listed below are designed to assess your confidence that you will overcome each barrier to physical activity to make sure you engage in regular physical activity. Using the scale below, please indicate how confident you are that you will overcome each barrier to physical activity to enable you to engage in regular physical activity.

Note: *Regular physical activity* is defined on the next page.

How confident are you that you will engage in regular physical activity EVEN IF...	extremely unconfident	moderately unconfident	slightly unconfident	neutral	slightly confident	moderately confident	extremely confident
1. you are too tired / lacked energy	1	2	3	4	5	6	7
2. you have no time because of work	1	2	3	4	5	6	7
3. you are feeling under the weather	1	2	3	4	5	6	7
4. you don't feel like it	1	2	3	4	5	6	7
5. you have family commitments	1	2	3	4	5	6	7
6. the weather is bad (hot, humid, rainy, cold)	1	2	3	4	5	6	7
7. you have to exercise alone	1	2	3	4	5	6	7
8. you are under personal stress of some kind	1	2	3	4	5	6	7
9. you feel self-conscious about your appearance	1	2	3	4	5	6	7
10. it costs too much	1	2	3	4	5	6	7
11. you don't have access to facilities	1	2	3	4	5	6	7

Appendix I (continued)

Definition of regular physical activity

Regular physical activity is defined as meeting at least one (or more) of the following recommendations put forth by Health Canada:

1. accumulating **60 minutes** of **light intensity** physical activity (e.g., light walking, easy gardening, stretching) **4 – 7 times per week...**

AND/OR

2. accumulating **30 to 60 minutes** of **moderate intensity** physical activity (e.g., brisk walking, biking, raking leaves, swimming, dancing) **4 – 7 times per week...**

AND/OR

3. accumulating **20 to 30 minutes** of **vigorous intensity** physical activity (e.g., aerobics, jogging, fast swimming) **4 – 7 times per week...**