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The Utility of a Protection Motivation Theory Framework for Understanding Sedentary Behaviour

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A thesis submitted in partial fulfillment of the requirements for the degree in Master of Arts
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THE UTILITY OF A PROTECTION MOTIVATION THEORY FRAMEWORK FOR
UNDERSTANDING SEDENTARY BEHAVIOUR

(Thesis format: Monograph)

by

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Master of Arts

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Abstract

This study aimed to 1) examine the factor structure and composition of sedentary-derived Protection Motivation Theory (PMT) constructs and 2) determine the utility of these constructs in predicting general and leisure sedentary goal intention (GI), implementation intention (II), and self-reported sedentary behaviour (SB). PMT, GI, II constructs, and a modified SB questionnaire were completed by undergraduate students. After completing socio-demographics and the PMT items, 787 participants were randomized to complete general or leisure intention and SB items. Irrespective of model, principal axis factor analysis revealed that the PMT items grouped into eight coherent and interpretable factors. Using linear regression, general and leisure models predicted 5% and 1% of the variance in GI, 10% and 16% of the variance in II, and 3% and 1% of the variance in SB, respectively. Support now exists for the tenability of an eight-factor PMT sedentary model and its utility in predicting intentions and behaviour.

Keywords

Acknowledgments

I would like to thank certain individuals who have been essential in guiding me through this research project. To my supervisor, Harry Prapavessis, thank you for your encouragement, mentorship and expertise. You have challenged me in ways that has furthered my growth not only as a researcher, but also as a person. Thank you for seeing beyond what I could see and helping me get there. To Anca Gaston and Stefanie DeJesus, both of you have been a tremendous help in providing intellectual support, and having the confidence in me to continue your initial work. To the EHPL team, it has been a pleasure working with those who have come and gone, and for the laughs and conversations along the way. To my family, thank you for your overwhelming love and provision. I would not be here without you. Last but not least, I'd like to thank my husband, Michael. Thank you for reminding me to see past what's in front of me and walking beside me. Thank you for pointing me back to the One who really deserves the acknowledging. To Him be the glory forever.

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Chapter 1 : Literature Review

1   Introduction

Sedentary behaviour has permeated almost all aspects of North American daily living for the past 30 years (Katzmarzyk & Tremblay, 2007). Social and industrial changes such as the "screen invasion" of electronic entertainment products in North American homes, increased dependence on cars, and a greater number of labour-saving devices at home and work have resulted in an overly sedentary lifestyle (Katzmarzyk & Tremblay, 2007; Lanningham-Foster, Nysse, & Levine, 2003). Population-based accelerometer studies have confirmed that only 15% of Canadian adults are meeting physical activity guidelines (at least 150 minutes of moderate to vigorous intensity physical activity [MVPA] per week), and that 68% of males and 69% of females' waking days are spent sedentary (Colley et al., 2011). It is evident that individuals are both failing to meet public physical activity guidelines and highly sedentary.

Behaviours such as screen viewing, computer use, and sitting in an automobile can be defined as sedentary, a distinct class of waking behaviours characterized by an energy expenditure of ≤ 1.5 metabolic equivalents (METs) while in a sitting or reclining posture (Canadian Society for Exercise Physiology, 2012). A MET is a unit that represents the metabolic equivalent of an activity expressed in multiples of resting rate of oxygen consumption, with one MET corresponding to resting metabolic rate (Tremblay, Colley, Saunders, Healy, & Owen, 2010). Key findings have supported the notion that sedentary behaviour is separate from physical inactivity. Physical inactivity describes the absence of physical activity and is often defined as failing to meet prescribed activity guidelines (Tremblay et al., 2010). Sedentary behaviour describes specific behaviours (i.e., sitting or reclining postures) that may occur during the absence of physical activity, but is not synonymous to physical inactivity. Therefore, individuals can be both physically inactive and sedentary (e.g., failing to meet the physical activity guidelines and sitting for long periods of time at an energy expenditure of <1.5 METs; Owen, Healy, Matthews, & Dunstan, 2010). Affectionately labeled, "the active couch potato," individuals can also be both physically active and sedentary. For instance, an individual

may exercise for 30 minutes per day, but sit at work for 8 hours (Owen et al., 2010). Studies indicate that regardless of MVPA levels, individuals who engage in uninterrupted sitting are still at higher risk for certain health conditions, including obesity, type 2 diabetes, and all-cause mortality (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008).

In 2011, Canadian sedentary behaviour guidelines were established for adolescents (ages 5 to 17). In addition to limiting recreational screen time to no more than two hours per day, adolescents are also advised to limit sedentary (motorized) transport, extended sitting, and time spent indoors throughout the day (Canadian Society for Exercise Physiology, 2014). Although there are currently no public sedentary guidelines for adults, ergonomic recommendations suggest adults limit continuous sitting to no more than two hours over an eight-hour workday in relation to static work postures (e.g., sitting or standing at the same spot or little whole body physical activity; Commissaris, Douwes, Schoenmaker, & de Korte, 2006). However, this two-hour threshold being hazardous to health is not an established guideline and only based on a small amount of evidence (Commissaris et al., 2006).

Given the ubiquitous and seemingly unavoidable nature of sedentary behaviour, the question still remains: how do we decrease sedentary behaviour? The answer to this question is multifaceted and requires a deeper understanding of the health consequences, strategies, effects, and determinants of sedentarism.

1.1 Health Consequences of Sedentary Behaviour

Mortality

Findings from the Canada Fitness Survey (1981 – 1993) revealed that Canadians who reported sitting for the majority of their day had significantly poorer long-term mortality from all causes and cardiovascular disease than those who sat for a smaller portion of their day (Katzmarzyk, Church, Craig, & Bouchard, 2009). Sitting time mortality relationships were apparent even in those who were physically active and even stronger in those who were overweight or obese. Importantly, these observed associations were independent of demographic factors (age, sex), negative health behaviours (smoking,

alcohol consumption), and positive health behaviours (leisure time physical activity; Katzmarzyk et al., 2009). Another study conducted in the U.S. determined that population life expectancy would be 2.00 years higher if adults reduced their sitting time to less than three hours per day and 1.38 years higher if they reduced television viewing to less than two hours per day (Katzmarzyk & Lee, 2012). Specifically, mortality from all causes and from cardiovascular disease demonstrates the strongest positive relationship with sedentary behaviour based on a systematic review of prospective studies (Proper, Singh, Van Mechelen, & Chinapaw, 2011).

Cardio-Metabolic Changes

Metabolic deterioration, characterized by increased plasma triglyceride levels, decreased high-density lipoprotein (HDL) cholesterol levels, and decreased insulin sensitivity is strongly associated with sedentary behaviour (Tremblay et al., 2010). For example, a bed rest study examining metabolic health outcomes in adult volunteers was conducted (Hamburg et al., 2007). Participants remained in bed for 23.5 hours per day over five days, rising only for personal hygiene related matters. Despite no changes in body weight, they experienced significant increases in total cholesterol, plasma triglycerides, glucose, and a 67% greater insulin response to a glucose load after the intervention. In a 20-day bed rest study, Yanagibori et al. (1998) found significant increases in plasma triglycerides and significant decreases in high-density lipoprotein lipase (HDL) cholesterol levels. These findings suggest that an extended dose of sedentary behaviour can result in dramatically increased metabolic risk.

Laboratory evidence has identified unique mechanisms of "inactive physiology" distinct from the biological basis of exercising (Hamilton et al., 2008). Specifically, these physiological changes include suppression of lipoprotein lipase (LPL), an enzyme responsible for triglyceride uptake and HDL production. When LPL decreases, rapid and clinically relevant decreases in HDL cholesterol occur, heightening the risk of metabolic and cardiovascular disease (Hamilton et al., 2008). As seen on a physiological level, these biological mechanisms provide evidence of the unique cardiometabolic risks associated with sedentarism.

Healy and colleagues (2008) examined the relationship between metabolic health consequences and prolonged sitting through self-reported TV viewing time from a national, cross-sectional sample of men and women ($n = 4064$) who reported meeting physical activity guidelines. After adjusting for potential confounders (age, parental history of diabetes, smoking, alcohol intake, income, education, total physical activity time, and diet quality), high doses of TV time were observed with significantly increased waist circumference, systolic blood pressure, and two-hour plasma glucose in both men and women. Healy and colleagues (2008) extended these findings through objective measures (i.e., accelerometers). Following adjustment for potential confounding variables, clinically significant independent associations of sedentary time with waist circumference were found in physically active adults. On average, each 10% increase in sedentary time was associated with a 3.1 cm (95% CI 1.2-5.1) larger waist circumference. Authors suggested that sedentary time may have a stronger influence on waist circumference than MVPA. Thus, findings from both self-reported and objectively measured studies confirm that the protective effects of daily physical activity may be independent from the health risks related with prolonged sitting.

Other Health Outcomes

In the aforementioned systematic review (Proper et al., 2011), the most consistent and robust evidence for sedentary behaviour and other health outcomes among adults was the risk for type 2 diabetes. This longitudinal relationship was observed with time spent TV viewing (Hu et al., 2001) as well as with other sedentary behaviours (e.g., sitting at work or sitting and driving; Hu, Li, Colditz, Willett & Manson, 2003). Due to the best-evidence synthesis approach for rating the quality of studies, the authors concluded there was insufficient evidence for a relationship between sedentary behaviour and body weight, cardiovascular disease risk, and endometrial cancer (Proper et al., 2011).

Thorp et al. (2011) followed up on their work by examining prospective studies among adults without prejudice of the methodological quality of studies. Findings revealed time spent in sedentary behaviour was linked to increased risk for site-specific (ovarian and endometrial among women, colon among men) cancer and diabetes. These

associations seemed to be a consequence of overweight/obesity because adjustment for body mass index (BMI) attenuated several of the reported relationships. Similar to conclusions drawn from Proper et al. (2011), there was no clear evidence of a longitudinal relationship between sedentary behaviour and cardiometabolic risk and metabolic markers (e.g., cardiovascular disease, symptomatic gallstone disease, hypertension). Results for obesity and weight gain-related measures showed mixed results. Several significant associations between weight gain/obesity and sedentary behaviour were no longer evident after adjusting for baseline BMI and BMI at follow up. Therefore, these systematic reviews indicate that sedentary behaviour is linked to type 2 diabetes and site-specific cancers, but more research is needed to confirm the relationship with cardiometabolic diseases, obesity and weight gain.

In regards to the association between sedentary behaviour and psychological outcomes (i.e., depression), much less is known. Cross-sectional studies revealed an inverse relationship between sedentary time and mental health in older adults (Ku, Fox, Chen, & Chou, 2011; Teychenne, Ball, & Salmon, 2010), disadvantaged women (Teychenne et al., 2010), and overweight and obese adults (Breland, Fox, & Horowitz, 2013). Van Uffelen et al. (2013) examined the relationship between concurrent and prospective associations between sitting time and physical activity, individually and together, with prevalent depressive symptoms in mid-aged women. Findings indicated that the combination of higher sitting time (>7 hours/day) and lower physical activity were associated with a tripled risk of current depressive symptoms in comparison to women who sat for <4 hours/day and met physical activity guidelines. Sitting time was not associated with future depressive symptoms, whereas no physical activity, regardless of the amount of sitting time, was associated with an increased risk of future symptoms (van Uffelen et al., 2013). Therefore, preliminary evidence exists for excessive sitting time and current depressive symptoms.

1.2   Strategies for Breaking Up Sedentary Behaviour

Although the health consequences of sedentarism are extensive and detrimental, several studies have been successful in significantly reducing sedentary behaviour. An in-depth

analysis of the literature will not be discussed in this paper because of the non-intervention nature of the present study. Nevertheless, an overview of the different strategies that researchers conducting intervention studies have used to break up sitting and its impact on sitting time is warranted.

Multicomponent Interventions

Multicomponent interventions are usually conducted in workplace settings that target the environment, individual, and/or organization (Carr, Karvinen, Peavler, Smith, & Cangelosi, 2013; Healy et al., 2013; Parry, Straker, Gilson, & Smith, 2013). In one study, participants received individual (weekly telephone calls), environmental (sit-stand workstations) and organizational (managerial support) components, which resulted in significant effects for increased standing time (127 minutes/workday) and reduced sitting time (-73 minutes/workday; Healy et al., 2013). Carr and colleagues (2013) also integrated individual and environmental components via a portable pedal machine, motivational website, and pedometer, which led to significant changes in sitting time (-58 minutes/workday). This study was unique in comparison to Healy et al.'s (2013) because the individual component (motivational website) was grounded in social cognitive theory (Bandura, 1986), which aimed to increase self-monitoring, social support, and self-efficacy through daily messages on pedal time, group competitions and goal setting. Interestingly, it appeared that the motivational website resulted in improved daily compliance to the pedal machine, in comparison to a similar study that only used a pedal machine without the motivational component (Carr, Walaska, & Marcus, 2012).

Multicomponent interventions are advantageous because they are more likely to reduce sedentary behaviour due to their multifaceted approach (Carr, Karvinen, Peavler, Smith, & Cangelosi, 2013; Healy et al., 2013; Parry, Straker, Gilson, & Smith, 2013). However, a major limitation is identifying which component is the most salient in effectively reducing sedentary time. Therefore, the following strategies will include discussions of single-component interventions that attempted to reduce sedentary behaviour.

Goal-Setting and Feedback Interventions

Interventions grounded in well-established health behaviour theories targeted at the individual level may aid in the development of robust experimental studies. To our knowledge, only one feasibility study exists that utilized an individual-level (non-environmental), theoretical approach (Gardiner, Eakin, Healy, & Owen, 2011). Older adults ($n = 59$) underwent a face-to-face goal setting intervention with the main message to stand up and move after 30 minutes of uninterrupted sitting. This message integrated constructs from social cognitive theory (Bandura, 1986) and behavioural choice theory (Rachlin, 1989) including self-efficacy (realistic and measurable goal setting), outcome expectancies (barriers and benefits to reduce sedentary time), and reinforcement (rewarding behaviour change). Despite the brief, small-scale intervention, the significant reductions in sedentary time, and increases in breaks, light intensity physical activity (LIPA), and MVPA were a direct result of an individually tailored, social-cognitive theoretical intervention.

Active Workstations

Active workstations including pedal desks, treadmill desks, and sit-stand workstations, comprise a vast majority of the sedentary intervention literature (Alkhajah et al., 2012; Carr et al., 2013; Chau, Daley et al., 2014; Dutta, Walton, & Pereira, 2014; Healy et al., 2013; John et al., 2011; Thorp, Kingwell, Owen, & Dunstan, 2014). These interventions typically involved office-workers being retrofitted with an active workstation, brief instructions on correct ergonomic posture and its use, followed by specification of the duration and frequency of active workstation usage, or a general guideline to use as often as possible.

Focusing on sit-stand interventions that objectively monitored behaviour (e.g., activPAL activity monitor), significant reductions in sitting time ranged from -73 minutes/workday over four weeks (Chau, Grunseit et al., 2014) to -137 minutes/workday over three-months (Alkhajah et al., 2012). No significant differences were found in another study that implemented shared sit-stand workstations in an open-concept workplace (Gilson, Suppini, Ryde, Brown, & Brown, 2012). Authors attributed the lack of change to the type of activity monitor used (accelerometer vs. inclinometer) that did

not provide information on posture or sit-stand ratios. For treadmill workstations, significant increases in objectively monitored physical activity and/or decrease time spent in sedentary behaviour were found. For example, John et al. (2011) found significant reductions in sitting/lying time (1238-1150 minutes/day), significant increases in standing time (146-203 minutes/day) and stepping time (52-90 minutes/day) in office workers who were overweight and obese.

Overall, active workstations are an effective way to reduce sedentary behaviour, specifically in the workplace. It allows individuals to break up their sitting while continuing with their work tasks, and for the most part, has been positively received by employees and employers (e.g., easy to use, enjoyable, comfortable; Alkhajah et al., 2012). A main reason for the increased preference is its ability to allow individuals to alternate freely between sitting and non-sitting postures (Roelofs & Straker, 2002). However, major disadvantages include financial burden (can range from $900-$8000), management burden (how to equally distribute workstation alternatives among employees), lack of portability (difficult to move workstations between rooms), and potential injury especially for employees who are older or have gait restrictions (Tudor-Locke, Schuna, Frensham, & Proenca, 2014).

Mobile Interventions

Mobile health (mHealth) interventions have been growing in popularity due to the increasing number of smartphone users (68% in Canada) and minutes using a device (59 min/day) in today's society (Böhmer, Hecht, Schöning, Krüger, & Bauer, 2011). Given the habitual and frequent nature of sitting, smartphones are a relevant and innovative platform for sedentary behaviour interventions because it is simple, requires minimal forethought, and can be easily implemented in most environments (Bond et al., 2014). Bond and colleagues (2014) attempted to decrease objectively-measured sedentary time using a smartphone-based intervention and to determine the most effective strategy for maximizing break frequency and duration. In a community sample, participants ($n = 30$) were presented with three smartphone-based physical activity break conditions across seven days: (1) 3 minute breaks after 30 minutes of sitting, (2) 6 minute breaks after 60

minutes of sitting, and (3) 12 minute breaks after 120 minutes of sitting. Findings revealed that 90% of participants found the real-time smartphone display and feedback increased their motivation to take physical activity breaks and was a direct result of their reduction in sedentary time. It appeared that prompting shorter breaks (i.e., 3 minutes every 30 minutes) yielded greater decreases in sedentary time over a seven-day period (-47 min/day). Another smartphone sedentary intervention suggested that simple reminders, as opposed to persuasive message content, were more important in triggering breaks from sitting (Dantzig, Geleijnse, & Halteren, 2013). Additionally, it was advised that break reminder applications should be discrete and unobtrusive, which can be achieved when the user has autonomous control of when he/she takes a break from sitting (Dantzig et al., 2013).

In conclusion, findings from these interventions are important because they challenge the traditional public health model of thinking. The current model of physical activity and health is well documented by over 60 years of scientific research and the benefits of MVPA have been clearly defined (Katzmarzyk, 2010). However, it is suggested that the existing paradigm of increasing MVPA levels in order to achieve the greatest health improvements should also focus towards increasing regular, short, and incidental movements.

1.3   Effects of Breaking Up Sedentary Behaviour

While strong evidence supports the significant impact various interventions have on reducing sedentary time, its effects on the physiological level and on work performance warrant discussion.

Physiological Effects

Evidence shows that walking breaks lead to greater improvements in physiological outcomes compared to standing breaks. A review by Tudor-Locke and colleagues (2014) indicated that the energy expenditure of using a sit-stand desk is comparable to a traditional seated condition (~1.2 kcal/min), whereas a treadmill desk is double the energy expenditure (~2-4 kcal/min). Another systematic review indicated that

treadmill desks were significantly related to enhanced postprandial glucose, HDL cholesterol, and anthropometrics (MacEwen, MacDonald, & Burr, 2015). Interrupting sitting time with as little as 2-minute bouts of light-intensity activity every 20 minutes can acutely lower postprandial glycemia in healthy adults. These effects were not found in 2-minute bouts of standing (Bailey & Locke, 2015). Postprandial glucose levels have tremendous implications for cardio-metabolic diseases because postprandial hyperglycemia is a cardiovascular risk factor in both people with type 2 diabetes and those without diabetes (Cavalot et al., 2006). Moreover, the frequency of walking breaks largely influences physiological changes. Independent of total sedentary time and MVPA, an individual's metabolic profile improves as the total number of breaks from sitting increases (Healy, Dunstan, Salmon, Cerin et al., 2008). Healy et al. (2008) demonstrated that those in the highest quartile of breaks (673 breaks) had an approximate 5.95cm lower waist circumference and 0.88mmol/L 2-h plasma glucose in comparison to those in the lowest quartile of breaks (506 breaks; Healy et al., 2008). However, standing breaks should not be undermined as an effective strategy to reduce sitting. In a sit-stand workstation intervention, significant increases in HDL cholesterol (0.26 mmol/L) and a trending but non-significant decrease in weight (-0.9 kg) was observed (Alkhajah et al., 2012). As well, results from a large Canadian survey revealed a significant relationship between standing and reduced mortality rates among physically inactive individuals (Katzmarzyk, 2014). In summary, walking breaks elicits greater physiological improvements primarily due to changes in postprandial glucose, HDL cholesterol, and waist circumference, but standing breaks are associated with improved HDL cholesterol and reduced mortality rates.

Work Performance Effects

In settings such as an academic institution or workplace where sitting while doing work is universal, one may wonder whether interrupting sitting with active breaks influences work performance. Robust evidence supports no decrease in worker productivity (e.g., typing, computer tasks, error rate) from sit-stand workstations (Karakolis & Callaghan, 2014; MacEwen et al., 2015). However, the method of measuring productivity and the frequency of breaks varies considerably. Studies revealed

no significant changes in the number of errors after using a sit-stand workstation after four hours (Husemann, Von Mach, Borsotto, Zepf, & Scharnbacher, 2009), computer task performance over 40 minutes (Drury et al., 2008), typing ability over 20 minutes (Beers et al., 2008), and typing and mouse performance over 3 minutes (Straker, Levine, & Campbell, 2009). For treadmill desks, it appears than walking at an optimal speed between 1.6 km/h and 3.2 km/h is ideal to minimize decreases in typing and mouse performance (Alderman, Olson, & Mattina, 2014). Any speed that is greater may be more likely to impair work performance. Treadmill walking does not cause deficits in higher order thinking (information processing speed, executive abilities, selective attention, inhibiting habitual responses) and is suggested to decrease stress (Alderman, Olson, & Mattina, 2014; Edelson & Danoffz, 1989).

Moreover, alternating between a seated and standing posture every 30 minutes significantly reduced self-reported fatigue and lower back musculoskeletal discomfort compared to a static seated posture (Karakolis & Callaghan, 2014; Thorp et al., 2014). Dutta et al. (2014) found that participants reported a high level of satisfaction, greater energy and alertness, increased face-to-face interaction with co-workers, and 96% would choose to use sit-stand workstations regularly. In conclusion, sit-stand workstations and treadmill desks (depending on the walking speed) do not appear to impair productivity, may reduce fatigue and lower back discomfort, and are generally accepted by participants.

1.4   Determinants of Sedentary Behaviour

Environmental and Individual Determinants of Sedentary Behaviour

Behavioural choice theory. Salmon and colleagues (2003) examined the associations of physical activity and sedentary behaviour using a behavioural choice theory framework. Behavioural choice theory (Rachlin, 1989) explicitly incorporates both individual-level and environmental influences by taking into account the roles of environmental barriers, preferences, and determinants of reinforcement value for sedentarism (Vuchinich & Tucker, 1988). Findings demonstrated that preference for

sedentary behaviour was associated with the decreased likelihood of being physically active in male and female adults ($n = 1332$). Additionally, respondents who reported weather and cost as barriers to physical activity were more likely to report high participation in sedentary behaviour, television viewing, and reading. This study provided unique evidence on the interrelationships between physical activity enjoyment, preferences, and barriers, and participation in leisure-time sedentary behaviours. However, understanding the environmental and individual determinants for sedentary behaviour alone cannot be inferred. Furthermore, the sedentary measures used in this study were newly developed and had less than desirable levels of reliability and validity.

Ecological model of sedentary behaviour. Owen's (2011) ecological model of sedentary behaviour is one of the few models that has thoroughly identified the factors that influence sedentarism. A significant feature of the ecological model is its principle of behavioural specificity. He proposed four behavioural settings (domains) in which sedentary behaviours occur: leisure time (e.g., recreation environment); the household (e.g., screen time at home); occupation (e.g., school environment); and transportation (e.g., driving a vehicle to a destination). Time spent sitting in these behavioural settings will likely have distinct determinants that are shaped by the physical and social attributes in each setting. Thus, knowing specific sedentary behaviours in each setting can help tailor more effective interventions. Furthermore, one can separate the behavioural domains into volitional and non-volitional domains. Volitional domains such as leisure time and household are settings that often occur during the weekend and are areas that individuals have greater control over. On the other hand, non-volitional domains such as transportation and occupation are settings that often occur during the weekday and are areas that individuals have less control over. Separating volitional from non-volitional sedentary activities is important because the amount of time spent sedentary and reasons for being sedentary will vary considerably.

While this ecological model places a premium on the context-specific environment, it does not acknowledge the role of psycho-social variables in explaining sedentary behaviour. Psychological theories provide structure that enables researchers to identify key variables related to desired health behaviour changes or outcomes (National

Cancer Institute, 2005). Specifically, change or action theories provide frameworks that guide the development of interventions, translate concepts to messages and strategies, and form a basis for evaluation (Green, 2000; National Cancer Institute, 2005). Social cognitive theories (e.g., theory of planned behaviour, Azjen, 1988; transtheoretical model, Prochaska & DiClemente, 1982; protection motivation theory, Rogers, 1975) have proven useful for gaining a better understanding of conscious (reasoned) processes underlying the adoption of health-related behaviours including physical activity and exercise (Plotnikoff, Lubans, Penfold, & Courneya, 2013). Hence, the constructs that are used to represent these theories have the potential to enhance our current understanding of sedentarism. The absence of research focused on the relationship between social-cognitive factors and sedentary behaviour has been commented in a systematic review, thus supporting the need for future research (Rhodes, Mark, & Temmel, 2012).

Theory of Planned Behaviour and Sedentary Behaviour

To date, only the theory of planned behaviour (TPB; Ajzen, 1985) has examined the psycho-social context of sedentarism. The basic tenets of TPB are attitudes, subjective norms, and perceived behavioural control are the proximal determinants to intention, and intention is the proximal determinant to behaviour. In the first study that examined TPB's predictive utility for sedentarism, 26% and 17% of variance was explained for intention to be sedentary and actual physical activity, respectively (Smith & Biddle, 1999). However, specific sedentary behaviours were not measured and there was inconsistency in phrasing the TPB constructs as sedentary behaviours but using physical activity as the outcome behaviour. Rhodes and Dean (2009) followed up on these limitations by applying TPB to the most highly reported leisure sedentary behaviours (television viewing, computer use, reading/music, and socializing) according to the Canadian Fitness and Lifestyle Research Institute (1996). Intentions to perform sedentary behaviours were a consistent correlate among the four behaviours, suggesting sedentary behaviour to be a planned behaviour like other activities in daily life. Findings also demonstrated that volitional strategies to reduce sedentary behaviour might be a prudent course of future action. For example, planned times to turn off the television may be useful considering its link to intentional behaviour. Overall, TPB cognitions explained a

substantive portion of variance in intention (14-75%) and intention mediated the relationship between TPB constructs and sedentary behavior (Rhodes & Dean, 2009). However, two main limitations were (1) sedentary behaviour was measured using an invalidated scale and was generally defined (i.e., accumulating 30+ minutes in the previous week and weekend) and (2) only reliability but not factor validity evidence was provided for the TPB constructs.

Consequently, Prapavessis et al. (2015) addressed these limitations by examining the factor structure and predictive utility of sedentary intention and behaviour through TPB. Sedentary behaviour was measured using a modified sedentary behaviour questionnaire (SBQ; Rosenberg et al., 2010). In line with Rosenberg et al.'s (2010) suggestions, additional sedentary pursuits were added (i.e., sitting to eat, sitting for spiritual pursuits) and response items were expanded from 6h or more to 9h or more to improve the sensitivity of sedentary behaviour measurement. TPB items grouped into coherent factors consistent with the theory and explained 9-58% and 8-43% of the variance in intention and behaviour, respectively. Using a general model and domain specific models (weekday/weekend and volitional/non-volitional), findings demonstrated a wide discrepancy in sedentary intention and sedentary behaviour. This highlights the importance of distinguishing domain-specific sedentary behaviour (volitional vs. non-volitional activities) from general sedentary behaviour (volitional and non-volitional combined). Other key findings included subjective norms and intentions being the strongest and most consistent predictor of intention and behaviour, respectively, as well as mediation analyses indicating a relationship between attitudes and sedentary behaviour through intention. Two main limitations were identified (1) the cross-sectional design prevented researchers from making causal inferences and (2) the factor structure and composition of the TPB survey was not cross-validated using different samples with confirmatory factor analysis (Prapavessis, Gaston, & DeJesus, 2015). Due to the nature of intention being a prospective construct, it would be advantageous to measure retrospective sedentary behaviour following measurement of prospective intentions.

There are only a limited number of studies that have attempted to predict sedentary behaviours with psychological variables in adult samples (Prapavessis et al.,

2015; Salmon et al., 2003; Smith & Biddle, 1999). This limited research demonstrates that sedentary activities can be predicted by social-cognitive constructs, but more work is needed to understand specific sedentary activities. Social-cognitive theories other than TPB have the potential to enhance our understanding of sedentarism.

1.5   Protection Motivation Theory

The protection motivation theory (PMT) is one of the major health psychology theories that has proven useful for gaining a better understanding of the conscious processes underlying the adoption of health related behaviours such as physical activity (Plotnikoff et al., 2010). PMT aims to explain health behaviour motivation from a disease prevention perspective (Gaston & Prapavessis, 2009; Rogers, 1983).

The origin of PMT stems from fear appeals – an informative communication about a threat to an individual's well-being from failure to adopt the communicator's recommendations (Rogers, 1975). PMT was designed to specify and operationalize the components of a fear appeal in order to determine the common variables that produced attitude change. Rogers (1975) proposed three crucial stimulus variables in a fear appeal (1) the magnitude of noxiousness of a depicted event, (2) the probability of that event's occurrence, and (3) the efficacy of a protective response. These fear appeal variables would initiate a cognitive mediating process that would in turn, influence protection motivation, a type of intention that would adopt the recommended behaviour contained within the fear appeal (Milne, Sheeran, & Orbell, 2000). In the revised version (Rogers, 1983), perceived self-efficacy was added to the model as another variable that would prompt protection motivation. Therefore, behavioural intentions are led by protection motivation, which is led by the cognitive appraisal of a depicted event as noxious and likely to occur, along with the belief that a recommended coping response can effectively prevent the occurrence of the aversive event (Rogers, 1975).

Finally, Rogers (1975) acknowledged that, "theory construction needs to be cumulative in the same sense as [the cumulative nature of science … the slow, systematic accumulation of empirical data that builds upon previous findings]" (Rogers, 1975, p.98). Thus, we deemed it necessary to modify the PMT model by adding an additional

construct, implementation intention.

Structure and Variables of the PMT Model

Threat Appraisals. The two threat appraisal constructs include perceived severity (PS) and perceived vulnerability (PV). PS assesses how serious an individual believes that the threat would be to his or her own life. PV assesses how susceptible an individual feels to the communicated threat (Milne et al., 2000).

Coping Appraisals. The two coping appraisal constructs include response efficacy (RE) and self-efficacy (SE). RE assesses how effective an individual believes the coping response is in averting the threat. SE assesses how confident an individual believes that he/she can perform the coping response (Plotnikoff et al., 2010).

Goal Intention. These four appraisals are thought to predict protection motivation, which is often measured by goal intention. Goal intentions specify a certain end point that follows the structure, "I intend to reach x," in which x is a desired performance or an outcome. By forming goal intentions, individuals translate their noncommittal desires into binding goals (Gollwitzer, 1999). The intent to adopt the communicator's recommendation (i.e., perform the protective behaviour) is mediated by the amount of protection motivation aroused (Rogers, 1975). In the traditional model, protection motivation is the proximal determinant of protective behaviour (Norman, Boers, & Seydel, 2005). Thus, the four PMT constructs predict goal intention, which should then predict behaviour.

Modifying the PMT Model

Implementation Intention. In the modified PMT framework, a post-intentional process, implementation intention, is included (Gaston & Prapavessis, 2009). Implementation intention is subordinate to goal intentions and specifies when, where, and how a response may lead to goal attainment. It follows the structure, "When situation x arises, I will perform response y." Implementation intention operates on two things (1) the specified situation and (2) the intended behaviour. Since implementation intention implies selecting a suitable future situation, it is assumed that the mental representation of

that future situation becomes highly activated and highly accessible. This heightened activation allows one to detect the environment more easily, attend to it when distracted, and recall it more effectively. Second, implementation intention implies selecting an effective goal-directed behaviour once the individual has encountered the specified situation. This process is thought to be automatic (i.e., swift, efficient, does not require conscious intent) because of the heightened accessibility from the first principle. In summary, the formation of implementation intentions allows one to switch from conscious and effortful control of the goal-directed behaviour to being automatically controlled by the selected situational cue (Gollwitzer, 1999).

The modified PMT model is summarized in Figure 1, in which the four PMT constructs predict goal intention, which should predict implementation intention, which should then predict behaviour.

Threat Appraisals

| Perceived Vulnerability |

| Perceived Severity |

Coping Appraisals

| Response Efficacy |

| Self-Efficacy |

| Goal Intention | → | Implementation Intention | → | Behaviour |
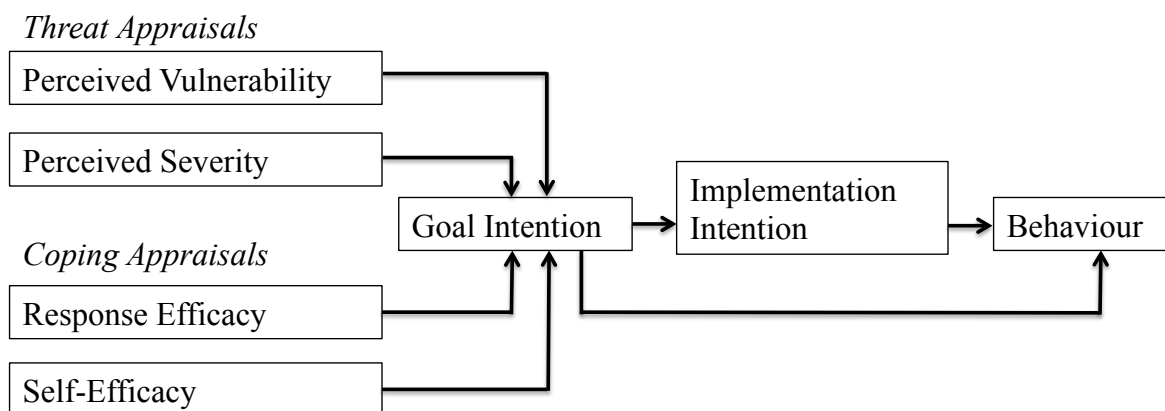
Figure 1 Conceptual model of the modified Protection Motivation Theory

Application of the Modified PMT to Health-Related Behaviours

PMT has been moderately successful in predicting an array of health-related intentions and behaviours such as smoking, alcohol consumption, nutrition, and exercise (Floyd, Prentice-Dunn, & Rogers, 2000; Milne et al., 2000). The following summarizes the main findings of the prediction and intervention of the PMT model in health-related threats.

First, coping appraisal constructs, namely self-efficacy, were more strongly and consistently associated with intention than the threat appraisal constructs across all studies. This is consistent with the findings from Plotnikoff and colleagues (2009) who found a more distal effect of threat appraisals on goal intention than the coping appraisals regarding physical activity behaviour. It was suggested that threat recognition may prompt action contemplation, but it was the perceptions of efficacy and feasibility that determined the kind of action one may choose, and were thus the more proximal determinants of action (Ruiter, Abraham, & Kok, 2001). However, Rogers (1975) noted that the threat and coping appraisals are equally potent in changing attitude, and one should not assert a particular PMT variable to be more important than another.

Second, intention has the strongest, most robust, and most consistent association with concurrent behaviour and a medium to strong association with subsequent behaviour. This supports the traditional PMT model, which predicts intention to be the best and most immediate predictor of behaviour (Floyd et al., 2000; Milne et al., 2000).

Third, the majority of studies that used implementation intentions found improvements in the initiation and performance of the intended behaviour (Gollwitzer & Oettingen, 1998; Orbell & Sheeran, 2000). For example, one study examined whether college students' participation in vigorous exercise would increase by using implementation intentions (Milne et al., 2002). After focusing on increasing self-efficacy to exercise, the perceived severity of and vulnerability to coronary heart disease, and the expectation that exercising will reduce the risk of coronary heart disease, the intervention raised exercise compliance from 29% to only 39%. However, the addition of implementation intention increased compliance to 91% (Milne et al., 2002). Few studies received no additional benefit from implementation intention (Higgins & Conner, 2003; Lavin & Groarke, 2005). It was suggested that certain behaviours that are repeated on a daily basis (e.g., vitamin C supplements, dental flossing; Lavin & Groarke, 2005; Sheeran & Orbell, 1999), required more time for implementation intention effects to emerge (e.g., 3 weeks vs. 10 days; Sheeran & Orbell, 1999).

PMT and Sedentary Behaviour

Despite the wide application of PMT to various health and safety-related behaviours, PMT has not been used to predict sedentary behaviour. Considering the deleterious and extensive consequences of sedentarism, a PMT model grounded in fear appeals may be an important route in enhancing our current understanding of sedentarism. Unlike other social-cognitive theories, PMT can identify the role of threat and coping perceptions in one's intentions to decrease sedentary behaviour and in turn, actual sedentary time. With this understanding, current and future studies can be better informed on designing more efficacious interventions given the added value theoretical interventions have over atheoretical interventions in changing health behaviours (Plotnikoff et al., 2010). These findings can also provide researchers with a reliable, validated, and theoretically based instrument to measure sedentary cognitions, which is lacking in the sedentary literature (Rhodes et al., 2012).

1.6   Purpose and Hypothesis

Purpose

The purpose of this study is to (1) examine the factor structure and composition of sedentary-derived PMT constructs and (2) determine whether general and leisure PMT models can predict sedentary goal intention, implementation intention, and behaviour in university students.

The general model combined volitional and non-volitional activities whereas the leisure model only measured volitional activities. The leisure domain was selected because it was the only domain (versus occupation, transportation, household) that could be clearly measured by volitional-only activities. If a non-leisure domain were selected, it would require combining volitional and non-volitional activities, which could cause confusion for the respondent and weaken the variability (e.g., for an occupational model, sitting while doing work could be interpreted as volitional if the individual is not in class, and non-volitional if the individual is in class). A possible solution could be a delineation into volitional and non-volitional models (e.g., occupation-volitional, occupational-non volitional, general), but this would substantially increase the number of models to factor

analyze. Finally, volitional activities have the most pragmatic value for future interventions because they are contexts in which individuals are not restrained to change their sedentary patterns.

Hypothesis

Irrespective of model type, we hypothesized that (1) the two coping appraisals (response and self-efficacy) will contribute to greater variance in goal intention than the two threat appraisals (perceived severity and vulnerability), 2) goal intention and the four PMT variables will explain unique variance in implementation intention, but the former will contribute to greater variance than the latter four, 3) both goal intention and implementation intention will directly explain variance in behaviour but the latter will contribute to greater variance than the former, and 4) goal intention will explain behaviour through implementation intention.

Chapter 2 : The Current Study

2   Methods

The conduct of this study adhered to the guidelines outlined in the Declaration of Helsinki (World Medical Association, 2013) and the Handbook for Good Clinical Research Practice (WHO, 2002). Ethical approval was granted from Western University's Health Sciences Research Ethics Board (#105301; Appendix A). All participants read the Letter of Information (Appendix A), and provided informed consent (Appendix A) prior to participation in the study.

2.1   Design

The research study used an integrated cross-section longitudinal design.

2.2   Participants

Participants represented a convenience sample of university students. Inclusion criteria included (1) aged 18 to 35 years, (2) able to read and understand English, and (3) had Internet access. Exclusion criteria included suffering from a medical condition or physical limitation that prevented them from being physically active. The final sample consisted of 596 students (69% female, M_{age} = 19.44 years, SD = 1.81).

2.3   Instruments

Leisure Score Index

Exercise behaviour was assessed using the Leisure Score Index (LSI; Appendix B) of the Leisure Time Exercise Questionnaire (Godin & Shephard, 1985). The LSI is a four-item assessment that measures intensity and frequency of physical activity. Participants were asked to estimate the number of strenuous, moderate, and mild exercises that lasted over 15 minutes from the past seven days. The frequency of each intensity level was multiplied by the respective metabolic equivalents (METs) for the activities (9 for strenuous, 5 for moderate, 3 for mild) to obtain three activity scores (Jacobs, Ainsworth, Hartman, & Leon, 1993). Jacobs et al. (1993) have shown the LSI to exhibit acceptable

test-retest reliability and concurrent validity (correlates with objective measures such as CALTRAC accelerometer and VO_2 max).

Modified Protection Motivation Theory Questionnaire

A thirty-four-item PMT questionnaire derived from an existing PMT scale for physical activity measured the two threat appraisals (PV, PS), two coping appraisals (RE, SE) and two intention items (goal intention, implementation intention) for sedentary behavior (Gaston & Prapavessis, 2009). Only PV, PS, RE, and SE items were tested for factor structure and composition.

Threat term. A focus group ($N = 15$) was conducted prior to the study to determine an appropriate threat term that was most relevant to the sample age group based on our review of the literature. Fifteen individuals (undergraduate and graduate students and one working professional) received a handout with instructions to rank how threatening four different health consequences were to them and to their peers in their age group (Appendix B). Individuals' ranked metabolic deterioration, all-cause mortality, death from cardiovascular disease, and type 2 diabetes from a scale of one to four ($1 =$ least threatening to $4 =$ most threatening) based on an evidence-based definition per term. Ten out of the fifteen individuals ranked all-cause mortality as the most threatening consequence because death was the only consequence that was the most immediate to them. It was assumed that all-cause mortality would not produce much variability in our analysis because the majority of individuals would likely rate death with uniformly high PS and uniformly low PV scores. Therefore, metabolic deterioration was selected because it was the second most threatening ranked health consequence ($n = 7$) and would likely produce some variability in both PS and PV in our target sample of university students. Metabolic deterioration also was deemed the most appropriate and empirically supported threat term. Previous systematic reviews (Proper et al., 2011; Saunders, Larouche, Colley, & Tremblay, 2012) examining sedentary behaviours and health outcomes among adults from prospective intervention studies identified deleterious changes in insulin sensitivity, glucose tolerance, and plasma triglyceride levels receiving the most consistent and moderate quality evidence, whereas fasting glucose, fasting

insulin, and HDL or LDL cholesterol were associated with low quality evidence. Furthermore, this was supported by other literature that identified these same, specific cardio-metabolic changes in a bed rest study of healthy adults (Hamburg et al., 2007) as well as in another study that reduced ambulatory activity in healthy, active adults (Thyfault & Krogh-Madsen, 2011).

The following definition of metabolic deterioration was included in the stem for the PV, PS, and RE items (Appendix B): "When you see "metabolic deterioration" in the following questions, this refers to problems with chemical reactions in the body, specifically (1) Problems with insulin. Insulin is a hormone that lowers glucose levels (a type of sugar) in the blood. When there are problems with insulin, glucose cannot easily enter the body's cells. This means blood sugar levels go up and can remain high. This can lead to serious damage to the heart, kidneys, eyes, and feet, (2) Increases in fat around the stomach region. This can lead to type 2 diabetes, high blood pressure, and heart disease, and (3) Higher levels of fat in the bloodstream. This can lead to diseases of the heart."

To determine an appropriate readability level, the Flesch grade level readability formula was used (http://readibility-score.com, 2015). The Flesch grade level readability formula is best suited in the field of education to judge the readability level of various books and texts for students. The formula is calculated using the average number of words used per sentence and the average number of syllables per word (My Byline Media, n.d.). The definition for metabolic deterioration received a Flesch grade level of 6.6. DeVellis (2003) recommends aiming for a reading level between the fifth and seventh grades as an appropriate target for most instruments that will be use with the general population. Thus, this definition was considered an appropriate reading difficulty level.

Threat appraisals. PV was assessed by five 7-point items and PS was assessed by four 7-point items (1 = strongly disagree to 7 = strongly agree), commonly used in the PMT literature (Courneya & Hellsten, 2001). Example items include, "I feel vulnerable to developing metabolic deterioration" (PV) and "I feel metabolic deterioration is a serious health condition" (PS; see Appendix B).

Coping appraisals. RE was assessed by four 7-point items (1 = strongly disagree to 7 = strongly agree). For example, "I feel that sitting less would help me reduce my risk of developing metabolic deterioration" (see Appendix B).

Self-efficacy was assessed prospectively by 15 items rated on a scale from 0% (not at all confident) to 100% (completely confident; see Appendix B). Specifically, one's confidence about scheduling a break from sitting (e.g., standing or doing some light activity) every two hours in the face of common challenges to decrease sitting – a type of self-regulatory efficacy – was assessed. A two-hour sitting threshold was selected based on the Canadian Sedentary Behaviour guidelines for children and youth since there are no current recommendations for adults (Canadian Society for Exercise Physiology, 2014). This threshold also meets the ergonomic recommendations for adults for sitting over an eight-hour workday (Commissaris, Douwes, Schoenmaker, & de Korte, 2006).

Scheduling challenges consisted of psychological and situational events where people have difficulty sitting less. Each SE item was assessed in three durations of break time (1-5 minutes, 6-10 minutes, 11-15 minutes) similar to the Self-Efficacy Scale, which assessed confidence about exercising for increasing durations (McAuley & Mihalko, 1998). This is supported by McAuley and Mihalko's (1998) recommendation to assess beliefs in the ability to exercise at some prescribed frequency, duration, and intensity over ascending periods of time.

Although task SE is traditionally used in PMT, scheduling SE was determined to be the most appropriate assessment of SE for sedentary behaviour for two reasons. First, task SE was ruled out because the basic motor skills or capabilities to "not sit" requires very little confidence in our sample of participants (all participants suffering from a medical condition were excluded). Thus, results would be fairly consistent across all participants producing little variation. Second, barriers SE was ruled out because most barriers to sedentary behaviour are non-volitional (e.g., sitting in class). This would produce an inaccurate representation of participants' confidence to take a break from sitting because the situation would already inhibit them from taking a break from sitting. Barriers SE is sometimes considered an untrue measure of self-regulatory SE because it

only assesses one's confidence in overcoming the barrier instead of how self-regulation is used to overcome the barrier.

Each scheduling SE item was categorized into psychological events and situational events. The psychological events had three subcategories (productivity, focused, tired) and the situational events had two subcategories (studying, screen time leisure). Each subcategory was measured by three items totaling to nine psychological items and six situational items. Sample items for psychological events were: "when you are productive doing your work, how confident are you in scheduling a break from sitting every two hours for a duration of …" (productivity), "when you are very focused (i.e., "in the zone") how confident are you in scheduling a break from sitting every two hours for a duration of …" (focused) and "when you are feeling worn out, how confident are you in scheduling a break from sitting every two hours for a duration of …" (tired). Sample items for situational events were: "when you are studying in the library, how confident are you in scheduling a break from sitting every two hours for a duration of …" (studying) and "when you are watching TV or playing video games how confident are you in scheduling a break from sitting every two hours for a duration of …" (screen time leisure). These five events are supported from previous literature that identified enjoyment of sedentary activities (e.g., enjoyment of watching television), taking short breaks during work (e.g., taking a break will cause one to lose their train of thought), peer and societal pressure (e.g., sitting meetings), and lack of energy (e.g., physically or mentally tired and wanting to rest without concern for getting up regularly) as barriers to sitting less (Chastin, Fitzpatrick, Andrews, & DiCroce, 2014; Greenwood-Hickman, Renz, & Rosenberg, 2015).

Goal intention. Intentional goals for sitting time were assessed using three items adapted from Graham, Prapavessis and Cameron (2006), which exhibited adequate reliability ($\alpha = 0.81$). Items were rated on the same scale as the Sedentary Behaviour Questionnaire (SBQ; Rosenberg et a., 2010) with extended responses (i.e., 10h, 11h, 12h … 18h) similar to the intention items from the TPB questionnaire (Prapavessis et al., 2014). A sample item was, "How much time do you expect to spend sitting over the next week" (see Appendix B). Intentional goals for sitting time, but not for sitting less were

measured due to the phenomenon of mere measurement effect (Morwitz, Johnson, & Schmittlein, 1993). Mere measurement effect has been demonstrated in health behaviours, such as blood donation (Godin, Sheeran, Conner, & Germain, 2008). When a behavioural intention question is asked (e.g., I intend to give blood in the next six months), this heightens the accessibility of participants' attitudes towards a behaviour, which in turn, increases the likelihood that the behaviour will be performed (e.g., 8.6% significantly greater number of registrations at blood drives at six months; Godin et al., 2008; Morwitz & Fitzsimons, 2004). Thus, a neutral goal intention measure for sitting time was deemed appropriate.

Implementation intention. Implementation intention was assessed using three items adapted from (Norman, Boer, & Seydel, 2005). Participants were asked whether they knew when, where, and what they can do to sit less over the next week. Responses were rated on a 7-point scale (1 = strongly disagree to 7 = strongly agree). A sample item was, "I know what I can do to sit less on a typical day over the next week" (see Appendix B).

Sedentary Behaviour Questionnaire

The modified twelve-item SBQ measured the quantity of time spent sitting on a typical day over the previous week. The SBQ was a separate survey that was emailed one week following completion of the PMT questionnaire to correspond with the future-tense time frames of scheduling self-efficacy, goal intention and implementation intention. Thus, the stem of the SBQ ("…how much time did you spend doing the following this past week") matched the time frame of goal intention and implementation intention ("…over the past week").

Although the original, nine-item SBQ provided initial evidence for the reliability and validity (α from .48 to .93, r = .64 to .90 for weekdays, and r = .51 to .93 for weekend days), the authors acknowledged that measures of sedentary behaviours might need to be tailored for populations (Rosenberg et al., 2010). Therefore, three behaviours were added (i.e., driving/riding in a motor vehicle for leisure-related transportation purposes; sitting and eating; sitting for religious or spiritual pursuits) that provided a

more comprehensive representation of the university population. The response options were also modified to expand beyond "6 hours or more" and included the following: none, 15 minutes or less, 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, 6 hours, 7 hours, 8 hours and 9 hours or more. Since most individuals sit for over 6 hours, additional response options (i.e., 7 hours, 8 hours, 9 hours or more) allowed for a more accurate quantity of sitting time. A sample item was, "On a typical day, how much time did you spend (from when you wake up until you go to bed watching TV) sitting and watching TV" (see Appendix B).

Seven items assessed leisure-specific, volitional sedentary activities: watching TV, using the computer for recreational purposes, listening to music, reading for pleasure, doing arts and crafts, driving/riding in a motor vehicle for leisure-related transportation purposes, socializing/visiting or non-work related phone conversations. A separate SBQ score was computed for the general and leisure-specific model. The general model computed an average daily score from all twelve items. The leisure-specific model computed an average daily score from the seven leisure-specific, volitional items.

2.4   Procedure

Male and female undergraduate students were recruited from multiple faculties from Western University in London, Ontario (i.e., Science, Health Science, Social Science, Medicine and Dentistry, English, Arts and Humanities, Engineering, Music). The researcher emailed 22 professors from the School of Kinesiology, Health Sciences, Science, English, and Social Science to receive permission to conduct a study on sedentary behaviour and cognitions in their classroom (Appendix A). Twelve professors agreed and ten professors declined the request due to unavailability or timing issues. In the 12 classrooms, the researcher invited students to participate in a study on thoughts about sedentary behaviour. The researcher informed them that this was a two-part online survey, separated by one week, and required an email address to obtain the link to the second survey. Students were told that they could win one of five $100 gift cards, with the completion of the second survey increasing their chances by three times. To minimize social desirability bias, students were told that the questionnaire was not a test, would not affect their academic status, and that they could exit the survey at any time. To ensure

confidentiality, students were told that email addresses would only be used to email the link to the second survey and to be entered in the draw for the prize, and that it would be destroyed at the end of the study. Two professors agreed to allow the students to complete the online questionnaire during class. Ten professors agreed to have the researcher give the announcement but have students complete the survey outside of class time via survey information that was posted on the course website. The survey link and instructions to participate was provided on the course website for all 12 classes (Appendix A).

On the first survey link, participants were directed to the letter of information, asked to provide informed consent and then proceeded to the questionnaire package. The questionnaire package included socio-demographics (gender, age, ethnicity, level of education, employment, height and weight, and medical conditions), the LSI, and modified PMT questionnaire (Appendix A). Upon completion of the modified PMT questionnaire (PS, PV, RE, SE), participants were randomized to two models (general, leisure) through an internal computer-generated randomization scheme (via Survey Monkey) when completing the goal intention and implementation intention items. The general model had the following stem: "sitting for work, school, or personal, leisure, or recreational pursuits (e.g. watching TV, using the computer, doing office or school work, reading, talking on the phone, sitting in lectures or meetings, sitting in a car, train, or bus, eating, socializing, sitting for religious or spiritual pursuits) on a typical day over the next week." The leisure-specific model had the following stem: "sitting for personal, leisure, or recreational pursuits pursuits on a typical day over the next week." The wording of these stems was taken directly from the SBQ to ensure correspondence between behavioural and cognitive measures (Ajzen, 2002).

At the end of the first survey, participants were asked to enter their email address in order to receive the link to the second survey one week later (Appendix B). Participants were emailed the second survey link one week later, which included the modified SBQ (Appendix B). This ensured that the temporal sequence (PMT cognitions were assessed prior to sedentary behaviour) of assessment was in line with the proposed model being tested. Completion of both surveys signified the end of their involvement in

the study.

Participants that provided implausible sedentary behaviour data (i.e., average daily SBQ score exceeded 24 hours per day) or failed to complete the questionnaire were excluded from the analysis. See Figure 2 of the flow of participants through the study.

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                              ┌──────────────────────────┐
                              │  12 classrooms invited to │
┌─────────────────────────┐  │  participate (n = 938)    │
│ Survey #1 (general): GI  │  └──────────────┬───────────┘
│       (n = 308)          │                 │
└────────────┬────────────┘  ┌──────────────▼───────────┐
             │               │ Survey #1: letter of      │
┌────────────▼────────────┐  │ information, consent,     │
│ Survey #1 (general): II │  │ demographics, LSI, PS,    │
│       (n = 307)         │  │ PV, RE, SE items (n = 787)│
└─────────────────────────┘  └──────────────┬───────────┘
                              ┌──────────────▼───────────┐
                              │      Randomization        │
                              └──────────────┬───────────┘
┌─────────────────────────┐  ┌──────────────▼───────────┐  ┌──────────────────┐
│ Survey #1 (leisure): GI │  │ Completion of Survey #1  │--│ Exclusion from   │
│       (n = 309)         │  │       (n = 615)          │  │ Survey #1 (n=191)│
└────────────┬────────────┘  └──────────────┬───────────┘  └──────────────────┘
┌────────────▼────────────┐  ┌──────────────▼───────────┐
│ Survey #1 (leisure): II │  │ One week later: Survey #2 │
│       (n = 308)         │  │ SBQ Emailed (n = 615)     │
└─────────────────────────┘  │ Responded (n=431; 70.08%) │
                              └──────────────┬───────────┘
                              ┌──────────────▼───────────┐  ┌──────────────────┐
                              │ Completion of Survey #2  │--│ Exclusion from   │
                              │       (n = 411)          │  │ Survey #2 (n=124)│
                              └──────────────┬───────────┘  └──────────────────┘
                              ┌──────────────▼───────────┐
                              │ Final sample for factor   │
                              │ analysis (completed data  │
                              │ only; n = 596)            │
                              └──────────────────────────┘
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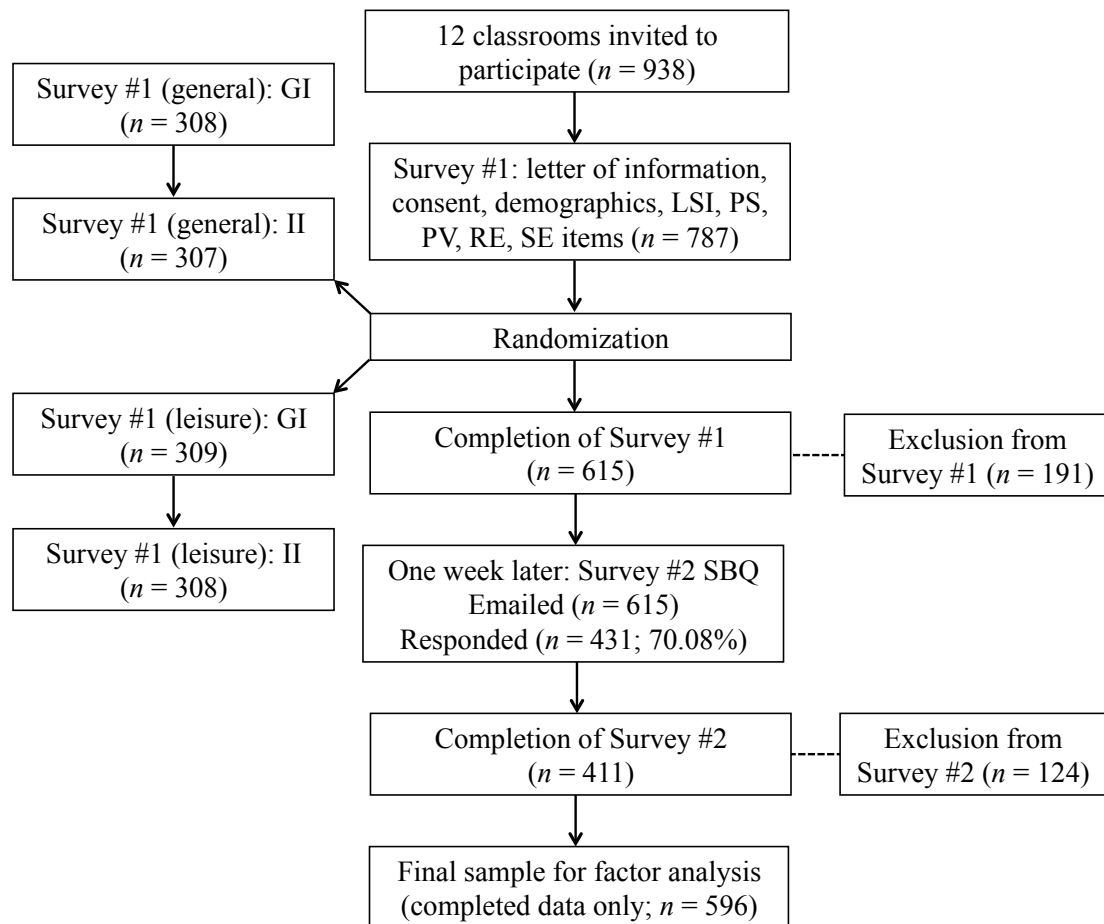
Figure 2 Flow of participants

Note: LSI = leisure score index, PS = perceived severity, PV = perceived vulnerability, RE = response efficacy, SE = self-efficacy, GI = goal intention, II = implementation intention, SBQ = sedentary behaviour questionnaire

2.5 Statistical Analysis

Sample Size and Power

It is recommended to have a ratio of ten cases for each item to be factor analyzed (Nunnally, 1978). For the 28 items that represented PV, PS, RE, and SE, a sample size of 596 satisfied this recommendation. Using the multiple R regression approach for the six sedentary derived PMT constructs (two coping appraisals, two threat appraisals, goal intention, implementation intention), 134 participants were required for each model to provide a power of 80% at an alpha of .01 and to detect an effect (R^2 = .15) in sedentary behaviour (Cohen, 1992; SamplePower 3.0). All data were analyzed using IBM AMOS or SPSS Version 22.

Group Equivalency

ANOVA and chi-square analyses were used to examine group equivalency with respect to demographic characteristics and LSI scores between participants with complete and incomplete data.

Outliers

Outliers were identified using a boxplot technique. A datum point was considered an outlier if it extended to more than 1.5 box-lengths from the edge of the box. An extreme outlier was if it extended to more than three box-lengths (Pallant, 2013).

Psychometric Analysis (Factor Structure and Composition)

The sedentary derived PMT items were subjected to psychometric analysis. Using an online computer randomization generator, participants who provided complete PMT data were randomized into exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) groups. EFA was conducted prior to CFA for the following reasons. First, an exploratory approach is often recommended and followed during the early stages of scale development and testing (Schutz & Gessaroli, 1993). It is not influenced by a researcher's expectations regarding the nature of number of constructs or factors (Thompson, 2004). Since sedentary derived PMT constructs have not been tested before and modifications were made to the PMT model (i.e., multiple measures of scheduling SE), EFA was considered a more conservative and unbiased first approach.

Prior to performing EFA, the data were inspected for factorability (suitability for factor analysis) based on correlations ($r > .30$; Tabachnick and Fidell, 2007), Bartlett's test of sphericity ($p < .05$; Bartlett, 1954), and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO; $> .50$; Kaiser, 1970, 1974). Unique factors were extracted using principal factor analysis based on eigenvalues (>1; Kaiser, 1960), visual inspection of Catell's scree test (Catell, 1966), and pattern matrix loadings. Factors were rotated with oblique rotation (Direct oblimin method) because constructs were assumed to be related. The reliability of the items that deemed to be one factor was assessed by Cronbach's alpha in order to measure each scale's internal consistency.

CFA was performed on the factors that emerged from EFA from the second half of the data set. Items were restricted to load on their corresponding factor, latent factors were not allowed to correlate with other latent factors, and the errors of measurement associated with each observed variable were allowed to be correlated. Model fit was assessed using chi-square (χ^2) test, Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Incremental Fit Index (IFI), and chi-square/degree of freedom ratio (CMIN/DF). AMOS was used to conduct all CFAs in this study. According to Kenny's (2014) recommendations for evaluating fit scores, CFI, IFI and NFI $>.9$ was considered marginal fit, RMSEA $<.08$ was considered mediocre fit, and CMIN/DF >3.0 was considered acceptable fit (Carmines & McIver, 1981).

Prediction Analysis

Pearson bivariate correlations were used to examine relationships between the four PMT constructs and sedentary behaviour. After ensuring there was no violation of the assumptions of normality, linearity, homoscedasticity, and multicollinearity, the PMT constructs significantly related to goal intention were entered in a linear regression model. Items that were significantly related to implementation intention were entered in a regression model with goal intention entered in step 1, and the PMT constructs entered at step 2. Finally, items that were significantly related to sedentary behaviour were entered with implementation intention entered in step 1, goal intention entered in step 2, and the

PMT constructs entered in step 3. Each regression model was assessed by the R^2, adjusted R^2, R^2 change, and the standardized beta (β) associated with each individual construct. The fit of the general and leisure models was compared using Fisher's Z which was computed using Garbin's (n.d.) FZT.exe program.

Mediation Analyses

Mediation was tested by computing the indirect effect of the following (1) the PMT constructs on implementation intention through goal intention, (2) the PMT constructs on sedentary behaviour through goal intention, (3) the PMT constructs on sedentary behaviour through implementation intentions, and (4) goal intention on sedentary behaviour through implementation intention. Although the PMT model illustrated in Figure 1 describes mediation between goal intention and sedentary behaviour through implementation intention, all other possible mediation pathways were tested due to the exploratory nature of the PMT framework. Mediation was tested using the Sobel test and bootstrapped sampling distribution (Preacher & Hayes, 2004). A significant indirect effect is represented by a significant Sobel test ($p < .05$, two-tailed). Preacher and Hayes (2004) also recommend following up any non-significant Sobel test with an inspection of the bootstrapped sampling distribution because distributions are commonly skewed. A significant indirect effect is represented when the 95% confidence interval (CI) derived from 1000 bootstrap resamples do not cross zero. The level of significance was at $p < .05$ for all statistical analyses.

Chapter 3 : Results

3   Results

3.1   Treatment of Data

Missing and Excluded Data

All missing data was removed from the study. Out of the 787 students who responded to survey #1, 615 students finished the survey (students could complete the survey even if some questions were incomplete). A total of 191 students were excluded due to incomplete data ($n = 190$) and not within the age range ($n = 1$). Out of the 431 students who responded to survey #2, 411 students finished the survey. 124 students were excluded due to incomplete data ($n = 20$) and implausible data (reported sedentary response times as >24 hours; $n = 104$). Fifty-six participants who reported suffering from a medical condition were removed only for the predictability analyses (i.e., linear regression, hierarchical linear regression). Therefore, 596 participants who provided complete PMT data were analyzed for factor analysis.

Outliers

Fourteen outliers were found for the general SBQ, and 20 outliers were found from the leisure SBQ. These outliers also reported implausible SBQ scores, and were thus removed from the final data set.

Assumptions of Statistical Techniques

The assumption of multicollinearity was assessed for multiple regression. The cut-off points for determining multicollinearity was a tolerance value of less than .10 or a VIF value of above 10. Tolerance (range = .377-.964, .974-1.00, .928-1.00) and VIF (range = 1.038-2.64, 1.000-1.026, 1.000-1.094) values for models predicting goal intention, implementation intention, and behaviour, respectively indicated multicollinearity was not an issue (Pallant, 2013).

Group Equivalency at Baseline

One-way ANOVAs revealed a significant difference between complete and incomplete data for age, $F(1, 721) = 6.74$, $p = .01$, however the mean age between the two groups were very similar (19.49 (SD = 1.79) complete; 18.84 (2.03) incomplete). There was no significant difference for strenuous LSI score, $F(1, 95) = .08$, $p = .77$, moderate LSI score, $F(1, 662) = .14$, $p = .70$, light LSI score, $F(1, 648)$, $p = .67$, weekly leisure activity score $F(1, 622) = .636$, $p = .426$, and BMI $F(1, 726) = .25$, $p = .62$.

Chi-square tests indicated no significant differences between complete and incomplete data for gender, $\chi^2 (1, n = 728) = .52$, $p = .47$, $phi = -.03$, and faculty $\chi^2 (11, n = 726) = 15.74$, $p = .15$, $phi = .15$.

3.2 Psychometric Analysis

Exploratory Factor Analysis

Inspection of the correlation matrix revealed the presence of all coefficients of .3 and above for both models. The Kaiser-Meyer-Olkin value was .88 (general) and .89 (leisure), exceeding the recommended value of .6 (Kaiser, 1970; Kaiser, 1974). Bartlett's Test of Sphercity (Barlett, 1954) reached statistical significance ($p < .00$) for both models, supporting the factorability of the correlation matrix.

The factor analysis pattern matrix can be found in Appendix C. Principal axis factoring revealed the presence of ten components with eigenvalues exceeding one, explaining 1.78-39.88% of the variance. An inspection of the screeplot revealed a change (or elbow) after the ninth component. After examining the pattern matrices, the criteria for the factor loadings included (1) primary loading > .58, (2) secondary loading < .3, and (3) minimum of two items were required to load onto each factor. Principal axis factor analysis with oblique rotation revealed the presence of nine factors. However, one of the factors (scheduling SE cellphone) was excluded because the secondary loadings were greater than .3. Thus, a total of eight factors emerged: PV, PS, RE, scheduling SE Tired, scheduling SE Productive/Focused, scheduling SE TV/Videogames/Computer, scheduling SE Studying at home, scheduling SE Studying in a Wi-Fi area/library.

Confirmatory Factor Analysis

The CFA results from an eight factor PMT model revealed the following fit index scores: χ^2 (845) = 2313.130, p = .000; RMSEA = .079 (90% confidence interval = .075-.083), CFI = .915, IFI = .916, NFI = .874, CMIN/DF = 2.737. Error terms associated with the observed variables were correlated with each other in order to improve the model fit. The standardized regression weights for each construct can be found in Appendix C.

Correlation Analysis

Bivariate Pearson correlations are presented in Table 1. In the general model, scheduling SE productive/focused and scheduling SE studying in library/Wi-Fi area were significantly related to sedentary behaviour. In the leisure model, perceived vulnerability, scheduling SE TV/video games/computer, scheduling SE studying in library/Wi-Fi and goal intention were significantly related to sedentary behaviour.

Table 1 Pearson correlations for the modified protection motivation theory variables and sedentary behaviour

Variable	n	Mean	SD	2	3	4	5	6	7	8	9	10	11
Model 1 (general)													
1. Perceived Severity	496	5.92	1.13	.01	.13**	.14**	.09	.03	.09	.08	-.05	.01	-.02
2. Perceived Vulnerability	496	3.01	1.25	-	.02	-.17**	-.18**	-.11*	-.13**	-.14**	.09	-.19**	.11
3. Response Efficacy	496	5.11	1.02		-	.04	.05	.09	.13**	.06	-.16*	.25**	.02
4. SE – Tired	496	68.13	29.49			-	.41**	.35**	.47**	.43**	.04	.06	-.08
5. SE – Productive/Focused	496	59.69	27.23				-	.47**	.71**	.67**	-.05	.21**	-.13*
6. SE – TV/VG/Computer	496	58.23	30.43					-	.39**	.46**	.03	.14*	-.09
7. SE – Studying at home	496	73.47	25.33						-	.59**	-.12	.07	-.03
8. SE – Studying in library and Wi-Fi area	496	52.99	27.63							-	-.10	.12	-.14*
9. Goal Intention	237	8.68	3.77								-	.01	.13
10. Implementation Intention	236	5.33	1.22									-	-.06
11. Sedentary Behaviour	236	13.71	4.92										
Model 2 (leisure)													
1. Perceived Severity	496	5.92	1.13	.01	.13**	.14**	.09	.03	.09	.08	.04	.14*	.03
2. Perceived Vulnerability	496	3.01	1.25	-	.02	-.17**	-.18**	-.11*	-.13**	-.14**	-.00	-.26**	.12*
3. Response Efficacy	496	5.11	1.02		-	.04	.05	.09	.13**	.06	-.05	.24**	-.01
4. SE – Tired	496	68.13	29.49			-	.41**	.35**	.47**	.43**	-.07	.09	-.08
5. SE – Productive/Focused	496	59.69	27.23				-	.47**	.71**	.67**	-.10	.21**	-.10
6. SE – TV/VG/Computer	496	58.23	30.43					-	.39**	.46**	.03	.07	-.13*
7. SE - Studying at home	496	73.47	25.33						-	.59**	-.14*	.24**	-.11
8. SE – Studying in library and Wi-Fi area	496	52.99	27.63							-	-.00	.23**	-.11*
9. Goal Intention	253	7.92	3.66								-	-.07	.20*
10. Implementation Intention	252	5.38	1.27									-	-.07
11. Sedentary Behaviour	297	8.16	5.51										

Note: SE= Self-efficacy, VG = Video games, *p < .05; **p < .01;

Linear Regression Analysis

Linear regression analyses of each model are presented in Tables 3, 4, and 5. For goal intention, 5% and 1% of the variance was explained in the general and leisure model, respectively. Response efficacy and scheduling SE studying at home were significant contributors for the general model only.

For implementation intention, 10% and 16% of the variance was explained in the general and leisure model, respectively. In the general model, perceived vulnerability, response efficacy, and scheduling SE productive/focused were significant contributors. For the leisure model, perceived vulnerability, response efficacy, and scheduling SE studying at home were significant contributors.

For sedentary behaviour, 3% and 1% of the variance was explained in the general and leisure model, respectively. Goal intention was a significant contributor in the leisure model only.

Fisher's Z. Post hoc analysis using Fisher's Z revealed no significant difference between the two models (Garbin, n.d.). For goal intention, $Z = .819$, $p = .413$; for implementation intention, $Z = .867$, $p = .386$; for sedentary behaviour $Z = .294$, $p = .767$.

Mediation Analyses

The results of the Sobel tests and bootstrapped sampling distributions are presented in Table 6. The Sobel test revealed no significant indirect effects. The bootstrapped sampling distributions revealed most of the 95% CIs crossing zero, however, the means of the relationships were very small. Three indirect relationships emerged that had the larger means: implementation intention mediated the relationship between response efficacy and sedentary behaviour ($M = -.13$; general), goal intention mediated the relationship between perceived severity and sedentary behaviour ($M = .12$; leisure), and implementation intention mediated the relationship between perceived vulnerability and sedentary behaviour ($M = .10$; leisure).

Table 1 Linear regression analyses predicting goal intention

Variable	Model 1 (general) ($n = 237$ GI; 496 PMT)		Model 2 (leisure) ($n = 253$ GI; 496 PMT)	
	B (SE B)	β	B (SE B)	β
Perceived Severity	-.11 (.22)	-.03	.20 (.21)	.06
Perceived Vulnerability	.33 (.20)	.11	-.07 (.19)	-.02
Response Efficacy	-.59 (.24)**	-.16	-.16 (.23)	-.05
SE – Tired	.02 (.01)	.14	-.01 (.01)	-.05
SE – Productive/Focused	.02 (.01)	-.14	-.01 (.01)	-.11
SE – TV/VG/Computer	.01 (.01)	.08	.01 (.01)	-.10
SE - Studying at home	-.03 (.01)*	-.21	-.02 (.01)	-.16
SE – Studying in library and Wi-Fi area	-.02 (.01)	.14	.02 (.01)	.14
Adjusted R^2	.05*		.01	
ΔF (df1, df2)	2.41 (8,228)		1.40 (8,244)	

Note: Only PMT variables which were significantly correlated with intention were entered in each regression model.

*$p < .05$; **$p < .01$; ***$p < .001$; SE = Self-efficacy, VG = Video games

Table 2 Hierarchical linear regression analyses predicting implementation intention

Variable	Model 1 (general) (n = 236 II; 237 GI; PMT 496)		Model 2 (leisure) (n = 252 II; 253 GI; 496 PMT)	
	B (SE B)	β	B (SE B)	β
Step 1				
Goal Intention	.00 (.02)	.01	-.02 (.02)	-.07
Adjusted R^2	-.00		.00	
ΔR^2	.00		.01	
ΔF (df1, df2)	.02 (1,234)		1.25 (1,250)	
Step 2				
Goal Intention	.02 (.02)	.06	-.02 (.02)	-.07
Perceived Severity	-.02 (.07)	-.02	.12 (.07)	.11
Perceived Vulnerability	-.18 (.06)***	-.18	-.25 (.06)***	-.25
Response Efficacy	.28 (.08)***	.24	.27 (.07)***	.22
SE – Tired	-.00 (.00)	-.04	-.00 (.00)	-.09
SE – Productive/Focused	.01 (.01)*	.24	-.00 (.00)	-.03
SE – TV/VG/Computer	.00 (.00)	.07	-.00 (.00)	-.06
SE - Studying at home	-.01 (.01)	-.13	.01 (.00)*	.18
SE – Studying in library and Wi-Fi area	-.00 (.00)	-.03	.01 (.00)	.15
Adjusted R^2	.10***		.16***	
ΔR^2	.14***		.19***	
ΔF (df1, df2)	4.54 (8,226)		6.98 (8,242)	

Note: Only PMT variables which were significantly correlated with intention were entered in each regression model.
*p < .05; **p < .01; ***p < .001; SE = Self-efficacy, VG = Video games

Table 3 Hierarchical linear regression analyses predicting sedentary behaviour

Variable	Model 1 (general) ($n = 236$ SB,II; 237 GI; 496 PMT)		Model 2 (leisure) ($n = 297$ SB; 252 II; 253 GI; 496 PMT)	
	B (SE B)	β	B (SE B)	β
Step 1				
Implementation Intention	-.25 (.39)	-.06	-.29 (.35)	-.07
Adjusted R^2	-.01		-.00	
ΔR^2	.00		.01	
ΔF (df1, df2)	.42 (1,107)		.70 (1,153)	
Step 2				
Implementation Intention	-.26 (.39)	-.06	-.23 (.35)	-.05
Goal intention	.17 (.13)	.13	.30 (.12)**	.20
Adjusted R^2	.00		.03**	
ΔR^2	.02		.04**	
ΔF (df1, df2)	1.78 (1,106)		6.28 (1,152)	
Step 3				
Implementation Intention	-.13 (.42)	-.03	-.07 (.39)	-.02
Goal intention	.19 (.13)	.14	.31 (.12)**	.21
Perceived Severity	-.04 (.44)	0.01	.15 (.40)	.03
Perceived Vulnerability	.23 (.41)	.06	.43 (.38)	.10
Response Efficacy	.33 (.50)	.07	.00 (.45)	.00
SE – Tired	-.01 (.02)	-.05	.00 (.02)	.00
SE – Productive/Focused	-.03 (.03)	-.16	.01 (.03)	.06
SE – TV/VG/Computer	-.01 (.02)	-.03	-.02 (.02)	-.11
SE - Studying at home	.04 (.03)	.19	-.01 (.03)	-.03
SE – Studying in library and Wi-Fi area	-.02 (.03)	-.09	-.02 (.02)	-.08
Adjusted R^2	-.03		.01	
ΔR^2	.04		.03	
ΔF (df1, df2)	.54 (8,98)		.59 (8, 144)	

Note: Only PMT variables which were significantly correlated with intention were entered in each regression model.

p < .05; **p* < .01; ***p* < .001; SE = Self-efficacy, VG = Video games

Table 4 Mediation analyses examining the indirect effect of PMT constructs on sedentary intention and behaviour

Model	Sobel test				95% CI for bootstrap indirect effect		
	Value	S.E.	z	p-value	Mean	S.E.	LL 95% CI
Model 1 (general)							
PV → Goal Intention → SB	0.09	0.09	0.95	0.34	0.08	0.10	-0.10, 0.28
PS → Goal Intention → SB	-0.03	0.06	-0.48	0.63	-0.02	0.06	-0.15, 0.12
RE → Goal Intention → SB	-0.08	0.09	-0.87	0.38	-0.07	0.08	-0.27, 0.07
Prod/Foc → Goal Intention → SB	0.00	0.00	0.63	0.53	0.00	0.00	-0.00, 0.09
Tired → Goal Intention → SB	0.06	0.00	1.23	0.22	0.00	0.00	-0.00, 0.01
TV/VG/Comp → Goal Intention → SB	-0.00	0.00	0.60	0.55	0.00	0.00	-0.00, 0.01
Study Library → Goal Intention → SB	0.00	0.00	0.49	0.63	0.00	0.00	-0.00, 0.01
Study Home → Goal Intention → SB	0.00	0.00	1.05	0.29	0.00	0.00	-0.00, 0.01
PS → Goal Intention → Imp Intention	-0.00	-.00	-0.16	0.87	-0.00	0.01	-0.01, 0.01
PV → Goal Intention → Imp Intention	0.00	0.00	0.34	0.73	0.00	0.01	-0.01, 0.02
RE → Goal Intention → Imp Intention	-0.09	0.01	-0.72	0.47	-0.01	-.01	-0.04, 0.01
Prod/Foc → Goal Intention → Imp Intention	0.00	0.00	-0.12	0.90	0.00	0.00	-0.00, 0.00
Tired → Goal Intention → Imp Intention	0.00	0.00	0.09	0.93	0.00	0.00	-0.00, 0.00
TV/VG/Comp → Goal Intention → Imp Intention	0.00	0.00	0.03	0.98	0.00	0.00	-0.00, 0.00
Study Library → Goal Intention → Imp Intention	0.00	0.00	-0.17	0.86	0.00	0.00	-0.00, 0.00
Study Home → Goal Intention → Imp Intention	-0.00	0.00	-0.20	0.84	0.00	0.00	-0.00, 0.00
PV → Imp Intention → SB	0.09	0.10	0.92	0.36	0.09	0.10	-0.07, 0.30
PS → Imp Intention → SB	-0.03	0.06	-0.52	0.60	-0.03	0.06	-0.14, 0.06

RE → Imp Intention → SB	-0.14	0.11	-1.22	0.22	-0.13	0.11	-0.38, 0.03
Prod/Foc → Imp Intention → SB	-0.00	0.00	-0.79	0.43	-0.00	0.00	-0.01, 0.00
Tired → Imp Intention → SB	-0.00	0.00	-0.12	0.90	-0.00	0.00	-0.01, 0.00
TV/VG/Comp → Imp Intention → SB	-0.00	0.00	-1.08	0.28	-0.00	0.00	-0.01, 0.00
Study Library → Imp Intention → SB	-0.00	0.00	-0.04	0.97	-0.00	0.00	-0.01, 0.00
Study Home → Imp Intention → SB	0.00	0.00	0.55	0.58	0.00	0.00	-0.00, 0.01
Goal Intention → Imp Intention → SB	-0.02	0.02	-0.78	0.43	-0.01	0.02	-0.06, 0.23
Model 2 (leisure)							
PV → Goal Intention → SB	0.00	0.08	0.07	0.95	0.00	0.08	-0.16, 0.16
PS → Goal Intention → SB	0.13	0.11	1.11	0.27	0.12	0.11	-0.08, 0.37
RE → Goal Intention → SB	0.04	0.10	0.38	0.71	0.04	0.10	-0.17, 0.24
Prod/Foc → Goal Intention → SB	-0.00	0.00	-0.98	0.33	-0.00	0.00	-0.01, 0.00
Tired → Goal Intention → SB	-0.00	0.00	-1.06	0.29	-0.00	0.00	-0.01, 0.00
TV/VG/Comp → Goal Intention → SB	-0.00	0.00	-0.40	0.69	-0.00	0.00	-0.01, 0.01
Study Library → Goal Intention → SB	0.00	0.00	0.27	0.79	0.00	0.00	-0.01, 0.01
Study Home → Goal Intention → SB	-0.00	0.00	-1.14	0.26	-0.00	0.00	-0.02, 0.00
PV → Goal Intention → Imp Intention	-0.00	0.01	-0.34	0.73	-0.00	0.00	-0.01, 0.01
PS → Goal Intention → Imp Intention	-0.00	0.01	-0.38	0.70	-0.00	0.00	-0.02, 0.01
RE → Goal Intention → Imp Intention	0.00	0.01	0.34	0.74	0.00	0.01	-0.01, 0.02
Prod/Foc → Goal Intention → Imp Intention	0.00	0.00	0.37	0.71	0.00	0.00	-0.00, 0.00
Tired → Goal Intention → Imp Intention	0.00	0.00	0.49	0.62	0.00	0.00	-0.00, 0.00
TV/VG/Comp → Goal Intention → Imp Intention	0.00	0.00	-0.14	0.89	0.00	0.00	-0.00, 0.00
Study Home → Goal Intention → Imp Intention	0.00	0.00	0.37	0.71	0.00	0.00	-0.00, 0.00
Study Library → Goal Intention → Imp Intention	0.00	0.00	0.30	0.76	0.00	0.00	-0.00, 0.00
PV → Imp Intention → SB	0.10	0.09	1.05	0.30	0.10	0.10	-0.07, 0.34
PS → Imp Intention → SB	-0.05	0.06	0.70	0.48	-0.05	0.07	-0.22, 0.06

RE → Imp Intention → SB	-0.07	0.08	-0.85	0.40	-0.07	0.09	-0.28, 0.09
Prod/Foc → Imp Intention → SB	-0.00	0.00	-1.04	0.30	-0.00	0.00	-0.01, 0.00
Tired → Imp Intention → SB	-0.00	0.00	-0.71	0.48	-0.00	0.00	-0.01, 0.00
TV/VG/Comp → Imp Intention → SB	-0.00	0.00	-0.67	0.50	-0.00	0.00	-0.01, 0.00
Study Library → Imp Intention → SB	-0.00	0.00	-0.10	0.32	-0.00	0.00	-0.01, 0.00
Study Home → Imp Intention → SB	-0.00	0.00	-1.02	0.31	-0.00	0.00	-0.01, 0.00
Goal Intention → Imp Intention → SB	-0.00	0.01	-0.10	0.92	-0.00	0.02	-0.03, 0.04

Note: PV = Perceived Vulnerability, PS = Perceived Severity, RE = Response Efficacy, Prod/Foc = Productive/Focused, VG = Video Games, Comp = Computer, SB = Sedentary Behaviour; Imp Intention = Implementation Intention; Boldface indicates significant indirect effect.

Chapter 4 : Discussion

4 Discussion

The first purpose of the present study was to examine the factor structure and composition of sedentary derived PMT constructs. Factor analysis findings support the tenability of an eight-factor PMT sedentary model representing PV, PS, RE, scheduling SE Tired, scheduling SE Productive/Focused, scheduling SE TV/Video games/Computer, scheduling SE Studying at home, scheduling SE Studying in library/Wi-Fi area. All constructs demonstrated a high degree of internal consistency. As recommended by DeCoster (1998) and Prapavessis, Gaston, and DeJesus (2015), EFA was first used to provide preliminary evidence for the sedentary derived PMT constructs, which was supported by CFA on a separate data set. This approach strengthened the psychometric findings of our model. As construct validation is an ongoing process, it is recommended that the emerging factor structure and composition of this measurement tool be cross-validated using different samples (Pedhazur & Schmelkin, 1991).

The second purpose of this study was to determine whether general and leisure sedentary derived PMT models can predict sedentary goal intention, implementation intention, and behaviour. It was hypothesized that irrespective of model type, the coping appraisals (RE, SE) would contribute to greater variance in goal intention than the threat appraisals (PV, PS; Hypothesis 1); goal intentions and the four PMT variables would explain unique and significant variance in implementation intentions with the former contributing to greater variance than the latter (Hypothesis 2); both implementation intention and goal intention would explain unique and significance variance in sedentary behaviour with the former contributing to greater variance than the latter (Hypothesis 3); and goal intention would explain sedentary behaviour through implementation intention (Hypothesis 4). In general, moderate-to-strong evidence was found for the prediction of implementation intention (Table 3) whereas only mild evidence was found for the prediction of goal intention (Table 2) and sedentary behaviour (Table 4). Specifically, 10% and 16% of the variance in implementation intention was explained in the general

and leisure model, respectively. In contrast, the models only explained 1-5% of the variance in goal intention and 1-3% of variance in sedentary behaviour.

This study provides theoretical inroads for the protection motivation theory model. The addition of implementation intention, the substitution of task SE with scheduling SE, the expansion of scheduling SE into psychological and situational events, and the assessment of scheduling SE items through ascending durations of break time (1-5 minutes, 6-10 minutes, 11-15 minutes) further develops the traditional protection motivation theory model and may increase the effectiveness in engendering sedentary behaviour change for future interventions.

4.1   Hypothesis 1

Hypothesis 1 was supported, in that the coping appraisals (RE, SE) contributed to greater variance in goal intention (β= .08-.21 general; .05-.16 leisure) than the threat appraisals (PS, PV; β= .03-.11 general; .02-.06 leisure). Specifically, RE and scheduling SE Studying at home were significant and salient independent contributors to goal intention (β= -.16, -.21, respectively) in the general model. Thus, scheduling breaks from sitting while studying at home may be an optimal context in which students may feel more in control to reduce their sedentary behaviour, as opposed to studying in the library or Wi-Fi area where social norms may play a larger role.

In regards to the threat appraisals, neither PV nor PS exhibited a significant association with goal intention in either model, contrary to previous findings. Other PMT literature for physical activity also supports the observed distal effect of threat perceptions on protection motivation, although previous findings still observed a significant effect (Floyd, Prentice-Dunn, & Rogers, 2000; Milne et al., 2000; Plotnikoff, Rhodes, & Trinh, 2009). Researchers suggest that threat recognition may only prompt action contemplation, but it is efficacy and feasibility cognitions that form intention and subsequent action (Ruiter, Abraham, & Kok, 2001). The overall perception of being vulnerable to developing metabolic deterioration was very low (M_{PV} = 3.06, SD = 1.25), likely due to the young mean age of the present study. Low threat awareness may have been because the immediacy of the onset of metabolic deterioration was distant, the

visibility of the symptoms of metabolic deterioration was low, and the rate of onset of metabolic deterioration was gradual (Smith-Klohn & Rogers, 1991). In turn, participants would have been less motivated to protect themselves from the threat, and thus, less likely to form a behavioural intention to adopt the protective behaviour to sit less (Milne et al., 2000). Despite coping appraisals being better predictors for intention, experimental manipulations of threat appraisals appear to be more successful than coping appraisals in changing beliefs (Milne et al., 2000). In conclusion, future studies should focus on developing the severity and vulnerability of metabolic deterioration, given its potential to significantly reduce sedentary behaviour, as well as forming strong RE and scheduling SE studying at home cognitions.

4.2   Hypothesis 2

Our findings partially supported Hypothesis 2. Goal intention explained a significant 10% (general) and 16% (leisure) of the variance in implementation intention, but goal intention (β= .06 general; -.07 leisure) did not make significant and unique contributions to implementation intention compared to the four PMT constructs (β= -.02- .24 general; -.03- -.25 leisure).

Goal intention was not a significant predictor when it was entered in the first step of hierarchical regression, accounting for 0% (general) and 1% (leisure) of the variance in implementation intention, $F(1, 234) = .02$ (general), $F(1, 250) = 1.25$ (leisure). However, when the four PMT constructs were added in the second step, they significantly increased the predictive utility of the model, explaining an additional 14% (general) and 19% (leisure) of the variance in implementation intention. An examination of beta coefficients revealed that PV, RE, and scheduling SE Productive/Focused (general), and PV, RE, and scheduling SE Studying at home (leisure), made significant and unique contributions to implementation intention.

Despite goal intention being the closest proxy to implementation intention, it did not make greater, unique contributions than the more distal proxies (PV, PS, RE, SE). Pearson correlation findings also indicated no significant relationship between goal intention and implementation intention. In other words, the amount of time one expects,

plans, or intends to sit, was not related to knowing when, where and how one would sit less. At first glance, this may seem odd because implementation intentions are subordinate to goal intentions (Gollwitzer, 1999). Logically speaking, goal intentions should make some significant contributions to the prediction of implementation intention. However, further examination of this relationship points to the difference in the sedentary goals between the two intentions constructs. Goal intention measured the expected amount of time one would sit over the next week, whereas implementation intention measured when, where, and how one would sit *less* over the next week. Goal intention may have led to stronger associations with implementation intention if it assessed goal intentions to sit *less*, but our rationale was adhering to the study's purpose of merely understanding individuals' current sedentary cognitions. The study did not aim to manipulate sedentary cognitions so that individuals would sit less. Another explanation could be the lack of scale correspondence between the two constructs. Goal intention was measured temporally (i.e., none, 15 min, 30 min, 1h, 2h … etc.) whereas implementation intention was measured on a seven-point Likert scale of agreement. Future studies should determine one consistent scale for goal intention, implementation intention, and sedentary behaviour since previous physical activity research has shown the intention-behaviour relationship to be stronger when there is scale congruence between the measures (Courneya & McAuley, 1995; Maddison & Prapavessis, 2004).

In a comparable study that utilized a PMT framework with implementation intention to examine exercise's role in preventing maternal-fetal disease, goal intention explained 18.6% of the variance in implementation intention and an additional 7.0% of the variance was explained once RE and SE was added (Gaston & Prapavessis, 2009). Similar to the present study, SE made significant and unique contributions to implementation intention. Since Gaston and Prapavessis (2009) were conducting an intervention, goal intention was measured by one's intentions to start exercising in order to reduce their risk of health problems. Conversely, the current study did not measure intentions to sit less in order to reduce their risk of metabolic deterioration because it was not an intervention study and we were only assessing individuals' sedentary cognitions based on whatever knowledge they knew about sedentary behaviour.

Potential reasons for why PV, RE, scheduling SE Productive/Focused, scheduling SE Studying at home were salient contributors to implementation intention are the following. It was expected that the coping appraisals would make unique contributions based on previous literature (Gaston & Prapavessis, 2009), but it was surprising that PV was also a significant contributor. Pearson correlations indicated a significant negative relationship with implementation intention (-.19, general; -.26, leisure) suggesting that high perceptions of vulnerability to metabolic deterioration was associated with low perceptions of planning when, where, and how to sit less. Defense denial offers a possible explanation for this counterintuitive negative relationship. Since the average age of our sample was young, it was possible that participants were in denial about being at risk of metabolic deterioration as indicated by their relatively low PV scores. As participants felt more vulnerable to metabolic deterioration, defensive denial may have manifested by participants making fewer plans on how to sit less as a protective mechanism. However, this is speculative and requires testing. This is important for future studies because manipulation of PV may be a key player in improving implementation intentions that in turn, can reduce sedentary behaviour.

Lastly, some clarification is needed in defining implementation intention in our model. In the literature, the term, "action-planning" is frequently used synonymously with the term, "implementation intention" because of some overlapping features such as the cue-response contingency and linking an unconditional cue with a behavioural response (Hagger & Luszczynska, 2014). However, there are differences in how the two terms are conceptualized and operationalized. Implementation intention follows an explicit "if-then" formula, which tends to target a single cue-to-action response. On the other hand, action-planning follows a less concrete "if-then" formula by identifying when, where and how one may conduct a broader set of behavioural responses. The "how" component is a distinguishing feature that separates action-planning from implementation intention. It is suggested that action-planning involves deliberate and conscious processing whereas implementation intention involves automatic and non-conscious processing (Hagger & Luszczynska, 2014). Therefore, it is more correct to use the term, "action-planning" for the present study due to the wording of the items (i.e., "I

know [what/when/where] I can sit less on a typical day over the next week"). Future prediction and intervention studies should be aware of these differences.

4.3   Hypothesis 3

Contrary to Hypothesis 3, only goal intention explained a statistically significant 3% of the variance in sedentary behaviour in the leisure model only. Implementation intention did not explain more variance than goal intention (0-1% vs. 0-3%) in either model.

Unlike our findings, Prapavessis et al. (2015) found sedentary intentions to explain greater variance in sedentary behaviour (2-36%). This is likely attributable to the short time interval between the assessment of intentions and behavior in the Prapavessis et al. (2015) study. Participants completed the SBQ on the same day prior to the TPB questionnaire, possibly reflecting on their sitting time right before their TPB cognitions. In the present study, sedentary behaviour was assessed one week after participants completed the PMT questionnaire. It is suggested that the strength of association between intention and behaviour diminishes as the time interval between intention and behaviour increases, because intention becomes more malleable to new information (Conner, Sheeran, Norman, & Armitage, 2000). This is further supported by evidence from Milne et al. (2000) who found intention to have the strongest and most consistent association with concurrent behaviour, in comparison to only medium to strong correlations for subsequent behaviour. In short, the one-week lapse may have weakened the association between sedentary intention and behaviour in the present study.

There are plausible explanations for why implementation intention performed so poorly in predicting sedentary behaviour. For instance, the small variances being explained by implementation intention may be due to the demographics of our sample. Our sample of university students (M_{age} = 19.44 years, SD = 1.81) was considerably younger than Prapavessis' et al. (2015) sample of working professionals, summer and graduate students (M_{age} = 39.93 years, SD = 12.69). University students have varying durations of class time per day and as well as possible extracurricular commitments, likely weakening the association between implementation intention and behaviour. Thus, it may have been more difficult for students to plan when, where, and how they would sit

less during the upcoming week in comparison to working professionals who may have a routine and fixed 9-5pm work schedule each day. Although our sample may have had strong goal intentions to sit less during the upcoming week (β= .14-.21), a student's schedule is far more complex and inconsistent on a day-to-day basis, making it difficult to execute the implementation intention.

Gollwitzer (1999) explained that the strength of the implementation intention effect depends on the difficulty of the behaviour and strength of commitment. In our study, action initiation may have been too easy to begin with (i.e., sitting less on a typical day), and thus, automatization through implementation intention may not have produced an additional advantage. Furthermore, rigid adherence to plans (i.e., high commitment) has been shown exhibit stronger implementation intention effects than having flexible plans (i.e., low commitment; Gollwitzer, 1999). Since we were only assessing students' current perceptions on sedentary behaviour (and not manipulating), it was not surprising to see an overall low commitment to sit less and hence, a minimal percent of variance being explained by implementation intention.

Since there was poor association between implementation intention and sedentary behaviour, one may postulate that general planning may be more advantageous than specific planning to decrease sedentary behavior. However, this suggestion errs on the side of caution. In a recent study by Mistry and colleagues (2015), individuals who created higher quality action plans (i.e., implementation intentions) were not more likely to change their physical activity than those who created vague plans. Authors noted that while specific plans may facilitate the quick and accurate identification of cues to action, vague plans allow for flexibility in the event that specific cues are not identified or missed. Unlike other health behaviours (e.g., physical activity, smoking cessation) that require conscious thought and planning, sedentary behaviour is much more pervasive and habitual, indicating that general planning may be more suitable. For example, general plans to stand up while taking the bus may be more beneficial than forming specific plans to stand up while taking the bus on Monday, Wednesday, and Friday. Creating restrictions on exactly when to decrease sedentary behaviour may actually make the execution more complicated and harder to remember because it happens so frequently.

However, very few studies have tested the effects of vague plans relative to specific plans (de Vet, Oenema, & Brug, 2011; Mistry et al., 2015).

On the other hand, the lack of specificity in the implementation intention items may have contributed to the lack of variance being explained by implementation intention for sedentary behaviour. Implementation intention is thought to lead to automaticity when a goal-directed behaviour (i.e., sitting less) is linked to a selected situation (i.e., one of the 12 SBQ contexts). It is possible that the situational cues in the stem of the intention items needed to be more specific in order to prompt heightened recognition and activation that typically occurs during implementation intention. For example, rather than using the stem, "for personal, leisure, or recreational pursuits" in the leisure model, an alternative such as, "when watching TV, on the computer for recreational purposes, reading for pleasure, listening to music, doing arts and crafts, in a motor vehicle for leisure related transportation purposes, or socializing for non-work related phone conversations" may have lead to stronger associations.

4.4   Hypothesis 4

There essentially was no support for mediation (Hypothesis 4) in the present study. The Sobel test indicated no significant indirect relationships between goal intention and sedentary behaviour via implementation intention in both models. Although the 95% CIs for the bootstrapped sampling distribution crossed zero indicating a significant indirect relationship for the general and leisure models (-.06, .23 and -.03, .04, respectively), the mean of each test was quite low (0.01 and -.00, respectively). These preliminary findings show that implementation intention may not play a large role in changing sedentary behaviour given its minor direct and indirect effects. However, the predictive utility for implementation intention was the strongest in explaining the most variance out of all the other predictive models. This is encouraging because implementation intention is the closest proxy to sedentary behaviour and has the most tangible application for future interventions (i.e., identifying when, where, and how to sit less). Thus, future interventions should focus on decreasing the gap between intention and sedentary behaviour (i.e., intention-behaviour gap). Due to the findings from Hypothesis 3, the weak direct relationship between implementation intention and sedentary behaviour may

have influenced the weak indirect relationship that implementation intention mediated between goal intention and sedentary behaviour.

The current study also examined all other possible indirect relationships due to the exploratory nature of the PMT framework. The indirect pathways that had the largest means from the bootstrapped sampling distributions were (1) response efficacy to sedentary behaviour via implementation intention ($M = -.13$; general), (2) perceived severity to sedentary behaviour via goal intention ($M = .12$; leisure), and (3) perceived vulnerability to sedentary behaviour via implementation intention ($M = .10$; leisure). Implementation intention and goal intention may have a role in facilitating some mediation between the PMT variables (RE, PV, PS) and sedentary behaviour, but more work is needed.

4.5   Sedentary Behaviour Questionnaire (SBQ)

The present sample appears to sit an average of 13.71 hours per day ($SD = 4.92$) in the general model, and 8.16 (5.51) hours per day in the leisure model. Sitting for school or work had the highest reported hours of sitting time ($M = 6.14$, $SD = 2.50$), followed by sitting and using the computer for recreation purposes ($M = 2.99$, $SD = 2.50$).

4.6   Strengths and Limitations

Strengths

There are a number of strengths in the present study including a robust factor analysis design where both EFA and CFA were employed. Sedentary behaviour was assessed prospectively (i.e., one week after sedentary intentions), which extends the existing cross-sectional research. Thus, reliability and validity evidence was provided. Moreover, there was scale correspondence between goal intention and sedentary behaviour measurements, which has been shown to strengthen the intention-behaviour relationship from physical activity research (Courneya & McAuley, 1995; Maddison & Prapavessis, 2004). Lastly, conducting a focus group to determine the most relevant health consequence was advantageous because it informed our decision to select metabolic deterioration as the health problem for PMT.

Limitations

Despite the aforementioned strengths, the study is not without limitations. Sedentary behaviour was measured using a self-report method (SBQ). Subsequently, a large portion of data were considered implausible and were removed due to an over-reporting of sedentary time (>24h). Future studies should objectively measure sedentary behaviour (e.g., activPAL). Due to the prospective design, 30% of the sample that completed the first survey failed to complete the second survey. Additionally, the SBQ was modified with the addition of three items and expansion of response times. Future studies should examine the measurement of agreement between this modified scale and an objective criterion (e.g., accelerometer counts <100). Importantly, the results can only be generalized to a university population, and more work needs to be done to determine its applicability to other populations such as children, adults, and older adults. It is likely that a different age group, such as older adults, may have a stronger threat perception towards metabolic deterioration compared to university students. Since the visibility of symptoms, and immediacy and rate of the onset of metabolic deterioration is more proximal in older adults, protection motivation cognitions could increase, which could then decrease sedentary time. As a result, the overall predictability of the model would strengthen considerably, due to the significant and unique contribution PV made for implementation intention.

4.7　Conclusions

The present study explored the utility of a modified PMT framework for understanding sedentarism. Preliminary findings now exist to support the tenability of an eight-factor PMT sedentary model in university students. Stronger evidence was found for the utility of a sedentary derived PMT framework for predicting implementation intentions than for predicting goal intention and sedentary behaviour. Separating general and leisure sedentary behaviour may not be necessary, but more predictive evidence is required before PMT can be used as a framework to guide intervention studies to more effectively reduce sedentary behaviour.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. *Action control: From cognition to behavior* (pp. 11-39). Springer Berlin Heidelberg.

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review, 6*(2), 107-122.

Alderman, B. L., Olson, R. L., & Mattina, D. M. (2014). Cognitive function during low-intensity walking: A test of the treadmill workstation. *Journal of Physical Activity & Health, 11*(4), 752-758. doi:10.1123/jpah.2012-0097; 10.1123/jpah.2012-0097

Alkhajah, T. A., Reeves, M. M., Eakin, E. G., Winkler, E. A. H., Owen, N., & Healy, G. N. (2012). Sit–Stand workstations: A pilot intervention to reduce office sitting time. *American Journal of Preventive Medicine, 43*(3), 298-303. doi:http://dx.doi.org/10.1016/j.amepre.2012.05.027

Bailey, D. P., & Locke, C. D. (2015). Breaking up prolonged sitting with light-intensity walking improves postprandial glycemia, but breaking up sitting with standing does not. *Journal of Science and Medicine in Sport, 18*(3), 294-298. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1016/j.jsams.2014.03.008

Bandura, A. (1986). Social foundations of thought and action: A social-cognitive view. Prentice-Hall, Inc.

Beers, E. A., Roemmich, J. N., Epstein, L. H., & Horvath, P. J. (2008). Increasing passive energy expenditure during clerical work. *European Journal of Applied Physiology, 103*(3), 353-360. doi:10.1007/s00421-008-0713-y; 10.1007/s00421-008-0713-y

Böhmer, M., Hecht, B., Schöning, J., Krüger, A., & Bauer, G. (2011). Falling asleep with angry birds, facebook and kindle: A large scale study on mobile application usage. Paper presented at the *Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Services,* 47-56.

Bond, D. S., Thomas, J. G., Raynor, H. A., Moon, J., Sieling, J., Trautvetter, J., . . . Wing, R. R. (2014). B-MOBILE--a smartphone-based intervention to reduce sedentary time in overweight/obese individuals: A within-subjects experimental trial. *PloS One, 9*(6), e100821. doi:10.1371/journal.pone.0100821; 10.1371/journal.pone.0100821

Breland, J. Y., Fox, A. M., & Horowitz, C. R. (2013). *Screen time, physical activity and depression risk in minority women.* Elsevier. doi:10.1016/j.mhpa.2012.08.002

Canadian Fitness and Lifestyle Research Institute. (2002). 2002 physical activity monitor. Retrieved April, 2015, from http://www.cflri.ca

Canadian Society for Exercise Physiology. (2012). *Statement on the standardized use of the terms "sedentary" and "sedentary behaviours".* Retrieved April 2015 from http://www.csep.ca/english/view.asp?x=724&id=385

Canadian Society for Exercise Physiology. (2014). Canadian sedentary behaviour guidelines. Retrieved from http://www.csep.ca/english/view.asp?x=804

Carmines, E. G., & McIver, J. P. (1981). Analyzing models with unobservable variables. In G. W. Bohrnstedt, & E. F. Borgatta (Eds.), *Social measurement: Current issues* (pp. 65-115). Beverly Hills, CA: Sage.

Carr, L. J., Karvinen, K., Peavler, M., Smith, R., & Cangelosi, K. (2013). Multicomponent

intervention to reduce daily sedentary time: A randomised controlled trial. *BMJ Open, 3*(10)

doi:10.1136/bmjopen-2013-003261; 10.1136/bmjopen-2013-003261

Carr, L. J., Walaska, K. A., & Marcus, B. H. (2012). Feasibility of a portable pedal exercise

machine for reducing sedentary time in the workplace. *British Journal of Sports Medicine,

46*(6), 430-435. doi:10.1136/bjsm.2010.079574; 10.1136/bjsm.2010.079574

Cavalot, F., Petrelli, A., Traversa, M., Bonomo, K., Fiora, E., Conti, M., . . . Trovati, M. (2006).

Postprandial blood glucose is a stronger predictor of cardiovascular events than fasting blood

glucose in type 2 diabetes mellitus, particularly in women: Lessons from the san luigi

gonzaga diabetes study. *The Journal of Clinical Endocrinology and Metabolism, 91*(3), 813-

819. doi:10.1210/jc.2005-1005

Chastin, S. F., Fitzpatrick, N., Andrews, M., & DiCroce, N. (2014). Determinants of sedentary

behavior, motivation, barriers and strategies to reduce sitting time in older women: A

qualitative investigation. *International Journal of Environmental Research and Public

Health, 11*(1), 773-791. doi:10.3390/ijerph110100773; 10.3390/ijerph110100773

Chau, J. Y., Daley, M., Dunn, S., Srinivasan, A., Do, A., Bauman, A. E., & van der Ploeg, H. P.

(2014). The effectiveness of sit-stand workstations for changing office workers' sitting time:

Results from the Stand@Work randomized controlled trial pilot. *The International Journal

of Behavioral Nutrition and Physical Activity, 11*, 127-014-0127-7. doi:10.1186/s12966-014-

0127-7; 10.1186/s12966-014-0127-7

Chau, J. Y., Grunseit, A., Midthjell, K., Holmen, J., Holmen, T. L., Bauman, A. E., & van der

Ploeg, H. P. (2014). Cross-sectional associations of total sitting and leisure screen time with

cardiometabolic risk in adults. Results from the HUNT study, Norway. *Journal of Science*

and Medicine in Sport / Sports Medicine Australia, 17(1), 78-84.

doi:10.1016/j.jsams.2013.03.004; 10.1016/j.jsams.2013.03.004

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155.

Colley, R. C., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. S. (2011). Physical activity of Canadian adults: Accelerometer results from the 2007 to 2009 Canadian health measures survey.

Commissaris, D., Douwes, M., Schoenmaker, N., & de Korte, E. (2006). Recommendations for sufficient physical activity at work. Paper presented at the *Proceedings of the IEA 2006 Conference, Maastricht,*

Conner, M., Sheeran, P., Norman, P., & Armitage, C. J. (2000). Temporal stability as a moderator of relationships in the theory of planned behaviour. *The British Journal of Social Psychology, 39*, 469-93. Retrieved from http://search.proquest.com.proxy1.lib.uwo.ca/docview/219191231?accountid=15115

Courneya, K., & Hellsten, L. (2001). Cancer prevention as a source of exercise motivation: An experimental test using protection motivation theory. *Psychology, Health & Medicine, 6*(1), 59-64.

Courneya, K., & McAuley, E. (1995). Cognitive mediators of the social influence-exercise adherence relationship: A test of the theory of planned behavior. *Journal of Behavioral Medicine, 18*(5), 499-515.

Dantzig, S., Geleijnse, G., & Halteren, A. T. (2013). Toward a persuasive mobile application to reduce sedentary behavior. *Personal and Ubiquitous Computing, 17*(6), 1237-1246.

de Vet, E., Oenema, A., & Brug, J. (2011). More or better: Do the number and specificity of implementation intentions matter in increasing physical activity? *Psychology of Sport and Exercise, 12*(4), 471-477. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1016/j.psychsport.2011.02.008

Drury, C. G., Hsiao, Y. L., Joseph, C., Joshi, S., Lapp, J., & Pennathur, P. R. (2008). Posture and performance: Sitting vs. standing for security screening. *Ergonomics, 51*(3), 290-307. doi:10.1080/00140130701628790; 10.1080/00140130701628790

Dutta, N., Walton, T., & Pereira, M. A. (2014). Experience of switching from a traditional sitting workstation to a sit-stand workstation in sedentary office workers. *Work,* doi:10.3233/WOR-141971

Edelson, N., & Danoffz, J. (1989). Walking on an electric treadmill while performing VDT office work. *ACM SIGCHI Bulletin, 21*(1), 72-77. doi:10.1145/67880.67890

Floyd, D. L., Prentice-Dunn, S., & Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology, 30*(2), 407-429.

Gardiner, P. A., Eakin, E. G., Healy, G. N., & Owen, N. (2011). Feasibility of reducing older adults' sedentary time. *American Journal of Preventive Medicine, 41*(2), 174-177.

Gaston, A., & Prapavessis, H. (2009). Maternal-fetal disease information as a source of exercise motivation during pregnancy. *Health Psychology, 28*(6), 726-733. doi:10.1037/a0016702; 10.1037/a0016702

Gilson, N. D., Suppini, A., Ryde, G. C., Brown, H. E., & Brown, W. J. (2012). Does the use of standing 'hot' desks change sedentary work time in an open plan office? *Preventive Medicine, 54*(1), 65-67. doi:http://dx.doi.org/10.1016/j.ypmed.2011.10.012

Godin, G., Sheeran, P., Conner, M., & Germain, M. (2008). Asking questions changes behavior: Mere measurement effects on frequency of blood donation. *Health Psychology, 27*(2), 179.

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences.Journal Canadien Des Sciences Appliquees Au Sport, 10*(3), 141-146.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*(7), 493-503. doi:10.1037/0003-066X.54.7.493

Graham, S. P., Prapavessis, H., & Cameron, L. D. (2006). Colon cancer information as a source of exercise motivation. *Psychology and Health, 21*(6), 739-755.

Greenwood-Hickman, M. A., Renz, A., & Rosenberg, D. E. (2015). Motivators and barriers to reducing sedentary behavior among overweight and obese older adults. *The Gerontologist,* doi:10.1093/geront/gnu163

Hagger, M. S., & Luszczynska, A. (2014). Implementation intention and action planning interventions in health contexts: State of the research and proposals for the way forward. *Applied Psychology: Health and Well-Being, 6*(1), 1-47. doi:10.1111/aphw.12017

Hamburg, N. M., McMackin, C. J., Huang, A. L., Shenouda, S. M., Widlansky, M. E., Schulz, E., . . . Vita, J. A. (2007). Physical inactivity rapidly induces insulin resistance and microvascular dysfunction in healthy volunteers. *Arteriosclerosis, Thrombosis, and Vascular Biology, 27*(12), 2650-2656. doi:10.1161/ATVBAHA.107.153288

Hamilton, M. T., Healy, G. N., Dunstan, D. W., Zderic, T. W., & Owen, N. (2008). Too little exercise and too much sitting: Inactivity physiology and the need for new recommendations

on sedentary behavior. *Current Cardiovascular Risk Reports, 2*(4), 292-298.

doi:10.1007/s12170-008-0054-8

Healy, G. N., Dunstan, D. W., Salmon, J., Cerin, E., Shaw, J. E., Zimmet, P. Z., & Owen, N.

(2008). Breaks in sedentary time: Beneficial associations with metabolic risk. *Diabetes Care, 31*(4), 661-666. doi:10.2337/dc07-2046; 10.2337/dc07-2046

Healy, G. N., Dunstan, D. W., Salmon, J., Shaw, J. E., Zimmet, P. Z., & Owen, N. (2008).

Television time and continuous metabolic risk in physically active adults. *Medicine and Science in Sports and Exercise, 40*(4), 639-645. doi:10.1249/MSS.0b013e3181607421; 10.1249/MSS.0b013e3181607421

Healy, G. N., Eakin, E. G., Lamontagne, A. D., Owen, N., Winkler, E. A., Wiesner, G., . . .

Dunstan, D. W. (2013). Reducing sitting time in office workers: Short-term efficacy of a multicomponent intervention. *Preventive Medicine, 57*(1), 43-48. doi:10.1016/j.ypmed.2013.04.004; 10.1016/j.ypmed.2013.04.004

Healy, G. N., Wijndaele, K., Dunstan, D. W., Shaw, J. E., Salmon, J., Zimmet, P. Z., & Owen, N.

(2008). Objectively measured sedentary time, physical activity, and metabolic risk: The Australian diabetes, obesity and lifestyle study (AusDiab). *Diabetes Care, 31*(2), 369-371. doi:10.2337/dc07-1795

Higgins, A., & Conner, M. (2003). Understanding adolescent smoking: The role of the theory of

planned behaviour and implementation intentions. *Psychology, Health & Medicine, 8*(2), 173-186. doi:10.1080/1354850031000087555

Hu, F. B., Leitzmann, M. F., Stampfer, M. J., Colditz, G. A., Willett, W. C., & Rimm, E. B.

(2001). Physical activity and television watching in relation to risk for type 2 diabetes mellitus in men. *Archives of Internal Medicine, 161*(12), 1542-1548.

Hu, F. B., Li, T. Y., Colditz, G. A., Willett, W. C., & Manson, J. E. (2003). Television watching
      and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in
      women. *Jama, 289*(14), 1785-1791. doi:10.1001/jama.289.14.1785

Jacobs, D. R.,Jr, Ainsworth, B. E., Hartman, T. J., & Leon, A. S. (1993). A simultaneous
      evaluation of 10 commonly used physical activity questionnaires. *Medicine and Science in
      Sports and Exercise, 25*(1), 81-91.

John, D., Thompson, D. L., Raynor, H., Bielak, K., Rider, B., & Bassett, D. R. (2011). Treadmill
      workstations: A worksite physical activity intervention in overweight and obese office
      workers. *Journal of Physical Activity & Health, 8*(8), 1034-1043.

Kaiser, H. (1970). A second generation little jiffy. *Psychometrika* (35th ed., pp. 401-415).

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika* (39th ed., pp. 31-36).

Karakolis, T., & Callaghan, J. P. (2014). The impact of sit–stand office workstations on worker
      discomfort and productivity: A review. *Applied Ergonomics, 45*(3), 799-806.
      doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1016/j.apergo.2013.10.001

Katzmarzyk, P. T., Church, T. S., Craig, C. L., & Bouchard, C. (2009). Sitting time and mortality
      from all causes, cardiovascular disease, and cancer. *Medicine and Science in Sports and
      Exercise, 41*(5), 998-1005.

Katzmarzyk, P. T., & Tremblay, M. S. (2007). Limitations of Canada's physical activity data:
      Implications for monitoring trends. *Applied Physiology, Nutrition, and Metabolism,
      32*(S2E), S185-S194.

Katzmarzyk, P. T. (2014). Standing and mortality in a prospective cohort of Canadian adults. *Medicine and Science in Sports and Exercise, 46*(5), 940-946. doi:10.1249/MSS.0000000000000198; 10.1249/MSS.0000000000000198

Katzmarzyk, P. T., & Lee, I. M. (2012). Sedentary behaviour and life expectancy in the USA: A cause-deleted life table analysis. *BMJ Open, 2*(4), 10.1136/bmjopen-2012-000828. Print 2012. doi:10.1136/bmjopen-2012-000828; 10.1136/bmjopen-2012-000828

Katzmarzyk, P. T. (2010). Physical activity, sedentary behavior, and health: Paradigm paralysis or paradigm shift? *Diabetes, 59*(11), 2717-2725.

Kenny, D. A. (2014,). Measuring model fit. Retrieved April 2015, from http://davidakenny.net/cm/fit.htm

Ku, P. O., Fox, K. R., Chen, L. I., & Chou, P. (2011). Physical activity, sedentary time and subjective well-being in Taiwanese older adults. *International Journal of Sport Psychology, 42*(3), 245-262.

Lanningham-Foster, L., Nysse, L. J., & Levine, J. A. (2003). Labor saved, calories lost: The energetic impact of domestic labor-saving devices. *Obesity Research, 11*(10), 1178-1181.

Lavin, D., & Groarke, A. (2005). Dental floss behaviour: A test of the predictive utility of the theory of planned behaviour and the effects of making implementation intentions. *Psychology, Health & Medicine, 10*(3), 243-252. doi:10.1080/13548500412331334127

MacEwen, B. T., MacDonald, D. J., & Burr, J. F. (2015). A systematic review of standing and treadmill desks in the workplace. *Preventive Medicine, 70*, 50-58. doi:10.1016/j.ypmed.2014.11.011; 10.1016/j.ypmed.2014.11.011

Maddison, R., & Prapavessis, H. (2004). Using self-efficacy and intention to predict exercise compliance among patients with ischemic heart disease. *Journal of Sport & Exercise Psychology, 26*, 511-524.

McAuley, E., & Mihalko, S. (1998). Measuring exercise-related self-efficacy. *Advances in Sport and Exercise Psychology Measurement,* 371-390.

Milne, S., Sheeran, P., & Orbell, S. (2000). Prediction and intervention in health-related behavior: A meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology, 30*(1), 106-143.

Mistry, C. D., Sweet, S. N., Rhodes, R. E., & Latimer-Cheung, A. (2015). Text2Plan: Exploring changes in the quantity and quality of action plans and physical activity in a text messaging intervention. *Psychology & Health,* 1-18. doi:10.1080/08870446.2014.997731

Morwitz, V. G., & Fitzsimons, G. J. (2004). The mere-measurement effect: Why does measuring intentions change actual behavior? *Journal of Consumer Psychology, 14*(1), 64-74.

Morwitz, V. G., Johnson, E., & Schmittlein, D. (1993). Does measuring intent change behavior? *Journal of Consumer Research,* 46-61.

My Byline Media. (n.d.). The flesch grade level readability formula. Retrieved April 2015, from http://www.readabilityformulas.com/flesch-grade-level-readability-formula.php

Norman, P., Boer, H., & Seydel, E. R. (2005). Predicting health behavior: Research and practice with social cognition models. In M. Conner, & P. Norman (Eds.), *Protection motivation theory* (2nd ed., pp. 81-126). Buckingham: Open University Press.

Owen, N., Healy, G. N., Matthews, C. E., & Dunstan, D. W. (2010). Too much sitting: The
population health science of sedentary behavior. *Exercise and Sport Sciences Reviews, 38*(3),
105-113. doi:10.1097/JES.0b013e3181e373a2; 10.1097/JES.0b013e3181e373a2

Pallant, J. (2013). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*
(5th ed.). Berkshire, England: McGraw-Hill.

Parry, S., Straker, L., Gilson, N. D., & Smith, A. J. (2013). Participatory workplace interventions
can reduce sedentary time for office workers--a randomised controlled trial. *PloS One, 8*(11),
e78957. doi:10.1371/journal.pone.0078957; 10.1371/journal.pone.0078957

Pedhazur, E., & Schmelkin, L. (1991). *Measurement, design, and analysis: An integrated
approach*. Hillsdale, New Jersey: Erlbaum.

Plotnikoff, R. C., Lippke, S., Trinh, L., Courneya, K. S., Birkett, N., & Sigal, R. J. (2010).
Protection motivation theory and the prediction of physical activity among adults with type 1
or type 2 diabetes in a large population sample. *British Journal of Health Psychology, 15*(Pt
3), 643-661. doi:10.1348/135910709X478826; 10.1348/135910709X478826

Plotnikoff, R. C., Lubans, D. R., Penfold, C. M., & Courneya, K. S. (2013). Testing the utility of
three social-cognitive models for predicting objective and self-report physical activity in
adults with type 2 diabetes. *British Journal of Health Psychology,* doi:10.1111/bjhp.12085;
10.1111/bjhp.12085

Plotnikoff, R. C., Rhodes, R. E., & Trinh, L. (2009). Protection motivation theory and physical
activity: A longitudinal test among a representative population sample of Canadian adults.
Journal of Health Psychology, 14(8), 1119-1134. doi:10.1177/1359105309342301;
10.1177/1359105309342301

Prapavessis, H., Gaston, A., & DeJesus, S. (2015). The theory of planned behavior as a model for understanding sedentary behavior. *Psychology of Sport and Exercise, 19*(0), 23-32. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1016/j.psychsport.2015.02.001

Preacher, K., & Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36*(4), 717-731. doi:10.3758/BF03206553

Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice, 19*(3), 276-288. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1037/h0088437

Proper, K. I., Singh, A. S., Van Mechelen, W., & Chinapaw, M. J. (2011). Sedentary behaviors and health outcomes among adults: A systematic review of prospective studies. *American Journal of Preventive Medicine, 40*(2), 174-182.

Rachlin, H. (1989). *Judgement, decision, and choice: A cognitive behavioral synthesis*. New York: WH Freeman.

Rhodes, R. E., & Dean, R. N. (2009). Understanding physical inactivity: Prediction of four sedentary leisure behaviors. *Leisure Sciences, 31*(2), 124-135.

Rhodes, R. E., Mark, R. S., & Temmel, C. P. (2012). Adult sedentary behavior: A systematic review. *American Journal of Preventive Medicine, 42*(3), e3-e28. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1016/j.amepre.2011.10.020

Roelofs, A., & Straker, L. (2002). The experience of musculoskeletal discomfort amongst bank tellers who just sit, just stand or sit and stand at work. *Ergonomics SA, 14*(2), 11-29.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology, 91*(1), 93-114.

Rogers, R. W. (1983). Social psychology: A sourcebook. In I. Cacioppo J, & R. Petty (Eds.), *Cognitive and psychological processes in fear appeals and attitude change: A revised theory of protection motivation* (pp. 153-176). New York: Guilford Press.

Rosenberg, D. E., Norman, G. J., Wagner, N., Patrick, K., Calfas, K. J., & Sallis, J. F. (2010). Reliability and validity of the sedentary behavior questionnaire (SBQ) for adults. *Journal of Physical Activity & Health, 7*(6), 697-705.

Ruiter, R. A., Abraham, C., & Kok, G. (2001). Scary warnings and rational precautions: A review of the psychology of fear appeals. *Psychology and Health, 16*(6), 613-630.

Salmon, J., Owen, N., Crawford, D., Bauman, A., & Sallis, J. F. (2003). Physical activity and sedentary behavior: A population-based study of barriers, enjoyment, and preference. *Health Psychology, 22*(2), 178-188. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1037/0278-6133.22.2.178

Saunders, T. J., Larouche, R., Colley, R. C., & Tremblay, M. S. (2012). Acute sedentary behaviour and markers of cardiometabolic risk: A systematic review of intervention studies. *Journal of Nutrition and Metabolism, 2012*, 712435. doi:10.1155/2012/712435; 10.1155/2012/712435

Schutz, R. W., & Gessaroli, M. E. (1993). Use, misuse, and disuse of psychometrics in sport psychology research. In R. N. Singer, M. M. Murphey & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 901-917). New York: MacMillan.

Smith, A., & Biddle, S. (1999). Attitudes and exercise adherence: Test of the theories of reasoned action and planned behaviour. *Journal of Sports Sciences, 17*(4), 269-281. doi:10.1080/026404199365993

Smith-Klohn, L., & Rogers, R. W. (1991). Dimensions of the severity of a health threat: The persuasive effects of visibility, time of onset, and rate of onset on young women's intentions to prevent osteoporosis. *Health Psychology, 10*(5), 323-329. doi:http://dx.doi.org.proxy1.lib.uwo.ca/10.1037/0278-6133.10.5.323

Straker, L., Levine, J., & Campbell, A. (2009). The effects of walking and cycling computer workstations on keyboard and mouse performance. *Human Factors, 51*(6), 831-844.

Teychenne, M., Ball, K., & Salmon, J. (2010). Physical activity, sedentary behavior and depression among disadvantaged women. *Health Education Research, 25*(4), 632-644. doi:10.1093/her/cyq008

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC: American Psychological Association.

Thorp, A. A., Kingwell, B. A., Owen, N., & Dunstan, D. W. (2014). Breaking up workplace sitting time with intermittent standing bouts improves fatigue and musculoskeletal discomfort in overweight/obese office workers. *Occupational and Environmental Medicine, 71*(11), 765-771. doi:10.1136/oemed-2014-102348; 10.1136/oemed-2014-102348

Thorp, A. A., Owen, N., Neuhaus, M., & Dunstan, D. W. (2011). Sedentary behaviors and subsequent health outcomes in adults: A systematic review of longitudinal studies, 1996–2011. *American Journal of Preventive Medicine, 41*(2), 207-215. doi:http://dx.doi.org/10.1016/j.amepre.2011.05.004

Thyfault, J. P., & Krogh-Madsen, R. (2011). Metabolic disruptions induced by reduced ambulatory activity in free-living humans. *Journal of Applied Physiology, 111*(4), 1218-1224. doi:10.1152/japplphysiol.00478.2011; 10.1152/japplphysiol.00478.2011

Tremblay, M. S., Colley, R. C., Saunders, T. J., Healy, G. N., & Owen, N. (2010). Physiological and health implications of a sedentary lifestyle. *Applied Physiology, Nutrition, and Metabolism, 35*(6), 725-740. doi:10.1139/H10-079; 10.1139/H10-079

Tudor-Locke, C., Schuna, J. M.,Jr, Frensham, L. J., & Proenca, M. (2014). Changing the way we work: Elevating energy expenditure with workstation alternatives. *International Journal of Obesity (2005), 38*(6), 755-765. doi:10.1038/ijo.2013.223; 10.1038/ijo.2013.223

van Uffelen, J. G. Z., van Gellecum, Y. R., Burton, N. W., Peeters, G., Heesch, K. C., & Brown, W. J. (2013). Sitting-time, physical activity, and depressive symptoms in mid-aged women. *American Journal of Preventive Medicine, 45*(3), 276-281. doi:http://dx.doi.org/10.1016/j.amepre.2013.04.009

Vuchinich, R. E., & Tucker, J. A. (1988). Contributions from behavioral theories of choice to an analysis of alcohol abuse. *Journal of Abnormal Psychology, 97*(2), 181-195. doi:http://dx.doi.org/10.1037/0021-843X.97.2.181

Yanagibori, R., Kondo, K., Suzuki, Y., Kawakubo, K., Iwamoto, T., Itakura, H., & Gunji, A. (1998). Effect of 20 days' bed rest on the reverse cholesterol transport system in healthy young subjects. *Journal of Internal Medicine, 243*(4), 307-312.

Appendix A

Recruitment Email

Subject line: Permission to conduct a questionnaire study in your class

We, Tiffany Lam and Dr. Harry Prapavessis, would like to ask for your permission to conduct a study on sedentary behaviour and cognitions in your class. This involves students to complete an online questionnaire package that will take approximately 15 minutes. Tiffany will come at the end of your class, direct them to the Survey Monkey website where they can access the letter of information, will be asked whether they agree to participate in the study, and if so, proceed to the questionnaire package. We would like to ask for you to also post the URL after class on OWL so that students may access the site if they wish to complete the questionnaire outside of class. The questionnaire includes socio-demographics, leisure score index, sedentary behaviour questionnaire, and protection motivation theory questionnaire. Completion of the questionnaire signifies the end of the students' involvement with the study. You may recall granting permission for a similar study to be conducted in your class to Stephanie DeJesus, which has the same protocol. Please let me know if you have any questions and looking forward to hearing back.

Principal Study Investigator:

Harry Prapavessis, Ph.D. (School of Kinesiology, The University of Western Ontario)

Co-Investigator:

Tiffany Lam, B.A. (School of Kinesiology, Western University)

Instructions to Participate

Thoughts on Sedentary Behaviour Survey

The URL link below is for a research study at Western. The study is a two-part survey, which asks about your thoughts on sitting. Your email is required to send you the link to a second survey ONE WEEK LATER. The first survey should take approximately 15 minutes and the second survey should take approximately 5 minutes. Your email will only be used to send you the link to the second survey as well as to be entered into a draw to **win one of five $100 President Choice gift cards**. Those who complete the first survey will be entered into the draw ONCE. Those who complete the second survey will be entered into the draw THREE ADDITIONAL times. This is not a test and will not affect your academic status.

Thank you for participating!

If you have any questions about the study, please contact Tiffany Lam

Survey Link: https://www.surveymonkey.com/s/BQSB5NV

Ethics Approval

Western Research

Western University Health Science Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Prof. Harry Prapavessis
Department & Institution: Health Sciences\Kinesiology, Western University

NMREB File Number: 105301
Study Title: The Predictive Utility of Protection Motivation Theory for Sedentary Behaviour
Sponsor:

NMREB Initial Approval Date: June 09, 2014
NMREB Expiry Date: June 30, 2015

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Western University Protocol	Western protocol	2014/05/23
Recruitment Items	Recruitment permission email	2014/05/23
Letter of Information & Consent	Letter of information	2014/05/23
Instruments	Appendix questionnaire package	2014/05/23

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the HSREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Ethics Officer to Contact for Further Information

Erika Basile	Grace Kelly	Mina Mekhail	Vikki Tran
ebasile@uwo.ca	grace.kelly@uwo.ca	mmekhail@uwo.ca	vikki.tran@uwo.ca

This is an official document. Please retain the original in your files.

Letter of Information

LETTER OF INFORMATION

Study Title: The predictive utility of protection motivation theory for sedentary behaviour.

Principal Study Investigator:

Harry Prapavessis, Ph.D. (School of Kinesiology, Western University)

Co-Investigator:

Tiffany Lam, B.A. (School of Kinesiology, Western University)

You are being invited to participate in a research study examining the predictive utility of a social-cognitive theory for sedentary behaviour. You are being asked to participate because we are looking at a population of undergraduate students between 18 to 30 years of age who are prone to long hours of prolonged sitting. Please take your time to make a decision, and discuss this proposal with your personal doctor, family members and friends, as you feel inclined. The purpose of this letter is to provide you with the information you require to make an informed decision on participating in this research. This letter contains information to help you decide whether or not to participate in this research study. It is important for you to know why the study is being conducted and what it will involve. Please take the time to read this carefully and feel free to ask questions if anything is unclear or there are words or phrases you do not understand.

Purpose of the Study

The purpose of the study is to determine whether general and domain specific Protection Motivation Theory models can predict sedentary goal intention, implementation intention, and behaviour in university students.

Participants

Approximately 1000 students will be recruited from multiple faculties from Western University. Participants will be invited to complete an online questionnaire during class time or outside of class time. To be eligible to participate, you must meet the following criteria: 18 to 30 years of age, able to read and understand English, and access to a computer with Internet. If you wish to enter the draw (five $100 gift cards), you must have an email account that the investigators can contact you at.

You are not eligible to participate if you are younger than 18 or older than 30, unable to read and understand English, and do not have access to the Internet. If you are participating in another study at this time, please inform the study researchers right away to determine if it is appropriate for you to participate in this study.

Research Procedure

If you choose to take part in this study, you will be asked to complete a two-part questionnaire. The questionnaire is not a test and will not affect your academic status. You may exit the survey at any point.

On the Survey Monkey website, you will complete the first questionnaire package that contains three items: socio-demographics, Leisure Time Exercise Questionnaire, and a purpose built Protection Motivation Theory questionnaire. One week later, you will be asked to complete the second questionnaire, the modified Sedentary Behaviour Questionnaire. The time involvement for the first questionnaire should be around 15 minutes, while the second questionnaire should be around 5 minutes. Completion of the questionnaire package will signify the end of your involvement in the study.

You will be randomized to receive one of two versions of the Protection Motivation Theory questionnaire. This includes one general version and one domain specific version.

The general version looks at your thoughts on sedentary behaviour in all day-to-day settings. The domain specific version looks at your thoughts on sedentary behaviour in leisure settings only.

Risks

Anticipated risks or discomforts associated with participating in this study include boredom and disruption of your personal time. These feelings are normal and should be momentary.

Benefits

You may not directly benefit from participating in this study but information gathered may provide benefits to society as a whole which include the ability to develop theory-driven interventions.

Participation

Participation in this study is voluntary. You may refuse to participate or withdraw from the study at any time with no effect on your academic status. If you decide to take part, you will be asked to consent to the study at the end of the page. If you withdraw from the study, you maintain the right to request that any data collected from you not be used in the study. If you make such a request, all of the data collected from you will be destroyed. Please contact the study coordinator, Tiffany Lam _____, if you wish to withdraw from the study. If you are participating in another study at this time, please inform the study researchers right away to determine if it is appropriate for you to participate in this study.

Confidentiality

We will be collecting information from approximately 1000 students for this study. All the information you provide to the researcher will be kept in the strictest confidence. We will not be asking for any personal identifiers (ex. name, date of birth) except your email address to send you the second survey and to notify you if were successful in the draw

(five $100 gift cards). All data will be stored on a university local hard drive accessible only to research staff in a secure office. Only for the duration of the study, email addresses will be stored on an electronic file that is password protected. No information obtained during the study will be discussed with anyone outside of the research team.

Representatives of the Western University Health Sciences Research Ethics Board and regulatory bodies (Health Canada) may contact you or require access to your study-related records to monitor the conduct of the research. If we find information we are required by law to disclose, we cannot guarantee confidentiality. We will strive to ensure the confidentiality of your research-related records. Absolute confidentiality cannot be guaranteed, as we may have to disclose certain information under certain laws.

Compensation

Upon completion of first questionnaire package, you will be entered into a draw. Upon completion of the second questionnaire, you will be entered three more times. If you do not want to be entered into the draw, you may select the option to opt out at the beginning of the questionnaire. The draw is to win one out of five $100 President Choice gift cards. The draw will not affect the study results.

Publication

If the results of the study are published, your name will not be used. If you would like to receive a copy of the potential study results, please contact Tiffany Lam or Dr. Harry Prapavessis

Contact person(s)

If you have any questions about your rights as a research participant or the conduct of the study you may contact the Office of Research Ethics at Western University . If you have any questions about the study, please

contact Tiffany Lam   or Dr. Harry Prapavessis

If you have any concerns, please feel free to contact one of the researchers below. You may request the general findings of this research study from the researchers after the study is complete.

Tiffany Lam   Dr. Harry Prapavessis

Graduate Student   Professor

School of Kinesiology, UWO   School of Kinesiology, UWO

Consent

Consent

Clicking on the "agree" button below indicates that you have read the above information, you voluntarily agree to participate, and you are at least 18 years of age.

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button. If you do not wish to participate in the research study, you may leave this site now.

☐ Agree

☐ Disagree

Appendix B

Focus Group Handout

Date: _____

Area of study (if applicable): _____

Health Consequences:

Metabolic deterioration: *The worsening of one's metabolism specifically through (1) decreased insulin sensitivity (i.e., when the body is unable to use insulin from the bloodstream which increases the demand for insulin and increases blood glucose level[1]), (2) increased central adiposity (i.e., accumulated fat in the abdominal area[2]), and (3) increased plasma triglycerides (high levels of fat in the bloodstream[3]).*

All cause mortality: *Death regardless of its cause[4].*

Death from cardiovascular disease: *Death resulting from an acute myocardial infarction, sudden cardiac death, or death due to the following: heart failure, stroke, cardiovascular procedures, cardiovascular hemorrhage or other cardiovascular causes[5].*

Type II diabetes: *A disorder of carbohydrate metabolism characterized by increased blood glucose level and glucose in the urine. It is caused by delayed or impaired insulin secretion, impaired insulin action or excessive glucose output by the liver[6].*

Please rank in order how threatening each health consequence is to you and your peers in your age group (1 = least threatening to 4 = most threatening).

Metabolic deterioration _____

All cause mortality _____

Death from cardiovascular disease _____

Type II diabetes _____

---

[1] National Diabetes Information Clearinghouse. (2014). Insulin resistance and prediabetes. In *Diabetes.* Retrieved from http://diabetes.niddk.nih.gov/

[2] Lebovitz, H.E., & Banerji, M.A. (2005). Point: Visceral adiposity is causally related to insulin resistance. *Diabetes Care, 28*(9), 2322-2325.

[3] National Library Medicine. (2014) Triglyceride level. Retrieved from http://www.nlm.nih.gov/

[4] Batterham, P., Mackinnon, A. J., & Yuen, K. (2010). Mortality. *Encyclopedia of research design* (pp. 833-836) Sage Publications.

[5] Hicks, K., Hung, J., Mahaffey, K.W., Mehran, R., Nissen S.E., Stockbridge, N.L., Targum, S.L., & Temple, R. (2012). *Standardized definitions for cardiovascular and stroke end points event in clinical trials.* Unpublished manuscript.

[6] Kent, M. (2006). Diabetes mellitus. *The Oxford dictionary of sports science and medicine* (3rd ed.,) Oxford University Press.

Survey #1

Sedentary Behaviour Cognitions Survey

This study is a two-part survey, which asks about your thoughts on sitting. At the end of this survey, we will ask you for your email address. Your email is required to send you the link to a second, short survey ONE WEEK LATER. Completion of the second survey is very important for the purpose of this study. Your email will only be used to send you the link to the second survey as well as to be entered into a draw to win one of five $100 President Choice gift cards. Those who complete the first survey will be entered into the draw ONCE. Those who complete the second survey will be entered into the draw THREE ADDITIONAL times. You may choose to opt in or out of the draw below. All responses are completely confidential and your email address will be destroyed from our file after the study is completed.

This is not a test and will not affect your academic status. There are no right or wrong answers. Please answer honestly. If you wish to stop the survey, you may exit from it at any time. However, in order to keep moving forward, you need to complete all questions on each page. If you do not click on the "done" button at the end of the survey, your answers and participation will not be recorded.

Thank you for participating!

Please select ONE of the options:

☐ Opt IN to the draw

☐ Opt OUT of the draw

Demographics

1. With which gender do you identify? _____
2. What is your date of birth (only month and year)? _____(mth)/_____(yr)
3. What is your ethnicity? _____
4. What is your education level (check as many that apply)?
   □ Some high school
   □ Completed all high school years
   □ Undergraduate student
   □ Other _____
5. Do you suffer from any medical condition which prohibits you from being physically active (e.g., spinal cord injury) or have you ever been told by your doctor to avoid physical activity?
   □ No
   □ Yes
6. What is your weight (lbs or kg)? _____
7. What is your height (ft, in or cm)? _____
8. Do you participate in varsity-level or extracurricular sport teams?
   □ No
   □ Yes

Leisure Score Index

1. Consider a **7-day period** (week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write in each blank)

    a) STRENUOUS EXERCISE (HEART BEATS RAPIDLY)
        (i.e., running, jogging, hockey, football, soccer, basketball, cross-country, skiing, judo, roller skating, vigorous swimming, long distance bicycling)
    b) MODERATE EXERCISE (NOT EXHAUSTING)
        (i.e., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, popular dance)
    c) MILD EXERCISE (MINIMAL EFFORT)
        (i.e., yoga, archery, fishing, bowling, golf, easy walking)

2. Considering a **7-day period** (a week) during your leisure-time, how often do you engage in any regular activity long enough to **work up a sweat** (heart beats rapidly)? (pick one)

    Often   Sometimes   Rarely   Never

Metabolic Deterioration Stem

When you see "metabolic deterioration" in the following questions, this refers to:

Problems with chemical reactions in the body, specifically:

- ➢ Problems with insulin. Insulin is a hormone that lowers glucose levels (a type of sugar) in the blood. When there are problems with insulin, glucose cannot easily enter the body's cells. This means blood sugar levels go up and can remain high. This can lead to serious damage to the heart, kidneys, eyes, and feet.
- ➢ Increases in fat around the stomach region. This can lead to type 2 diabetes, high blood pressure, and heart disease.
- ➢ Higher levels of fat in the bloodstream. This can lead to diseases of the heart.

Perceived Severity

1. I feel metabolic deterioration is a serious health condition.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

2. If I developed metabolic deterioration it would interfere with me leading a normal life.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

3. Metabolic deterioration would seriously affect me.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

4. The thought of developing metabolic deterioration scares me.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

Perceived Vulnerability

5. I feel vulnerable to developing metabolic deterioration.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

6. I feel that my chance of developing metabolic deterioration is:

1	2	3	4	5	6	7
Extremely Low	Quite Low	Fairly Low	Neither low nor high	Fairly High	Quite High	Extremely High

7. I think it is likely that I will develop metabolic deterioration.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

8. Compared to the average person, I feel that my chance of developing metabolic deterioration is:

1	2	3	4	5	6	7
Much Lower	Lower	Slightly Lower	Neither Lower nor Higher	Slightly Higher	Higher	Much Higher

9. I think I am susceptible to developing metabolic deterioration.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

Response Efficacy

10. I feel that sitting less would help me to reduce my risk of developing metabolic deterioration.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

11. How effective do you feel sitting less would be for reducing your risk developing metabolic deterioration?

1	2	3	4	5	6	7
Extremely Ineffective	Quite Ineffective	Slightly Ineffective	Neither ineffective nor effective	Slightly Effective	Moderately Effective	Extremely Effective

12. I think sitting too much is one of the most important risk factors for developing metabolic deterioration.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

13. I feel that the evidence linking too much sitting to metabolic deterioration is very strong.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

Self-Efficacy

The items below are common reasons people have difficulty sitting less over a waking day.
Using the scale below, please indicate **how confident you are that you can schedule a break**
(e.g., standing or doing some light activity) every two hours over the NEXT WEEK:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all confident			Really not confident		Kind of confident		Reasonably confident		Almost confident	Completely confident

Psychological Events

Productivity

14. When you are PRODUCTIVE doing your work, how confident are you in
    scheduling a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

15. When you are GETTING A LOT OF WORK DONE, how confident are you in
    scheduling a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

16. When you are EFFICIENT doing you work, how confident are you in scheduling
    a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

Focused

17. When you are very FOCUSED (i.e., "in the zone"), how confident are you in
    scheduling a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

18. When you are NOT DISTRACTED BY OTHER THINGS WHILE DOING
    YOUR WORK, how confident are you in scheduling a BREAK FROM SITTING
    every two hours for a duration of
a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

19. When you are CONCENTRATING AT A HIGH LEVEL DOING YOUR WORK, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of ...

a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

Tired

20. When you are feeling WORN OUT, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of ...

a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

21. When you HAVE LOW ENERGY, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of ...

a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

22. When you are feeling TIRED, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of ...

a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

Situational Events

Studying

23. When you are STUDYING IN THE LIBRARY, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of

a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

24. When you are STUDYING AT HOME FROM SITTING, how confident are you in scheduling a BREAK every two hours for a duration of

a) 1-5 minutes

b) 6-10 minutes

c) 11-15 minutes

25. When you are STUDYING IN A WI-FI AREA OTHER THAN THE LIBRARY AND HOME (e.g., coffee shop), how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of

a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

Screen Time Leisure

26. When you are WATCHING TV OR PLAYING VIDEO GAMES, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

27. When you are USING YOUR COMPUTER FOR NON-SCHOOL AND/OR NON-WORK RELATED PURPOSES, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

28. When you are USING YOUR CELL PHONE FOR NON-SCHOOL AND/OR NON-WORK RELATED PURPOSES, how confident are you in scheduling a BREAK FROM SITTING every two hours for a duration of
a) 1-5 minutes
b) 6-10 minutes
c) 11-15 minutes

Goal Intention – General

The following questions refer to sitting for WORK, SCHOOL, or PERSONAL, LEISURE, OR RECREATIONAL pursuits (e.g. watching TV, using the computer, doing office or school work, reading, talking on the phone, sitting in lectures or meetings, sitting in a car, train, or bus, eating, socializing, sitting for religious or spiritual pursuits) on a typical DAY over the NEXT WEEK.

29. How much time do you EXPECT to spend sitting on a typical day over the next week?

None	15 min or less	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	9 hrs	10 hrs	11 hrs	12 hrs	13 hrs	14 hrs	15 hrs	16 hrs	17 hrs	18 hrs

30. How much time do you PLAN to spend sitting on a typical day over the next week?

None	15 min or less	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	9 hrs	10 hrs	11 hrs	12 hrs	13 hrs	14 hrs	15 hrs	16 hrs	17 hrs	18 hrs

31. How much time do you INTEND to spend sitting on a typical day over the next week?

None	15 min or less	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	9 hrs	10 hrs	11 hrs	12 hrs	13 hrs	14 hrs	15 hrs	16 hrs	17 hrs	18 hrs

Goal Intention – Leisure

The following questions refer to sitting for PERSONAL, LEISURE, OR RECREATIONAL pursuits on a typical day over the NEXT WEEK.

29. How much time do you EXPECT to spend sitting on a typical day over the next week?

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○
None 15 min 30 min or less 1 hr 2 hrs 3 hrs 4 hrs 5 hrs 6 hrs 7 hrs 8 hrs 9 hrs 10 hrs 11 hrs 12 hrs 13 hrs 14 hrs 15 hrs 16 hrs 17 hrs 18 hrs

30. How much time do you PLAN to spend sitting on a typical day over the next week?

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○
None 15 min 30 min or less 1 hr 2 hrs 3 hrs 4 hrs 5 hrs 6 hrs 7 hrs 8 hrs 9 hrs 10 hrs 11 hrs 12 hrs 13 hrs 14 hrs 15 hrs 16 hrs 17 hrs 18 hrs

31. How much time do you INTEND to spend sitting on a typical day over the next week?

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○
None 15 min 30 min or less 1 hr 2 hrs 3 hrs 4 hrs 5 hrs 6 hrs 7 hrs 8 hrs 9 hrs 10 hrs 11 hrs 12 hrs 13 hrs 14 hrs 15 hrs 16 hrs 17 hrs 18 hrs

Implementation Intention – General

The following questions refer to sitting for WORK, SCHOOL, or PERSONAL, LEISURE, OR RECREATIONAL pursuits (e.g. watching TV, using the computer, doing office or school work, reading, talking on the phone, sitting in lectures or meetings, sitting in a car, train, or bus, eating, socializing, sitting for religious or spiritual pursuits) on a typical DAY over the NEXT WEEK.

32. I know WHAT I can do to sit less on a typical day over the next week.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

33. I know WHEN I can sit less on a typical day over the next week.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

34. I know WHERE I can sit less on a typical day over the next week.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

Implementation Intention – Leisure

The following questions refer to sitting for PERSONAL, LEISURE, OR
RECREATIONAL pursuits on a typical day over the NEXT WEEK.

32. I know WHAT I can do to sit less on a typical day over the next week.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

33. I know WHEN I can sit less on a typical day over the next week.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

34. I know WHERE I can sit less on a typical day over the next week.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree Nor Agree	Slightly Agree	Moderately Agree	Strongly Agree

Email Entry

Thank you for participating in the first part of the survey!

There is a second part of the survey that is extremely important for the purpose of the study. If you would like to complete the second short survey, please enter your email address so we can email you the link ONE WEEK FROM NOW.

Your email address will not be shared and will not be used against you. It is strictly to send you the link for the second survey and to be entered in to the draw to win one of five $100 President Choice gift cards. Those who complete the first survey will be entered into the draw ONCE. Those who complete the second survey will be entered into the draw THREE ADDITIONAL times.

If you would NOT like to participate in the second survey, click "done" now.

35. What is your email address?

Email Script for Survey #2

Subject Line: Thoughts about Sedentary Behaviour Survey Part 2

Hello,

Thank you for completing the first part of the survey. Below is the link to access the second part of the survey. Please complete within 48 hours. This link will no longer be active after **October 31st:**

https://www.surveymonkey.com/s/BR8FMJ6

Thank you for your participation!

Sincerely,

Tiffany Lam

Graduate Student

School of Kinesiology, UWO

Survey #2

Sedentary Behaviour Questionnaire

This is the second part of the two-part survey. It will take approximately 5 minutes to complete. At the end of this survey, we will ask you again for your email address. You will be entered into the draw to win one of five $100 President Choice gift cards THREE more times. All responses are completely confidential and your email address will be destroyed from our file after the study is completed.

This is not a test and will not affect your academic status. There are no right or wrong answers. Please answer honestly. If you wish to stop the survey, you may exit from it at any time. However, in order to keep moving forward, you need to complete all questions on each page. If you do not click on the "done" button at the end of the survey, your answers and participation will not be recorded.

Thank you for your time!

Do you want to continue?

□ I would like to continue

□ I do not want to continue

On a typical **day**, how much time did you spend (from when you woke up until going to bed) doing the following **this past week**? The sitting behaviour specified is the predominant sitting behaviour. For example, you may be sitting in a motor vehicle while listening to music but the predominant behaviour would be sitting in a motor vehicle.

1. Sitting and watching TV

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

2. Sitting and using the computer for recreational purposes (i.e., games, Facebook, Youtube, movies, Skype, social media websites, etc.)

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

3. Sitting for school or work (working at the computer, talking on the phone, office work, studying, reading, sitting in lecture or meetings, teleconferences, etc.)

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

4. Sitting reading for pleasure

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

5. Sitting and listening to music

□	□	□	□	□	□	□	□	□	□	□	□
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

6. Sitting and playing a musical instrument

□	□	□	□	□	□	□	□	□	□	□	□
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

7. Sitting and doing arts and crafts (e.g., scrapbooking, cardmaking, painting, drawing)

□	□	□	□	□	□	□	□	□	□	□	□
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

8. Sitting in a motor vehicle in order to get to work or school (i.e., commuting in a car or *sitting* in a bus or train).

□	□	□	□	□	□	□	□	□	□	□	□
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

9. Sitting in a motor vehicle for leisure-related transportation purposes (i.e., sitting in a car, bus, or train to get to and from recreational activities, visiting friends or family, going out, etc.)

□	□	□	□	□	□	□	□	□	□	□	□
None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours

10. Sitting and eating

None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

11. Sitting and socializing/visiting or non-work related phone conversations (e.g., talking with a friend, family member, etc.)

None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

12. Sitting for religious or spiritual pursuits (e.g., meditation, prayer, sitting in church or other religious/spiritual meetings)

None	≤15 min	30 min	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs	7 hrs	8 hrs	≥9 hours
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Appendix C

Pattern Matrix

Pattern Matrix[a]

	Factor									
	1	2	3	4	5	6	7	8	9	10
SE_focused3_11_15minbreak	.909	.010	.069	.000	.006	.084	.025	.164	.049	-.040
SE_focused_11_15minbreak	.888	.040	.089	.018	-.054	.072	-.014	.146	.040	-.057
SE_focused3_6_10minbreak	.864	.055	.090	-.021	.012	.060	.024	.034	-.132	-.054
SE_productivity2_11_15minbreak	.856	.020	-.019	-.006	.025	.022	-.031	-.008	.215	.034
SE_focused_6_10minbreak	.825	.049	.108	-.031	-.033	.091	-.013	.008	-.131	-.081
SE_productivity3_11_15minbreak	.759	-.009	.001	-.052	.042	.048	-.005	-.102	.252	.130
SE_focused2_11_15minbreak	.743	.037	.013	.027	-.038	.201	.021	.053	.163	.009
SE_productivity2_6_10minbreak	.712	.036	.012	-.065	.062	.004	.012	-.282	.030	.082
SE_focused3_1_5minbreak	.690	.076	.090	-.012	.051	.087	-.031	-.105	-.354	-.013
SE_focused2_6_10minbreak	.689	.070	.054	-.006	-.048	.191	.018	-.092	-.023	.005
SE_focused_1_5minbreak	.686	.044	.095	-.068	-.012	.087	-.047	-.125	-.322	-.051
SE_productivity3_6_10minbreak	.668	.010	.042	-.096	.033	.001	.046	-.327	.078	.127
SE_productivity_11_15minbreak	.614	.069	-.074	.003	.035	.113	-.017	-.140	.336	.132
SE_focused2_1_5minbreak	.562	.099	.052	-.007	-.032	.162	-.038	-.210	-.255	.026
SE_productivity2_1_5minbreak	.542	.055	.037	-.057	.077	-.018	-.009	-.438	-.180	.067
SE_productivity3_1_5minbreak	.514	.038	.046	-.071	.066	-.006	-.003	-.464	-.148	.134
SE_productivity_6_10minbreak	.498	.083	-.006	.006	.052	.060	.013	-.421	.123	.188
SE_tired2_6_10minbreak	-.048	.954	.022	-.055	-.026	.037	.021	-.012	.003	-.011
SE_tired3_6_10minbreak	-.007	.947	.049	.020	-.054	.002	.038	.030	-.014	-.027
SE_tired2_11_15minbreak	-.009	.941	.005	-.027	-.018	.031	.010	.097	.152	-.042
SE_tired3_11_15minbreak	-.026	.934	-.012	.019	.002	.053	.009	.115	.147	-.035
SE_tired_11_15minbreak	.120	.912	-.042	-.004	.034	-.071	-.016	.094	.112	.035
SE_tired_6_10minbreak	.081	.911	-.047	-.004	.034	-.053	-.013	-.049	-.035	.052
SE_tired3_1_5minbreak	-.085	.904	.035	.031	.014	.053	-.013	-.040	-.129	-.004
SE_tired2_1_5minbreak	-.078	.881	.066	-.056	-.004	.031	-.011	-.102	-.146	.005
SE_tired_1_5minbreak	.042	.851	-.014	.019	.057	-.042	-.029	-.140	-.168	.052
SE_leisure_TV_6_10minbreak	-.013	.048	.936	.003	-.002	.002	-.011	-.023	-.054	-.059
SE_leisure_TV_11_15minbreak	.030	-.002	.926	.013	.009	.018	-.020	.094	.105	-.083

	1	2	3	4	5	6	7	8	9	10
SE_leisure_TV_1_5minbreak	-.041	.078	.804	.020	.035	.017	-.035	-.115	-.186	.024
SE_leisure_computer_6_10minbreak	.073	.017	.734	-.011	-.032	.008	.054	-.044	.027	.250
SE_leisure_computer_11_15minbreak	.138	.005	.728	.001	-.015	-.010	.054	.056	.192	.212
SE_leisure_computer_1_5minbreak	.032	.038	.649	-.008	-.019	.025	.014	-.138	-.114	.292
q0019_PV	-.044	.016	.016	.926	.032	-.010	.000	-.035	.031	.015
q0020_PV	.052	-.009	.063	.867	-.003	-.037	-.004	.041	.012	-.077
q0022_PV	.030	-.014	-.021	.836	-.071	.081	.017	-.003	-.030	-.002
q0018_PV	.028	-.015	.028	.806	.125	-.036	-.046	.012	.006	.031
q0021_PV	-.020	.006	-.039	.788	-.062	.010	.039	-.034	-.019	.029
q0016_PS	.098	.034	-.021	-.067	.897	-.030	-.006	.146	-.039	.009
q0015_PS	.055	-.036	-.007	-.035	.800	.043	-.023	.122	-.036	-.099
q0014_PS	-.064	-.034	-.024	-.017	.618	-.008	.035	-.064	.027	.105
q0017_PS	-.092	.076	.051	.133	.586	.004	-.039	-.123	.047	-.026
SE_studyingWiFi_6_10minbreak	-.016	.075	.021	-.032	.003	.873	.036	-.019	.084	-.017
SE_studyingWiFi_1_5minbreak	-.053	.027	.064	-.064	.001	.848	.028	-.090	-.116	.031
SE_studyinglibrary_6_10minbreak	.146	.007	-.017	.025	-.001	.768	-.023	-.014	-.035	.083
SE_studyingWiFi_11_15minbreak	.050	.088	.047	-.027	.012	.744	-.036	.059	.242	-.028
SE_studyinglibrary_1_5minbreak	.016	.044	-.035	.023	.039	.734	-.073	-.114	-.271	.153
SE_studyinglibrary_11_15minbreak	.310	-.032	.050	.012	-.014	.631	-.037	.155	.106	-.015
q0023_RE	-.009	.035	-.049	.011	-.066	-.059	-.809	.059	-.001	.140
q0024_RE	-.050	-.018	-.021	.025	-.105	-.050	-.806	-.063	.030	.145
q0025_RE	.073	-.014	.025	-.013	.129	.053	-.617	.017	-.038	-.191
q0026_RE	-.016	-.014	.035	-.032	.074	.057	-.593	-.004	.026	-.106
SE_studyinglhome_1_5minbreak	.010	.099	.138	-.014	-.005	.280	-.062	-.700	.006	-.044
SE_studyinglhome_6_10minbreak	.116	.100	.169	-.041	-.030	.282	-.012	-.613	.231	-.151
SE_productivity_1_5minbreak	.331	.081	.021	.039	.032	.038	.005	-.552	-.130	.189
SE_studyinglhome_11_15minbreak	.188	.119	.144	-.042	-.003	.268	-.017	-.382	.444	-.165
SE_leisure_cellphone_6_10minbreak	.010	.074	.335	-.053	.019	.162	-.034	.067	.017	.694
SE_leisure_cellphone_11_15minbreak	.044	.078	.344	-.074	.021	.128	-.018	.157	.132	.668
SE_leisure_cellphone_1_5minbreak	-.053	.055	.329	-.014	.022	.165	-.052	-.076	-.138	.624

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.[a]

a. Rotation converged in 22 iterations.

Confirmatory Factor Analysis Standardized Regression Weights

Item	Factor	Estimate
SE_focused3_11_15minbreak	Selfefficacy_focused_productive	.857
SE_focused_11_15minbreak	Selfefficacy_focused_productive	.897
SE_focused3_6_10minbreak	Selfefficacy_focused_productive	.818
SE_productivity2_11_15minbreak	Selfefficacy_focused_productive	.858
SE_focused_6_10minbreak	Selfefficacy_focused_productive	.797
SE_productivity3_11_15minbreak	Selfefficacy_focused_productive	.872
SE_focused2_11_15minbreak	Selfefficacy_focused_productive	.832
SE_productivity2_6_10minbreak	Selfefficacy_focused_productive	.836
SE_focused2_6_10minbreak	Selfefficacy_focused_productive	.807
q0014_PS	Perceived_severity	.537
q0015_PS	Perceived_severity	.804
q0016_PS	Perceived_severity	.950
q0017_PS	Perceived_severity	.599
SE_tired_1_5minbreak	Selfefficacy_tired	.791
SE_tired2_1_5minbreak	Selfefficacy_tired	.933
SE_tired3_1_5minbreak	Selfefficacy_tired	.875
SE_tired_6_10minbreak	Selfefficacy_tired	.879
SE_tired_11_15minbreak	Selfefficacy_tired	.757
SE_tired3_11_15minbreak	Selfefficacy_tired	.859
SE_tired2_11_15minbreak	Selfefficacy_tired	.893
SE_tired3_6_10minbreak	Selfefficacy_tired	.923
SE_tired2_6_10minbreak	Selfefficacy_tired	.977
SE_leisure_TV_6_10minbreak	Selfefficacy_TV_Comp	.985
SE_leisure_TV_11_15minbreak	Selfefficacy_TV_Comp	.969
SE_leisure_TV_1_5minbreak	Selfefficacy_TV_Comp	.888
SE_leisure_computer_6_10minbreak	Selfefficacy_TV_Comp	.758
SE_leisure_computer_11_15minbreak	Selfefficacy_TV_Comp	.734
SE_leisure_computer_1_5minbreak	Selfefficacy_TV_Comp	.691
q0018_PV	Perceived_vulnerability	.806
q0019_PV	Perceived_vulnerability	.945
q0020_PV	Perceived_vulnerability	.822
q0021_PV	Perceived_vulnerability	.812
q0022_PV	Perceived_vulnerability	.808
SE_studyinglibrary_11_15minbreak	Study_Wifi_library	.914
SE_studyinglibrary_1_5minbreak	Study_Wifi_library	.908
SE_studyingWiFi_11_15minbreak	Study_Wifi_library	.556
SE_studyinglibrary_6_10minbreak	Study_Wifi_library	.998
SE_studyingWiFi_1_5minbreak	Study_Wifi_library	.606
SE_studyingWiFi_6_10minbreak	Study_Wifi_library	.619

Item	Factor	Estimate
q0026_RE	Response_efficacy	.891
q0025_RE	Response_efficacy	.835
q0024_RE	Response_efficacy	.574
q0023_RE	Response_efficacy	.496
SE_studyinghome_6_10minbreak	Study_home	.000
SE_studyinghome_1_5minbreak	Study_home	.999

Curriculum Vitae for Tiffany Wong

POST-SECONDARY EDUCATION AND DEGREES

Western University
London, Ontario, Canada
Bachelor of Arts, Scholar's Electives Program Module, Honours Kinesiology
2012

Western University
London, Ontario, Canada
Master of Arts (Thesis), Kinesiology, Exercise and Health Psychology
2015

HONOURS AND AWARDS

Ontario Graduate Scholarship
Master's Award
2014 – 2015

Western Graduate Research Scholarship
Master's Award
2013- 2015

Graduation with Distinction
Undergraduate Award
2012

Dean's Honour List
Undergraduate Award
2008-2012

REFEREED PUBLICATIONS

Upshaw, A., **Lam, T.**, Bandegan, A., & Lemon, P. R. (2012). *Time Trial Performance 4 h Following Glycogen-Depleting Exercise is Enhanced Similarly with Recovery Non-Dairy Chocolate Beverages vs. Chocolate Milk*. Manuscript submitted for publication. Submission # IJSNEM.2015-0056.

CONFERENCE POSTERS AND PRESENTATIONS

Wong, T. (2015, June). *Predicting Sedentary Intentions and Behaviour: An Application*

of Protection Motivation Theory. Oral presentation at 14th meeting of the International Society of Behavioral Nutrition and Physical Activity, Edinburgh, Scotland.

Wong, T. (2015, June). *An Action-Planning Intervention Can Reduce Workplace Sitting Time: A Pilot Study.* Poster presentation at 14th meeting of the International Society of Behavioral Nutrition and Physical Activity, Edinburgh, Scotland.

Wong, T. (2015, March). *Predicting Sedentary Intentions and Behaviour: An Application of Protection Motivation Theory.* Oral presentation at the 19th meeting of the Eastern Canadian Sport and Exercise Psychology Symposium, Ottawa, Ontario.

Lam, T. (2013, January). *Too Much Sitting: A Distinct Health Hazard.* Oral presentation at the Schulich School of Medicine and Dentistry's Retiring with Strong Minds, London, Ontario.

Lam, T. (2012, March). *Chocolate and Dairy Milk Enhance Performance After Exercise.* Poster presentation at the Western University Scholar's Electives' Making Connections Conference, London, Ontario.

Upshaw, A., **Lam, T.,** Bandegan, A., Lemon, P.W.R. (2012, May). *Cycling Time Trial Performance 4 h Following Glycogen-Depleting Exercise is Enhanced Similarly with Recovery Non-Dairy Chocolate Beverages vs. Chocolate Milk.* Oral presentation at the 59th meeting of the American College of Sports Medicine, San Francisco, California.

UNDERGRADUATE THESIS

Lam, T. Time Trial Performance 4h following Glycogen-Depleting Exercise is Enhanced Similarly with Recovery Non-Dairy Chocolate Beverages vs. Chocolate Milk. Supervisor: Dr. Peter W.R Lemon, Exercise Nutrition Laboratory, Western University

TEACHING EXPERIENCE

Kinesiology 3476G (Exercise and Health Behaviour Change), School of Kinesiology at Western University. Teaching Assistant.
2014

ADDITIONAL RESEARCH EXPERIENCE

Research Associate, Smart Heart Trial
London Health Sciences Centre Children's Hospital, Exercise and Health Psychology Laboratory
Contact: Meghan Rombeek, M.Sc., RD

2014 – 2015

Project Description: This study is a pilot telemedicine intervention to see if fitness and nutrition coaching provided over mobile phones for one year can have a positive impact on health, well-being and body measurements in overweight children and teenagers (7 -17 years old) who have had heart surgery. Biometrical measures are conducted every six months to evaluate the program success.

Research Associate, Be Healthy in Pregnancy with Nutrition and Exercise
  Exercise and Pregnancy Laboratory, Exercise and Health Psychology Laboratory
  Contact: Dr. Michelle Mottola, Ph. D., FACSM
  2014 – 2015

Project Description: In collaboration with McMaster University, this study aims to find ways to control gestational weight gain by developing diet and exercise strategies targeted to overweight pregnant women that hold promise of improving their health both during pregnancy and thereafter. Participants will be randomized into two research arms: Exercise and Nutrition Intervention or Usual Prenatal Care. The experimental intervention is a diet of higher protein combined with an exercise program.

Co-Investigator, Decreasing Workplace Sitting through Action-Planning
  Libro Credit Union
  Contact: Tiffany Wong, B.A.
  2014

Project Description: The primary objective was to determine whether a four-week action-planning intervention decreases sitting time by targeting non-exercise activity thermogenesis activities (i.e., standing, stretching while standing, light intensity physical activity) in office employees. Thirty-three participants were recruited from Libro Credit Union in London, Ontario.

Research Assistant, Prediabetes Research and Education Promoting Activity and Responsible Eating (PREPARE)
  Brescia University College
  Contact: Dr. Isabelle T. Giroux, Ph. D
  2010 – 2011

Project Description: The purpose of this study was to determine if a 6-month community-based prediabetes lifestyle and behaviour change intervention for middle and older adults with prediabetes would result in positive lifestyle behaviour change. Participants were randomized into two arms: PREPARE education program or control.

ADDITIONAL QUALIFICATIONS

Trained to operate a Metabolic Cart and interpret data
Able to conduct Spirometry, Peak VO_2 assessments, glycogen depletion, and 30s Wingate tests

Trained to operate Dual-emission X-ray absorptiometry and interpret accompanying data
Able to operate DEXA body composition scans

Trained to operate Actical accelerometer and interpret accompanying data
Able to prepare Actical monitors and manage data on Kinesoft

Standard First Aid CPR/AED Level C
Lifesaving Society

Fitness Instructor Specialist, Schwinn Fitness
Able to teach group fitness classes

RECENT EMPLOYMENT HISTORY

Laboratory manager, Exercise and Health Psychology Laboratory, Western University
2014 – 2015
> Manage finances, contracts, documentation and technical issues for the lab

Exercise supervisor, Health and Psychological Outcomes of Physical Activity, Western University
2014 – 2015
> Supervise individual exercise sessions and conduct fitness assessments

Exercise instructor and fitness assessor, Colon Health and Life-Long Exercise Change, Western University
2014 – 2015
> Conduct bi-weekly exercise sessions and physical assessments with cancer survivors

Fitness assessor, Smart Heart Trial, Western University
2014 – 2015
> Conduct VO2 maximal fitness tests, lung health assessments, and DEXA scans

Program developer, Employee Wellness Solutions Network, London, Ontario
2011 – 2015
> Researched and created evidence-based wellness programs for employers of large to small sizes

Group fitness instructor, Western Student Recreation Centre, London, Ontario
2011 – 2015
> Instruct and motivate gym members through safe and enjoyable aerobic and resistance training classes

VOLUNTEER EXPERIENCE

2015
School Evaluations Volunteer, ACT-i-Pass, London, Ontario

Assisted in the one-year evaluation of the program by conducting surveys to children in elementary schools and inputting data

2015
Conference Volunteer, 4th Canadian Obesity Summit, Toronto, Ontario
Assisted in the preparation and implementation of the first EPODE Canada Obesity workshop

2014 – 2015
Teacher Partnership and Community Events, Let's Talk Science, London, Ontario
Planned interactive science lessons with grade eight students and local organizations (e.g., Boys and Girls Club, Scouts Canada Beaveree)

2014
Conference Volunteer, Canadian Society for Psychomotor Learning and Sport Psychology, London, Ontario
Registered delegates to the conference and assisted with questions.

2010 – 2011
Physiotherapist Volunteer, Fowler Kennedy Sport Medicine Clinic
Conducted ultrasounds and supervised patients' performing rehabilitative exercises