Just Sitting?

Social Cognition and the New Sedentary Psychology

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By

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ABSTRACT

Since 2000, considerable research attention has been directed toward understanding sedentary behaviour. Today, it is widely accepted that (1) sedentary behaviour is an independent predictor of morbidity and mortality, (2) the average Western adult engages in excessive amounts of sedentary behaviour, and (3) individuals should make efforts to reduce their sitting time. Considerably less work has examined the psychological aspects of the behaviour, such as motivation for sitting or how sedentary behaviour differs across context. Cognisant of these shortcomings, the purpose of the following dissertation was to explore two broad questions: first, does a psychological understanding of sedentary behaviour enrich our understanding of the behaviour as a whole?; second, which psychological factors play a role in predicting and/or changing sedentary behaviour? Three primary research studies were conducted. Study One aimed to develop a bottom-up understanding of how individuals define, understand, and experience sedentary behaviour. Participants completed a mixed-methods questionnaire that included items on, for instance, whether they perceived themselves as being high- or low-sedentary; or whether they wanted to change their level of sedentary behaviour. A prominent theme that emerged in this work was "rest and recovery": that is, when asked to describe the benefits of their *personal* sedentary behaviour, the majority of participants noted mental and/or physical rest. Study Two examined how perceptions of sedentary behaviour are affected by activity type (television versus studying) and posture (sitting versus standing). Post-secondary students read four vignettes, with each vignette followed by questions on perceived self-efficacy, psychological outcome expectancies, and physical outcome expectancies. A series of secondary items examined preferences for sitting versus standing. Not only did participants express a clear preference for sitting, but a significant main effect was observed for posture and activity. The final study examined the utility of the Theory of Planned Behaviour (TPB) in prospectively predicting sedentary behaviour and standing breaks. Office workers completed four questionnaires across a period of two weeks, with items on attitudes, social norms, and perceived behavioural control; behavioural intentions; and self-reported behaviour. While results supported the basic tenets of the TPB, they also cast light on the complexity of sedentary behaviour: for instance, by highlighting psychological differences between work-time and break-time sitting. Collectively, the three studies indicate that the psychological basis of sedentary behaviour is neither simple nor necessarily intuitive, and that there is a need to engage in further psychological research before rushing toward intervention.

LIST OF PAPERS

This dissertation features three original studies:

Study One: Sedentary … What? Lay Perceptions of Sedentary Behaviour

Study Two: Do "Posture" and "Activity" Matter? Exploring Sedentary Behaviour Cognitions Across Context

Study Three: The Efficacy of the Theory of Planned Behaviour in Predicting Sitting and Standing Breaks in Office Workers

In addition, the following papers, refereed posters, and invited talks arose from presentation of material from this dissertation. None of the content in those presentations is a published version of the material in the dissertation.

1. Gierc, M., & Brawley, L. (2017, June). *Is physical activity a rose-coloured glass through which we view sedentary behaviour?* Poster presented to the International Society of Behavioural Nutrition and Physical Activity, Victoria, British Columbia.
2. Gierc, M., & Brawley, L. (2017, April). *Can we predict sedentary behaviour? Using the TPB to prospectively predict occupational sitting and standing breaks*. Poster presented at the Society of Behavioral Medicine Annual Conference, San Diego, CA.
3. Gierc, M., & Brawley, L. (2016, October). *Investigating workplace standing breaks: Do Planned Behaviour constructs reveal individual and social context relationships?* Paper presented at the Canadian Society of Psychomotor Learning and Sport Psychology Annual Conference, Waterloo, Ontario.
4. Gierc, M., & Brawley, L. (2016, March). *Do "posture" and "activity" matter? Psychological reactions to sedentary behaviour*. Poster presented at the Society of Behavioral Medicine Annual Conference, Washington, DC.

5. Gierc, M., & Brawley, L. (2015, October). *The effect of health messaging on sedentary behaviour risk perceptions: Does immediacy of risk matter?* Paper presented at the Canadian Society of Psychomotor Learning and Sport Psychology Annual Conference, Edmonton, Alberta.
6. Gierc, M., & Brawley, L. (2015, April). *Is standing more depleting than sitting? The effect of posture on acute psychological outcomes*. Poster presented at the Society of Behavioral Medicine Annual Conference, San Antonio, Texas.
7. Gierc, M., & Brawley, L. (2015, February). *Changing sedentary behaviour: Do we understand the challenges*? Paper presented to the Exercise Psychology and Behaviour Change Laboratories, Kinesiology Department, McMaster University, Hamilton, Ontario.
8. Gierc, M., & Brawley, L. (2014, October). *Is sedentary behaviour a health risk? Laypersons perceive both costs and benefits in their sedentary activity*. Poster presented at the Canadian Society of Psychomotor Learning and Sport Psychology Annual Conference, London, Ontario.
9. Gierc, M. S. H., & Brawley, L. R. (2014, April). *A view from the couch: Perceptions of sedentary behaviour in the more- and less-active*. Poster presented at the Society of Behavioral Medicine Annual Conference, Philadelphia, Pennsylvania.

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[1] Though, good god, why?! You realise that this is a 300 page monster, right?! Friendly advice? Head to the library and grab a nice novel … It'll have better character development and fewer statistics.

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DEDICATION

for Mom and Dad

xo xo xo

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COMMON ABBREVIATIONS

Attitudes	AT
Cohen's effect size	*d*
Body Mass Index	BMI
Light-Intensity Physical Activity	LPA
Leisure-Time Moderate-to-Vigorous Physical Activity	LT-MVPA
Leisure-Time Physical Activity	LT-PA
Metabolic Equivalent of Task	MET
Moderate-to-Vigorous Physical Activity	MVPA
Outcome Expectancy	OE
Perceived Behavioural Control	PBC
Physical Activity	PA
Sedentary Behaviour	SB
(Perceived) Self-Efficacy	SE
Social Cognitive Theory	SCT
Subjective Norms	SN
Theory of Planned Behaviour	TPB

PHRASING AND TERMINOLOGY

For the purpose of this dissertation:

- Individuals who are "sufficiently active" are those who meet or exceed national physical activity guidelines (i.e., $\geq$ 150 minutes of moderate-to-vigorous physical activity (MVPA) per week; Canadian Society of Exercise Physiology, 2011). Conversely, individuals who are "insufficiently active" are those who fail to meet national physical activity guidelines (i.e., < 150 minutes of MPVA per week).
- The term "sedentary behaviour" may be used interchangeably with "sedentary activity", "sedentary", or simply "SB".
- At the time of writing, there is no consensus on what constitutes "high" or "low" levels of adult sedentary behaviour. Literature reviews – such as a review conducted for the Australian government (Brown, Bauman, Bull, & Burton, 2012) – often identify sedentary behaviour as being a health risk if in excess of eight hours per day; however, this is by no means a definite value and substantial variability exists between studies. For example, Katzmarzyk and Lee (2012) have estimated that as little as three hours of sedentary behaviour per day – equivalent to a single *Lord of the Rings* movie – could decrease population life expectancy by two years. In contrast, research by Healy et al (2008) suggests that sitting bout duration may have a greater impact on health than total daily sitting time. Given this uncertainty, the current research treated sedentary behaviour as a continuous variable.
- "Screen time" refers to time spent using screen-based technologies: for example, smart phones, video games, computers, tablets, and televisions. While screen time is typically conducted in sedentary posture, being sedentary is not necessary.

TOPIC DEVELOPMENT

It is an old complaint that study, though essentially necessary to the mind, is hurtful to the body.

S. A. Tissot, M.D., 1772

Background

The past century has produced indisputable evidence in favour of physical activity as a determinant of health (Health Canada, 2011; Das & Horton, 2012; 2016). Across populations – and regardless of age, gender, ethnicity, and socioeconomic status – regular physical activity is associated with improved health and well-being, decreased risk of chronic disease, and enhanced symptom management in those with a pre-existing chronic condition. Conversely, the World Health Organisation (2016) has identified *in*sufficient physical activity as a leading behavioural risk factor for morbidity and mortality, accounting for 21-25% of breast and colon cancers, 27% of diabetes, and 30% of coronary artery disease. In light of such findings, adults are strongly encouraged to engage in at least 150 minutes of moderate-to-vigorous physical activity (MVPA) per week (Canadian Society of Exercise Physiology, 2011; World Health Organisation, 2010).

For a long time the health risks associated with sedentary behaviour were thought to be a direct result of, and equivalent to, insufficient physical activity. Under this paradigm, vigorous physical activity and sedentary behaviour existed at opposite ends of a single continuum: differing in absolute energy expenditure, but influencing the same biological systems and health outcomes. Though sedentary behaviour – particularly screen time – was generally frowned upon, it was of secondary concern *so long as* individuals regularly achieved the recommended amount of MVPA.

Starting in the late 1990s, spurred by the growing burdens of chronic disease and overweight/obesity, a handful of researchers began to question the occurrence of sedentary behaviour (Dietz, 1996; Hamilton, Hamilton, & Zderic, 2004; Levine, 2004; Levine, Schleusner, & Jensen, 2000; Owen, Leslie, Salmon, & Fotheringham, 2000; Smith & Biddle, 1999). The primary purpose of this early work was to establish whether excessive sitting, even if accompanied by sufficient physical activity, presents a risk to health. Evidence was quick to accumulate, with animal, human, and epidemiological studies converging on two major conclusions: first, that too much sitting is not the same as too little physical activity; second, that sitting can exert a negative and independent effect on health (Hamilton, Hamilton, & Zderic, 2007).

Conceptualising Sedentary Behaviour

Within the empirical literature, “sedentary behaviour” is an umbrella term used to describe *any waking*[2] *behaviour characterised by low energy expenditure and a seated or reclining posture* (e.g., Hamilton et al, 2004; Pate, O’Neill, & Lobelo, 2008; Sedentary Behaviour Research Network, 2012; Yates et al, 2011). As such, it includes activities like sitting to read or sitting on an airplane; while excluding low-effort activities performed standing/moving (e.g., taking the elevator, gentle walking) and higher-effort activities performed seated (e.g., rowing, cycling). Following this definition, sedentary behaviour research is concerned with the *presence of inactivity* opposed to the *absence of physical activity* – a subtle distinction, but important to emphasise in that “sedentary” is often used in physical activity research to describe individuals who are insufficiently active for health benefits (Sedentary Behaviour Research Network, 2012).

Beyond being conceptually distinct, research demonstrates that sedentary behaviour and physical activity frequently co-exist. While, of course, one cannot be *simultaneously* sedentary and active, high levels of sedentary behaviour do not preclude individuals from being sufficiently

[2] It is noteworthy that early definitions of sedentary behaviour, such as the definition presented by Pate et al (2008), considered sleep to be a sedentary behaviour. More recent definitions purposefully exclude sleep, likely due to the growing recognition that sleep is an independent determination of health (e.g., Cappuccio et al, 2008).

active for health benefits. For example, a kinesiology graduate student might sit for 11 hours per day (i.e., be high sedentary), but also exercise for one hour per day (i.e., be sufficiently active for health benefits; cf. Biddle, Gorely, Marshall, Murde, & Cameron, 2004; Burton, Khan, Brown, & Turrell, 2012). Indeed, high levels of sedentary behaviour has been observed in marathon and half-marathon runners (Whitfield, Gabriel, Kelley, & Kohl, 2014). Consequently, it is increasingly necessary for researchers to consider both the *independent* and *interactional* effects of sedentary behaviour and physical activity on health outcomes (Biswas et al, 2015).

Prevalence

Even though humans have engaged in sedentary behaviour throughout history, widespread, frequent, and excessive sitting is a strikingly modern phenomenon. Time use data from the United States and United Kingdom shows an increase in sedentary time since the 1960s, with similar albeit delayed trends currently occurring in China and India (Ng & Popkin, 2012). Observed increases in sedentary time are most commonly attributed to the industrial, mechanical, and social changes of the twentieth century (e.g., Levine, 2004; Owen, 2012).

In Canada, data indicates that sedentary behaviour occurs at endemic levels. For instance, in an accelerometer study of 2838 Canadian adults, Colley et al (2011) observed that adults were sedentary for an average of 9.7 hours (men = 9.6 hours, women = 9.8 hours) per day. Similar figures have been found in other Western nations, including Australia (Australian Bureau of Statistics, 2013), the United States (Matthews et al, 2008; 2012), the United Kingdom (British Heart Foundation National Centre for Physical Activity and Health, 2012), and select European nations (Milton, Gale, Stamatakis, & Bauman, 2015; Sjöström, Oja, Hagströmer, Smith, & Bauman, 2006). Other work has identified high-risk subgroups, including older adults (e.g., up to 86% of waking hours spent sedentary; Gorman et al, 2013), office employees (e.g., 79% of work hours; Hadgraft et al, 2016), and truck drivers (Apostolopoulos et al, 2012; Sieber et al, 2007). While prevalence figures are disconcerting, Hamilton and colleagues have noted that humans have yet to reach their "full sitting potential" (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008, pp. 293). That is, with technological advances and the ongoing transition to post-industrial economies, levels of sedentary behaviour may continue to rise.

Health and Intervention Research

Research concerning the outcomes of sedentary behaviour can be roughly categorised as either "physiological" or "health". In terms of physiological research, animal and human studies have found excessive sedentary behaviour to be associated with multiple deleterious outcomes, including impaired metabolic function (Stephens, Granados, Zderic, Hamilton, & Braun, 2011), decreased bone mineral content (Zwart et al, 2007) and cardiovascular risk biomarkers (Hamburg et al, 2007; cf. Tremblay et al, 2010). Research conducted by Hamilton, Hamilton, and Zderic (2004) suggests that such outcomes may be partially attributable to the inactivation of the large, lower-body muscles rather than being in a low-energy state. In their study, rats that had their hind legs elevated – but had free run of their enclosure – had significantly poorer metabolic health than control rats. In terms of human health implications, such results suggest that changing posture – e.g., from sitting to standing – may be sufficient to mitigate the deleterious effects of sedentary behaviour.

Complementary health/epidemiological research has linked sedentary behaviour to outcomes like obesity (Hu, Lui, Colditz, Willett, & Binns, 2004) and mortality (Katzmarzyk, Church, Craig, & Bouchard, 2009). There is also a growing body of evidence on the relationship between sedentary behaviour and poor mental health (Atkin, Adams, Bull, & Biddle, 2012) and impaired functional abilities (Chen, Narazaki, Haeuchi, Chen, Honda, & Kumagai, 2016). These relationships appear to persist when controlling for physical activity level, indicative that sedentary behaviour is an independent determinant of health (e.g., Edwardson et al, 2012; Hamilton et al, 2004 & 2007; Patel et al, 2010; van der Ploeg, Chey, Korda, Banks, & Bauman, 2012). However, despite the rapid pace of health research, the field has yet to reach the point where – like physical activity and tobacco – specific, evidence-based, and realistic health behaviour recommendations can be made for adults. That said, the above risk findings have been cause for concern, and there is growing consensus that individuals should make efforts to reduce their sedentary time. In recent years, multiple governmental and non-governmental groups have discussed the importance of sedentary reduction (e.g., Australian Government Comcare, 2014; Canadian Cancer Society, 2017; ParticipACTION, 2016). For instance, both the United Kingdom (Government of the United Kingdom Department of Health, 2011) and Australia (Australian Government Department of Health, 2014) have acknowledged sedentary behaviour in their adult physical activity guidelines.

While it may be tempting to view physical activity as the solution to sedentary behaviour, a systemic review by Prince and colleagues found exercise interventions to be largely ineffective at creating meaningful reductions in sedentary time (Prince, Saunders, Gresty, & Reid, 2014). Rather, it has been suggested that sedentary behaviour be *specifically addressed* through a series of "micro-interventions" that emphasise light-intensity physical activity, such as purposeful fidgeting, standing breaks, and gentle walking (Barwais, Cuddihy, & Tomson, 2012; Owen, Sugiyama, Eakin, Gardiner, Tremblay, & Sallis, 2011; Tremblay et al, 2010). Such interventions may carry the benefit of being transferrable to multiple contexts (e.g., a general "move more" strategy may be applicable to many settings); require fewer resources than traditional physical activity programs (e.g., no specialised equipment, clothing, spaces, or training); and being highly-accessible to individuals – perhaps even those who dislike exercise or are limited due to a medical condition.

Multiple published articles have examined interventions for sedentary behaviour reduction ("sedentary intervention"). Typically, programs attempt to reduce total sitting time by increasing standing and/or light-intensity physical activity (e.g., gentle walking), though certain interventions have also examined indicators like the number of sit-stand transitions and sitting bout duration. Feasibility studies, such as those conducted by Alkhajah et al (2012) and Carr, Walaska, and Marcus (2012), suggest that such interventions are generally well-tolerated by participants; however, literature reviews of intervention efficacy are mixed and raise issues regarding methodological quality and the ability to produce meaningful changes in health outcomes, particularly across time (Table 1).

Sedentary Behaviour Psychology

In contrast to health and intervention research, remarkably little attention has been afforded to the psychological basis of sedentary behaviour. Broadly defined, "psychology" refers to the *scientific study of the mind and body*, with "behaviour" being *observable actions* and "the mind" referring to *subjective experiences, unconscious processes, and the physical nervous system* (Gray, 2006, pp. 1). Though psychology recognises that humans exist in a complex sociolinguistic environment, the individual – specifically, the individuals' mind – is assumed to be the ultimate cause of behaviour and conscious experience.

Table 1 – Summary of systematic and meta-analytic literature reviews on sedentary behaviour intervention.

Citation	Purpose	Sample	Findings	Conclusions
Chau, 2010	Systematic review of the effectiveness of workplace interventions for reducing sitting.	6 studies	(1) All studies had a primary aim of increasing PA; a secondary aim of reducing SB. (2) No studies showed that sitting decreased significantly in the intervention group.	There is insufficient evidence to suggest that workplace PA interventions are effective at decreasing SB.
Karakolis, 2014	Examined the effectiveness of sit-stand workstations at reducing worker discomfort without causing a decrease in productivity.	14 publications	(1) 7/14 reported discomfort scores, of which 6/7 indicated that sit-stand workstations led to lower levels of reported subjective discomfort. (2) 3/6 studies had statistically significant improvements. (3) 4/8 productivity studies indicated no effect.	Sit-stand workstations may be effective in reducing physical discomfort.
MacEwen, 2015	Examine the evidence for standing and treadmill desks in relation to physiological and psychological outcomes.	19 quasi-experimental studies and 4 RCTs	(1) Treadmill desks led the greatest improvement in physiological outcomes. (2) Standing and treadmill desks showed mixed results for improving psychological well-being.	Standing and treadmill desk show some utility for break-up sitting time and potentially improving select health outcomes. However, there are substantial evidence gaps.
Martin, 2015	Evaluate the effect of interventions which included a SB measure in adults.	51 studies	(1) 34/51 studies showed a reduction of 22 min/day SB. (2) Lifestyle interventions: -24 min/day SB. (3) SB-specific interventions: -42 min/day. (4) There was no evidence for the effect of PA and PA+SB interventions on reducing SB.	Lifestyle and SB-specific interventions may be effective at reducing SB. Available evidence is low quality and lack long-term follow-up.
Neuhaus, 2014	The effect of activity-permissive workstations on SB, health-risk biomarkers, work performance, and feasibility.	19 field-based trials and 19 laboratory studies	(1) Pooled effect size = -77 minutes (95% CI = -120 t0 -35) of SB per 8hr workday. (2) No significant changes reported for most health- and work-related outcomes. (3) Participants generally responded positively to intervention.	Preliminary evidence indicates activity-permissive workstations can reduce SB without compromising work performance. Insufficient evidence is available regarding health outcomes.

Table 1 (continued) – Summary of systematic and meta-analytic literature reviews on sedentary behaviour intervention.

Citation	Purpose	Sample	Findings	Conclusions
Prince, 2014	Systematic review of the SB reduction literature.	65 studies	(1) Studies that focused on PA promotion produced less-consistent findings, and generally resulted in modest reductions in sedentary time. (2) There was moderate-quality evidence that SB-specific interventions can produce large and meaningful reductions in SB.	Intervention ability to reduce SB: SB-specific > PA-specific > SB+PA
Shrestha, 2016	To evaluate the effects of workplace interventions to reduce sitting at work.	20 studies	(1) Interventions included: physical changes to the workplace, policy changes, information and counselling, and multi-component interventions. No studies examined standing breaks or standing/walking meetings. (2) There is low-quality evidence that interventions reduce sitting. (3) Sit-stand desks did not have a considerable effect on work performance, musculoskeletal symptoms, or sick leave. (5) The observed reductions are “considerably less” than the amount needed to produce meaningful benefits.	There is low quality evidence that interventions reduce workplace sitting in the short-term. There is no evidence on the effects in the long-term.
Tew, 2015	The effect of height-adjustable (sit-stand) workstations on workplace sitting time in office workers.	5 RCTs	(1) Risk of bias was high in all studies. (2) All studies reported that sit-stand desks reduced sedentary behaviour. (3) Insufficient evidence to determine the effects of sit-stand desks on health outcomes (e.g., body composition).	Insufficient evidence to conclude the effect of sit-stand desks on SB and SB-related health outcomes.

The fact that sedentary behaviour is a *behaviour* carries three implications for psychological research: first, that sedentary behaviour is of inherent interest to psychological and behavioural researchers; second, that sedentary behaviour has a corresponding set of mental processes; and third, that it is possible to study sedentary behaviour with psychological theory and methodology. With these points in mind, there are multiple justifications for pursuing a sedentary behaviour psychology research program – one of which it is that it promises to provide novel insight into a widely-practiced-but-poorly-understood activity. As such, findings could contribute to the broader field of psychology; specifically, our understanding of everyday human behaviour.

Within the field of sedentary behaviour, a psychological perspective is important for two primary reasons: the limitations of physiological research and to inform intervention design. Though physiological research (i.e., “inactivity physiology”; Hamilton et al, 2004) is valuable in that it describes biological processes and disease states, it cannot capture the complexities of social life and individual psychology. For example, as illustrated in Study One (see pp. 44 and pp. 53), not all types of sedentary behaviours are *perceived* as being equal – a finding that cannot be accounted for by physiological research. As such, if sedentary behaviour researchers are interested in understanding the behaviour in its entirety, it must not neglect the psychosocial sphere.

Psychological research, with its focus on the antecedents and outcomes of behaviour, also carries implications for sedentary intervention. As emphasised by the World Health Organisation (2003; 2011; 2015) and multiple health researchers (e.g., Armitage & Conner, 2000; Conner & Norman, 2005; Engel, 1977; Marks, Sykes, & McKinley, 2003; McKinlay & Marceau, 2000), social- and individual-level factors serve as key determinants of health. Given this, it is unsurprising that some of the most successful health interventions are those that take into account psychological factors like motivation and self-regulatory skills (i.e., the “why” and “how” of behaviour; Artinian et al, 2010; Brawley, Gierc, & Locke, 2013). As these findings emerge consistently across health behaviours, it seems reasonable to expect psychology to be equally applicable to sedentary behaviour reduction (see Biddle, 2011).

Literature Review

While a large body of research has examined the psychological correlates of screen time and insufficient physical activity, this work offers little insight into sedentary behaviour psychology. To elaborate, consider screen time research: since the mid-1900s, thousands of studies from dozens of research traditions have attempted to understand the effect of screen time on individuals and societies. For example, media researchers might ask why individuals prefer a given television genre; developmental psychologists are frequently concerned with the effect of violent television shows on aggression; whereas health researchers have explored relationships between television, snacking, and obesity. The purpose of this research is to understand why we watch television and what happens when we watch television. Sedentary behaviour is often an inherent assumption[3] of such work and is rarely an explicit variable of interest. Physical activity research proves unhelpful for similar reasons: sedentary behaviour is often conceptualised as a “bad” behaviour that competes with moderate-to-vigorous physical activity (e.g., Rhodes &

[3] Many sedentary behaviour studies have used measures of television viewing time as a proxy for sedentary behaviour. The use of television as a proxy is troubling for two primary reasons. First, it is a highly specific behaviour that may not necessarily reflect the psychological and behavioural aspects of other types of sedentary behaviour. Second, television viewing measures rarely require individuals to report the *posture* they adopt while watching television. For example, Otten, Littenberg, and Harvey-Berino (2010) used a self-report measure that asked participants: “How many hours do you watch TV per day, on average?” No items examined posture. While it is *likely* that individuals watch television in a sedentary posture, it remains very possible that they are watching television while running on a treadmill, cooking, standing at an airport, etc.

Blanchard, 2011). Many physical activity researchers and interventionists are interested in *reducing* sedentary behaviour – not understanding it.

After omitting screen time and physical activity research, what do we know about sedentary behaviour? In short: not much. While working on this dissertation, regular literature searches were conducted for peer-reviewed articles on the *psychological correlates* of *adult sedentary behaviour*. Publications were excluded if they emphasised children/adolescents; if they focused on the demographic/environmental correlates of sedentary behaviour (e.g., age, gender, neighbourhood walkability); if they examined psychological strategies for intervention (e.g., motivational interviewing, self-monitoring); or if they were concerned with abnormal psychology (e.g., occupational sitting and psychological distress). After exclusions, twenty-five manuscripts were identified. An overview of this work can be found in Table 2 (qualitative) and Table 3 (quantitative).

Though it is difficult to draw conclusions from such a small and varied body of work, several emergent trends are noteworthy. First, and perhaps most importantly, research has consistently observed differences between sedentary psychology and exercise psychology. While the specific nature of these differences requires further research, the consistency of findings across studies reinforces the need to conceptualise sedentary behaviour as *an independent health behaviour with its own set of psychological correlates* – not simply the opposite of physical activity. That is, although sedentary behaviour is often perceived as infringing upon (or competing with) physical activity, we should not automatically assume that the psychological determinants of sedentary behaviour are equivalent to the psychological determinants of insufficient physical activity. For example, consider that an individual's motivation for watching television (e.g., rest, socialising, Star Wars marathon) could be quite different than the

Table 2 – Overview of qualitative sedentary psychology research

CITATION	PURPOSE	DESIGN	PRIMARY FINDINGS
Chastin, 2014	What are (1) the determinants of sedentary behaviour, and (2) strategies and motivations to reduce sitting time in older women?	Qualitative, semi-structured interviews with 9 community-dwelling older women.	(1) Sitting was described as a positive strategy that allowed women to cope with pain and retain their independence. (2) Women commented on a non-supportive social and built environment. (3) Several expressed lack of confidence for standing. (4) Many stated that they could not see benefits in standing more. (**PA)** Some identified determinants were identical to those affecting PA (e.g., self-efficacy, functional limitations); some appear to be specific to sedentary behaviour (e.g., pain, locus of control).
Deliens, 2015	What are the (1) determinants of PA and SB in Belgian university students, and (2) strategies for increasing PA and decreasing SB?	Semi-structured focus groups with 46 university students.	(1) PA and SB are influenced by social factors (e.g., perceived enjoyment, social factors (e.g., social support), and the environment (e.g., accessibility). (2) Students reported that increasing PA (e.g., via on-campus sports) might simultaneously decrease their SB.
Gilson, 2011	Examine office-based employees' perceptions of the health risks associated with prolonged sitting at work.	Qualitative, semi-structured focus groups, with 22 Australian office workers.	(1) The workplace was seen as the dominant sedentary context. (2) Workers associated SB with poor health, especially musculoskeletal issues, fatigue, and low motivation. (3) Barriers to intervention include reduced productivity, the built and social environment. (**PA**) Workers expressed the need to *both* reduce SB and increase PA.
Mabry, 2014	To explore barriers and solutions to physical inactivity and SB in adult Omanis.	Cross-sectional study of N = 10 Omani public health managers.	(1) Participants' responses regarding SB were limited relative to responses relating to PA. (2) Identified correlates of population SB included intrapersonal (e.g., low awareness), social (e.g., sedentary culture) and environmental (e.g., limited places for active leisure). (3) Potential SB intervention strategies included participation and volunteerism.

Table 2 (continued) – Overview of qualitative sedentary psychology research

CITATION	PURPOSE	DESIGN	PRIMARY FINDINGS
McGuckin, 2017	Explore office workers' perceptions of (1) SB and (2) SB intervention.	Cross-sectional, mixed-methods survey of N = 140 Australian office workers; follow-up focus groups with N = 12.	(1) 88% of participants agreed that there was a relationship between SB and health. The most prominent theme was musculoskeletal complaints, followed by general health, weight gain, and obesity. (2) Focus groups identified intervention strategies like education, manager support, and addressing preferences and barriers.
Shuval, 2013	Examine issues related to PA and SB engagement in urban, poor adults.	Qualitative, semi-structured interviews with low-SES, ethnic minority adults.	(1) Participants were unfamiliar with the term "sedentary behaviour", and did not perceive a relationship between SB and health outcomes. (2) Once defined, all understood the term and most reported being sedentary. (**PA**) Participants were familiar with PA and could identify its health benefits, but reported low levels of engagement. In contrast, they were unfamiliar with SB, could not identify health risks, and reported engaging in it.
Van Uffelen 2011	Examine older adults' ability to answer sitting-time questionnaires.	Think-aloud study, where older adults answered the IPAQ and PA Scale for the Elderly	(1) Many participants had difficulties understanding what activities to report (e.g, typical day vs. specific recall). (2) Participants used a variety of strategies when responding. (3) Recommendation: verify the clarity of SB measures before applying.

Table 3 – Overview of quantitative sedentary psychology research

THEORY	CITATION	PURPOSE	DESIGN	MEASURES	PRIMARY FINDINGS
Dual-Process	Conroy, 2013	To examine the influence of habit strength and intentions on SB	14-day prospective study N = 125 undergrad students	Intentions to limit SB to (1) 75 min/bout and (2) 5 hrs/day total Self-Report Habit Strength Accelerometer IPAQ – SB measures	(1) Stronger sedentary habits were associated with greater SB. (2) Stronger intentions to limit SB were associated with less SB. (3) Conclusion: SB is regulated by both automatic and controlled motivational processes. (**PA**) Negative correlation observed between SB intentions and MVPA behaviour; between MVPA intentions and SB behaviour.
Dual-Process	Maher, 2015	To examine whether (1) action planning predicts SB, and (2) if habit strength moderates the relationship	7-day action planning intervention N = 195 undergrad students	Self-Report Habit Strength Intentions to reduce SB; intentions to increase PA IPAQ – PA and SB measures	(1) SB was positively correlated with SB habit strength. (2) SB was negatively correlated with SB intentions. (3) Conclusion: Action planning is ineffective at reducing sedentary behaviour. (4) Consideration: Domain-specific measures may be needed to determine how interventions affect SB. (**PA**) Action planning had an impact on physical activity but not sedentary behaviour.
Dual-Process	Maher, 2016	To examine a dual-process model of older adults' sedentary behaviour.	Longitudinal diary study, with	Self-report SB Accelerometer Various psychological, incl. self-efficacy, planning, intentions, motivation	(1) SB was positively correlated with SB habit strength. (2) SB was negatively correlated with plans to reduce SB at the within-person, but not between-person level. (3) Intentions to limit SB were positively associated with self-efficacy. (4) Intentions to limit SB were not associated with **light-intensity PA** OEs, SB risk perceptions, or SB habit strength.

Table 3 (continued) – Overview of quantitative sedentary psychology research

THEORY	**CITATION**	**PURPOSE**	**DESIGN**	**MEASURES**	**PRIMARY FINDINGS**
Dual-Process	Warner, 2011 [Abstract]	To examine the TPB and habit strength in predicting SB.	Cross-sectional survey.	SB measure (not described) TPB questionnaire Self-Report Habit Strength	(1) Intentions did not significantly predict SB. (2) Habit strength emerged as a large and significant predictor.
Protection Motivation Theory	Wong, 2016	Determine the utility of PMT constructs in predicting SB	Questionnaire, with participants randomised to receive either general or leisure-time SB items N = 787 undergrad students	Self-report SB PMT questionnaire: Threat and coping appraisals; intentions;	(1) Psychometric analysis indicated an eight-factor PMT sedentary model. (2) 10-16% of variance in implementation intentions was accounted for. (3) 5% of the variance in goal intention was accounted for. (4) 1-3% of the variance in sedentary behaviour was accounted for.
Self-Determination Theory	Gaston, 2016	To determine whether motivational constructs are related to SB.	Cross-sectional SDT questionnaire, examining either general or specific SB (i.e., week vs. weekend; volitional vs. non-volitional) N = 571 university students and staff members	Self-report SB SB-modified Behavioural Regulation in Exercise Questionnaire	(1) Motivational constructs were not related to general SB. (2) Motivational constructs accounted for 3-10% of the variance in specific forms of sedentary behaviour. (3) Autonomous motives were more related to volitional SB, whereas controlled motives were more related to non-volitional SB.
Self-Determination Theory	Quartiroli, 2014	To examine SB from a SDT perspective.	Cross-sectional survey of 875 undergrads.	IPAQ Basic Psychological Needs in Exercise Scale Behavioral Regulation in Exercise Questionnaire-2	(1) SDT variables were negatively and weakly related to SB. (4) Findings suggest that physical activity and SB should be treated as different entities. (**PA**) Observed a small but statistically significant negative relationship between MVPA and sedentary behaviour. SDT variables were moderately related to MVPA, but only weakly related to SB. Findings suggest that MPVA and SB should be treated as different entities.

Table 3 (continued) – Overview of quantitative sedentary psychology research

THEORY	CITATION	PURPOSE	DESIGN	MEASURES	PRIMARY FINDINGS
Theory of Planned Behaviour	Lowe, 2014	To examine the demographic, medical, and social-cognitive correlates of SB in advanced cancer patients.	Cross-sectional survey interview of patients with brain metastases. 7-day accelerometer. N = 31	Accelerometer TPB PA questionnaire – previously validated in cancer patients	(1) Instrumental and affective attitudes were negatively related to SB. Item e.g.: "I think that for me to perform regular PA over the next month would be enjoyable/unenjoyable."
Theory of Planned Behaviour	Prapavessis, 2015	To examine the utility of theTPB in predicting SB intentions and time spent in SB	Cross-sectional TPB questionnaire, examining either general or specific SB (i.e., week vs. weekend; volitional vs. non-volitional) N = 372 adults	Self-report SB TPB questionnaire	(1) AT, SN, and PBC explained 9-58% of the variance in intention. (2) TPB variables explained 8-43% of the variance in behaviour. (3) Differences were found between weekday and weekend SB; work and leisure SB.
Theory of Planned Behaviour	Rhodes, 2009	To apply the TPB to four leisure SBs: TV, computer, reading/music, and sedentary socialising	Cross-sectional questionnaire of 206 community-based adults 2-week prospective questionnaire of 175 undergrad students	Self-report SB: bouts of leisure SB $\geq$ 30 minutes over the past week TPB questionnaire	(1) Positive correlations were observed between AT/INT and INT/SB. (2) Non-significant correlations were observed between SN/INT and PBC/INT. (3) The four leisure behaviours show similar correlation patterns, but differed in strength of relationship. (4) Consideration: The need to study types of SB individually.
Theory of Planned Behaviour	Smith, 1999	To determine the relationship between PA, SB, and TPB variables.	Cross-sectional survey of 155 British office workers.	SB not measured PA: Godin Leisure-Time Exercise Questionnaire Two TPB surveys: one for leisure PA, one for SB.	(1) TPB was a poor fit overall for the sedentary data. (**PA**) Observed a negative relationship between SB intentions and leisure MVPA behaviour.

Table 3 (continued) – Overview of quantitative sedentary psychology research

THEORY	CITATION	PURPOSE	DESIGN	MEASURES	PRIMARY FINDINGS
Atheoretical	Busschaert, 2016	To examine the relationship between interpersonal, social cognitive, and physical environmental variables with sedentary behaviour.	Cross-sectional survey of 301 adults; longitudinal data available for 188	Self-report SB Psychological, incl. attitudes, self-efficacy Interpersonal, incl. family situation, occupation, etc. Environment, incl. TV and computer access	(1) Cross-sectional predictor variables differed from longitudinal predictor variables. (2) The correlates of SB were found to differ between activities. (3) Social cognitive variables, particularly attitude, self-efficacy, and social norms, were consistently related to SB.
Atheoretical	De Cocker, 2014	To identify socio-demographic, health-related, work-related, and psychological correlates of occupational sitting.	Cross-sectional survey of N = 993 Australian adults.	Demographics Health: e.g., general, BMI Employment information Psychology: Social norms, self-efficacy, advantages, intention	(1) Work-related and socio-demographic factors were the strongest correlates of sitting. (2) Of the eight psychosocial factors, only higher awareness of the advantages of sitting less was associated with SB. (3) Moderating effect of occupation: Perceived control was associated with SB in white-collar and professional workers, not blue-collar
Atheoretical	O'Neill, 2016	To assess the association between various sedentary activities and self-reported psychological health.	Data from the Canadian Community Health Survey; N = 17,289 adults aged 45+	Self-report SB Perceived health Sense of belonging Life satisfaction	(1) Sedentary activities with a large social or cognitive component were more likely to be associated with better health. (2) Sense of belonging was consistently and positively associated with SB.

Table 3 (continued) – Overview of quantitative sedentary psychology research

THEORY	CITATION	PURPOSE	DESIGN	MEASURES	PRIMARY FINDINGS
Atheoretical	Salmon, 2003	To examine whether differences in preferences, barriers, and enjoyment predict SB and PA.	Cross-sectional survey of N = 1332 adults.	Leisure PA 1-week SB recall Barriers to PA PA and SB enjoyment Behavioural preferences	(1) Personal barriers were inversely related to leisure SB. (2) Positive correlations between time spent in an activity and enjoyment/preference. (**PA**) Financial and weather barriers were negatively related to MVPA, but were positively related to SB (TV, reading)
Atheoretical	Van Dyck, 2011	To identify the socio-demographic, home-environmental, and psychosocial factors associated with SB.	Cross-sectional survey of N = 419 Belgian adults.	Self-report domestic screen time Demographics Home environment Psychological, incl. self-efficacy	(1) Self-efficacy to reducing screen time, perceived pros and cons for reducing screen time, were most consistent correlates of SB.
Atheroretical	Uijtdewilligen, 2014	To examine the relationship between personal-related factors with leisure time TV and computer use.	Sample of N = 475 Dutch young adults who were participants in the Amsterdam Growth and Health Longitudinal Study	Self-report leisure TV and computer Self-reported health Psychological, incl. personality	(1) Individuals who scored lower on emotion-focused coping reported higher computer time; non-significant in multivariable model. (2) Personality traits of rigidity and self-sufficiency were associated with increased TV use.

Table 3 (continued) – Overview of quantitative sedentary psychology research

THEORY	CITATION	PURPOSE	DESIGN	MEASURES	PRIMARY FINDINGS
Atheoretical	Wallmann-Sperlich, 2014	To examine the correlates of prolonged SB in the workplace	Cross-sectional sample of N = 1515 German employees	Self-report SB Self-report PA Two items regarding beliefs about sitting: (1) Duration of sitting and (2) Discomfort.	(1) The only associated cognitive correlate of occupational sitting was men's belief: "Sitting for long periods does not matter to me."

motivation for not joining a recreational volleyball team (e.g., low task self-efficacy, fear of injury, dislike of volleyball).

Second, while the Theory of Planned Behaviour (Ajzen, 1991; see Study Three, pp. 100) has had mixed success in predicting sedentary behaviour (Warner, 2011; Smith & Biddle, 1999), there is some evidence that *attitudes* predict leisure-time sedentary behaviour. Similarly, Salmon et al (2003) observed that preference strength was positively correlated with self-reported behaviour. In contrast, research by Prapavessis and colleagues (Prapavessis, Gaston, & DeJesus, 2015) suggests that *social norms* are particularly important in occupational settings. Together, results indicate that the psychological predictors of sedentary behaviour differ across context and/or activity type.

Third and lastly, self-report habit strength was consistently found to be a positive predictor of sedentary time (Warner, 2011; Conroy et al, 2013; Maher & Conroy, 2015). While there is debate over whether self-report habit strength accurately measures habit (i.e., habit as a non-conscious phenomenon where stimuli trigger behaviour; Gardner, 2015) data nonetheless suggests that sedentary behaviour is perceived by individuals as being a less-deliberative behaviour.

Reflecting on research and behaviour, Biddle (2011) has questioned whether social cognitive models of health behaviour – which assume that individuals engage in an active decision-making process – apply to sedentary behaviour. Though social cognitive models have been quite successful in understanding behaviours like tobacco cessation and healthy diets (Conner & Norman, 2005), sedentary behaviour may differ from other health behaviours in a number of qualitative and quantitative ways (Table 4). For example, sedentary behaviour is thought to require "little or no conscious decision making" (Biddle, 2011, pp. 7), whereas

Table 4 – Comparing the characteristics of SB and MVPA (adapted from Biddle, 2011)

Sedentary Behaviour	**MVPA**
METs ≲ 1.5	METs ≳ 3
Most/all people engage in SB on a regular basis; average 9.7 hours per person per day	Only about 15% of Canadians are sufficiently active on a regular basis
Occurs multiple times throughout the day	Limited to several bouts per week
Can persist for hours without interruption	Typically lasts one hour or less, with breaks
Many environmental supports for the behaviour (e.g., chairs, benches, couches, social norms)	Environmental cues frequently discourage MVPA (e.g., escalators and elevators); individuals often go out of their way to exercise (e.g., to gyms, pools, walking trails, leagues)
Occurs mainly as a by-product of a purposeful activity or context	Purposeful; people consciously engage in MVPA for exercise and/or its outcomes
Frequently occurs without planning	Frequently requires preparation and planning

leisure-time physical activity frequently demands purposeful self-regulation (e.g., Gierc, Locke, Jung, & Brawley, 2014; Gyurcsik, Brawley, Spink, & Sessford, 2013). Given these hypothesised differences, Biddle has suggested that it may be useful to turn to approaches that account for non-conscious processes (e.g., habit), reinforcement value (e.g., behavioural economics), and ease of access (e.g., nudge), in that they better conceptualise sedentary behaviour as a natural part of everyday life.

Given the dearth of research, it seems premature to make broad judgements regarding the nature of sedentary behaviour, including which theories should be adopted or discarded. This is particularly true given that past theory-based research has many methodological limitations (see Study Three, pp. 104, for further discussion). In short, dismissing social cognitive theories at this time may be tantamount to “throwing the baby out with the bathwater.” Nonetheless, Biddle’s (2011) underlying argument should not go unrecognised: to reemphasise, *sedentary behaviour is a natural part of everyday life*. The history, prevalence, social function, – and perhaps even biological necessity – of sedentary behaviour all suggest the need to treat it as something other than a prototypical health behaviour. That is, as being something different than explicit health behaviours like cancer screening, mindfulness meditation, or decreasing sodium intake.

The Current Dissertation

The following dissertation studies examine an area of sedentary behaviour that has, to date, gone largely unexplored: its psychological antecedents and outcomes. Why do individuals engage in sedentary behaviour *so often* and across *so many* settings? What happens if we reduce sedentary behaviour? Does exercise participation affect perceptions of sedentary behaviour? Research was particularly interested in examining relationships between the person (e.g., attitudes), the built/social environment, and behaviour (e.g., type of sedentary behaviour). For instance, Study One examined how perceptions of sedentary behaviour are affected by context, while Study Two explored how self-efficacy differs across postures and activities. Such work attempts to systematically consider sedentary behaviour psychology and, as such, contribute to the emerging field of sedentary behaviour.

A second purpose of this dissertation was to respond to Biddle's (2011) call for increased research into the psychological factors associated with sedentary behaviour intervention. For example: What are realistic intervention targets? Which individual-level factors influence willingness to engage in intervention? As has been illustrated by intervention research (e.g., Artinian et al, 2010; Brawley et al, 2013), such information could prove key to designing clinically effective interventions.

Theoretical Orientation

While empirical research on the psychology of sedentary behaviour is limited, it is not uncommon for sedentary behaviour researchers – psychologists or otherwise – to discuss the determinants of sedentary behaviour. Hypothesised determinants fall under four complementary thematic areas: evolutionary psychology (e.g., Hamlin & Paterson, 2014; Wadsworth, Gleason, & Stoner, 2014), automatic/non-conscious processes (e.g., Warner, 2011; Conroy et al, 2013), social cognitions/conscious processes (e.g., Rhodes & Dean, 2009; Salmon et al, 2003), and ecological models (e.g., Owen, 2012; Owen et al, 2011). Though each of the above perspectives will be required for a comprehensive understanding of sedentary behaviour, – and, indeed, there likely exists significant overlap between each area – this dissertation adopts a social cognitive perspective. Not only do social cognitive theories have an established research history with well-defined theories and techniques, but they include the concept of psychological beliefs being a function of person-by-situation interactions. As these theories have proven to be effective in helping to understand other types of health behaviours (Conner & Norman, 2005), it is reasonable to hypothesise that they will be of value in understanding sedentary behaviour.

The three studies of this dissertation were written as independent manuscripts, with a final discussion providing a summary of major results and contributions. Associated pilot studies and research materials (e.g., ethics certificates, questionnaires) can be found in the Appendixes.

STUDY ONE:

SEDENTARY … WHAT?

LAY PERCEPTIONS OF SEDENTARY BEHAVIOUR

Introduction

Since 2000, considerable attention has been directed toward understanding sedentary behaviour – activities that involve low effort sitting/reclining (Sedentary Behaviour Research Network, 2012). Multiple studies have found evidence of a deleterious relationship between sitting and health, including increasing population-level risk of cardiovascular disease (Ford & Caspersen, 2012), type-2 diabetes (Biswas et al, 2015), and mortality (Katzmarzyk et al, 2009; Katzmarzyk & Lee, 2011). At the same time, there is growing awareness that most adults spend a significant portion of their waking hours engaged in sedentary behaviour. For instance, an accelerometer study conducted by Statistics Canada (Colley et al, 2011) found that the average Canadian adult is sedentary for 9.7 hours each day.

In contrast to health and prevalence research, substantially less work has considered the psychological antecedents of sedentary behaviour. Reviews by Biddle (2011), Owen et al (2011), and Rhodes, Mark, and Temmel (2012) have called attention to this lack of research, and have noted the necessity of such work for informing intervention. Work is particularly lacking in adult and older adult populations, as is illustrated by a recent review by Rollo, Gaston, and Prapavessis (2016). During the course of dissertation research, only twenty-five studies were located that examined the psychological correlates adult sedentary behaviour (see Table 2, pp. 13, and Table 3, pp. 15). Consequently, there is not so much a "gap" in our understanding as there is a "chasm": not only do we lack an understanding of *why* individuals engage in sedentary behaviour, but many conceptual and methodological issues (e.g., how to adequately describe constructs to participants) have gone unaddressed. Without a foundational understanding of sedentary behaviour, researchers are poorly equipped in their ability to identify themes, select theories, and design effective interventions.

Despite the need to engage in exploratory/first generation research, a number of researchers have proceeded to investigate sedentary behaviour with previously established theory and methodology: for example, 17 of the 25 studies identified by Rollo et al (2016) utilised theory in some fashion. While some research has applied theory quite effectively by taking into account the uniqueness of sedentary behaviour, others have simply applied exercise psychology paradigms to sedentary behaviour. An example is a study by Quartiroli and Maeda (2014), which examined "whether physical activity related behavioural regulations and psychological needs [Self-Determination Theory, "SDT"] predict sedentary behaviour as strongly as MVPA" (pp. 89). While examining sedentary behaviour through SDT might be useful, the study's methods raise questions about conceptual correspondence between measures and the dependent variable. For instance, sedentary behaviour is recognised as encapsulating a diverse array of activities across the domains of work, leisure, transportation, and communication (Owen, 2012). Quartiroli and Maeda ignore this variability, and instead attempt to explain *global* sedentary behaviour with a narrow set of psychological correlates. The psychological scales themselves were specifically designed for use in exercise settings rather than sedentary behaviour. Items included, for instance, "The way I exercise is in agreement with my choices and interests" (Basic Needs in Exercise Scale; Vlachopoulos & Michailidou, 2006) and "I feel ashamed when I miss an exercise session" (Behavioural Regulation in Exercise Questionnaire, Second Edition; Markland & Tobin, 2004). Psychological variables accounted for only 2.8% of the variance in self-reported sedentary behaviour compared to 14.3% of the variance in self-reported physical activity. If sedentary behaviour is indeed the independent health behaviour that is so often claimed (e.g., Hamilton et al, 2007; Pate et al, 2008), then we should not expect prediction through exercise psychology measures. Indeed, sedentary behaviour likely necessitates entirely new methods of study.

To date, seven publications have examined adult sedentary behaviour using qualitative methods (Table 2, pp. 13). Though qualitative work is not necessarily exploratory, it opens the door for novel insights into the subtleties and complexities of phenomena (Anderson, 2010). Given the current state of research on adult sedentary behaviour psychology, a qualitative approach is particularly appropriate in that it fosters a "bottom-up" understanding of individuals' lived experiences. This, in turn, provides insight into prominent themes and relevant issues for future research. In contrast, approaching behaviour through a "top-down" researcher-as-expert lens carries the high risk of making incorrect assumptions regarding which constructs, topics, and/or theories are most central to sedentary behaviour.

While the seven qualitative studies differed in their population of interest, – older adults, public health officials, office workers, and low-income ethnic minority adults – most (e.g., Chastin et al, 2014; Mabry et al, 2014) examined the following three research questions: (1) Do individuals know what sedentary behaviour is?, (2) Do individuals associate sedentary behaviour with poor health?, and (3) Is sedentary intervention possible? A final study (Van Uffelen et al, 2011) examined older adults' ability to complete the sedentary behaviour sections of the International Physical Activity Questionnaire (IPAQ) and the Physical Activity Scale for the Elderly (PASE). Collectively, the five studies raise a number of themes for future research: for instance, the role of the built/social environment, the motivational basis of sedentary behaviour, and the need for health education/awareness-raising.

The Current Study

Though qualitative research has notable strengths, it is also imbued with a set of inherent challenges to interpretation (Anderson, 2010). Small and highly-specific samples make it difficult to extend results to the broader population, whereas narrative and anecdotal data make systematic comparisons impossible. Thus, the purpose of the current study was to extend the scope of exploratory research by obtaining a larger and more-diverse sample than existing qualitative research on sedentary behaviour. This was accomplished through the use of an online, mixed-methods questionnaire.

Three primary research questions were posed:

1. **How do individuals understand and define sedentary behaviour?**

   Hypothesis: Informed by Mabry et al (2014), Shuval et al (2013), and Van Uffelen et al (2011), it was hypothesised that participants' personal definitions of sedentary behaviour would differ from the empirical definition of sedentary behaviour (see pp. 3). Specifically, it was hypothesised that individuals would conceptualise sedentary behaviour as *insufficient physical activity*.

2. **What outcomes (risks and/or benefits) do individuals associate with their personal sedentary behaviour?**

   Hypothesis: Informed by Gilson et al (2011), it was hypothesised that participants would primarily discuss the risks of sedentary behaviour in terms of ergonomic/musculoskeletal conditions (e.g., back pain) rather than chronic disease (i.e., as is highlighted by modern sedentary behaviour research; e.g., Tremblay et al, 2010). Given a lack of previous research, no *a priori* hypotheses were made regarding the perceived benefits of sedentary behaviour.

3. **Do perceptions of sedentary behaviour change as a function of the social context and/or activity?**

   Hypothesis: Given a lack of previous research, no *a priori* hypotheses were made.

A fourth and final question examined the relationship between sedentary psychology and leisure-time moderate-to-vigorous physical activity (LT-MVPA). Physiological and behavioural evidence suggests that sedentary behaviour and physical activity exist independently from one another: not only does sedentary behaviour appear to exert an independent effect on health (e.g., Edwardson et al, 2012), but highly sedentary individuals can also be sufficiently active for health benefits (e.g., Biswas et al, 2015). Psychological research has similarly concluded that the cognitions associated with sedentary behaviour are different from the cognitions associated with physical activity (see Table 2, pp. 13, and Table 3, pp. 15). However, in emphasising the differences between sedentary behaviour and physical activity, psychological research has neglected the possibility of an interaction between the two behaviours. Thus, it was asked:

4. **Do individuals who engage in greater amounts of LT-MVPA perceive their sedentary behaviour differently than individuals who engage in lesser amounts of LT-MVPA?**

   Hypothesis: Given a lack of previous research, no *a priori* hypotheses were made.

Method

Research protocol was approved by the University of Saskatchewan Research Ethics Board prior to commencing participant recruitment and data collection (Appendix B).

Participants

Participants were recruited through a series of online advertisements, including the University of Saskatchewan PAWS bulletin board, social media (Facebook, Tumblr), and community classified websites (Craigslist, Kijiji). No incentive was offered for participation. For maximum reach, no eligibility criteria were set save for being age 18 years or older.

The survey was accessed 258 times, with 183 individuals (70.9%) completing the survey beyond the demographic questionnaire. The final sample had a mean age of 34.1 (*SD* = 15.2) years, and was primarily female (76.0%) and Caucasian (77.6%). Detailed participant demographics can be found in Table 5.

Measures

The complete Study One questionnaire can be found in Appendix C.

Demographics. Basic demographic information, including age, ethnicity, and employment status, was collected for descriptive purposes.

Sedentary behaviour and physical activity. Individuals' self-reported sedentary behaviour was collected for descriptive purposes. As a gold standard self-report measure had not been established at the time of research, the scale used by Salmon et al (2003) and Gardiner et al (2010) was modified to include a more-diverse range of daily sedentary activities, and to incorporate insights from Atkin et al (2013) and Hardy et al (2013). Specifically, it had been suggested that individuals are better at recalling (1) participation in specific activities (e.g., reading) or domains (e.g., work) rather than total (global) sedentary time, and (2) "typical days" over specific recall.

Participants were first prompted to reflect on a typical weekday, and the different activities in which they participate. They were then asked to self-report the time, in minutes, that

Table 5 – Study One participant demographics.

	Total N = 183	**Complete** N = 162	**Incomplete** N = 21	**More-Active** N = 90	**Less-Active** N = 53
Age ± SD	34.1 ± 15.2	34.0 ± 15.0	34.3 ± 16.0	34.3 ± 15.8	33.5 ± 13.7
% Female	80.6	79.9	79.5	74.4	88.7
% English	94.6	97.2	84.6	96.7	98.1
% Caucasian	80.1	84.0	71.8	85.6	81.1
% ≥ 1 Chronic Disease	26.2	25.0	30.8	26.6	22.6
BMI ± SD	25.8 ± 7.3	25.7 ± 6.7	25.8 ± 9.4	24.9 ± 5.8	26.8 ± 7.5
Employment					
Full-/Part-Time	43.0	47.3	30.8	44.5	50.9
Student	39.2	36.8	51.3	37.8	35.8
Retired	10.2	9.7	12.8	12.2	5.7
Education					
≤ High School	8.1	7.6	10.2	3.3	15.1
College/Trades	4.8	4.9	5.1	4.4	5.7
(Some) University	85.4	87.5	84.5	92.1	79.2

Note: Column clusters include the total sample of 183 individuals; comparisons between individuals who exited the survey mid-way ("Incomplete") versus those who reached the end ("Complete"); and individuals who were identified as being more- or less-active.

they normally spend in (1) eleven common activities (e.g., eating, working at a desk) *while sitting down*, and (2) LT-MVPA. To reduce recall error, participants were instructed to only report activities of longer duration, defined as 15 minutes or greater (Gierc, Locke, Jung, & Brawley, 2014; Gionet & Godin, 1989).

For participant clarity, LT-MVPA was conceptualised as any activity that "makes your body feel warm, your breathing increase, your heart pump faster, and which might cause you to sweat." While current Canadian physical activity guidelines (Canadian Society of Exercise Physiology, 2011) recommend that adults engage in 150 minutes per week of moderate-to-vigorous physical activity, the self-report measure used in this study asked participants to report their *typical weekday LT-MVPA*. This daily format was adopted to ensure correspondence with the sedentary behaviour self-report measure participants had just completed. LT-MVPA – rather than global, occupational-, transportation-, or household-related physical activity – was specifically measured to aid participant recall: that is, leisure-time physical activity of more than 15 minutes typically requires planning and purposeful action, making it easier for participants to remember and accurately recall.

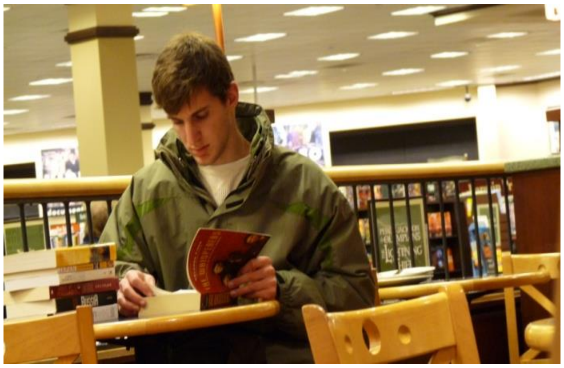
Definitional knowledge of sedentary behaviour. Four individual items were used to assess individuals' conceptual understanding of sedentary behaviour. The first item asked participants if, prior to the study, they had heard the term "sedentary" before. Responses were scored on a 1 (Definitely Not) to 7 (Definitely Yes) scale. Immediately following, participants were asked to provide a personal definition of "sedentary" along with examples of sedentary activities. Lastly, participants were asked to indicate whether they perceived certain sedentary activities as being "more sedentary" or "less sedentary" relative to others.

Health outcomes. Three items assessed the perceived health and mental health outcomes of individuals' *personal* sedentary behaviour. The first item asked, "Do you consider **your** sedentary behaviour to be healthy or unhealthy?" [emphasis in original]. Responses were scored on a 1 (Very Unhealthy) to 7 (Very Healthy) scale. Participants were then asked to describe the health and/or mental health outcomes of their personal sedentary behaviour. Specifically, the second item asked about the *benefits* of sedentary behaviour, while the third item asked about the *costs* of sedentary behaviour.

Sedentary behaviour engagement. Three items assessed individuals' perceived level of sedentary behaviour. Given national (Colley et al, 2011) and international (e.g., Matthews et al, 2012) figures illustrating the high prevalence of sedentary behaviour, the purpose of these questions was to examine whether individuals self-identify as being high- or low-sedentary. The first item asked, “Would you consider yourself to be a sedentary person?” (1 = Not Sedentary, 7 = Very Sedentary); the second, “Are you more- or less-sedentary than your peers?” (1 = Less Sedentary, 7 = More Sedentary); and the third, “Would you like to increase or decrease your sedentary behaviour?” (1 = Decrease, 7 = Increase).

The effect of context. To examine whether perceptions of sedentary behaviour vary across social contexts and activity types, participants were shown a series of seven photographs (Figure 1). Each photograph depicted individuals engaged in everyday activities, such as watching television, working in an office, and running outdoors. In total, two photographs featured moderate-to-vigorous physical activity, while five photographs featured sedentary activity. Participants were shown the images individually, and were told that the photographed individual(s) had engaged in the activity for a period of one hour. They were then asked to describe the photographs along three domains: whether the individual(s) were being sedentary (1 = Unsedentary, 7 = Sedentary); productive (1 = Unproductive, 7 = Productive); and healthy (1 = Unhealthy, 7 = Healthy). A fourth item asked participants whether they perceived the activity as being desirable (1 = Would Not Like to do the Activity, 7 = Would Like to do the Activity). Photographs were presented in a random order to reduce the risk of order effects. To help control for the possible effects of gender, age, ethnicity, and overweight/obesity, all photographs featured non-overweight Caucasian males between approximately 25 and 50 years of age. Additionally, emotion (facial expression) was controlled for in photographs that would be contrasted: for instance, in the “having coffee” photograph and “playing video games” photographs, all the men appear to be enjoying themselves.

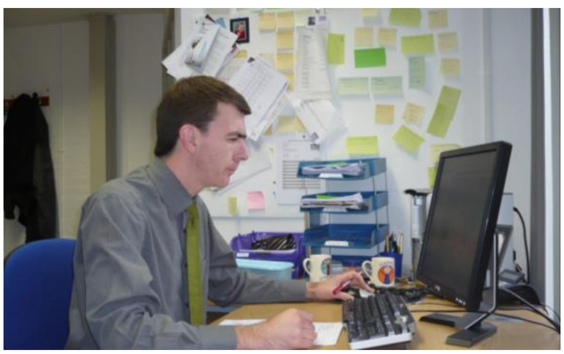
Figure 1 – Photograph stimuli used in Study One

a. 

b. 

c. 

d. 

e. 

f. 

g. 

Photograph Credit (Flickr user names):

a. Ruthanne Reid, 2010
b. Eric Mesa, 2009
c. Heymarchetti, 2004
d. David Goehring, 2006
e. Tryingmyhardest, n.d.
f. Peter Mooney, 2012
g. Analea Styles, 2004

All photographs were retrieved from Flickr's Creative Commons in June 2013.

Procedure

The study followed a cross-sectional, mixed-methods design. Interested volunteers were automatically directed to the online survey via hyperlink. After indicating consent and completing demographic variables, participants completed a series of items on their perceptions of sedentary behaviour. Question order was as follows: (1) knowledge of sedentary behaviour, (2) perceptions of sedentary behaviour engagement (e.g., high or low sedentary), (3) health outcomes (e.g., perceived risks), (4) photographs of sedentary behaviour, and (5) self-report sedentary behaviour and leisure-time MVPA.

Analytical Plan

Quantitative data was analysed using SPSS version 22.0 (IBM, 2013). Data management and screening strategies were used to address issues of missing data, the presence of outliers, and to examine statistical assumptions. The same data management procedures were used for all dissertation studies, and are outlined in detail in Appendix A.

To reflect Study One's four research questions (pp. 29), data analysis took place in four stages. For **Question 1**, knowledge of sedentary behaviour, inductive content analysis was used to examine how individuals define sedentary behaviour and the activities they identify as being sedentary (Elo and Kyngäs, 2008; Appendix A). In brief, responses were read and prominent themes noted (e.g., "television", "poor posture"). Response frequency – the percentage of participants reporting a particular theme – was tallied to gauge the relative salience of perceptions within the overall sample. Inductive content analysis was likewise used for **Question 2**, perceptions of the health risks and benefits of sedentary behaviour. For **Question 3**, the effect of context and activity, three repeated-measures multivariate analyses of variance (MANOVAs) were conducted to examine differences between sedentary and active photographs, and within sedentary photographs (reading versus computer; coffee versus video games). Following statistical conventions, repeated-measure MANOVAs were considered statistically significant and follow-up analyses conducted (e.g., Cohen's effect sizes) if $p < 0.05$.

Question 4 examined the relationship between LT-MVPA and sedentary perceptions, Participants' self-reported LT-MVPA was used to categorise individuals as either "more-active" (> 30 minutes of daily LT-MVPA) or "less active" (≤ 30 minutes of daily LT-MVPA). The threshold level of 30 minutes was selected given its congruence with past Canadian public health guidelines (Health Canada and the Canadian Society of Exercise Physiology, 1998) and current American Heart Association (2017) recommendations. Four sets of analyses were subsequently conducted. First, ANOVA and chi-squared was conducted to explore group equivalency in demographic variables and baseline knowledge of sedentary behaviour. Second, ANOVA analysis examined whether more- and less-active individuals differed in their amount of self-reported sedentary behaviour. If significant, it would suggest that any subsequently observed differences between more-active and less-active participants may be attributable to *actual differences* in behaviour rather than *perceptual differences*. Next, chi-squared analysis was used to examine whether more- and less-active individuals differed in how they personally defined "sedentary". Lastly, repeated-measures MANOVA was used to examine the relationship between LT-MVPA and (1) perceptions of sedentary behaviour engagement (e.g., level of sedentary behaviour relative to peers) and (2) the perceived healthiness/unhealthiness of one's personal sedentary behaviour.

Results

Data Management Strategies

Missing data. For Study One, 11.48% of participants left the survey prior to completion; as such, there were several instances of missing data that exceeded 5%. However, as described by Tabachnick and Fidell (2013), there is no clear-cut rule as to how much missing data can be tolerated and that "the pattern of missing data is more important than the amount missing" (pp. 62). Visual inspection of the data set indicated that (1) the amount of missing data increased as the questionnaire progressed, and (2) qualitative data were more likely to be missing than quantitative data. ANOVA and chi-squared analysis found no significant demographic differences, *p*s > 0.05, between participants who completed the full questionnaire versus those who exited early, with the exception of primary language spoken, $\chi 2$ (1) = 9.442, $p < 0.05$. Likewise, ANOVA indicated that participants with complete versus incomplete data **did not** significantly differ in their self-reported familiarity with the term "sedentary" at baseline, F (1, 181) = 3.446, $p > 0.05$. Given that the primary goal of Study One was to engage in exploratory research and the pattern of missing data appeared relatively random, the decision was made to retain all 183 participants.

Outliers. Univariate outliers were defined as having a standardised score greater than 3.29, $p < 0.05$. A total of 40 outliers were initially identified: 9 in self-reported behaviour, 27 in participants' responses to photographs,[4] and 4 in perceptions of sedentary engagement. In the case of self-reported behaviour, outliers were made less-deviant by changing scores to one unit above the next-most-extreme score in the distribution (Field, 2009; Tabachnick & Fidell, 2013).

[4] It is noteworthy that nearly half of the detected outliers (12 of 27) came from the photograph of men running. Specifically, perceptions of whether running is sedentary or unsedentary (N = 8), and whether running is healthy or unhealthy (N = 4).

Adjustment for these outliers did not produce changes in whether participants were categorised as more- or less-active.

Participants' photograph responses and perceptions of sedentary engagement were to be analysed via repeated-measures MANOVA. Cook's distances were calculated to determine whether outliers would significantly affect analyses. As proposed by Cook and Weisberg (1985, as cited in Field, 2009), a Cook's value greater than 1 indicates that a data point exerts a disproportionate influence on results. No Cook's distances were observed to exceed a value of 0.06. As such, no subsequent transformations or adjustments were made.

Testing of assumptions. Statistical assumptions for repeated-measures MANOVA, chi-squared analyses, and Pearson's bivariate correlation were examined prior to conducting analyses. Skew and kurtosis values were in an acceptable range, and were deemed to be non-problematic. Homogeneity of variance was violated for analyses between (1) more-active and less-active participants and (2) sedentary and active photographs. However, both of these violations were anticipated given unequal sample size between analyses (e.g., recall that two photographs were active while five photographs were sedentary). In these instances, Welch's ANOVA was used as it does not assume equal variances and group sizes (Field, 2009).

Question 1: Knowledge of Sedentary Behaviour

Familiarity with "sedentary". The vast majority of participants reported having heard the term "sedentary" prior to initiating research, with a mean familiarity score of 6.0 (SD = 2.1) out of 7. Twenty-eight (15.3%) participants provided a score of 3 or less, of which three failed to provide a definition of sedentary behaviour (e.g., "sorry, not sure"), and of which two mentioned they had conducted a Google search for a definition. Additionally, one participant reported a familiarity score of 6/7, but provided a definition of "sanitary" ("clean, germ free") rather than "sedentary."

Defining sedentary behaviour. Inductive content analysis (Elo and Kyngäs, 2008) was used to examine participants' personal definitions of sedentary behaviour. Four major themes were observed: sedentary (43.7% of respondents), insufficient movement (54.1%), insufficient MVPA (35.0%), and laziness (12.0%).

Congruent with academic definitions of sedentary behaviour (e.g., Sedentary Behaviour Research Network, 2012; see pp. 3), the first theme – *sedentary* – conceptualised the behaviour as stillness and sitting. For example, one participant wrote, "I think it means sitting down or sitting quiet" (female, age 64); another, "Being in the same position for a long period of time" (female, age 19). In contrast, the second theme was *insufficient movement*. Typical responses included, "To spend a lot of your day not moving" (female, age 35) and, "Not including activity in your lifestyle" (female, age 27). Though sedentary and insufficient movement are similar to each other, they were identified as being distinct given their semantic focus: one emphasised the *presence of inactivity,* whereas the other emphasised the *absence of movement*.

Distinct from insufficient movement, the third theme specifically highlighted an absence of MVPA. Participant responses included, "Less than 30 minutes of physical activity in a day" (female, age 23), and "Not participating in sports or exercising" (male, age 68).

The last theme was laziness, where participants related sedentary behaviour to being a "couch potato" and/or not engaging in productive work. For example, "Lazy, getting nothing done" (female, age 29).

It is noteworthy that nearly half (44.8%) of participants provided a mixed definition of sedentary behaviour, which drew upon one or more thematic areas. In particular, it was not uncommon for participants to describe sedentary behaviour as *both* excessive sitting and insufficient movement. Examples of combined responses included, “Generally not active, spending much time sitting and not enough time moving” (female, age 23), and “Not going out of your way to get additional physical exertion, sitting around watching tv/internet” (male, age 53).

Examples of sedentary behaviour. The 183 participants provided 703 examples of behaviours they personally consider to be sedentary. The most frequently reported activity (78.1% of participants) was watching television and movies. Other common activities included computer use (leisure, occupational, or general; 45.5%), reading (44.8%), and non-computer occupational tasks (e.g., desk work, meetings; 29.0%). Only a small proportion of respondents (12.0%) reported activities that would be classified as light-intensity physical activity, such as easy walking, gardening, and yoga.

After providing examples of typical sedentary behaviours, participants were asked to reflect upon their responses, and to indicate whether (and, if so, why) certain activities were more- or less-sedentary than others (see Table 6 and Table 7). A total of 171 participants provided 234 examples of more-sedentary activities, with the most frequently listed activities being watching television (59.1% of respondents), computer use (15.2%), and sitting/lying down (12.9%). Of these, 130 participants provided justification for their choice of activity. Rationale fell under three primary themes, the first being that the activity was *physically inactive* (66.9% of respondents): for example, “Watching TV, because you hardly move at all when you’re doing it” (female, age 21). The second rational was a *lack of (mental) engagement* (25.4%), such as “Watching TV or movies, as you aren’t really engaging in what you’re doing. You’re just sitting there like a lump on a bump” (female, age 24). The final rationale, reported by 16.2% of

Table 6 – Activities identified as participants as being “more-sedentary” and “less-sedentary”.

More-Sedentary		Less-Sedentary	
Activity	**% Reporting**	**Activity**	**% Reporting**
Television	59.1	Movement/Exercise	22.3
Computer	15.2	Work	14.9
Sitting/Lying Down	12.9	Reading	12.4
Sleeping	12.3	Video Games	10.6
Video Games	8.2	Driving	9.9
Reading	5.3	School / Studying	8.1
Being Lazy	4.1	Computer	7.5
		Board Games	6.2

Table 7 – Participants’ rationale for more- and less-sedentary activities.

More-Sedentary Activities		
Theme	**% Reporting**	**Example**
Physical Inactivity		
No Movement	58.5	Watching TV … you hardly move at all when doing it
Calories	7.7	Lying down as it requires the least amount of calories.
Poor Posture	4.6	Lying down … your stabilizers are not working as hard to maintain good posture
Engagement	25.4	Watching TV, since often not even your brain is working
Excessive Time	16.2	Working in a computer is most sedentary because you lose track of time and forget to stand up and walk once in a while
Less-Sedentary Activities		
Theme	**% Reporting**	**Example**
Physical Activity		
Movement	49.4	Driving is least sedentary as you must control the wheel and use the brake and gas pedals. If it's a standard you must use the gear shift and clutch.
Standing Breaks	20.5	One may stand or walk around a bit when on the phone so that helps.
Mental Activity	31.5	Reading a book or listening to music as you're at least engaging your brain.

participants, emphasised *excessive time*. That is, participants described the activity not as being sedentary in and of itself, but because of the large amounts of time spent on it. For example, "Watching TV and playing video games are most sedentary because these are activities that people often spend entire days doing" (male, age 20).

A total of 159 participants provided 212 examples of less-sedentary activities, including occupational tasks (14.9% of respondents), reading (12.4%), and playing video games (12.4%). Interestingly, the most commonly listed activity (22.3%) were those that featured light-, moderate-, and/or vigorous-intensity physical activity; for example, running or team sports. A total of 126 participants provided rationale for their identified activities, with the most common rationale being that the activity featured some amount of movement (49.4%; e.g., using one's hands to play video games or turn book pages) or because it allowed for regular standing breaks (20.5%; e.g., switching between tasks at work). Participants also described activities as being less-sedentary because they involved mental activity and purposeful engagement (31.5%).

Question 2: The Health Risks and Benefits of Sedentary Behaviour

Three items examined perceptions of sedentary behaviour and health. The first item asked individuals to rate their *personal* sedentary behaviour on a 1 (Unhealthy) to 7 (Healthy) scale. Participants reported a mean score of 3.3 (SD = 1.5) out of 7, suggestive that they viewed their sedentary behaviour as being relatively neutral/benign.

Two subsequent items asked participants to report the costs ("risks") and benefits of their *personal* sedentary behaviour. A total of 148 participants provided 251 health benefits, with the most frequently listed benefit being mental rest and relaxation (52.4% of respondents). Other common benefits included mental stimulation (e.g., learning; 42.9%), physical rest and recovery (19.7%), and positive emotions (10.9%). In terms of health costs, 150 respondents provided 317 items. The most common costs related to risk of weight gain/obesity (33.0%), negative emotions (21.3%), physical activity (e.g., insufficient activity; 20.0% of respondents) and being unproductive (11.3%). An overview of participant responses can be found in Table 8.

Question 3: The Effect of Context and Activity Type

To examine the effect of context and activity on sedentary behaviour perceptions, participants were asked to respond to seven different photographs (pp. 35) along four domains: for instance, whether the individual in the photograph was being healthy or unhealthy.

Three repeated-measure MANOVAs were conducted. The first examined differences between active (running, canoeing) and sedentary (reading, working on a computer, having coffee, playing video games, watching television) photographs. Wilk's statistic indicated a significant effect of photograph type, $\Lambda = 0.802$, F (3, 1037) = 85.285, $p < 0.001$. Follow-up Welch's ANOVAs with Bonferroni adjustment indicated significant differences for all four dependent variables, *p*s < 0.001. Complete descriptive statistics can be found in Table 9.

The second repeated-measures MANOVA contrasted photographs of drinking coffee and playing video games. The comparison was chosen because each photograph featured a *group of men* participating in a *leisure activity*, but differed by *activity type*. Wilk's statistic indicated significant between-photograph differences, $\Lambda = 0.542$, F (3, 291) = 82.061, $p < 0.001$. Follow-up repeated-measures ANOVAs with Bonferroni adjustment showed a significant between-photograph effect across each of the four dependent variables. Playing video games was perceived as being more sedentary, less productive, less healthy, and less desirable than having coffee. Descriptive statistics can be found in Table 9.

Table 8 – Participants' commonly-listed costs and benefits

Perceived Benefits of Sedentary Behaviour		
Theme	**% Reporting**	**Example**
Mental Rest	52.4	It's an opportunity to slow down and relax
Mental Stimulation	42.9	Reading is stimulating the brain and studying improves knowledge
Physical Rest	19.7	It allows me to rest me knee
Positive Emotions	10.9	The activities I like tend to make me happy
Productivity	10.9	My sedentary activities help me to get from place to place
Goal Pursuit	9.5	Studying is obviously necessary to succeed in school
Social	5.4	I am somewhat socially connected at the computer
Entertainment	4.8	Visiting some web sites provides entertainment
Behavioural Control	2.0	I feel less stressed when I can do whatever I feel like doing

Perceived Costs of Sedentary Behaviour		
Theme	**% Reporting**	**Example**
Fitness / Physical Activity		
Low Activity	20.0	At times little actual true exercise
Low Fitness	11.3	It contributes to me getting out of shape
Muscle Loss	10.0	Most likely muscle strength loss
Chronic Disease		
Overweight/Obesity	33.3	My ass is going to need its own postal code soon
Cardiovascular	17.3	You could get heart condition
Musculoskeletal	15.3	My body becomes less flexible the more I sit
Diabetes	3.3	Inactivity = Metabolic syndrome
Other Health	11.7	I think you lose awareness of your body when you sit for long periods of time
Negative Emotions	21.3	I tend to overdo it … it can lead to bouts of depression
Unproductive	11.3	It's easy to get sucked into TV as a form of procrastination
Lethargy/Fatigue	8.7	Contributes to mental fatigue
Unhealthy Eating	6.7	Too easy to binge eat while sitting there
Social	4.7	Too much time on the computer can take away from personal relationships

Table 9 – Comparisons between photographs

		Sedentary+	**Productivity**✦	**Healthiness**×	**Desirability**■
Comparison 1: Active vs. Sedentary Photographs	Active	1.66 ± 2.61	5.43 ± 1.63	6.53 ± 1.05	5.17 ± 1.98
	Sedentary	5.77 ± 1.69	4.07 ± 2.21	3.47 ± 1.70	3.83 ± 2.12
	*d**	2.61***	0.70***	2.17***	0.65***
Comparison 2: Reading vs. Using Computer	Reading	5.6 ± 1.6	5.9 ± 1.3	4.9 ± 1.5	5.4 ± 1.6
	Computer	5.8 ± 1.6	6.1 ± 1.1	3.3 ± 1.3	2.8 ± 1.6
	*d**	0.11	0.20	1.02***	1.60***
Comparison 3: Coffee vs. Video Games	Coffee	5.1 ± 1.7	4.4 ± 1.4	4.3 ± 1.5	5.3 ± 1.6
	Video Games	5.9 ± 1.6	2.3 ± 1.3	2.7 ± 1.3	2.2 ± 1.7
	*d**	0.54***	1.53***	2.71***	1.88***

* = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$
+ 1 = Active, 7 = Sedentary ✦ 1 = Unproductive, 7 = Productive
× 1 = Unhealthy, 7 = Healthy ■ 1 = Would not like to do activity; 7 = Would like to do activity

The final repeated-measures MANOVA contrasted photographs of reading versus working on a computer. This comparison was selected as both featured *literacy-centred* and *indoor* activities, though differed in *context*. Wilk's statistic indicated significant between-photograph differences, $\Lambda = 0.282$, F (3, 294) = 249.298, $p < 0.001$. Follow-up repeated-measures ANOVAs with Bonferroni adjustment showed that reading and computer work did not significantly differ in the degree to which they were perceived as being sedentary or productive. However, reading was seen as being significantly healthier and more desirable than working on a computer. Descriptive statistics can be found in Table 9.

Question 4: LT-MVPA and Sedentary Behaviour Psychology

A total of 143 participants provided self-report data on their weekday sedentary behaviour and LT-MVPA. Using the 30 minutes/day threshold, a total of 90 participants were classified as "more-active" and 53 participants were classified as "less-active". Chi-squared and ANOVA analyses indicated no significant demographics differences between more- and less-active participants, *p*s > 0.05. Likewise, more- and less-active participants did not significantly differ in their baseline familiarity with the term "sedentary", $p > 0.05$. Finally, ANOVA indicated no significant differences in total daily sedentary behaviour between these two groups, $p > 0.05$.

Two analyses were used to examine the relationship between sedentary behaviour and LT-MVPA. First, chi-squared analysis was conducted to establish whether more- and less-active participants significantly differed in *how* they defined sedentary behaviour. Results indicated no significant differences in any of the four[5] identified themes, *p*s > 0.05.

Second, repeated-measures MANOVA was conducted to examine whether more- and less-active participants differed in how they perceived their *personal* sedentary behaviour. Four dependent variables were entered: whether individuals viewed themselves as being (1) high or low sedentary overall and (2) more or less sedentary than their peers; (3) whether they had a desire to change their personal sedentary behaviour; and (4) whether their personal sedentary behaviour was viewed as being healthy or unhealthy. Wilk's statistic indicated a significant main effect for activity group, $\Lambda = 0.611$, $F\ (3, 140) = 29.474$, $p < 0.001$. Follow-up Welch's ANOVA with Bonferroni adjustment indicated significant differences between more- and less-active participants in three of four dependent variables (Table 10). More-active participants viewed themselves as being lower sedentary overall, as being less sedentary than peers, and viewed their sedentary behaviour as being less unhealthy relative to less-active participants. No significant differences were observed in participants' desire to change their sedentary behaviour.

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[5] Sedentary, insufficient movement, insufficient exercise, and laziness

Table 10 – Descriptive statistics on the relationship between leisure-time MVPA and sedentary perceptions.

	Less-Active	**More-Active**	***d****
Overall Amount of Sedentary 1 = Low Sedentary, 7 = High Sedentary	4.7 ± 1.53	3.01 ± 1.42	1.06***
Peer Comparison 1 = Less, 7 = More Sedentary than Peers	4.30 ± 1.58	2.73 ± 1.46	1.07***
Desire to Change 1 = Decrease, 7 = Increase my Sedentary	2.00 ± 1.40	2.42 ± 1.38	0.30
Health Effect of Personal SB 1 = Very Unhealthy, 7 = Very Healthy	2.83 ± 1.46	3.58 ± 1.41	0.52**

* = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$

Discussion

Despite growing empirical interest in the health effects of sedentary behaviour, relatively little work has examined its psychological and behavioural aspects (Biddle, 2011; Owen et al, 2011, Rhodes et al, 2012). The primary purpose of Study One was to expand upon existing exploratory research by (1) utilising a mixed-methods research design, and (2) sampling from a larger and more-diverse population. Four research questions were posed, all of which examined how individuals experience and conceptualise sedentary behaviour. Together, results provide preliminary evidence on the complexity of sedentary behaviour and speak to the need for further research into its psychosocial correlates.

Question 1: Knowledge of Sedentary Behaviour

The first research question examined individuals' knowledge of sedentary behaviour. It was initially hypothesised that participants would conceptualise "sedentary behaviour" differently than researchers and, in particular, define it as insufficient moderate-to-vigorous physical activity. This hypothesis was partially supported: though participants reported high familiarity with the term “sedentary”, only 40% of participants provided a personal definition congruent with current academic definitions – that is, defining “sedentary” as the *presence of inactivity*. The remaining 60% of participants primarily defined “sedentary” as a *lack of movement*, including a *lack of moderate-to-vigorous physical activity*. Why so many participants conceptualise “sedentary” as “insufficient activity” remains unknown, and further research in the area is warranted. However, one explanation may be that participants’ definitions reflect the overall success of physical activity promotion combined with the ubiquitous nature of sedentary behaviour. Consider the following: despite endemically low physical activity participation (Colley et al, 2011), salient physical activity education campaigns (e.g., ParticipACTION), mass media coverage, and the growth of the fitness industry means that most people are aware of physical activity (e.g., Craig, Mindell, & Hirani, 2009). In contrast, sedentary behaviour is an everyday activity which, as some have argued, is habitual in nature (Warner, 2011; Conroy et al, 2013; Maher & Conroy, 2015). If so, it follows that sedentary behaviour does not receive substantial critical thought/consideration on a day-to-day basis: that is, sedentary behaviour may not be a salient behaviour. This is likely further compounded by the fact that sedentary behaviour is a novel field of study, and has only recently attracted public attention. Thus, not only might individuals be *unaware* of sedentary behaviour, but their attention may be inherently *drawn to* physical activity paradigms.

A second explanation may speak to divergence between empirical research and lay perceptions. The difference between “the presence of inactivity” and “the absence of activity” is subtle in nature, and may be more conceptual than practical. While this distinction may carry substantial implications for research, laypersons may view the two behaviours as being equivalent to one another and a non-issue.

Practically, such findings highlight the necessity of providing participants with a *clear definition of sedentary behaviour* prior to engaging in research and/or intervention work. Failure to do so may risk miscommunication between researchers and participants: namely, participants responding to a different behaviour than the one of interest to researchers. It is particularly noteworthy that participants possessed these divergent definitions *despite* reporting high familiarity with the concept. Thus, simply asking participants if they know about sedentary behaviour is not enough to guarantee understanding. To avoid risk of miscommunication, subsequent studies in this dissertation either (1) utilised the term "sitting" rather than "sedentary" (e.g., Study 3B, Appendix H) or (2) provided participants with a definition of "sedentary behaviour" prior to initiating research (e.g., Study 3A, Appendix G). As participant communication is an important methodological issue, future research should examine how to best describe/define "sedentary behaviour" to members of the public.

Examples of sedentary behaviour. After providing a personal definition of sedentary behaviour, participants were asked to list activities that they would consider to be sedentary. Individuals proved to be extremely adept at providing examples of sedentary activities: 92% of listed activities met the conceptual definition of sedentary behaviour (pp. 3). Though many participants listed prototypical examples, – for instance, watching television and using a computer – they also provided an extensive list of alternatives: for example, eating, meditation, crafting, playing board games, and tanning.

A related observation is that the majority of sedentary activities reported were leisure activities. Only a minority of participants reported occupational tasks and/or transportation as being sedentary, which contrasts with current research's emphasis on the office environment (e.g., Shrestha et al, 2016; Tew et al, 2015). Why individuals primarily listed leisure-time activities requires further research; however, one clue may be found in participants' definition of sedentary behaviour. Recall that 12% of respondents defined sedentary behaviour as "being lazy" or "doing nothing". As occupational (work/school) and transportation activities are often purposeful and goal-directed, they may be seen as being "less sedentary" than other types of behaviour. Alternatively, it may be that leisure-time activities – especially screen time – are frequently targeted by physical activity messaging, thus making these activities more-salient to individuals.

Question 2: The Health Risks and Benefits of Sedentary Behaviour

Modern interest in sedentary behaviour is largely founded on the observation that sedentary behaviour is associated with deleterious health outcomes (Biswas et al, 2015; Tremblay et al, 2010). Consequently, sedentary behaviour is often framed as something that needs to be reduced and/or replaced (e.g., Levine, 2010; 2014). Few have examined whether sedentary behaviour is *perceived* as being associated with positive benefits; whether benefits are *actively achieved* via sedentary behaviour engagement; and if these benefits (whether real or perceived) influence individuals' *willingness to adopt intervention*. Though such in-depth inquiry was beyond the scope of Study One, Question 2 provided preliminary insight into whether individuals associate their personal sedentary behaviour with a set of health and/or mental health outcomes.

In terms of health benefits, participants most frequently reported that sedentary behaviour provided them with the opportunity for mental rest and recovery. Other reported benefits include mental stimulation, positive emotions, and goal pursuit. Such benefits immediately suggest that sedentary behaviour is a valued and motivated activity. Interestingly, these results differ from Chastin et al (2014), who found that pain relief served as the primary motivator for sedentary behaviour in older women. Such differences raise a key consideration for future research: does the purpose/function of sedentary behaviour change across the life course? What is the role of chronic disease in shaping sedentary behaviour experiences?

Based upon past research by Gilson and colleagues (2012), it was hypothesised that participants would primarily describe musculoskeletal outcomes (e.g., sore back, stiff muscles) as a cost of sedentary behaviour. This hypothesis was not supported, with only 15% of respondents reporting these symptoms. Rather, the most commonly-listed costs of sedentary behaviour were those related to overweight/obesity and insufficient physical activity. Participants also noted psychosocial costs, including the occurrence of negative emotions, lack of productivity, lethargy and fatigue, and social consequences (e.g., isolation). Relatively few participants described the chronic diseases emphasised by sedentary behaviour health research. For example, only 3% of participants reported diabetes.

There is a particularly noteworthy trend in participants' cost/benefit perceptions: individuals primarily identified *proximal benefits* and *distal costs* to their sedentary behaviour. Benefits like rest, mental stimulation, and entertainment can be achieved over the course of minutes, hours, or days. In contrast, costs like decreased fitness and obesity emerge insidiously over the course of weeks, months, and years. Such findings raise a consideration for intervention design: it is well-known that short-term, proximal outcomes can serve as a powerful motivating force for behaviour (Bandura, 2004; Baumeister, Heatherton, & Tice, 1994). It is possible that the short-term benefits of sedentary behaviour supersede the distal costs salient to participants – and those identified by sedentary behaviour research. For example, at the end of a long day, an individuals' immediate desire for rest and relaxation (via sitting and watching television) may override their interest in preventing diabetes (via sedentary behaviour intervention). Interest in intervention may be further weakened if individuals perceive the intervention itself as being associated with negative proximal outcomes, such as undesirable physical, social, and/or psychological states.

Question 3: The Effect of Context and Activity Type

At present, little research has examined whether the effects of sedentary behaviour are moderated by activity: for example, if sitting to read a book and sitting on a city bus have differential effects on physiology/health/mental health. Rather, there has been an overall tendency to assume that *all* forms of sedentary behaviour are *equally-detrimental* to health (i.e., just as all types of moderate-intensity aerobic activity are equally-beneficial to cardiovascular health). For instance, consider the following statement by Spence (2014), in reference to children's sedentary behaviour intervention:

> The majority of studies would be targeted at trying to get children to watch less TV. So, given the definition I've given, I think we almost need to throw this literature out or this information be set aside, and we need a whole new set of studies that are going to be targeting how we get kids to stand up. They can still watch TV. Again, the Pediatrics Society or whoever might not be happy about that – or other public health people might not be happy about them consuming the TV. But, technically, from our point of view, we don't care about them watching TV. We just need them to stand up. As an adult, you can be running on a treadmill while watching TV; that's great. But, if you just stand up, that could be all we need you to be doing to ameliorate the effect of being sedentary. And that is where the shift is going to occur now and the research is being done.

If this is the case – if all types of sedentary behaviour are equally-detrimental – there may be little value gained in differentiating between activity types: at least, from a biomedical perspective (cf. Pinto Pereira, Ki, & Power, 2012, for an alternative perspective). However, just because two activities are equivalent physiologically *does not* mean they are equivalent psychologically. To gain insight into how different activities are perceived, Question 3 examined whether individuals' perceptions of sedentary behaviour varied across activity and social context.

"More-sedentary" and "less-sedentary" activities. After providing examples of sedentary behaviours, participants were asked to reflect on their activities and designate whether (and, if so, why) any activities were more- or less-sedentary than others. The most common more-sedentary activities were watching television and using the computer, whereas the most common less-sedentary activities were physical activity and occupational tasks. Participants' rationale for more-sedentary activities fell along two major themes: first, they described the activity as lacking movement; second, they described the activity as lacking mental activity/engagement. The opposite was found for less-sedentary activities: that is, less-sedentary activities were characterised by more movement and more mental activity.

Interestingly, many listed activities fell on both lists. Video games, for instance, were reported as more-sedentary by 8% of participants, but as less-sedentary by 10% of participants. Likewise, sleeping was reported as more-sedentary by 12% of participants, but less-sedentary by 5% of participants. Participants' rationale offers key insight into this phenomenon. Sleep, for instance, was classified as being more-sedentary because it doesn't require any "brain power" (female, age 30) and because "you are barely moving" (female, age 22). On the other hand, it was perceived as being less-sedentary because "the body is metabolically active" (female, age 29), because "it's natural and healthy" (male, age 24), and "because we need sleep" (female, no age). Similarly, video games were deemed more-sedentary because "it's a useless mind-numbing activity" (female, age 44), and less-sedentary because "it requires a lot of movement and brain interaction" (female, age 52).

As a final note: it is interesting that 22% of individuals identified physical activity (e.g., “movement”, “exercise”, “running”) as a less-sedentary sedentary activity. Though this may be attributable to methodological error (e.g., unclear instructions), this seems unlikely given the fact that participants had no difficulty answering the prior question on more-sedentary sedentary activities. It seems more likely that responses reflect participants’ perceptions of sedentary behaviour: if individuals primarily define sedentary behaviour as “not moving” or “not enough exercise”, they may naturally identify (moderate-to-vigorous) physical activities as less-sedentary alternatives.

Perceptions of sedentary behaviour in varied contexts and activities. In addition to asking participants about more- and less-sedentary activities, perceptions about context and activity type were quantitatively examined via participants’ responses to photographs. Participants were presented with a series of seven photographs, and asked to rank each along four domains: un/sedentary, un/healthy, un/productive, and un/desirable. Three analyses were conducted. In the first, photographs of individuals engaged in physical activity (e.g., running) were contrasted against sedentary behaviour (e.g., using a computer). The comparisons were significant with medium-to-large effect sizes. Specifically, participants reported that physically active photographs were less sedentary, more productive, more healthy, and more desirable than sedentary photographs. Such results strongly suggest that, not only do individuals distinguish between sedentary behaviour and physical activity, but also that physical activity is viewed more favourably overall. It is noteworthy that the current study did not feature light-intensity activities, such as low-effort physical activity (e.g., gentle walking, yoga) or low-effort standing behaviours (e.g., standing in an elevator). As these light-intensity activities (1) “fall between” sedentary behaviour and moderate-to-vigorous physical activity and (2) are often discussed as an alternative to sedentary behaviour, future research would benefit from including this third photograph category.

The second and third analyses contrasted different types of sitting behaviours: having coffee versus playing video games; and reading a book versus working on a computer. As with the sedentary versus active comparison, results indicated significant differences between the photographs including, for instance, the degree to which the activity was perceived as being sedentary (e.g., sitting playing video games as more sedentary than sitting having coffee) and the perceived healthiness of the behaviour (e.g., reading a book is more healthy than working on a computer). These differences occurred despite the activities being approximately equivalent to each other in form and function: for instance, the photographs of having coffee and playing video games both showed (1) leisure-time activities that were (2) performed in a group.

Together, participants' responses to photographs and their assessment of more- and less-sedentary activities provide evidence that (1) individuals distinguish between different types of sedentary behaviour, (2) these perceived differences exist across multiple characteristics of the behaviour, and (3) individuals are capable of articulating and justifying the nature of these differences. Particularly for sedentary behaviour psychology, such findings caution against approaching sedentary behaviour as a singular type of behaviour – even when behaviours appear to be similar to one another. Rather, to echo Pate et al (2008), efforts should be made to understand *specific types* of sedentary behaviour, and conclusions regarding sedentary behaviour should be specifically phrased in reference to the measured behaviour.

In terms of implications for intervention research, the fact that individuals differentiate between types of sedentary behaviour with respect to the degree of "sedentariness", productivity, health impact, and desirability raises a question regarding intervention targets. From the viewpoint of individuals, which behaviours – in which environments – are best-suited to sedentary intervention? If an individual perceives a given sedentary behaviour as being less-sedentary, more-desirable, or more-healthy, will they be less willing to modify it?

Question 4: LT-MVPA and Sedentary Behaviour Psychology

Past research has found that engaging in high levels of sedentary behaviour does not preclude individuals from achieving national physical activity recommendations (Biddle et al, 2004; Biswas et al, 2015; Burton et al, 2012; Whitfield et al, 2014). The results of this study correspond with this observation: there was only a very small and non-significant relationship between sedentary behaviour and LT-MVPA, with more-active and less-active individuals reporting approximately equal amounts of daily sedentary behaviour.

A foundational hypothesis of modern sedentary behaviour research is that sedentary behaviour is a distinct health risk, independent of individuals' level of physical activity (Hamilton et al, 2007; Tremblay et al, 2010). However, *physiological* independence does not necessarily mean *psychological* independence. Study One provides preliminary evidence that more- and less-active individuals differ in how they perceive their personal sedentary behaviour. Relative to less-active participants, more-active participants viewed themselves as being relatively low sedentary overall; as being less-sedentary than peers; and viewed their sedentary behaviour as being less unhealthy. The fact that these results emerged *despite no significant differences in reported level of sedentary behaviour* suggests that between-group differences are due to individuals' perceptions of sedentary behaviour rather than objective differences in behaviour. What drives these perceptual differences, however, remains unknown at this time. One explanation may lie in participants' definitions of sedentary behaviour: if a highly active individual defines sedentary behaviour as "not enough exercise" (etc.), then they would understandably identify themselves as being low sedentary. Thus, a challenge may lie in educating sufficiently active individuals about the independent risk of sedentary behaviour, and convincing them of the necessity of increasing their level of light-intensity physical activity. Alternatively, responses may reflect compensatory health beliefs: beliefs that the negative effects of unhealthy behaviour are compensated for and/or neutralised by engaging in healthy behaviour (e.g., Knäuper et al, 2004). Lastly, for individuals with strong exercise and/or health identity (Strachan, Brawley, Spink, & Jung, 2009), admitting to large amounts of sedentary behaviour may be dissonant with their personal exercise identities. Thus, individuals may be less-likely to recognise and/or report their sedentary behaviour.

Strengths and Limitations

To date, only a small number of empirical studies have examined the psychology of sedentary behaviour; thus, Study One adds to the literature in several ways. First, rather than making assumptions regarding individuals' knowledge of sedentary behaviour, emphasis was placed on developing a "bottom-up" understanding. This was accomplished through a mixed-methods design, which allowed for a larger- and more-diverse sample than is typically feasible for purely-qualitative designs.

It is likewise noteworthy that this study was the first to purposefully assess individuals' perceived costs *and* benefits of sedentary behaviour, how perceptions of sedentary behaviour vary across context and activity type, and whether individuals' sedentary behaviour perceptions are related to MVPA engagement. Results indicate that sedentary behaviour is a diverse behaviour with many possible conceptualisations, and that these are linked to the varied social and physical contexts in which it occurs.

A specific limitation of this research is its generalisability to the broader population. Though attempts were made to reach a diverse population, the final sample was primarily female, well educated, and Caucasian. It remains possible that perceptions of sedentary behaviour will vary by demographic factors: for example, research by Chastin and colleagues (2014) suggests that age may be a particularly important factor when considering the form and function of sedentary behaviour, whereas work by Mabry and colleagues (2014) highlights the importance of culture. In an effort to understand these factors, future research may benefit from using alternative sampling methods, such as random-digit dialing or mail-out surveys rather than online surveys.

A second limitation was the self-report nature of the sedentary behaviour and LT-MVPA measure. At the time of research, a gold standard self-report measure of sedentary behaviour did not exist; this remains the case to this day. The measure used in this study was informed by the work of Gardiner et al (2011) and Salmon et al (2003), both of whom found the measure to exhibit acceptable validity and sensitivity. To help ensure accurate recall, participants were asked to *only* report those activities that they had engaged in for 15 minutes or more. Future research may benefit from including an objective measure of sedentary behaviour time coupled with a self-report measure of activity type and context (cf. Pate et al, 2008; Hardy et al, 2013).

A final consideration concerns the use of inductive content analysis. While inductive content analysis is an effective tool for identifying salient themes – particularly when there is little former research in the field (Elo & Kyngäs, 2008) – it assumes that researchers are able to approach analysis atheoretically and without bias. In the case of the current study, efforts were made to reduce the effects of bias through a process of self-reflection, discussion with peers, and skeptical analysis of identified themes. Thus, while there remains risk of bias, it is felt that the themes identified are representative of individuals’ sedentary psychology beliefs, experiences, and perceptions. Lastly, the current analysis emphasised frequency analysis (i.e., identification of salient themes). Additional insight into sedentary behaviour psychology may be gained from alternative analysis procedures, such as content analysis or qualitative factor analysis. Future Directions

Consistent with the nature of exploratory research, this study raises more questions than it answers. Future research directions are plentiful; however, based upon results, two areas may be particularly enlightening. First, given the observation that individuals associate sedentary behaviour with a number of positive proximal outcomes, it may be beneficial to more closely examine individuals’ motivations for engaging in sedentary behaviour. This might include whether/which outcome expectancies positively predict time spent in sedentary behaviour, or whether engaging in sedentary behaviour actually results in the realisation of noted positive outcomes. Second, effort should be put toward understanding the effect of activity type and context. As was found, individuals’ perceptions can vary dependent on activity type, and even seemingly-similar types of sedentary behaviour can be perceived quite differently. The nature of these differences – and the occurrence of similarities – may prove crucial for not only understanding the occurrence of sedentary behaviour, but also determining the feasibility of intervention across context.

STUDY TWO:

DO "POSTURE" AND "ACTIVITY" MATTER?

EXPLORING SEDENTARY BEHAVIOUR COGNITIONS ACROSS CONTEXT

Introduction

Since the mid-1900s, sedentary behaviour has come to permeate nearly all aspects of Western culture (Levine, 2010; Ng & Popkin, 2012). There is now a large body of evidence illustrating that excessive sedentary time is associated with increased risk of morbidity and mortality independent of moderate-to-vigorous physical activity. Metabolic deterioration, for instance, is strongly associated with sedentary behaviour (Tremblay et al, 2010).

Given the public health implications of such risks, a number of governmental and non-governmental bodies have recommended that adults make efforts to reduce their daily sitting time (e.g., Australian Government Department of Health, 2014; Canadian Cancer Society, 2017). Concurrently, there is growing empirical interest in the feasibility of sedentary behaviour reduction ("sedentary intervention"). Intervention efforts have been predominantly informed by environmental models, with excessive sedentary behaviour conceptualised as being a by-product of the built and social environment. Not only do such explanations appeal to everyday experience, but there is growing evidence speaking to the detrimental effects of urbanisation and industrialisation on physical activity behaviour (Ng & Popkin, 2012; Owen, 2012). Despite the allure of environment-focused interventions, literature reviews have questioned their ability to produce sustained and clinically meaningful change (e.g., Chau et al, 2010; Martin et al, 2015; Shrestha et al, 2015; Tew et al, 2015). As argued by Prapavessis and colleagues (2015), one potential explanation for these findings is that environmental interventions "fail to acknowledge the role psychosocial variables can play in explaining sedentary behaviour" (pp. 24). Unfortunately, due to the novelty of sedentary behaviour psychology research, there is presently insufficient evidence to suggest which psychosocial variables are central to understanding sedentary behaviour and successful intervention. The process of identifying salient psychological variables, however, is not straightforward. Consider, for instance, the fact that "sedentary behaviour" encapsulates hundreds of different behaviours which, – despite all involving low-effort sitting/reclining – can vary dramatically in their form, function, and context (see Study One). For example, the psychosocial factors associated with *sitting to eat dinner* are likely different than the psychosocial factors associated with *sitting on an airplane* or *sitting in court while on trial*. As such, understanding sedentary behaviour may be significantly more complicated than understanding other health risk behaviours. There may be many more manifestations of sedentary behaviour than unhealthy eating, unsafe sex, etc.

In daily life, the frequent co-occurrence of sedentary postures alongside certain activities (e.g., studying, eating, screen-based entertainment) may mean that, for all intents and purposes, individuals perceive posture and activity holistically. However, this does not mean that all characteristically sedentary activities *require* a sedentary posture: for example, it's possible to watch television standing-up – it's just not done very often. The posture/activity distinction forms the basis of many sedentary interventions, such as stepping during television commercial breaks (Steeves et al, 2012) and the development of active workstations (e.g., Carr et al, 2012). However, to date only one study (Gierc & Brawley, 2015) has explicitly explored how activity and posture interact psychologically. In this study, participants were randomised to complete a brief (20 minute) task in either a sitting or standing posture. Results did not reveal any differences in participants' performance or immediate experience. Regardless, *sitting* participants perceived standing as being significantly more difficult, whereas *standing* participants viewed sitting as being significantly easier. Such results raise many questions regarding how posture is perceived by individuals, with implications for how we understand sedentary behaviour psychology and develop successful interventions.

Perceived Self-Efficacy and Sedentary Behaviour

Defined by Bandura (1997), *perceived self-efficacy* ("self-efficacy") refers to "beliefs in one's capacity to organise and execute the courses of action required to produce given attainments" (pp. 3) – that is, what people think they can accomplish under certain conditions. Self-efficacy is theorised to be a key determinant of human motivation and behaviour, affecting "the courses of actions people choose to pursue, how much effort is put forth in a given endeavour, … , and the level of accomplishment they realise" (pp. 3). The implication for health behaviour is relatively straightforward: if a person does not believe they have the ability to do something, – despite a strong incentive to engage in behaviour – they are less likely to try.

There is a considerable amount of research linking self-efficacy to physical activity behaviours. Across studies, individuals with higher self-efficacy are more likely to initiate and maintain physical activity compared to individuals with lower self-efficacy (e.g., McAuley & Blissmer, 2000; Culos-Reed, Gyurcsik, & Brawley, 2001; Jung & Brawley, 2013). In contrast, only one study[6] to date has explicitly examined the relationship between sedentary behaviour and self-efficacy. In this research, Adams (2013) tested the ability of a theory-based intervention to reduce sedentary behaviour in overweight/obese women. While self-efficacy was found to differ between compliant- and non-compliant participants, participants did not significantly differ in their amount of sedentary behaviour at the end of the intervention.

[6] It is noteworthy that several sedentary interventions reference self-efficacy; however, methodological/theoretical shortcomings make it difficult to draw conclusions. For instance, Chang et al (2013) attempted to reduce sedentary behaviour by targeting self-efficacy *for physical activity* – self-efficacy for sedentary behaviour was not measured or taken into consideration. Other interventions describe using self-efficacy in behaviour change, but fail to discuss how self-efficacy was strengthened, fail to measure self-efficacy, and/or fail to report the relationship between self-efficacy and intervention goals (e.g., Aittasalo et al, 2004; De Greef et al, 2010; 2011; Gardiner et al, 2011; King et al, 2013; Van Dyck et al, 2013).

If we turn to theory, how might we expect self-efficacy to be related to sedentary behaviour? According to Bandura (1986; 1997), task self-efficacy is hypothesised to be a

Figure 2 – The hypothesised "self-efficacy gap" between sitting and standing may serve as an indicator of how posture contributes to sedentary behaviour experiences.

predictor of behaviour when that behaviour is difficult or novel. For simple, well-learned, and commonly-practiced behaviours, task self-efficacy is thought to hold relatively little predictive power. As such, it would be reasonable to hypothesise that task self-efficacy is a poor predictor of sitting: sitting is a common, well-practiced, every-day behaviour; individuals sit in many situations for many reasons; and individuals typically sit for extended periods of time. In short, if we were to use self-efficacy as a predictor of sitting, we might expect individuals to "ceiling out" in the values they report for task efficacy measures. In contrast, individuals may be less accustomed to – and thus have more-variable self-efficacy for – doing certain activities standing up. The occurrence of a "self-efficacy gap" (Figure 2) between doing an activity seated versus standing may serve as an indicator of how posture contributes to the sedentary behaviour experience.

Outcome Expectancies

The concept of outcome expectancies dates to the 1930s, and today plays a central role in many theories of human behaviour (Williams, Anderson, & Winett, 2005). Within the agency aspect of Social Cognitive Theory (Bandura, 1986; 1997), perceived outcome expectancy ("outcome expectancy"; i.e., the perceived likelihood of an event occurring) is hypothesised to be related to an individuals' level of self-efficacy. For example, if a student has high self-efficacy for calculus, they would expect to do well on a calculus exam.

As with self-efficacy, almost no research has examined the relation of outcome expectancies to sedentary behaviour. Study One of this dissertation was among the first to systematically and purposefully investigate the perceived costs and benefits of engaging in sedentary activities (pp. 43 and pp. 51). While participants' costs largely focused on distal physical outcomes (e.g., obesity, low fitness), benefits were primarily proximal and psychological in nature. For instance, over 50% of participants reported mental rest and relaxation, while over 40% reported learning and mental stimulation. A major focus of sedentary intervention to date has been the prevention of long-term chronic disease outcomes by reducing and/or interrupting sedentary behaviour. As such, the observation that individuals associate sedentary behaviour with positive proximal outcomes raises a consideration for intervention: will interventions – despite best intentions – be perceived as interfering with the valued proximal outcomes of sitting? If so, we might expect intervention programs to struggle to attract widespread and sustained support.

The Present Study

Study Two aimed to build upon the results of Study One by examining relationships between sedentary context and sedentary perceptions, specifically highlighting how social cognitive variables may differ by posture and activity. To this end, Study Two asked:

1. **Do social cognitions differ by posture and activity type?**

   Hypothesis: Based upon Social Cognitive Theory (Bandura, 1986; 1997), it was hypothesised that a main effect of posture would emerge, with standing being associated with significantly lower self-efficacy and outcome expectancies relative to sitting. Given the lack of past research, no *a priori* hypotheses were made regarding the effect of activity type.

In addition, Study Two posed three secondary questions, the first of which examined relationships between social cognitive variables. As few studies have attempted to apply Social Cognitive Theory (Bandura, 1986; 1997) to sedentary behaviour, it remains unknown whether relationships exist between variables as predicted by theory: for instance, whether higher self-efficacy is associated with more-positive outcome expectancies. As such, it was asked:

2. **Do social cognitions follow theoretically-hypothesised relationships within the context of sedentary behaviour?**

   Hypothesis: Positive relationships would be observed between social cognitive constructs and between social cognitions and sedentary behaviour indicators.

The second question examined postural preferences: whether individuals express an overall preference for sitting over standing; whether preferences vary across activities (i.e., television versus studying); and whether preferences differ across different aspects of the behaviour (e.g., being able to relax versus being able to think critically about material). Past research (Gierc & Brawley, 2015) found that individuals tend to view sitting more-favourably than standing: for instance, sitting is perceived as requiring less mental effort and physical effort. However, whether these perceptions translate to overt preferences remains uncertain. Thus it was asked:

3. **Do individuals hold postural preferences? If so, do preferences differ between activities?**

   Hypothesis: Individuals will express a general preference for sitting over standing. Given the novelty of this research, no *a priori* hypotheses were made regarding whether preferences differ across activity types.

Informed by Study One (pp. 46 and pp. 57), the final question examined the relationship between leisure-time physical activity (LT-PA), body mass index (BMI), and sedentary psychology. While research has found little evidence of a relationship between individuals' amount of sedentary behaviour and their ability to meet physical activity guidelines (Biddle et al, 2004; Biswas et al, 2015; Burton et al, 2012), results from Study One suggest that a relationship may exist between physical activity and sedentary perceptions. With this in mind, it was asked:

4. **Is there a relationship between sedentary-related social cognitions and BMI? Sedentary-related social cognitions LT-PA?**

   Hypothesis: For **BMI**, it was hypothesised that no differences would occur in sitting cognitions, but that significant differences would emerge for standing cognitions. Specifically, it was hypothesised that higher-BMI individuals would report lower social cognitions (e.g., lower self-efficacy) relative to lower-BMI individuals. For **LT-PA**, it was hypothesised that no differences would be observed for sitting cognitions, but that significant differences would emerge for standing cognitions. Specifically, it was hypothesised that higher-activity individuals would express higher social cognitions for standing relative to their lower-activity peers.

Method

Research procedures were approved by the University of Saskatchewan Research Ethics Board prior to initiating participant recruitment and data collection (Appendix E). A visual schematic of research methods can be found in Figure 3, pp. 77.

Participants and Design

Study Two was a within-subjects, vignette-based study. Four vignettes were developed, which varied along two domains: posture (sitting versus standing) and activity (watching television versus studying). The vignettes are described in detail in the Procedures section (pp. 75).

Post-secondary students were recruited through the University of Saskatchewan PAWS bulletin board and social media (Facebook, Tumblr), with a draw for 1 of 5 $20 gift certificates serving as an incentive for participation. For maximum reach, no inclusion or exclusion were set other than participants being currently enrolled in a post-secondary program (i.e., part-time, full-time, or co-op/practicum). The study was accessed 879 times, of which 577 individuals (65.6%) completed the survey in part or full. Of the 302 incomplete responses, 17 were ineligible due to not being a post-secondary student, 79 failed to provide consent, and 206 left the survey before completing the demographics section. The final sample had a mean age of 22.21 (SD = 4.09) years, was 72.4% female, and 77.6% Caucasian. Detailed participants demographics can be found in Table 11.

Table 11 – Study Two participant demographics and physical activity levels.

Age ± SD	22.21 ± 4.09	BMI ± SD	23.61 ± 4.46
Gender (Female)	72.4%	Underweight	5.7%
Ethnicity (Caucasian)	77.6%	Normal Weight	68.1%
Student Status		Overweight	18.1%
Full-Time (3+ Classes)	93.1%	Obese	8.2%
Part-Time	4.2%	Physical Activity	
Co-Op / Practicum	1.4%	> 0 minutes	82.1%
University Program		≥ 90 minutes	59.8%
Diploma / Certificate	3.5%	≥ 150 minutes	40.7%
Undergraduate	75.2%	Physical Activity ± SD	
Master's / PhD	12.8%	Bouts/Week	3.39 ± 1.76
Professional	6.4%	Minutes/Bout	45.80 ± 14.84
Years in University		Minutes/Week	131.78 ± 114.24
1-2	40.2%	Physical Activity Intensity	
3-4	31.6%	Light	12.5%
5+	27.9%	Moderate	53.4%
Employment		Vigorous	16.3%
Not Employed	47.3%		
Full-Time	4.5%		
Part-Time	47.8%		

Measures

The complete Study Two questionnaire can be found in Appendix F.

Eligibility screening. Immediately upon accessing the questionnaire, participants were presented with a single eligibility screening item: “Are you currently a college, university, or post-secondary student?” Participants who responded “Yes” were directed to the consent page; participants who responded “No” were directed to a termination page.

Demographics. Basic demographic information, such as age, years of post-secondary information, and BMI (via self-reported height and weight) were collected for descriptive purposes.

Leisure-time physical activity. Participants' level of LT-PA was assessed with three self-report items. First, participants were asked: "Over the past two weeks, have you participated in any leisure-time physical activity? For example, hockey, volleyball, karate, weights, walking, running, swimming, swing dance, etc." Participants who responded "Yes" were then asked to indicate the frequency (times per week) and typical duration (bout length, in minutes) of their exercise over the past week. Frequency and duration were subsequently multiplied to produce total weekly minutes of LT-PA. That is:

$$\textit{Weekly LT-PA} = (\textit{Number of LT-PA Bouts})\ (\textit{LT-PA Bout Duration})$$

The measure is similar to that used by Statistics Canada in physical activity research (e.g., Garriguet & Colley, 2014) and, unlike the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985), – which asks participants to count the number of activity bouts – carried the benefit of providing greater detail into minutes of physical activity.

Perceived self-efficacy. Two self-efficacy scales were developed: one for studying and one for watching television. Items were developed through consultation with peers and participants' open-ended responses to Study Two's pilot work (Appendix D). Items were self-regulatory in nature, highlighting the various psychological processes required to engage in the activity. For example, one's ability to "focus on the task" (studying) and to "relax" (watching television).

After being presented with a vignette (discussion below), participants were asked to imagine themselves in the described situation and report their confidence for each self-efficacy item on a 0% (Not Confident) to 100% (Very Confident) scale. Participants' average score for all items was calculated and used in subsequent analyses. Scales exhibited excellent internal consistency, Cronbach's alphas = 0.95 to 0.98.

Psychological outcome expectancy. As with the self-efficacy scales, two lists of outcome expectancies were developed: one for studying and one for watching television. Items were informed by the results of Study One (pp. 43 and 51), through consultation with peers, and participants' open-ended responses to Study Two pilot work (Appendix D). Items focused on various mental/behavioural outcomes: for example, being able to "finish what I need to" (studying) or "disconnect from the day" (watching television).

After being presented with a vignette, participants were asked to imagine themselves in the described situation and report the likelihood of achieving each outcome on a 1 (Not Likely) to 10 (Very Likely) scale. Participants' average score for all items was calculated and used in subsequent analyses. Scales exhibited excellent internal consistency, Cronbach's alphas = 0.96 to 0.97.

Physical outcome expectancy. After completing items on psychological outcome expectancy, participants were asked how they would expect to feel physically after engaging in the described vignette scenario. Participants were presented with a list of six major body regions (e.g., head and neck, legs and feet) and were asked to rate their anticipated physical feelings on a -5 (Very Bad) to +5 (Very Good) scale. The affective components of physical outcomes (i.e., rather than likelihood or value) were explicitly examined given that no prior research had quantitatively examined whether posture is associated with good or bad physical states. Participants' average score for all items on a scale was calculated and used in subsequent analyses. Scales showed excellent internal consistency, Cronbach's alphas = 0.88 to 0.94.

Engagement and satisfaction. Two final vignette-specific items examined participants' perceptions of (1) how long would they be able to engage in the described activity for and (2) their level of satisfaction at the end of an hour. These items served to provide a final, global indicator of participants' reactions to the stimulus material.

Engagement items examined individuals' ability to participate in the activity over the course of an hour. For studying, participants were asked how many minutes would they be able to study productively. For television, participants were asked how many minutes they would be able to watch. Both items were scored on a 0 to 60 minutes scale.

For satisfaction, participants were asked to indicate how satisfied they would be with their progress (studying) or time (watching television) at the end of an hour on a 1 (Not Satisfied) to 10 (Very Satisfied) scale.

Postural preferences. After completing the four vignettes, participants were asked to report their preference for sitting or standing. The purpose of these items was to overtly examine individuals' postural preferences, in contrast to their more-implicit responses to the self-efficacy and outcome-expectancy items above.

For studying, participants were prompted with:

> A number of different factors (like the ability to pay attention) are important for studying. Likewise, when we study, we might have multiple goals in mind (e.g., grasping a complex concept, passing a class).
>
> Think about studying for an hour. You're given the choice between studying while (1) sitting at a traditional desk, or (2) standing at a standing-height desk. Which posture – sitting or standing – would best support the following outcomes?

Participants were presented with 16 items, including "Preserving my energy" and "Producing quality work". Items were informed by the results of Study One (pp. 43 and 51), through consultation with peers, and participants' open-ended responses to Study Two pilot work (Appendix D). Equivalent procedures were followed for television postural preferences.

For each item, participants were asked to indicate their postural preference on an 11-point scale, ranging from -5 (sitting) to +5 (standing). Note that, to prevent undue bias, the survey was coded so that participants were unable to see the positive (+) or negative (-) symbols. Subsequent analyses examined both (1) average score for all items on the scale, as well as (2) individual scale items independently. The scales showed excellent internal consistency, Cronbach's alphas = 0.934 and 0.941, respectively. Lastly, a final single item assessed individuals' overall preference for sitting (-5) or standing (+5) while watching television or studying.

Time perceptions. Participants completed two time perception items for each activity. The first item asked participants to report the longest amount of time they would consider *sitting* and studying (watching television) for; the second item asked participants to report the longest amount of time they would consider *standing* and studying (watching television) for. For each item, time was reported in hours and minutes.

Interest in intervention. The final section of the questionnaire examined sedentary behaviour reduction. A cluster of three items assessed *level of interest* for sedentary behaviour reduction at school and home. For instance, participants were asked: "If your university offered an alternative lecture format, where students stood up during class, would you be interested in participating?" (1 = Not Interested, 10 = Very Interested"). A second cluster asked participants to rate their *overall confidence* to reduce sedentary behaviour at school and at home on a 0% (Not Confident) to 100% (Very Confident) scale. A final cluster of items asked participants how reducing sedentary behaviour would *affect their physical health, mental health, and social health* (1 = Many Costs to Reduction, 10 = Many Benefits to Reduction).

Table 12 – Study Two experimental vignettes

	Sitting	**Standing**
Studying	It's a weekday afternoon, and you have a gap between classes. Normally you'd spend your time relaxing – but today's different. You have a big exam coming up, and really want to do well on it. You head to the library to study. It's crowded, but you manage to find a seat at a table. You sit down and pull out your notes. You plan on studying for the next hour.	It's a weekday afternoon, and you have a gap between classes. Normally you'd spend your time relaxing – but today's different. You have a big exam coming up, and really want to do well on it. You head to the library. It's crowded, and all the seats are full. There is a free space at a standing-height desk, but no chair – you must stand up to work. You pull out your notes. You plan on studying for the next hour.
Television	You share an apartment with three other roommates. The four of you get along really well, and often hang out. One of your favourite activities is watching a TV show together once a week. This week, your roommates have invited some friends over to watch TV with you. Your apartment is crowded, but you manage to find a seat. You plan on watching TV for the next hour.	You share an apartment with three other roommates. The four of you get along really well, and often hang out. One of your favourite activities is watching a TV show together once a week. This week, your roommates have invited some friends over to watch TV with you. Your apartment is crowded, and you can't find a seat – you stand up instead. You plan on watching TV for the next hour.

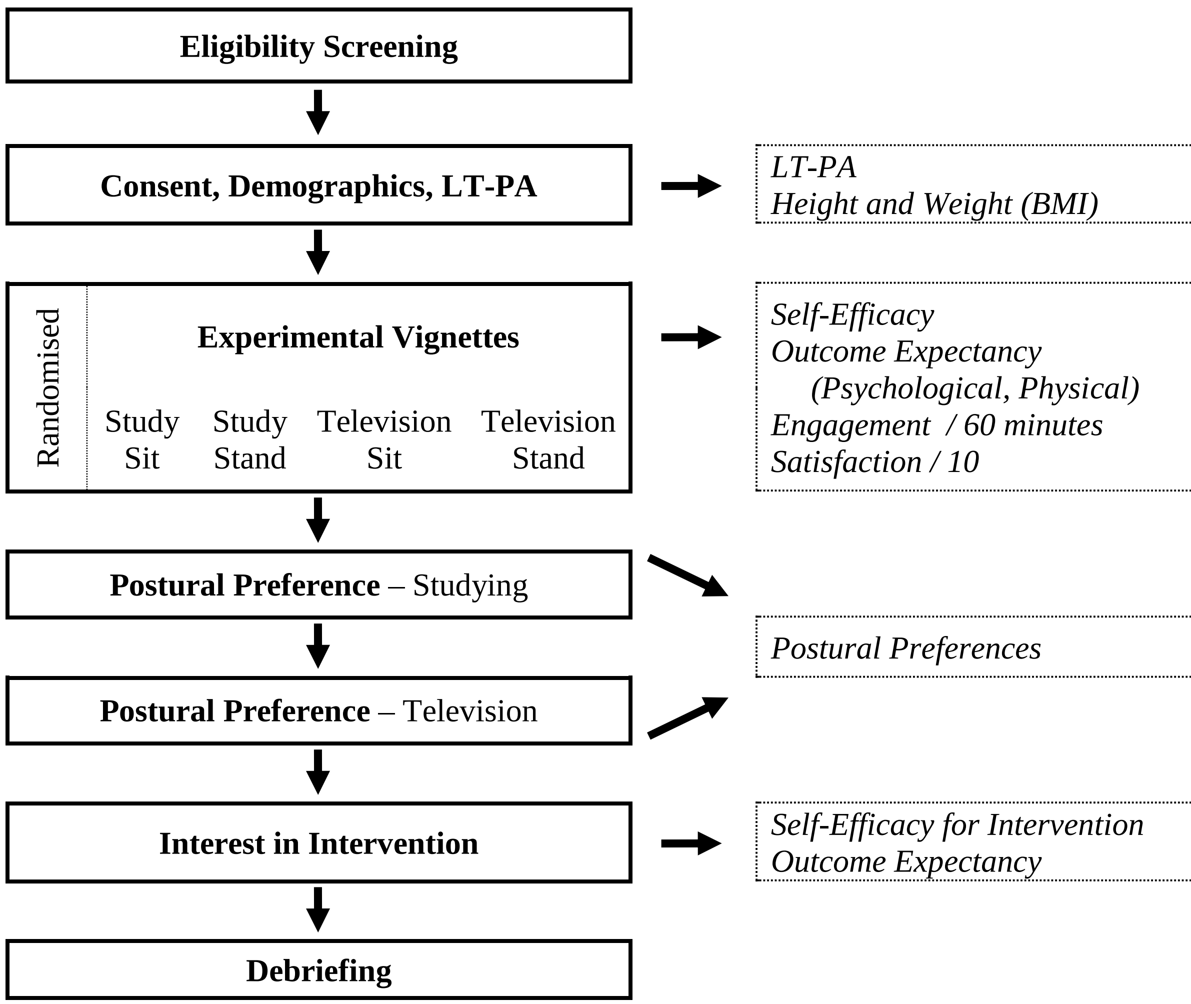
Procedure

Study Two was conducted online using a two (posture: sit, stand) by two (activity: studying, watching television) within-subjects factorial design. Participants were recruited online, with interested volunteers automatically directed to the study via hyperlink. Following eligibility screening, consent, demographics, and self-reported LT-PA, participants were presented with a series of four experimental vignettes. The vignettes were presented randomly, to reduce any potential order effects.

Each vignette varied along two domains: activity (watching television or studying for an exam) and posture (sitting or standing). For instance, in the sitting/studying vignette, the student was described as going to the library to study for an exam; the library is crowded, but they manage to find a seat. In contrast, in the standing/studying vignette, all the seats are filled so the student studies at a standing-height desk instead. As such, the vignettes forced the choice of posture upon the student, and did not provide them with the opportunity to seek out alternatives (e.g., going to another library, sitting on the floor, finding a chair; see Appendix D). The two activities were selected as they were felt to (1) represent motivated behaviours that differed by (2) domain and (3) degree of volition. The behaviours were also felt to be highly relevant and familiar to a post-secondary audience. As such, it was expected that students would have sufficient experience with these behaviours to be able to respond to items appropriately. Following the recommendations of Paddam et al (2010), vignettes were developed to be brief and easy-to-read, with "enough contextual information to allow participants to understand the target situation, while remaining slightly ambiguous" (pp. 63). The vignettes were written in a second-person narrative style, with no reference to age, gender, academic program, or year of study. Additionally, no explicit information on sedentary behaviour (e.g., its definition or health implications) was provided. Vignette reading level was estimated to be 4.6 (Flesch, 1944, via Microsoft Word, 2010), indicative that a university student audience would have little difficulty reading the text. The four vignettes were pilot tested prior to the study, and were found to be easy-to-read and understandable. Details regarding the pilot test can be found in Appendix D. The four experimental vignettes can be found in Table 12.

Immediately after reading each vignette, participants were presented with vignette-specific items on self-efficacy, outcome expectancy, satisfaction, and engagement. Participants were instructed to answer these items *in response to the vignette they had just read*. After completing all four vignettes, individuals were asked a series of items on postural preferences

Figure 3 – Study Two procedure and outcomes



(sitting versus standing, by activity) and sedentary behaviour intervention. A visual schematic of Study Two procedures can be found in Figure 3.

Analytical Plan

Data was analysed using SPSS version 23.0 (IBM, 2015). Data management and screening strategies were used to address issues of missing data, the presence of outliers, and to examine statistical assumptions. The same data management procedures were used for all dissertation studies, and are outlined in detail in Appendix A.

Question 1: Posture and activity. Question 1 examined whether self-efficacy and outcome expectancies significantly differed by posture and activity. Repeated-measures MANOVA was conducted with posture and activity serving independent variables; and self-efficacy, psychological outcome expectancy, physical outcome expectancy, engagement, and satisfaction serving as dependent variables. Results were deemed significant and follow-up analyses conducted (i.e., repeated-measures ANOVA with Bonferroni correction, Cohen's effect sizes) if $p < 0.05$.

Question 2: Theoretical relationships between variables. Question 2 explored theoretically-hypothesised relationships between sedentary cognitions. First, Pearson's bivariate correlations were used to examine relationships between self-efficacy, psychological outcome expectancy, and physical outcome expectancy. Using Bonferroni correction, correlations were deemed statistically significant if $p < 0.008$. Significant correlations were interpreted as per Cohen's (1998) recommendations: that is, *r*s of 0.10-0.29 were considered to be small correlations, 0.30-0.49 medium correlations, and 0.50-1.00 large correlations.

Next, hierarchical linear regression was used to examine the relationship between social cognitions and three different outcome variables: satisfaction, engagement, and interest in intervention. As per theory (Bandura, 1986; 1997), predictor variables were entered in two steps: self-efficacy in step one, and outcome expectancy in step two. Variance accounted for and beta weights were examined. Using Bonferroni correction, regressions were deemed statistically significant if $p < 0.004$.

Question 3: Postural preferences. Question 3 examined individuals' overt postural preferences. Descriptive statistics (means, standard deviations) were used to develop an initial sense of participants' preferences for sitting and standing, both overall and for specific outcome items. Next, repeated-measures MANOVA was used to examine whether postural preferences significantly varied between activities; a second repeated-measures MANOVA examined between-posture differences in time perceptions.

A final series of repeated-measures MANOVAs were used to examine between-activity differences in outcome expectancies. Outcomes were grouped together into thematic categories: attention, learning/engagement, and energy/affect. Results were deemed statistically significant and follow-up analyses conducted (repeated-measures ANOVAs with Bonferroni correction) if $p < 0.05$.

Question 4: The effect of BMI and LT-PA. Study Two's final question explored whether sedentary perceptions are affected by BMI and LT-PA level. Pearson's bivariate correlations were used to examine relationships between BMI/LT-PA and sedentary behaviour perceptions. If multiple significant correlations were observed, repeated-measures MANOVA would be used to examine significant differences between BMI categorisations (e.g., normal weight, overweight) and/or LT-PA levels (i.e., $<$ 150 minutes LT-PA or $\geq$ 150 minutes of LT-PA). As this was deemed to be exploratory analysis, follow-up analyses were conducted if ps < 0.10.

Results

Data Management Strategies

Missing data. There were no instances of missing data that exceeded 5% of any given scale.

Outliers. As per Tabachnick & Fidell (2013), univariate outliers were identified by a standardised score greater than 3.29, $p < 0.001$. Within the primary analyses, a number of outliers were observed in both scaled items and in participants' self-reported minutes. Cook's distances confirmed that scaled items did not exert undue influence on results, with all observed Cook's values falling at or below 0.2 (Field, 2009). In the case of self-reported minutes (i.e., maximum time spent sitting/standing), a number of values were in excess of what one would reasonably expect (e.g., reporting being able to stand and study for 20 continuous hours). As such, identified outliers were made less extreme by moving them within one unit of the next-most-extreme score.

Testing of assumptions. Statistical assumptions for Pearson's correlation, linear regression, and repeated-measures MANOVA were examined prior to conducting analyses. Skew and kurtosis values were in an acceptable range and deemed to be non-problematic.

Question 1: Posture and Activity

Question 1 examined whether self-efficacy and outcome expectancies significantly differ by posture and activity. Wilk's statistic indicated a significant main effect for both posture and activity, $\Lambda = 0.899$, F (5, 512) = 11.514, $p < 0.001$, and $\Lambda = 0.447$, F (5, 512) = 126.681, $p <$ 0.001, respectively. Complete descriptive statistics can be found in Table 13 and Table 14.

In terms of posture, repeated-measures ANOVA with Bonferroni adjustment indicated significant differences in all five dependent variables: self-efficacy, F (1, 516) = 30.387, $p <$ 0.001; psychological outcome expectancies, F (1, 516) = 47.601, $p < 0.001$; physical outcome expectancies, F (1, 516) = 22.589, $p < 0.001$; engagement, F (1, 516) = 26.060, $p < 0.001$; and satisfaction, F (1, 516) – 25.893, $p < 0.001$. For both, sitting was viewed more-positively than standing. For activity, repeated-measures ANOVAs indicated significant differences in four of five dependent variables: psychological outcome expectancies, F (1, 516) = 134.706, $p < 0.001$; physical outcome expectancies, F (1, 538) = 254.354 $p < 0.001$; engagement, F (1, 516) = 133.879, $p < 0.001$; and satisfaction, F (1, 516) = 38.343, $p < 0.001$. In all four cases, watching

Table 13 – Participant vignette responses, main effects of posture and activity

	Sit	Stand	d*	Studying	Television	d*
Self-Efficacy	56.3 ± 25.9	49.2 ± 26.7	0.27***	52.2 ± 27.3	53.3 ± 25.8	0.05
Psychological OEs	5.8 ± 2.7	4.9 ± 2.8	0.33***	4.8 ± 2.6	5.9 ± 2.8	0.41***
Physical OEs	-0.2 ± 1.9	-0.6 ± 1.9	0.21***	-0.8 ± 1.8	0.1 ± 2.0	0.47***
Engagement	41.0 ± 16.1	36.7 ± 17.1	0.26***	35.1 ± 15.8	42.7 ± 16.8	0.47***
Satisfaction	5.8 ± 2.9	5.0 ± 3.0	0.27***	5.1 ± 2.9	5.8 ± 3.0	0.24***

* = *p* < 0.05, ** = *p* < 0.01**,** *** = *p* < 0.001

Table 14 – Participant vignette responses, comparison of individual vignettes

	Studying			Television			Between-Activities	
	Sit	Stand	*d**	Sit	Stand	*d**	Sit, *d**	Stand, *d**
Self-Efficacy	56.3 ± 27.1	48.4 ± 26.9	0.29***	56.4 ± 24.8	50.3 ± 26.5	0.24***	0.00	0.07
Psychological OEs	5.2 ± 2.6	4.3 ± 2.5	0.35***	6.5 ± 2.6	5.5 ± 2.9	0.36***	0.50***	0.44***
Physical OEs	-0.7 ± 1.8	-1.0 ± 1.8	0.17*	0.3 ± 1.9	-0.2 ± 2.0	0.26***	0.54***	0.52***
Engagement	37.3 ± 15.1	33.2 ± 16.0	0.26***	45.1 ± 16.0	40.6 ± 17.3	0.27***	0.50***	0.44***
Satisfaction	5.5 ± 2.9	4.7 ± 2.9	0.28***	6.2 ± 2.9	5.5 ± 3.0	0.24***	0.24***	0.27***

* = *p* < 0.05, ** = *p* < 0.01**,** *** = *p* < 0.001

Table 15 – Correlation matrix, social cognitive variables by vignette

		Sit			Stand		
		SE	Psych OE	Phys OE	SE	Psych OE	Phys OE
Studying	SE	1			1		
	Psych OE	.902***	1		.919***	1	
	Phys OE	.424***	.464***	1	.446***	.464***	1
Television	SE	1			1		
	Psych OE	.776***	1		.835***	1	
	Phys OE	.470***	.474***	1	.512***	.598***	1

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

television was viewed more favourably than studying for an exam. There was no significant between-activity difference for self-efficacy, $F(1, 516) = 0.903$, $p > 0.05$.

Question 2: Theoretical Relationships between Variables

Question 2 examined whether Social Cognitive variables (self-efficacy, outcome expectancies) exhibit theory-congruent relationships within the context of sedentary behaviour. First, Pearson's bivariate correlation was used to examine relationships between variables at the level of the vignette. All analyses were significant, *p*s < 0.001, with correlations ranging from medium ($r = 0.424$) to large ($r = 0.919$) in strength (Table 15). Across analyses, the strongest correlations were observed between self-efficacy and psychological outcome expectancy.

Hierarchical linear regression was used to examine whether self-efficacy and outcome expectancy significantly predicted the sedentary behaviour indicators: satisfaction, engagement, and self-efficacy for intervention. For each regression, self-efficacy was entered in step one, and outcome expectancy (psychological and physical) entered in step two. Detailed regression tables can be found in Table 16 (studying vignettes) and Table 17 (television vignettes).

Table 16 – Regression matrix, studying.

		SITTING			STANDING		
		β	*t*	*p*	β	*t*	*p*
Engagement	Final Model	R^2_{Adj}= 0.656, F (3, 564) = 359.249, p < 0.001			R^2_{Adj}= 0.650, F (3, 554) = 343.726, p < 0.001		
	Self-Efficacy	**0.562**	9.777	< 0.001	**0.582**	9.178	< 0.001
	Psychological OE	0.215	3.664	< 0.001	0.219	3.407	0.001
	Physical OE	0.099	3.543	< 0.001	0.040	1.386	0.166
Satisfaction	Final Model	R^2_{Adj}= 0.734, F (3, 563) = 518.025, p < 0.001			R^2_{Adj}= 0.726, F (3, 552) = 487.879, p < 0.001		
	Self-Efficacy	0.288	5.700	< 0.001	0.369	6.539	< 0.001
	Psychological OE	**0.577**	11.167	< 0.001	**0.470**	8.229	< 0.001
	Physical OE	0.026	1.040	.299	0.063	2.510	0.012
Intervention SE	Final Model	R^2_{Adj}= 0.017, F (3, 533) = 4.129, p = 0.007			R^2_{Adj}= 0.053, F (3, 532) = 10.918, p < 0.001		
	Self-Efficacy	0.052	0.528	0.598	-0.117	-1.110	0.268
	Psychological OE	0.046	0.455	0.649	**0.292**	2.730	0.007
	Physical OE	**0.081**	1.678	0.094	0.086	1.801	0.072

Table 17 – Regression matrix, watching television

		SITTING			STANDING		
		β	*t*	*p*	β	*t*	*p*
Engagement	Final Model	R^2_{Adj}= 0.428, *F* (3, 548) = 137.513, *p* < 0.001			R^2_{Adj}= 0.563, *F* (3, 557) = 239.914, *p* < 0.001		
	Self-Efficacy	**0.362**	6.954	< 0.001	**0.462**	9.065	0.001
	Psychological OE	0.238	4.563	0.001	0.236	4.303	0.001
	Physical OE	0.153	4.112	0.001	0.129	3.686	0.001
Satisfaction	Final Model	R^2_{Adj}= 0.588, *F* (3, 547) = 261.092, *p* < 0.001			R^2_{Adj}= 0.698, *F* (3, 551) = 428.546, *p* < 0.001		
	Self-Efficacy	-0.002	-0.055	0.956	0.113	2.657	0.008
	Psychological OE	**0.691**	15.591	0.001	**0.683**	14.927	0.001
	Physical OE	0.145	4.546	0.001	0.090	3.060	0.002
Intervention SE	Final Model	R^2_{Adj}= 0.005, *F* (2, 532) = 2.443, *p* = 0.088			R^2_{Adj}= 0.021, *F* (2, 526) = 6.552, *p* = 0.002		
	Self-Efficacy	-0.060	-0.880	0.379	-0.130	-1.661	0.097
	Psychological OE	**0.134**	1.968	0.050	**0.247**	3.163	0.002
	Physical OE	–	–	–	–	–	–

Studying and sitting. Two of three studying/sitting regressions were significant, *p*s < 0.004: satisfaction (R^2_{Adj}= 0.656) and engagement (R^2_{Adj}= 0.734). For engagement, self-efficacy emerged as the strongest predictor variable, followed by psychological outcome expectancy and physical outcome expectancy. In contrast, for satisfaction, psychological outcome expectancy emerged as the strongest predictor variable, followed by self-efficacy and physical outcome expectancy. The regression model examining intervention self-efficacy was not significant, $p > 0.004$, R^2_{Adj}= 0.005.

Studying and standing. All three studying/standing analyses were significant, *p*s < 0.004. The regressions for engagement (R^2_{Adj}= 0.650) and satisfaction (R^2_{Adj}= 0.726) followed the same patterns as the studying/sitting vignette described above. Though the intervention self-efficacy model was significant, relatively little variance was accounted for, F (3, 532) = 10.918, $p < 0.001$, R^2_{Adj}= 0.053. In this case, neither self-efficacy nor outcome expectancies emerged as significant predictor variables.

Television and sitting. Two of three television/sitting regressions were significant, *p*s < 0.004: engagement (R^2_{Adj}= 0.428) and satisfaction (R^2_{Adj}= 0.588). These regressions followed the same pattern as the studying/television vignette described above. The regression model examining intervention self-efficacy was not significant, $p > 0.004$, R^2_{Adj}= 0.005.

Television and standing. All three television/standing analyses were significant, *p*s < 0.004. The regressions for engagement (R^2_{Adj}= 0.563) and satisfaction (R^2_{Adj}= 0.698) followed the same pattern as the studying/television vignette described above. While the regression for intervention self-efficacy was significant, only a relatively small amount of variance was accounted for, F (2, 526) = 6.552, $p < 0.004$, R^2_{Adj}= 0.021. Only psychological outcome expectancy emerged as a significant predictor, $\beta = 0.247$, $p = 0.002$.

Question 3: Postural Preferences

Question 3 examined individuals' overt postural preferences in three different ways. First, participants were asked to indicate their overall postural preference for sitting or standing (i.e., "If I were given the choice, I'd prefer to study [watch television] while … sitting [-5] or standing [+5]"). Second, participants reported how long they would be willing to engage in an activity (i.e., sitting or watching television) for if they were sitting or standing. Lastly, participants were presented with a list of activity-specific outcomes (e.g., "Being relaxed"), and were asked to indicate which posture – sitting or standing – would be best for achieving that outcome. Given that this is the first study to explicitly examine postural preference, this multi-item approach was adopted to provide both general and specific insight into individuals' perceptions. For instance, while individuals might possess an overarching sitting preference, their preferences might deviate dependent upon the outcome in question (i.e., "exceptions to the rule").

Repeated-measures MANOVA was used to examine whether postural preferences significantly differed between activities. Wilk's statistic indicated a significant between-activity difference, $\Lambda = 0.924$, F (4, 533) = 10.773, $p < 0.001$. Three of four follow-up ANOVAs were significant. No between-activity differences were observed in the overt postural preferences (i.e., the single-item preference measure), F (1,536) = 2.280, $p > 0.05$: that is, participants expressed an approximately equal strength sitting preference for both studying and watching television. In contrast, in terms of individual outcome items, participants' indicated a stronger overall preference for sitting while watching television versus sitting while studying, F (1, 536) = 13.188, $p < 0.001$. For the time items, participants indicated that they would be willing to study

Table 18 – Between-activity differences in overall posture preferences

	STUDYING	TELEVISION	*d**
Overt Preference	-4.09 ± 1.90	**-4.22±1.64**	0.093
Mean of Specific Outcomes	-3.11 ± 1.86	**-3.35 ± 1.64**	0.137***
Sit Minutes	**292.37 ± 205.07**	250.81 ± 161.33	0.225***
Stand Minutes	**63.90 ± 81.54**	52.07 ± 40.20	0.184***

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

longer than watch television, regardless of whether they were sitting (F (1, 536) = 20.031, p < 0.001) or standing (F (1, 536) = 11.353, p = 0.001). Full descriptive statistics can be found in Table 18.

Outcome-specific postural preferences. Descriptive statistics (Table 19) were calculated to develop an overall understanding of outcome-specific postural preferences. For studying, mean participant responses ranged from a high of -1.09 (*SD* = 3.65); “Boosting my energy”) to a low of -4.08 (*SD* = 1.83; “Preserving my energy”). For television, participants’ ranged from a high of -2.21 (*SD* = 3.31; “Boosting my energy”), to a low of -4.25 (*SD* = 1.52; “Being relaxed”). Thus, while some variability exists between the behaviours and specific outcomes, overall response patterns indicate a consistent preference for sitting over standing.

Though the outcome lists were developed to reflect either studying or watching television, there were a number of common items between the activities: for example, “Boosting my energy” and “Avoiding distractions” appeared on both the television list and studying list. Outcome items were grouped into three categories based upon thematic similarity between items: attention, learning/engagement, and energy/effort. Repeated-measures MANOVA was conducted on each of these three categories, to examine between-activity postural preferences.

Table 19 – Between-activity differences in posture preferences, by individual item

	STUDYING		TELEVISION		*d**
Attention	**Concentration**	**-3.78 ± 2.291**	Concentration	-3.58 ± 2.077	0.09
	Focus on my work	**-3.64 ± 2.133**	Focus on the show	-3.60 ± 1.939	0.02
	Avoid distractions	-3.38 ± 2.304	**Avoid distractions**	**-3.48 ± 2.002**	0.05
Learning/Engagement	Engage with material	-3.22 ± 2.402	**Engage with show**	**-3.39 ± 2.168**	0.07
	Aid memory	-2.32 ± 2.976	**Aid memory**	**-2.77 ± 2.480**	0.16***
	Understand material	**-3.38 ± 2.249**	Understand plot	-3.05 ± 2.223	0.15**
	Critical thought	**-2.74 ± 2.696**	Critical thought	-2.61 ± 2.451	0.05
	Creative thought	-1.73 ± 3.271	**Creative thought**	**-2.48 ± 2.554**	0.24***
Energy/Effort	Boost energy	-1.09 ± 3.650	**Boost energy**	**-2.21 ± 3.311**	0.32***
	Preserve energy	**-4.08 ± 1.832**	Preserve energy	-4.01 ± 1.763	0.04
	Being relaxed	-3.67 ± 2.078	**Being relaxed**	**-4.25 ± 1.517**	0.30***
	Enjoying studying	-2.88 ± 2.538	**Enjoying the show**	**-3.78 ± 1.837**	0.41***
Non-Common	Complete studying	-3.59 ± 2.233	Help me disconnect	-3.90 ± 1.772	–
	Quality studying	-3.54 ± 2.123	Help me de-stress	-3.92 ± 1.839	–
	Pass the exam	-3.40 ± 2.268			–
	Pass the class	-3.14 ± 2.277			–

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

The first MANOVA, examining attention, was non-significant, $\Lambda = 0.988$, F (3, 522) = 2.035, $p > 0.05$. However, significant between-activity differences were observed for both learning/engagement and energy/effort, $\Lambda = 0.854$, F (5, 508) = 17.384, $p < 0.001$, and $\Lambda = 0.784$, F (4, 518) = 35.782, $p < 0.001$, respectively. In terms of learning/engagement, follow-up ANOVAs with Bonferroni adjustment indicated significant differences in preference strength across three of five variables: aiding memory, understanding the material/plot, and encouraging creative thought. For energy/effort, follow-up ANOVAs with Bonferroni adjustment indicated significant differences in preference across three of four variables: boosting energy, being relaxed, and enjoying the show/studying. Full descriptive statistics can be found in Table 19.

Question 4: The Effect of BMI and LT-PA

Informed by Study One, Study Two's final question examined whether sedentary perceptions are significantly related to BMI and LT-PA level.

BMI. Participants' BMI was calculated using their self-reported height and weight. BMI values ranged from 12.08 to 54.88 kg/m^2, with a mean of 23.61 (SD = 24.46) kg/m^2. Pearson's bivariate correlation was used to examine a relationship between BMI values and sedentary perceptions (vignette variables, preferences, intervention; see Table 20). Correlations were generally small and non-significant, rs = -0.101 to 0.025. In light of results, no further analyses were conducted.

Physical activity. Participants' weekly minutes of LT-PA was calculated by multiplying their weekly bouts of leisure physical activity by average bout length. Three-quarters (76.6%) of participants reported engaging in some weekly leisure physical activity (i.e., > 0 minutes), with approximately half (48.7%) reporting 150 minutes or more. Participants who reported more than 150 minutes of LT-PA were classified as being "more active", and those reported less than 150 minutes were classified as being "less active".

Within sitting vignettes, Pearson's bivariate correlation showed no significant relationship between LT-PA and sitting perceptions. However, this was not the case for standing perceptions: for both the studying/standing and television/standing vignette, multiple small-but-significant positive correlations were observed, rs = 0.092 to 0.211. For postural preferences, a small-but-significant correlation was observed between LT-PA and overtly stated preferences; no

Table 20 – Correlations between BMI, LT-PA, and sedentary behaviour psychology outcomes.

		BMI		LT-PA	
		Sitting	**Standing**	**Sitting**	**Standing**
Studying Vignette	Self-Efficacy	0.022	0.022	0.020	0.176***
	Psychological OE	0.025	-0.036	0.043	0.211***
	Physical OE	-0.071	0.009	0.063	0.129***
	Engagement	0.025	0.006	0.030	0.177***
	Satisfaction	-0.004	0.016	0.042	0.160***
Television Vignette	Self-Efficacy	-0.096*	-0.069	-0.006	0.087
	Psychological OE	-0.061	-0.076	0.009	0.102*
	Physical OE	-0.079	-0.090*	0.043	0.136**
	Engagement	-0.047	-0.014	-0.033	0.129**
	Satisfaction	-0.032	-0.055	-0.075	0.092*
		Studying	**Television**	**Studying**	**Television**
	Overt Preference	-0.074	-0.044	0.098*	0.121*
	Outcome Preference	-0.056	-0.025	0.071	0.085
	Sitting Minutes	0.008	0.023	-0.001	-0.066
	Standing Minutes	-0.043	0.015	0.083	0.041
	Intervention, Interest	-0.101*		0.075	
	Intervention, Self-Efficacy				
	Studying	-0.003		0.166***	
	Leisure	-0.045		0.113**	
	Intervention OE				
	Physical Health	-0.069		-0.022	
	Mental Health	-0.056		0.051	
	Social Health	-0.063		-0.016	

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

Table 21 – The main effect of LT-PA on participants' vignette responses.

	Sitting			Standing			Between Posture	
	< 150	≥ 150	*d*	< 150	≥ 150	*d*	< 150 *d*	≥ 150 *d*
Self-Efficacy	56.0 ± 25.6	56.6 ± 26.2	0.02	47.1 ± 26.8	53.1 ± 26.7	0.22*	0.34**	0.13
Psych OE	5.8 ± 2.7	5.9 ± 2.7	0.03	4.7 ± 2.8	5.3 ± 2.7	0.22*	0.40**	0.22
Phys OE	-0.3 ± 1.8	-0.2 ± 2.0	0.05	-0.7 ± 1.8	-0.3 ± 2.1	0.20*	0.22**	0.05
Engagement	41.3 ±16.0	40.6 ± 16.1	0.04	34.9 ± 17.1	39.2 ± 16.8	0.25*	0.39**	0.09
Satisfaction	5.9 ± 2.9	5.7 ± 2.9	0.07	4.8 ± 2.9	5.4 ± 3.0	0.20	0.38**	0.10

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

significant relationships were observed in other preference variables. Lastly, for intervention, small-but-significant correlations were observed for intervention self-efficacy but not intervention outcome expectancies or interest in intervention. A complete summary of descriptive statistics can be found in Table 20. Informed by the pattern of correlations, repeated-measures MANOVA was used to examine whether more and less active individuals differed in their (1) vignette perceptions and (2) intervention self-efficacy. As this was deemed exploratory analysis, follow-up analyses (i.e., repeated-measures ANOVA with Bonferroni adjustment and Cohen's effect sizes) were conducted if $p < 0.10$. Postural preferences and other intervention variables were not examined due to the lack of significant correlations.

The first repeated-measures MANOVA examined the main effect of LT-PA on vignette responses. Wilk's statistic indicated significant differences, $\Lambda = 0.979$, F (5, 511) = 2.197, $p < 0.10$. Follow-up analysis indicated significant between-group differences in four of five dependent variables, *p*s < 0.05: self-efficacy, psychological outcome expectancies, physical outcome expectancies, and engagement. Additionally, satisfaction fell within the exploratory significance level, $p < 0.10$. Complete descriptive statistics can be found in Table 21.

The final MANOVA examined self-efficacy for engaging in sedentary behaviour reduction. Wilk's statistic indicated significant between-group differences, $\Lambda = 0.974$, $F(2, 539) = 7.151$, $p = 0.001$. Follow-up ANOVAs found significant differences in self-efficacy to reduce sitting while studying ($p < 0.001$, $d = 0.32$) and during leisure time ($p < 0.05$, $d = 0.18$). In both cases, more active individuals reported higher self-efficacy than less active individuals.

Discussion

The primary purpose of Study Two was to explore the conceptual definition of sedentary behaviour, specifically highlighting the distinction between posture and activity. Secondary research questions concerned how social cognitive variables (specifically, agency variables) manifest in the context of sedentary behaviour during two different activities, whether individuals hold postural preferences, and if BMI and LT-PA interact with sedentary psychology.

Question 1: Posture and Activity

Question 1 examined whether social cognitions (self-efficacy, outcome expectancies) differ across (1) different postures (sitting versus standing) and/or (2) different activities (watching television versus studying). This was accomplished by presenting students with a series of four experimental vignettes where they rated their perceived self-efficacy and outcome expectancy in relation to each vignette. Based upon Social Cognitive Theory (Bandura, 1986; 1997) and a previous experimental study on postural perceptions (Gierc & Brawley, 2015), it was hypothesised that a main effect for posture would emerge, with standing being associated with significantly lower self-efficacy and outcome expectancies relative to sitting. Analysis supported this hypothesis, with sitting consistently reported more favourably than standing. In short, individuals indicated greater confidence in their ability to sit as opposed to stand; and associated sitting with greater likelihood of attaining positive outcomes.

Given a lack of past research, no *a priori* hypotheses were made for the effect of activity. While self-efficacy did not significantly differ between studying and watching television, television was associated with more positive outcome expectancies. Such results fit with common sense observations, in that they suggest that individuals view leisure activities more-positively than scholastic activities.

It is noteworthy that the physical outcome expectancy measure emphasised affective outcomes (i.e., expecting to feel good or bad) rather than the constructs of *likelihood* and *value*. Affective components were explicitly examined as, prior to this research, no work had quantitatively examined whether posture is associated with good or bad physical states. Results of the current study suggest that, overall, standing is perceived as being associated with more-negative physical outcomes than sitting, particularly in the context of watching television. While participants' overall physical expectations fell close to the midpoint, reported values represent a mean of all five body regions assessed (e.g., head and neck, legs and feet). Future analysis may find certain body regions to be differentially impacted by posture: for instance, legs/feet may be more impacted by standing, whereas hips/buttocks may be more impacted by sitting. Activity may also prove to be an important variable: for instance, using a computer at work may be associated with increased neck/shoulder pain relative to sitting to read a leisure book.

Question 2: Theoretical Relationships between Variables

Given that little past research has applied Social Cognitive Theory to sedentary behaviour, Question 2 examined whether social cognitive variables exhibit theory-predicted relationships. Based upon the agency aspect of Social Cognitive Theory (Bandura, 1986; 1997), it was hypothesised that (1) self-efficacy would be positively related to outcome expectancy, and (2) self-efficacy and outcome expectancy would collectively predict behavioural indicators. Pearson's bivariate correlation supported the first hypothesis: significant and large positive correlations were observed between self-efficacy, psychological outcome expectancies, and physical outcome expectancy. Correlations were particularly strong (rs = 0.776 to 0.919) between self-efficacy and psychological outcome expectancy.

Hierarchical linear regression was conducted at the level of the vignette, examining three outcome variables: anticipated satisfaction, anticipated engagement, and self-efficacy for intervention. As hypothesised, both self-efficacy and outcome expectancy predicted outcomes: however, whereas self-efficacy emerged as the dominant predictor of engagement, psychological outcome expectancy was the dominant predictor of satisfaction. In terms of implications for sedentary intervention, such results would suggest the importance of emphasising *both* outcome expectancies and self-efficacy, with the goal of providing participants with both the (1) motivation and (2) the psychological and behaviour tools for successful sedentary reduction.

Question 3: Postural Preferences

Whereas Question 1 and the experimental vignettes examined more-implicit aspects of sedentary behaviour psychology, Question 3 was concerned with explicit postural preferences. That is, beyond simply engaging in a specific posture because of habit or tradition, do individuals hold preferences over whether they sit or stand?

Overall, participants' responses provide strong evidence for sitting preferences: when asked about overt preferences, participants overwhelmingly reported "sitting"; sitting was consistently identified as the best posture to obtain specific outcomes; and individuals reported that they would be able to sit for longer periods than stand. In terms of time perceptions, individuals reported they would be able to spend significantly longer amounts of time *studying* than watching television. Though the observed difference was small, it was nonetheless surprising: common sense might suggest that individuals would be willing to spend greater amounts of time watching television (i.e., a leisure activity) rather the studying (i.e., a non-leisure activity). Our observed results might reflect the attainment of outcomes. Watching television is associated with rest, relaxation and enjoyment; and it is known that individuals often turn to television/media to satisfy emotional needs (e.g., Anderson, Collins, Schmitt, & Jacobvitz. 1996; Kubey & Csikszentmihalyi, 1990; Reinecke, 2009). While television is characteristically fun and associated with positive outcome expectancies, individuals may be able to achieve their goals within relatively short periods of time: an hour, or perhaps two. Thus, it becomes unnecessary – and perhaps even counterproductive – to watch television for extended durations. In contrast, studying is both (1) oriented toward more-distal goals and (2) requires significant time and effort to achieve outcomes (e.g., perceived mastery of a subject). In short, the process of preparing for an exam is not often achieved over the span of an hour or two. Thus, even though studying is often experienced as onerous and/or strenuous, the promise of more-distal rewards may motivate individuals to dedicate greater amounts of time to this activity.

In addition to the above preference items, participants were presented with a list of activity-specific outcomes: for example, being able to relax (television) or passing the exam (studying). For each item, participants were asked to indicate which posture – sitting or standing – would be best for achieving the proximal outcome in question. While individuals consistently reported a preference for sitting, it was observed that strength of preference varied between outcomes: for instance, individuals reported a stronger preference for sitting when relaxing versus sitting to boost energy. Thus, results provide preliminary evidence that postural preferences may vary dependent on the specific goal individuals are pursuing.

Outcome items were grouped thematically (e.g., “attention”, “energy”), and MANOVA analysis was used to explore between-activity differences in posture preferences: that is, whether strength of posture preferences is consistent across activities. Analysis suggested that between-posture differences exist in the areas of (1) learning/engagement and (2) energy/effort, but not (3) attention. For both learning and energy, sitting preferences were stronger for watching television than they were for studying. Results raise the question of whether sitting plays a more-central role in the process of watching television than it does the process of studying.

Question 4: BMI and LT-PA

Informed by Study One, Study Two’s final question explored the relationship between (1) sedentary perceptions and BMI, and (2) sedentary perceptions and LT-PA. While research has found little evidence of a relationship between individuals’ sedentary behaviour and physical activity (e.g., sufficiently-active individuals can still engage in large amounts of sedentary behaviour; see Biddle et al, 2004; Biswas et al, 2015; Burton et al, 2012), results from Study One suggest that individuals’ level of physical activity could affect their perceptions of sedentary behaviour.

For BMI, it was hypothesised that (1) BMI would *not* be related to sitting perceptions, but (2) a significant negative correlation would be observed for standing perceptions, preferences, and interest in intervention. This hypothesis was not supported: there was no evidence of a relationship between BMI and sedentary behaviour perceptions.

For LT-PA, it was hypothesised that (1) LT-PA would *not* be related to sitting perceptions, but (2) a significant positive correlation would be observed for standing perceptions, preferences, and interest in intervention. Results partially support this hypothesis: Pearson's correlation found no relationship in sitting vignette perceptions, but small relationships in standing vignette perceptions and intervention outcome expectancies. Taken together, results support the theoretical tenets of Social Cognitive Theory. Sitting is an everyday behaviour, which is widely practiced by people regardless of their activity level; as such, we would not expect much variability in individuals' responses. In contrast, the standing vignettes described novel variants of studying and watching television. Given that individuals who are more-active generally have higher physical activity self-efficacy than individuals who are less-active (McAuley & Blissmer, 2000; Culos-Reed et al, 2001), it follows that more-active individuals perceive the standing vignettes more favourably. Likewise, more-active individuals reported greater self-efficacy for intervention. Interestingly, however, LT-PA did not significantly predict postural preferences, interest in engaging in intervention, or intervention outcome expectancy.

Strengths and Limitations

Study Two was the first study to explicitly recognise and systematically examine the *postural* and *activity* dimensions of sedentary behaviour. Results extend Study One's observation that sedentary behaviour perceptions differ by context, and suggest that researchers should also consider posture when conducting research and considering intervention. Additionally, Study Two was amongst the first to explicitly examine the agency aspects of Social Cognitive Theory in the context of sedentary behaviour. Results suggest that this theoretical model may be useful for understanding and predicting sedentary behaviour.

Methodologically, Study Two followed a vignette design. Prior to conducting research, all vignettes were pilot tested to ensure readability, understandability, and manipulation salience. Vignettes were selected for a variety of research and practical reasons. Scenarios are an effective tool to help examine constructs that might otherwise be difficult to measure or create overtly (Aguinis & Bradley, 2014; Hughes & Huby, 2002; Wallander, 2009). If properly constructed, vignettes allow for the controlled manipulation of target variables (Hughes, 1998) and for participants to respond in valid and reliable ways *even if* they lack first-hand experience with a phenomenon (Hughes & Huby, 2002). Practically, vignettes can be quickly and widely disseminated and where research is limited due to ethical, time, or financial concerns (Bradbury-Jones, Taylor, & Herber, 2012; Paddam et al, 2000; Wilson & While, 1998).One limitation of this research is its generalisability to the general population. The prepared vignettes were specifically tailored to post-secondary students and, as such, only post-secondary students were considered eligible for participation. How such findings translate to other populations (e.g., older adults, office workers) and behaviours (e.g., transportation, communication) remains unknown. Additionally, the final sample was primarily female and Caucasian. It remains possible that perceptions of sedentary behaviour may vary by demographic factors, such as gender and ethnicity.

Current analyses on the relationship between physical activity and sedentary behaviour perceptions examined *all* intensities of LT-PA: i.e., light, moderate, and vigorous. Light intensity activity is particularly important in the context of sedentary behaviour research, as it is often discussed as an alternative to sedentary behaviour (e.g., standing breaks as an intervention strategy; see Study Three). In contrast, national physical activity guidelines (Canadian Society for Exercise Physiology, 2011) specifically highlight moderate-to-vigorous physical activity. As such, the current results may differ from those achieved by comparing insufficiently- versus sufficiently-active individuals. (Note, however, that only 12% of respondents reported engaging in light-intensity physical activity.) Future research would benefit from explicitly contrasting individuals who achieve versus those who fail to achieve recommended levels of physical activity. Future Directions

As alluded to in the above discussion, Study Two raises multiple questions for future research. Based upon the pattern of results, examining the relationship between cognition and behaviour appears to be warranted. That is: both Study One and Study Two illustrate that individuals hold strong beliefs about sedentary behaviour. However, it remains to be seen how perceptions translate to real life behaviour. Does, for instance, greater self-efficacy for intervention *lead to* greater engagement in intervention? Are stronger sitting preferences – independent of activity preference – associated with increased sedentary behaviour? Far from being subtle conceptual points, research examining such questions could aid our understanding of the psychological aspects of sedentary behaviour research and intervention.

Future research would also benefit from examining the volitional component of posture. In the current student, the four vignettes asked individuals to imagine themselves in scenarios where they have *chosen* to sit or stand. Whether individuals perceive themselves as having control over their posture in day-to-day life remains unknown. Given that volition is a key assumption of social cognitive models, future research should examine (1) individuals' beliefs in the extent to which sitting is volitional, (2) whether such beliefs vary between individuals, and (3) whether such beliefs vary across activity and situation (e.g., sitting may be perceived as more volitional at an airport and less volitional at a movie theatre).

STUDY THREE:

THE EFFICACY OF THE THEORY OF PLANNED BEHAVIOUR IN PREDICTING SEDENTARY BEHAVIOUR AND STANDING BREAKS IN OFFICE WORKERS

Introduction

The proportion of sedentary jobs in the United States has increased 83% over the past 60 years, from 50% in the 1960s to over 80% today (Brownson, Boehmer, & Luke, 2005). Like "sedentary behaviour", – which serves as an umbrella term for low-effort sitting activities (see Introduction, pp. 3) – the term "sedentary job" is a catch-all for professions that commonly utilise a seated posture: for instance, certain artistic professions (e.g., writers), computers/technology work (e.g., programmers), surveillance jobs (e.g., air traffic controllers), and those in the transportation industry (e.g., long-haul truck drivers). Within this diversity, sedentary behaviour research has particularly gravitated toward office work. Not only are office jobs quite common and relatively diverse, but data indicates high levels of sedentary behaviour within this population. For instance, Parry and Straker (2013) observed that the average office worker is sedentary for over 70% of the work day, often in bouts of 30 minutes or greater. Similarly, Hadgraft et al (2016) have estimated that office workers spend 79% of the work day seated. In comparison, the average Canadian adult is sedentary for about 60% of total waking hours (Colley et al, 2011). Correspondent with health risk research, findings indicate that office workers with high levels of sedentary behaviour are at increased risk of chronic disease relative to office workers with lower levels of sedentary behaviour (Healy et al, 2008).

Given the observation that (1) office work frequently occurs in a sedentary posture, and (2) such high levels of sedentary behaviour are associated with increased risk of disease, a significant amount of intervention work has targeted the office environment. These interventions frequently emphasise changes to the built/social environment: for example, the installation of sit-stand desks, electronic cues, and supportive organisational policy (Shrestha et al, 2016). Feasibility studies, such as those conducted by Alkhajah et al (2012) and Carr, Walaska, and

Marcus (2012) suggest that such interventions are well-tolerated by participants. However, literature reviews of intervention efficacy are mixed: for instance, one review found a statistically significant but not clinically meaningful change (Martin et al, 2015), while another concluded that large and meaningful reductions in sedentary time are possible (Prince et al, 2014).

In an era of increasingly effective health behaviour change (cf. Artinian et al, 2010), why have sedentary behaviour interventions failed to produce consistently positive results? A contributing factor, certainly, is the novelty of the sedentary field: a certain amount of trial-and-error will be required to perfect the sedentary intervention "recipe". Complicating matters is the fact that, despite a rapidly growing body of health research, the field has yet to reach the point where specific, evidence-based, and realistic behaviour change recommendations can be made. This shortcoming is best illustrated by the United Kingdom's (2010) and Australia's (2014) sedentary behaviour guidelines: based upon a literature review and expert consensus process, both nations concluded that (1) sedentary behaviour is a health risk and that (2) individuals should avoid excessive amounts of sitting. However, given a *lack of evidence*, no advice could be provided as to what constitutes an extended period of sitting; how frequently sitting should be interrupted; the optimum break length; if sedentary behaviour intervention is effective at reducing risk of deleterious health outcomes; etc. Thus the advice, while well-intentioned, is tantamount to saying: "You should probably eat less junk food." Just as perceptions of "less junk food" will vary between people, so might perceptions of "avoiding extended periods of sitting". Without clear targets, goals, or behaviour change standards, it is unsurprising to find such variability across empirical interventions.

An additional explanation may lie in the fact that past research has largely neglected the psychosocial factors involved with sedentary behaviour change (Biddle, 2011; Prapavessis et al, 2015; Rhodes et al, 2011). Individual psychological factors, such as motivation and self-regulatory capabilities, have been identified as key predictors of health behaviour (Artinian et al, 2010: Brawley et al, 2013). Research conducted under social cognitive frameworks have proven valuable in understanding the conscious, reasoned processes that contribute to health behaviour (Conner & Norman, 2005). It seems reasonable to expect social cognitive factors to be of value in understanding sedentary behaviour. In that we currently lack such an understanding, it is unlikely that interventions sufficiently address individuals' reasons for engaging in sedentary behaviour, their motivation for intervention, and the self-regulatory strategies necessary to sustain behaviour change. Consider the following: to date, much sedentary behaviour research has emphasised the relationship between sitting and chronic disease (see Introduction, pp. 5). Informed by these findings, researchers often approach sedentary intervention as a strategy for chronic disease prevention. However, results from Study One (pp. 43 and 51) indicate that individuals tend to associate sedentary behaviour with obesity, low fitness, and poor well-being – not chronic disease. In short, the public's motivation for reducing sedentary behaviour might be quite different than researchers' motivation for intervention. Framing sedentary behaviour intervention as a method to combat distal, non-salient health risks may immediately reduce the public's interest in intervention. Similarly, empirical research has largely neglected the idea that individuals associate sitting with positive outcomes (e.g., rest and relaxation) while standing may be viewed negatively (e.g., more difficult than sitting; Gierc & Brawley, 2015). In summary, past sedentary interventions may, in part, be ineffective because they require individuals to (1) replace the positively-perceived experience of sitting with (2) the negatively perceived experience of standing, all in the name of (3) reducing the non-salient risk of chronic disease. Further, they (4) fail to provide a positive proximal benefit to motivate individuals, and (5) do not address individuals' low self-efficacy for the intervention (Bandura, 1986; 1997). If this is the case, it is not entirely surprising that sedentary interventions have been largely ineffective at producing meaningful or sustained change.

Sedentary Behaviour and the Theory of Planned Behaviour

While research on the psychology of sedentary behaviour is limited (see pp. 7), a relatively large proportion of available publications have utilised the Theory of Planned Behaviour (TPB). The TPB states that *intention* is the most proximal determinant of behaviour, and that intention is predicted by three cognitive factors: attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). *Attitudes* represent individuals' evaluation of perceived costs and benefits; *subjective norms* reflect the perceived expectations of significant others; and *perceived behavioural control* (PBC) refers to individuals' perceptions of the amount of control they have over a behaviour within a given context. The TPB has been successfully applied to a diverse range of health behaviours, and typically accounts for 30-40% of the variance in behaviour (Conner & Norman, 2005).

Past research has generally supported the application of the TPB to sedentary behaviour (Table 22). Results, however, are highly-variable, and it is challenging to draw clear conclusions: there is growing support for the role of intentions in shaping behaviour (see also Conroy et al, 2013; Maher et al, 2015), though the relative contribution of attitudes, subjective norms, and PBC remains uncertain. Tentatively, attitudes may be particularly important for leisure-time sedentary behaviour (Rhodes & Dean, 2008; see also Salmon, 2003), whereas subjective norms may be more important in occupational settings (Prapavessis, 2015).

Table 22 – Research applying the Theory of Planned Behaviour to sedentary behaviour

CITATION	PURPOSE	DESIGN	RESULTS
Lowe, 2014	To examine the demographic, medical, and social-cognitive correlates of SB in advanced cancer patients.	Interviews with N = 31 patients with brain metastases, using a TPB-PA inventory developed for cancer patients. SB measured with 7-day accelerometer.	An inverse relationship was observed between SB and PA-associated attitudes. No relationships observed between SB and other TPB-PA variables.
Smith, 1999	To determine the relationship between the TPB and intentions to be physically active and sedentary.	Cross-sectional survey in N = 155 British office workers.	An inverse relationship was observed between sedentary-related cognitions and MVPA. No behavioural data were collected on SB levels.
Rhodes, 2009	To apply the TPB to four leisure activities: TV, computer use, reading/music, and socialising.	Cross-sectional survey in N = 206 community-based adults + Two-week prospective study in N = 174 undergrad students	Leisure SB may be intentional and primarily informed by attitudes. The strength of relationships between AT/SN/PBC → INT varied across the four activities, suggestive that activities may differ psychologically.
Warner, 2011 [Abstract]	Examined the TPB and habit strength in the prediction of adult SB.	Survey of N = 101 adults Materials: Self-report SB (diary) TPB/SB questionnaire Habit/SB questionnaire	Intention did not significantly predict occupational or leisure SB. AT/SN/PBC increased variance accounted for in occupational but not leisure SB. Habit strength was a relatively large and significant predictor of SB.
Prapavessis, 2015	To examine the utility of the TPB in predicting SB intentions and time spent in SB	Cross-sectional survey in N = 372 adults, with participants randomised to one of five conditions: general; weekday or weekend; and volitional or non-volitional.	The models explained 8% to 43% of the variance in self-reported behaviour, with subjective norms emerging as the strongest and most consistent predictor variable.

Methodological Considerations for TPB-Informed Sedentary Behaviour Research

In recent years, the TPB has been subject to increasing criticism and, in some cases, calls for its retirement (Sniehotta, Presseau, & Araújo-Soares, 2014; see responses from Ajzen, 2015;

Armitage, 2015; Ogden, 2015). However, many of the complaints lodged against the TPB are related to methodological rather than theoretical shortcomings: as noted by Sneihotta et al, these shortcomings include a failure to engage in longitudinal/prospective research; to use experimental designs; to account for the effect of past behaviour; and concerns regarding the validity of measures. All of these concerns can be observed in the four sedentary behaviour psychology studies previously outlined: only one was prospective;[7] none accounted for past behaviour; and only one used a randomised design.

A particular concern with the existing TPB/sedentary research is how authors have conceptualised TPB constructs. Within the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and TPB, salient beliefs – easily-accessible thoughts and feelings – are hypothesised to be “the prevailing determinants of a person’s intentions and actions” (Ajzen, 1991, pp. 189). Given the central role of salient beliefs, Ajzen has stated that “salient beliefs must be elicited by the respondents themselves in pilot work” (pp. 192) prior to initiating research. This is particularly important when a new behaviour and/or new population are being studied, as is the case with sedentary behaviour. Failure to elicit salient beliefs runs the risk of presenting individuals with irrelevant items and reducing the overall predictive power of the TPB model. Despite the recognised importance, none of the four TPB studies report engaging in pilot elicitation work.

A second concern relates to the discord between TPB items and the target behaviour. Noted by Ajzen (2006) and Olson and Zanna (1987), the TRA and TPB are most effective when

[7] There are two potential exceptions to this claim. First, in the case of Warner (2011), it is reported that participants completed a three-day behavioural diary and TPB questionnaire. However, given that only an abstract was located, it remains unknown whether the measure was prospective or involved a three-day recall. Second, Rhodes & Dean (2009) utilised a 2-week prospective design. However, these results were pooled with a cross-sectional sample of adults. As such, the TPB’s ability to prospectively predict behaviour is unknown.

specific items predict specific and corresponding behaviours. In the case of Smith and Biddle (1999), sedentary-specific TPB items were used to predict leisure-time physical activity; in contrast, in the case of Lowe et al (2014), physical activity-specific TPB items were used to predict sedentary behaviour. Such incongruence may have contributed to the conclusion that the TPB was a "poor fit" for sedentary behaviour. Similarly, in the case of Rhodes et al (2009), participants answered TPB items in regards to weekly activity participation (e.g., "It is good to watch television 7 days per week"), but were asked to report bouts of sedentary behaviour greater than 30 minutes. Not only are these two measures inconsistent, but (1) the value of 30+ minutes was arbitrarily set, and (2) such a low threshold likely reduces the predictive power of the TPB due to reduced variability and accuracy in the outcome variable. Using the 30+ minute threshold, an individual who watches television for 30 minutes each day would be counted the same as an individual who watches for 300 minutes each day. Alternatively, an individual who watches two bouts of 30 minutes would be counted differently than an individual who watches one bout of 60 minutes.

A final consideration relates to the behaviour studied: all four TPB/sedentary studies attempted to predict sedentary behaviour, and none examined individuals' attempts to *reduce* or *modify* their sedentary behaviour. As such, it remains unknown whether the TPB is a useful theory for understanding and designing sedentary behaviour interventions.

The Present Study

The primary objective of Study Three was to examine whether the TPB can be used to prospectively predict (1) occupational sitting behaviour and (2) occupational standing breaks. A second objective was to examine whether a health message – a tool frequently used in sedentary behaviour intervention and public informational campaigns (e.g., Kozey-Keadle, Libertine, Staudenmayer, & Freedson, 2011; PartipACTION, 2016) – is capable of producing change in sedentary cognitions, intentions, and/or self-reported behaviour. These objectives were accomplished through a series of three studies: a pilot health messaging study ("Study 3A"), a pilot TPB elicitation study ("Study 3B"), and a prospective randomised experimental study ("Study Three"). For brevity, the current manuscript focuses on the main research study, Study Three. A summary of the pilot research can be found in Appendix G (Study 3A, messaging pilot) and Appendix H (Study 3B, elicitation pilot).

Study Three asked four primary research questions and one secondary question on the relationship between physical activity and sedentary behaviour psychology. An overview of these questions and associated hypotheses can be found in Table 23.

Question 1: What is the effect of sedentary-specific health risk messages on sedentary-related cognitions, intentions, and behaviour? Health messaging is increasingly being used to educate the public on the deleterious effects of sedentary behaviour. Despite this, research on the efficacy of sedentary behaviour messaging is limited, and no work has examined the potential psychological mediators. It also remains unknown whether the content of health risk messages – such as emphasis on proximal versus distal outcomes (see Study One, pp. 43) – has a significant effect on intentions and behaviour. As such, a purpose of Study Three was to examine the effect of (1) sedentary behaviour messaging and (2) message content on producing behaviour change.

Based upon the results of the health-risk messaging pilot (Appendix G) it was hypothesised that participants who received a health-risk message would perceive sedentary behaviour less-favourably and standing breaks more-favourably relative to those who received

Table 23 – Overview of Study Three questions and hypotheses

PRIMARY RESEARCH QUESTIONS	
Question 1: What is the effect of sedentary-specific health risk messages on sedentary-related cognitions, intentions, and behaviour?	
H1:	Participants who receive a health risk message will (1) viewing sitting less favourably, (2) report lower intentions to sit, and (3) report less sitting behaviour relative to those who receive an attention-control message.
H2:	Participants who receive a health risk message will (1) view standing breaks more favourably, (2) report higher intentions to engage in standing breaks, and (3) report more standing breaks relative to those who receive an attention-control message.
H3:	No significant differences will emerge in (1) perceptions, (2) intentions, or (3) behaviour between participants who receive a proximal or distal health risk message.
Question 2: Can the TPB prospectively predict occupational standing breaks?	
H4:	Attitude, subjective norms, and PBC will collectively predict intentions for sitting.
H5:	Intentions and PBC will collectively predict self-reported sitting behaviour.
Question 3: Can the TPB prospectively predict occupational sedentary behaviour?	
H6:	Attitude, subjective norms, and PBC will collectively predict intentions for standing breaks.
H7:	Intentions and PBC will collectively predict self-reported standing break behaviour.
Question 4: Does the TPB's efficacy vary across different sedentary behaviour indicators?	
N/A	No *a priori* hypotheses
SECONDARY RESEARCH QUESTION	
Question 5: Do more- and less-active individuals differ in their sedentary behaviour, standing breaks, and cognitions?	
H8:	More- and less-active individuals will not differ in their perceptions of sitting.
H9:	More-active individuals will view standing breaks more favourably (e.g., more-positive attitudes, greater intentions) than less-active individuals.
H10:	More- and less-active individuals will not differ in their self-reported behaviour.

an attention-control message. It was likewise hypothesised that, as a result of these cognitive changes, individuals would report less sedentary behaviour and greater engagement in standing breaks. Also based upon the results of the pilot, it was hypothesised that no significant differences would emerge between participants who received a proximal versus distal health risk message.

Questions 2 and 3: Can the TPB prospectively predict occupational sitting and standing breaks? In light of past research shortcomings, Questions Two and Three examined the utility of the TPB in predicting occupational sitting and standing breaks (collectively, "occupational sedentary behaviour"). Informed by past research (Conner & Norman, 2005; Rhodes & Dean, 2009; Prapevessis et al, 2015), it was hypothesised that the basic tenets of the TPB would be supported with: (1) attitudes/subjective norms/PBC collectively predicting intentions, and (2) intentions/PBC collectively predicting behaviour. Given the novelty of this research, no hypotheses were made regarding the relative contribution of each construct to the TPB model.

Question 4: Does the TPB's predictive utility vary across different sedentary behaviour indicators? Within sedentary behaviour research, sitting and standing breaks have been conceptualised in many different ways: for instance, total daily sitting time, sitting bout duration, standing break intensity, number of sit-to-stand transitions, etc. To date, no research had explicitly examined whether these behavioural facets are related to differing psychological factors. To address this gap, Study Three examined whether variance accounted for by the TPB would vary across different behavioural indicators. Given the novelty of this research question, no *a priori* hypotheses were made.

Question 5: Do more- and less-active individuals differ in their sedentary cognitions, intentions, and behaviour? Informed by the results of Studies One and Two, a secondary research purpose was to examine differences between more- and less-active individuals. In light of previous results, three hypotheses were raised: more- and less-active individuals (1) would not significantly differ in their perceptions of sitting, but (2) would significantly differ in their perceptions of standing-breaks; and that (3) more- and less-active individuals would not differ in their self-reported sedentary behaviour.

Method

Research protocol was approved by the University of Saskatchewan Research Ethics Board prior to commencing participant recruitment and data collection (Appendix I).

Participants

Participants were recruited through a combination of online advertisements, postings on the University of Saskatchewan PAWS bulletin board, and through outreach to various companies, non-profit groups, and governmental agencies. A range of industries were contacted, including oil and gas, transportation, banking and finance, and communications. A total of twelve companies agreed to collaborate. As an incentive for individual participation, participants had their names entered into a draw for a $50 gift certificate each time they completed a survey. Participation was limited to (1) self-identified office workers who were (2) currently employed either full-time or part-time. Additionally, given the study's prospective design, participants were considered ineligible if they were planning on being away from their workplace for an extended period of time (e.g., vacation, work-related travel, medical leave).

The Time-1 survey was accessed 811 times, of which 470 individuals (58.1%) completed the survey in full. Of the 341 participants who did not complete Time-1, 58 were not office workers, 125 indicated that they were going to be away, and 78 denied consent. A further 81 individuals exited mid-way through the Time-1 survey. At the end of Time-4, a total of 325 participants remained. A detailed schematic of participant attrition can be found in Figure 4.

The current analysis featured participants who completed all four time points (N = 325). This sub-sample had a mean age of 34.99 (*SD* = 11.9) years; was primarily female (82.8%) and Caucasian (77.5%); and was well-educated (35.1% with a bachelor's degree; 24.3% with a

Figure 4 – Study Three participant attrition

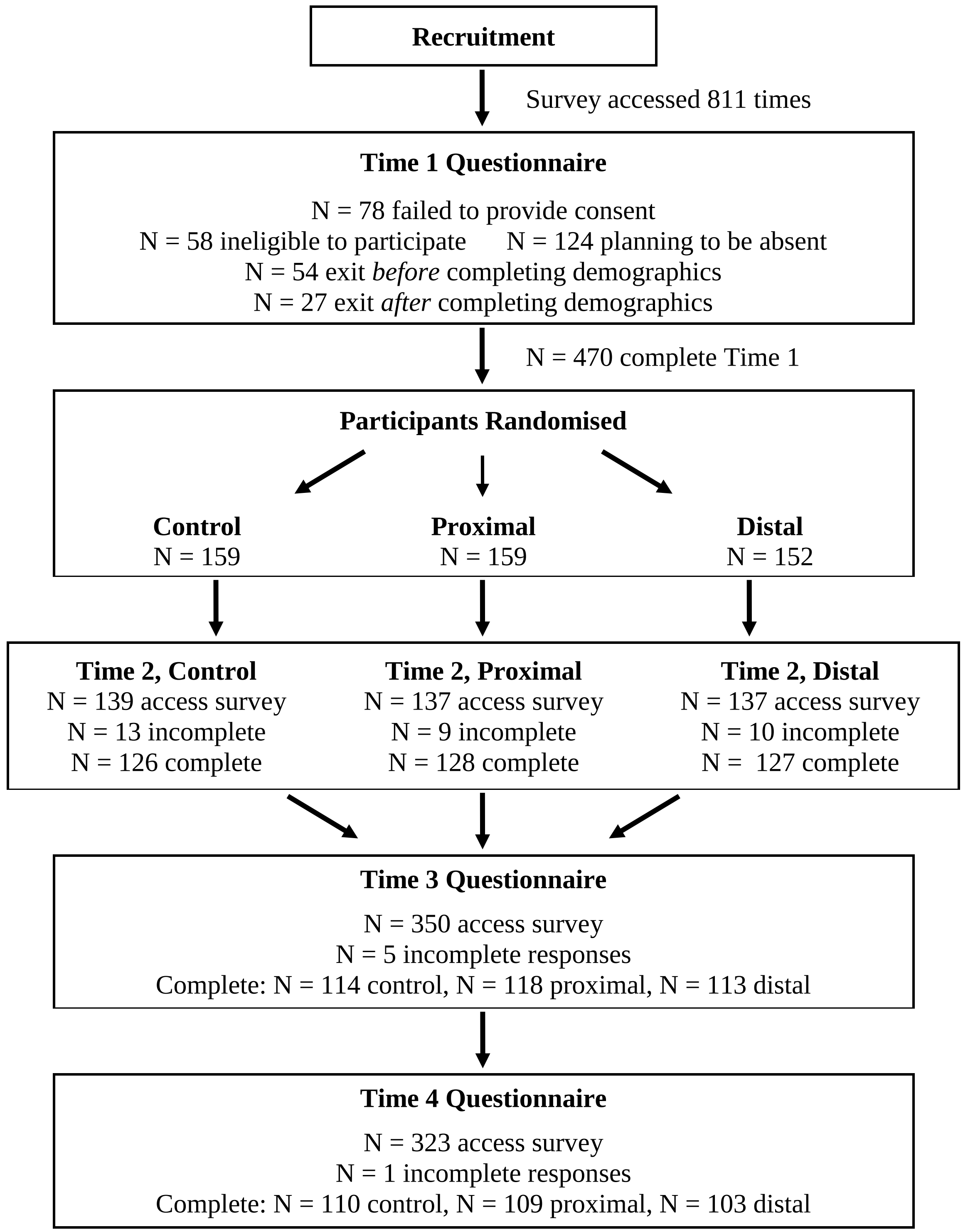


Table 24 – Between-group comparisons, complete and incomplete participants

	Total Sample N = 325	**Control Message** N = 113	**Proximal Message** N = 109	**Distal Message** N = 103
Demographics				
Age	34.9 ± 11.9	36.1 ± 12.8	35.9 ± 12.4	32.4 ± 10.1
Gender: Female	82.8%	84.1%	81.7%	82.5%
Ethnicity: Caucasian	77.5%	82.3%	75.0%	74.8%
Primary Language: English	88.6%	91.2%	87.2%	87.3%
Education > High School	84.6%	81.4%	87.1%	85.4%
Employed Full-Time	92.0%	91.2%	95.4%	89.3%
Health Status				
Chronic Disease ≥ 1	17.5%	22.1%	16.5%	13.6%
Condition that Impairs PA	9.2%	11.5%	5.5%	10.7%
Perceived Health / 10	7.69 ± 1.64	7.79 ± 1.72	7.62 ± 1.54	7.64 ± 1.65
Weekly Minutes MVPA	141 ± 110	155 ± 114	132 ± 103	136 ± 114
PA > 150	40.9%	48.7%	38.5%	35.0%
BMI	25.73 ± 5.77	26.42 ± 6.48	25.26 ± 5.44	25.46 ± 5.22
T1 Sedentary Behaviour				
% Work Time Sitting	85.79% ± 14.40	83.54% ± 16.65	86.72% ± 12.77	87.25% ± 13.16
% Break Time Sitting	60.17% ± 31.17	57.48% ± 33.14	58.50% ± 30.31	64.93% ± 29.55
Minutes Work Time Sitting	361 ± 78	350 ± 85	372 ± 69	360 ± 79
Minutes Break Time Sitting	34 ± 23	33 ± 23	32 ± 21	37 ± 23
Minutes Typical Sitting	98 ± 63	89 ± 63	107 ± 68	97 ± 57
Minutes Longest Sitting	199 ± 86	182 ± 71	206 ± 80	210 ± 102
% Purposeful Standing Breaks	43.93% ± 31.89	46.21% ± 30.65	44.00% ± 32.21	41.39% ± 31.89
Number Standing Breaks / Day	4.78 ± 5.31	5.34 ± 6.04	4.23 ± 3.98	4.78 ± 5.69

graduate degree). Most participants (92.0%) were employed full-time, and reported working a mean of 8.1 (*SD* = 1.141) hours per day. Detailed participant demographics can be found in Table 24.

Measures

The four Study Three questionnaires can be found in Appendix J through Appendix M. A visual schematic of when items were administered can be found in Table 25, pp. 120.

Demographic, health, and employment information. At the start of Time-1, participants were asked to provide descriptive information regarding their demographic profile, health status, and employment situation. Demographic items included age, gender, and ethnicity. Health status information included BMI (via self-reported height and weight), perceived health, and chronic disease diagnosis. Employment information included employment status (part- or full-time), industry, and position at work (e.g., manager, accountant, clerk).

Leisure-time physical activity. Participants' level of leisure-time physical activity (LT-PA) was assessed with three self-report items. Participants were first asked: "Over the past two weeks, have you participated in any leisure-time physical activity? For example: walking, biking, swimming, kayaking, tennis, team sports, karate, hiking, etc." Individuals who responded "Yes" were then asked to indicate the frequency (times per week) and typical duration (bout length, in minutes) of their physical activity. Frequency and duration were subsequently multiplied to produce total weekly minutes of LT-PA. The measure was similar to that used by Statistics Canada in physical activity research (e.g., Garriguet & Colley, 2014), and, unlike the Godin Leisure-Time Exercise Questionnaire (Godin & Shepherd, 1985), – which simply asks participants to report number of 15 minute activity bouts – carried the benefit of providing greater detail into minutes of physical activity.

Self-report occupational sitting. Individuals' level of occupational sitting was measured in terms of (1) amount of sitting and (2) sitting bout duration. In light of previous research indicating that volitional and non-volitional sitting may differ (e.g., Prapavessis, 2015), daily amount of sitting was broken into total sitting, work time sitting, and break time sitting. Participants were asked to report (1) the length of their shift and (2) the amount of break time they had each shift. Break time was subtracted from shift length to calculate work time. That is:

$$Total\ Minutes - Break\ Minutes = Work\ Minutes$$

Next, participants were asked to indicate the amount of time, as a percentage, they spent sitting (3) during work time and (4) during break time. Percentage of sitting time was multiplied by self-reported minutes to produce minutes of sitting. That is:

$$Work\ Sitting\ Minutes = Work\ Minutes\ \times \%\ Work\ Sitting$$

$$Break\ Sitting\ Minutes = Break\ Minutes\ \times \%\ Break\ Sitting$$

The above method was selected given concerns regarding participants' ability to accurately report their sedentary behaviour. In Study One, it was observed that a number of participants overestimated their daily sedentary behaviour (e.g., reporting greater than 24 hours/day of sedentary behaviour). It was felt, however, that participants would be able to accurately report objective details regarding their work shifts (i.e., duration). Thus, asking participants to report their daily work time provided an upper-threshold for their occupational sedentary behaviour. Subsequently, participants were able to estimate their overall level of work (break) sitting by using percentages. Though there may be some inaccuracies relative to objective measures (e.g., accelerometers), it is felt that this method would accurately represent individuals' perceptions of their level of sedentary behaviour. In the future, it would be beneficial to validate this measure against other measures.

Lastly, in light of evidence that duration of sitting bout may be more important than total amount of sitting (Healy et al, 2008), participants were also asked to report (5) how long they *typically* sit before standing-up, and (6) the *longest* they would sit before standing up. For both items, time was reported in hours and minutes.

Prompts for the above self-report items varied across the four survey time points to reflect study design and ensure congruence between items. For instance, at Time-1 participants were prompted to think of a “typical work day over the past two weeks”, whereas at Time-3 participants were asked to think of a “typical work day over the past three days.”

Intentions for occupational sitting. Participants’ sitting intentions were measured in the same manner as the above self-report items. Intentions were measured at Time-1 and -2, with participants prompted to think of “a typical work day over the next three days.” Thus, intentions were time-correspondent with the behaviour being assessed (e.g., T1: intent over the next three days; T2: behaviour over the prior three days).

Self-report occupational standing breaks. Standing breaks were measured two ways: effort put into standing breaks and total number of standing breaks taken. For total number of standing breaks, individuals were asked to report (1) how frequently they stand-up (i.e., x standing breaks per y time duration), (2) a gross count of how many times they stand-up from their desk on a typical weekday, and (3) the percentage of their standing-up that was for the *primary purpose* of movement. This last item was used to differentiate between incidental standing-up and the purposeful standing breaks that would be both (i) of interest to interventionists and (ii) reflect the planned behaviour of relevance to the TPB. For this item, participants were prompted to think of purposeful movement breaks, such as “taking stretching breaks, finding excuses to make an extra trip, etc.”

Lastly, at Time-3 and -4 participants were presented with a single item that examined the amount of effort they put toward standing breaks. Effort was measured on a 1 (No Effort) to 7 (Lots of Effort) scale.

As with sitting, prompts for the above items varied across the four survey time points so as to correspond with duration between time points. For instance, at Time-2 participants were prompted to think of a “typical work day over the past three days”; and at Time-4 a “typical work day over the past seven days”.

Intentions for occupational standing breaks. Participants’ standing break intentions were measured in the same manner as the above self-report items. Intentions were measured at Time-2, with participants prompted to think of “a typical work day over the next three days.” Additionally, at Time-2 participants were asked to report their overall intention to engage in standing breaks (1 = Never, 5 = Always) and their intention strength (1 = Very Weak, 7 = Very Strong; Ajzen, 2006).

Sitting-related attitudes. A seventeen-item sitting attitudes questionnaire was developed based upon the results of the pilot elicitation study (Study 3B, Appendix H). Participants were first instructed to “think about sitting at work – specifically, continuous sitting for the **majority of the work day**” [emphasis in original]. They were then presented with a list of six instrumental attitudes, and asked to indicate their level of agreement on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). Example items include, “Sitting at work lets me focus on the task”, and, “I have good posture when I sit at work”.

After the instrumental attitudes, participants were presented with five experiential (affective) attitudes. Items asked whether sitting was good or bad; useful or note useful; pleasant or unpleasant; good or bad for the body; and, finally, good or bad for mental health. Participants responded on a 7-point scale, with negative options (e.g., “bad”, “not useful”) anchored at 1, and positive outcomes (e.g., “good”, “useful”) anchored at 7.

Attitudes for standing breaks. Attitudes for standing breaks were assessed in the same manner as attitudes for sitting. Example items included, “Taking a standing break would help me be physically active”, and, “Taking a standing break would help refresh and energise me”.

Subjective norms for sitting. Subjective norms surrounding sitting were assessed with ten items. All items were informed by the pilot elicitation study. Items concerned both the descriptive norms (i.e., regarding the general social environment; e.g., “Sitting is part of our office culture”) and injunctive norms (i.e., regarding specific individuals within the workplace; e.g., “My supervisor thinks I should sit at work”). All responses were made on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

Subjective norms for standing breaks. Subjective norms for standing breaks were assessed in the same manner as subjective norms for sitting. Example items included, “Taking standing breaks would be socially awkward”, and, “Most of my co-workers think I should take standing breaks”.

Perceived behavioural control for sitting. Based on the pilot elicitation study, six PBC items were developed for sitting. Example items included, “I’m able to choose how much I sit at work”, and, “I’m required to sit as part of my job”. All responses were made on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

Perceived behavioural control for standing breaks. PBC for standing breaks were assessed in the same manner as PBC for sitting. Example items included, “I have a health condition that makes it hard to take standing breaks”, and, “My desk/workplace makes it easy to take standing breaks”.

Table 25 – Study Three time points and measures

	Time 1	**Time 2** +3 wrk days	**Time 3** +3 wrk days	**Time 4** +5 wrk days
Demographics, Health, & Work Information	✓			
Self-Report, Leisure-Time Physical Activity	✓			
Self-Report, Sedentary Behaviour	✓	✓	✓	✓
Self-Report, Standing Breaks	✓	✓	✓	✓
Attitudes, Sitting	✓	✓		
Attitudes, Standing Breaks		✓		
Social Norms, Sitting	✓	✓		
Social Norms, Standing Breaks		✓		
PBC, Sitting	✓	✓		
PBC, Standing Breaks		✓		
Intentions, Sitting	✓	✓		
Intentions, Standing Breaks		✓		

Procedure

Study Three followed a prospective between-within factorial design, with participants (1) randomised to receive one of three health messages and (2) tracked across four time points. A visual overview of the measures at each time point can be found in Table 25.

Participants accessed the Time-1 questionnaire via a hyperlink provided in recruitment material. After indicating consent, confirming eligibility, and completing baseline demographic and self-report items (i.e., LT-PA, sedentary behaviour), participants completed TPB measures of sitting-related attitudes, subjective norms, and perceived behavioural control. Lastly, participants reported intention to engage in sedentary behaviour over the next three work days. Note that the Time-1 questionnaire emphasised sitting, in order to develop a baseline/naturalistic understanding of sedentary perceptions. Standing break items and discussion on the health effects of sedentary behaviour were purposefully excluded out of concern that they would bias participants' responses.

Three work days after completing the Time-1 survey, participants were e-mailed the Time-2 questionnaire. Participants who failed to access the questionnaire within three days were sent a reminder e-mail. The Time-2 questionnaire started with self-report sitting and standing break behaviours, with participants prompted to report a typical work day over the *past three* work days. Participants were then randomised to receive one of three health messages (see Table 26): attention-control, proximal, or distal. After the health message, participants completed TPB items on sitting and standing over the next three work days.

Three work days later, participants were e-mailed the Time-3 questionnaire. As with Time-2, participants who failed to access the questionnaire within three days were sent a reminder e-mail. Time-3 was a self-report questionnaire, with participations asked to report their sitting and standing breaks over the past three work days.

Participants received the final Time-4 questionnaire five work days after completing the Time-3 questionnaire. A reminder e-mail was sent if the participant failed to access the questionnaire within three days. Like Time-3, Time-4 was a self-report questionnaire, with participants asked to report their sitting and standing breaks over the past five work days.

Analytical Plan

Data was analysed using SPSS version 23.0 (IBM, 2015). Data management and screening strategies were used to address issues of missing data, the presence of outliers, and to examine statistical assumptions. The same data management procedures were used for all dissertation studies, and are outlined in detail in Appendix A.

Table 26 – Study Three sedentary behaviour messages.

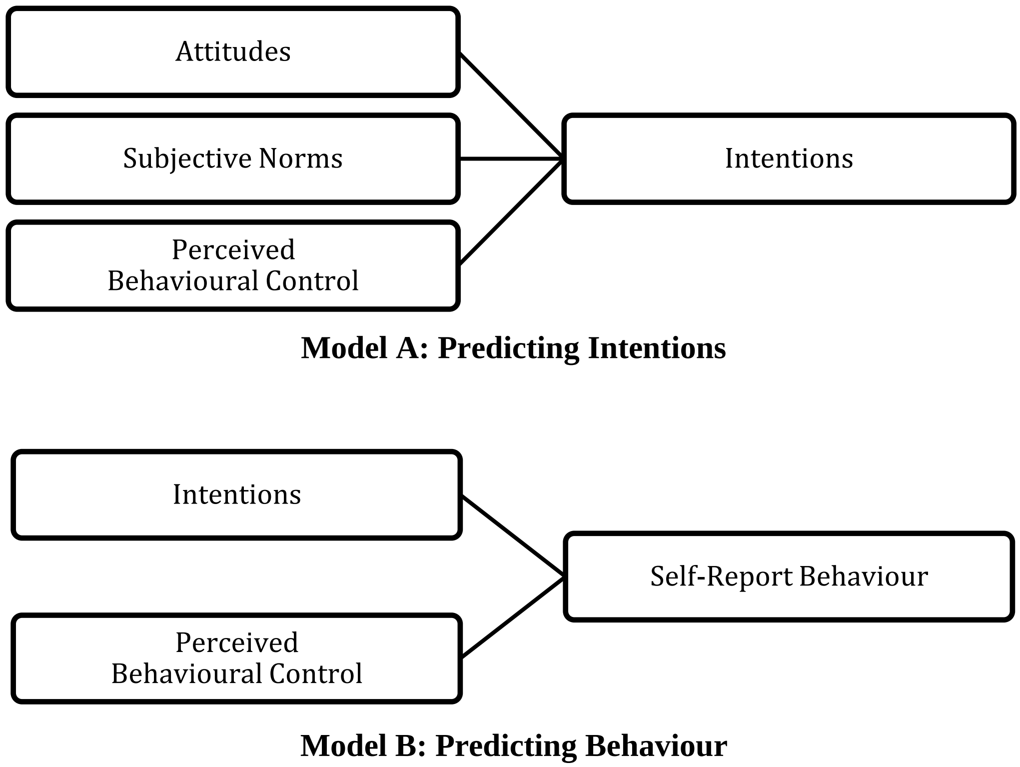
Attention-Control	**Proximal**	**Distal**
How much do you sit? If you’re like most people, your answer is probably “A lot!” In fact, according to Statistics Canada, the average adult sits nearly 10 hours each day! Sitting research didn’t begin until the late 1990s. Some studies (like this one) are observational, where people are tracked over a few days or weeks. Other research is more demanding. NASA once ran a study where people stayed in bed for 70 days straight! Studying sitting has proven to be quite difficult. One challenge is multi-tasking: scientific measures often assume a person is only doing one thing at a time. However, an office worker might be using a computer *and* snacking at the same time. A second challenge is context. Even though many activities involve sitting, sitting at work is probably different than sitting at the movie theatre, on an airplane, or when eating dinner. When we start to think about all the places and reasons we sit, it becomes clear that sitting is an extremely complex activity - in fact, Hardy et al (2013) have called it "notoriously challenging".	How much do you sit? If you’re like most people, your answer is probably “A lot!” In fact, according to Statistics Canada, the average adult sits nearly 10 hours each day! You probably suspect that sitting too much can be bad for you – but, did you know that sitting can be harmful *even if* you exercise regularly? People who sit a lot – like office workers – are more likely to experience: ▪ Neck and shoulder pain (Cagnie et al, 2007) ▪ Back pain (Janwantanakul et al, 2008) ▪ Sore wrists and hands (IJmker et al, 2006) ▪ Swollen feet (Paul, 1995) ▪ Eye strain (Rosenfield, 2011) ▪ Headaches (Yan et al, 2008) Other research has linked too much sitting to poor well-being. For example, office workers who sit for long periods of time are more likely to experience symptoms like anxiety and fatigue (Kilpatrick et al, 2013). The good news: decreasing sitting can help improve your health. In a study by Chau and colleagues, office workers who stood up more reported less fatigue, more energy, and improved focus.	How much do you sit? If you’re like most people, your answer is probably “A lot!” In fact, according to Statistics Canada, the average adult sits nearly 10 hours each day! You probably suspect that sitting too much can be bad for you – but, did you know that sitting can be harmful *even if* you exercise regularly? People who sit a lot – like office workers – are more likely to experience: ▪ Diabetes (Healy et al, 2008) ▪ Cancer (Lynch, 2013) ▪ Heart Disease (Grøntved & Hu, 2010) ▪ Obesity (Sugiyama et al, 2008) ▪ Weak Bones (Morey-Holton et al, 1998) ▪ Mental Illness, like Clinical Depression (Teychenne et al, 2010 Other research has linked sitting to increased risk of dying. For example, every hour of daily sitting is associated with a 2-5% increase in mortality risk (Chau et al, 2013). The good news: decreasing sitting can help improve your health. In a study by Healy and colleagues, office workers who stood up more had healthier weights and better insulin responses.

Psychometrics. Prior to addressing Study Three's research questions, TPB items were subjected to psychometric evaluation. Suitability for factor analysis was assessed through examination of correlations, Bartlett's test of sphericity, and the Kaiser-Mayer-Olkin (KMO) Test of Sample Adequacy (Field, 2009; Tabachnick & Fidell, 2013). Unique factors were extracted using principle factor analysis with oblique rotation, as the TPB constructs of attitude, subjective norms, and PBC are hypothesised to be correlated with each other (Ajzen, 1991; 2006). Factor retention was established based on eigenvalues, visual examination of Cattell's scree test, pattern matrix loadings, and consideration of the theoretical/conceptual integrity as informed by TPB first principles (e.g., Ajzen, 1991). Cronbach's alphas were then computed for items deemed to be one factor in order to measure each scale's internal consistency.

Question 1: The effect of health messaging. Question 1 asked whether the receipt of a health message (attention-control, proximal, or distal) led to significant differences in sedentary perceptions, intentions, and behaviour. Analysis of variance (ANOVA) and chi-squared analysis were initially used to establish group equivalence at Time-1. Next, (repeated measures) multivariate analysis of variance (MANOVA) was used to explore differences between (1) attention-control participants and participants who received a health risk message (i.e., either proximal *or* distal), and (2) proximal and distal participants. Six analyses were conducted, examining sitting- and standing-related TPB constructs (attitudes, subjective norms, PBC); sitting- and standing-related intentions; and sitting- and standing-break behaviour. Using Bonferroni correction, analyses were deemed statistically significant if $p < 0.008$.

Question 2/4: Predicting Sitting. Question 2 explored whether a TPB predictive model could be tested relative to workplace sitting. Following the recommendations of Ajzen (2006)

Figure 5 – Study Four TPB regressions: Model A and Model B



and Hankins, French, and Horne (1999), TPB constructs were entered into two regression models: Model A and Model B (Figure 5). In Model A, attitudes, subjective norms, and PBC were used to predict intention; in Model B, intention and PBC were used to predict self-report behaviour. Each regression model was evaluated by examining the percent variance accounted for (i.e., adjusted R^2 values) and the standardised beta (β) associated with each predictor variable.

To address Question 4, whether the utility of the TPB varies dependent on the behavioural indicator, regression analysis was conducted on the following sitting intention and sitting behaviour measures: percentage of work time and break time spent seated; minutes of work time and break time spent sitting; typical sitting duration; and longest sitting duration. Using Bonferroni correction, regressions were deemed statistically significant if $p < 0.008$.

Question 3/4: Predicting standing breaks. Question 3 examined whether a TPB predictive model could be tested relative to workplace standing breaks. The analysis strategy mirrored that of Question 2/4 above, with TPB constructs entered in two models. To address Question 4, regression analysis was conducted on the following standing intention and standing behaviour measures: effort toward standing breaks; number of times standing-up; percentage of standing breaks; and standing break frequency. Using Bonferroni correction, regressions were deemed statistically significant if $p < 0.0125$.

Question 5: LT-PA. A secondary purpose of Study Four was to examine the relationship between LT-PA and (1) sedentary perceptions and (2) sedentary behaviour. First, Pearson's bivariate correlations were used to explore relationships between LT-PA and TPB constructs. Next, participants' self-reported minutes of LT-PA was used to categorise participants as either sufficiently or insufficiently active (i.e., < 150 minutes or ≥ 150 minutes of LT-PA; Canadian Society for Exercise Physiology, 2011). Between-group demographic equivalency was examined with ANOVA and chi-squared analysis. Lastly, a series of MANOVAs was used to explore between-group differences in sitting-related and standing-related TPB constructs; sitting and standing intentions; and sitting and standing behaviour. As this was deemed to be exploratory analysis, follow-up analyses were conducted if $p < 0.10$. While the alpha value was set at a more liberal level than the traditional convention (i.e., $p < 0.05$), the rationale was to examine any interesting trends and avoid overlooking information that might prove useful to future research.

Results

Group Equivalency: Study Attrition

One-way ANOVA and chi-squared analysis were used to explore differences between participants who did and did not complete all four time points. Analysis indicated significant between-group differences in several areas, *p*s < 0.05, including age and overall shift length. However, Cohen's effect sizes indicated that observed differences were small, *d*s ≤ 0.32. A detailed comparison of participant demographics can be found in Figure 4.

Data Management Strategies

Statistical assumptions were examined prior to running analyses. No significant outliers were detected, and skew and kurtosis fell within an acceptable range. Examination of multivariate assumptions indicated that the homogeneity of variance assumption was violated when examining Risk versus No Risk health messages. However, this was anticipated given the unequal between-group sample sizes (i.e., 1:2 participant ratio due to grouping the Proximal and Distal treatments into a single "Risk" group). In these instances, Welch's ANOVA was used as it does not assume equal variances and group sizes (Field, 2009).

Psychometrics: Occupational Sitting

Prior to primary analyses, the TPB sitting questionnaire was subjected to psychometric evaluation. The KMO estimate verified sampling adequacy for analysis, KMO = 0.841. All KMO values for individual items fell above the acceptable limit of 0.5. Bartlett's test of sphericity was significant, χ^2 (276) = 2249.553, $p < 0.001$, indicating that correlations between items were sufficiently large for principle factor analysis (PFA).

An initial analysis was run to obtain eigenvalues for each component of the data. Five components had eigenvalues over 1, and in combination accounted for 66.195% of the variance. The scree plot showed inflection at three factors. Based upon the scree plot and the TPB, a three-factor extraction was conducted. In combination, the three factors accounted for 52.015% of the variance. Informed by first principles of TPB and pilot elicitation research (see Appendix H), eleven items were retained for attitudes (Cronbach's alpha = 0.847); five items were retained for subjective norms (Cronbach's alpha = 0.805); and four items were retained for PBC (Cronbach's alpha = 0.657). While PBC's factor structure has acceptable consistency (Field, 2009), it is lower than the attitudes and subjective norms scales. Several PBC items developed through the pilot elicitation study (Appendix H) were removed from the final scale due to poor factor loading. Specifically, the item "Sitting is easy" was omitted due to a ceiling effect; whereas items relating to physical disability were omitted due to a floor effect.

Psychometrics: Occupational Standing Breaks

A second psychometric evaluation examined TPB standing break items. The KMO estimate verified the sampling adequacy for analysis, KMO = 0.830. All KMO values for individual items fell above the acceptable limit of 0.5. Barlett's test of sphericity was significant, χ^2 (300) = 2290.304, $p < 0.001$, indicating that correlations between items were sufficiently large for PFA.

An initial analysis was run to obtain eigenvalues for each component of the data. Six components had eigenvalues over 1, and in combination accounted for 65.99% of the variance. Using the TPB as a guide, a four-factor extraction was conducted, which in combination accounted for 56.84% of the variance. The pattern matrix indicated that the items clustered around the four TPB constructs of instrumental attitudes, experiential (affective) attitudes, subjective norms, and PBC. Informed by first principles of the TPB and pilot elicitation research (see Appendix H), six items were retained for instrumental attitudes (Cronbach's alpha = 0.809); five items were retained for experiential attitudes (Cronbach's alpha = 0.902); seven items were retained for subjective norms (Cronbach's alpha = 0.812), and eight items were retained for PBC (Cronbach's alpha = 0.778).

Question 1: The Effect of Health Messages

Question 1 asked whether presenting individuals with a health risk message can produce significant changes in sedentary behaviour and/or sedentary perceptions. It also examined whether message content (i.e., communication of a proximal or distal health risk) impacted psychological constructs and behaviour.

Attention-control vs. health messages. The first set of analyses examined differences between attention-control participants ("No risk") and participants who received a health message ("Risk"). Welch's ANOVA and chi-squared analysis was first used to examine group equivalency in (1) demographic factors, (2) Time-1 TPB constructs, and (3) Time-1 and -2 self-report behaviour. No significant differences were observed in demographic or workplace placements; sitting-related attitudes, subjective norms, and PBC; intentions; and self-report behaviour, *p*s > 0.05. The exception to this was the longest continuous time spent sitting (No Risk = 182.5; Risk = 208.2; *d* = 0.31). In light of results, this latter variable was entered as a covariate in subsequent analyses.

Next, MANOVA was used to explore post-randomisation between-group differences in (1) sitting-related and (2) standing break-related attitudes, subjective norms, and PBC. No significant between-group differences were observed in post-randomisation sitting- or standing break-related cognitions, $\Lambda = 0.997$, $F\ (3, 278) = 0.287$, $p > 0.05$, and $\Lambda = 0.014$, $F\ (4, 276) = 0.942$, $p > 0.05$, respectively. Likewise, Wilk's statistic did not indicate any significant between-group differences in intentions or self-report behaviour, $\Lambda = 0.982$, $F\ (5, 257) = 0.982$, $p > 0.05$ and $\Lambda = 0.985$, $F\ (6, 248) = 0.609$, $p > 0.05$, respectively.

Proximal vs. distal health messages. The second set of analyses explored differences between participants who received a proximal versus distal health message. First, ANOVA and chi-squared analysis were used to examine group equivalency at Time-1. No between-group differences were observed in demographic, workplace, psychological, or behavioural factors. The one exception to this was age (Proximal = 35.91 years; Distal = 32.44 years; $d = 0.30$). As such, age was entered as a covariate in subsequent analyses.

MANOVA was used to examine between-group differences in sitting- and standing-break related cognitions and behaviour. Like the Risk and No Risk analysis, no significant between-group differences were observed, *p*s > 0.05. Given that there was no effect of messaging, participants in the three conditions were pooled for subsequent analyses.

Questions 2/4: Predicting Workplace Sitting.

Question 2 explored whether the TPB if efficacious at prospectively predicting occupational sitting. Following the recommendations of Ajzen (2006) and Hankins et al (2007), the TPB was tested with two multiple regression models (see Figure 5, pp. 124). In Model A, attitudes, subjective norms, and PBC predicted intentions. In Model B, PBC and intentions predicted behaviour. In regards to Question 4, the models were tested against six measures of intention/behaviour: (1) percentage of work time spent seated, (2) percentage of break time spent seated, (3) minutes of work time spent seated, (4) minutes of break time spent seated, (5) typical continuous sitting duration, and (6) longest continuous sitting duration. All models were significant, *p*s < 0.001. In the case of Model A (predicting sitting intentions), TPB constructs collectively accounted for 3.6% to 18.1% of variance in sitting intentions. The relative strength of attitudes, subjective norms, and PBC varied across the sitting indicators: for example, PBC more strongly predicted sitting during *work* time, whereas attitudes more strongly predicted sitting during *break* time. In the case of Model B (predicting sitting behaviour), intentions and PBC collectively accounted for 41.9% to 63.1% of sitting behaviour. For all Model B analyses, intention emerged as the strongest predictor of behaviour. A complete overview of descriptive results can be found in Table 27.

Questions 3/4: Predicting Workplace Standing

Similar to Question 2, Question 3 examined whether the TPB is effective at prospectively predicting standing breaks. In regards to Question 4, standing breaks were measured four ways: (1) effort put toward standing breaks, (2) standing break frequency, (3) the number of times individuals made a sit-stand transition, and (4) percentage of purposeful standing breaks. All models were significant, *p*s $\leq$ 0.01. In Model A, TPB constructs collectively accounted for 3.0% to 33.1% of the variance in standing break intentions. The strongest regression model was *effort for standing breaks*, whereas models for standing behaviours (i.e., number, percentage, frequency) were comparably weaker. For Model B, intention and PBC collectively accounted for 13.4% to 45.4% of the variance in standing break behaviour. As with sitting analyses, intention emerged as the strongest predictor of behaviour. A complete overview of regression results can be found in Table 28.

Question 5: Sedentary Behaviour Psychology and LT-PA

Informed by Study One and Study Two, the final research question examined the relationship between sedentary behaviour psychology and physical activity. Two aspects of physical activity were compared: first, minutes of LT-PA was used to categorise participants as “more active” or “less active”; second, participants’ perceived level of fitness.

Table 27 – Regression matrix, predicting sitting at work.

		Model A: AT + SN + PBC → INT				Model B: PBC + INT → BEH		
		β	*t*	*p*		β	*t*	*p*
% Work	Final Model	R^2_{Adj}= 0.181, *F* (3, 319) = 24.727, *p* < 0.001			Final Model	R^2_{Adj}= 0.442, *F* (2, 319) = 128.222, *p* < 0.001		
	T1 Attitudes	0.192	3.716	< 0.001	T2 PBC	-0.041	-0.867	> 0.05
	T1 Subjective Norms	0.131	2.129	< 0.05	T2 Intentions	**0.647**	13.675	< 0.001
	T1 PBC	**-0.260**	-4.234	< 0.001				
% Break	Final Model	R^2_{Adj}= 0.043, *F* (3, 317) = 5.771, *p* = 0.001			Final Model	R^2_{Adj}= 0.508, *F* (2, 317) = 166.009, *p* < 0.001		
	T1 Attitudes	**0.166**	2.963	< 0.01	T2 PBC	0.006	0.165	> 0.05
	T1 Subjective Norms	**0.166**	2.474	< 0.05	T2 Intentions	**0.716**	18.200	< 0.001
	T1 PBC	0.076	1.140	> 0.05				
Min Work	Final Model	R^2_{Adj}= 0.113, *F* (3, 319) = 14.615, *p* < 0.001			Final Model	R^2_{Adj}= 0.533, *F* (2, 319) = 184.294, *p* < 0.001		
	T1 Attitudes	0.154	2.871	< 0.01	T2 PBC	-0.009	-0.210	> 0.05
	T1 Subjective Norms	0.130	2.022	< 0.05	T2 Intentions	**0.729**	17.593	< 0.001
	T1 PBC	**-0.186**	-2.906	< 0.01				
Min Break	Final Model	R^2_{Adj}= 0.051, *F* (3, 306) = 6.494, *p* < 0.001			Final Model	R^2_{Adj}= 0.631, *F* (2, 305) = 263.524, *p* < 0.001		
	T1 Attitudes	**0.192**	3.385	= 0.001	T2 PBC	0.026	0.758	> 0.05
	T1 Subjective Norms	0.150	2.207	< 0.05	T2 Intentions	**0.797**	22.943	< 0.001
	T1 PBC	0.052	0.760	> 0.05				

Table 27 – Regression matrix, predicting sitting at work.

		Model A: AT + SN + PBC → INT				Model B: PBC + INT → BEH		
		β	*t*	*p*		β	*t*	*p*
Typical	Final Model	R^2_{Adj}= 0.036, *F* (3, 299) = 4.708, *p* < 0.01			Final Model	R^2_{Adj}= 0.551, *F* (2, 293) = 182.357, *p* < 0.001		
	T1 Attitudes	**0.168**	2.917	< 0.01	T2 PBC	-0.042	-1.065	> 0.05
	T1 Subjective Norms	0.067	0.989	> 0.05	T2 Intentions	**0.735**	18.497	< 0.001
	T1 PBC	-0.046	-0.670	> 0.05				

Table 27 (continued) – Regression matrix, predicting sitting at work.

		Model A: AT + SN + PBC → INT				Model B: PBC + INT → BEH		
		β	*t*	*p*		β	*t*	*p*
Longest	Final Model	R^2_{Adj}= 0.054, *F* (3, 288) = 6.590, *p* < 0.001			Final Model	R^2_{Adj}= 0.419, *F* (2, 273) = 100.069, *p* < 0.001		
	T1 Attitudes	0.117	1.981	< 0.05	T2 PBC	-0.105	-2.232	0.026
	T1 Subjective Norms	**0.176**	2.536	< 0.05	T2 Intentions	**0.620**	13.12	< 0.001
	T1 PBC	-0.037	-0.531	> 0.05				

Note: The differing degrees of freedom are attributable to item structure: if participants were uncertain of their sedentary behaviour, they were provided with a no-response option (i.e., "I'm not sure").

Table 28 – Regression matrix, predicting standing breaks at work.

		Model A: AT + SN + PBC → INT				Model B: PBC + INT → BEH		
		β	*t*	*p*		β	*t*	*p*
Intention / Effort	Final Model	$R^2_{\text{Adj}} = 0.331$, $F\ (4, 370) = 47.167$, $p < 0.001$			Final Model	$R^2_{\text{Adj}} = 0.270$, $F\ (2, 333) = 62.939$, $p < 0.001$		
	T2 Instrumental	**0.255**	5.392	< 0.001	T2 PBC	0.081	1.631	> 0.05
	T2 Experiential	**0.255**	5.352	< 0.001	T2 Intentions	**0.490**	9.855	< 0.001
	T2 Subjective Norms	0.163	3.359	< 0.001				
	T2 PBC	0.150	3.094	< 0.001				
Break Frequency	Final Model	$R^2_{\text{Adj}} = 0.044$, $F\ (4, 378) = 5.398$, $p < 0.001$			Final Model	$R^2_{\text{Adj}} = 0.134$, $F\ (2, 328) = 26.507$, $p < 0.001$		
	T2 Instrumental	**-0.146**	-2.617	< 0.01	T2 PBC	0.010	0.197	> 0.05
	T2 Experiential	-0.037	-0.655	> 0.05	T2 Intentions	**0.375**	7.170	< 0.001
	T2 Subjective Norms	0.018	0.318	> 0.05				
	T2 PBC	-0.135	-2.350	< 0.05				
Standing-Up	Final Model	$R^2_{\text{Adj}} = 0.030$, $F\ (4, 359) = 3.811$, $p < 0.01$			Final Model	$R^2_{\text{Adj}} = 0.454$, $F\ (2, 287) = 121.159$, $p < 0.001$		
	T2 Instrumental	0.034	0.589	> 0.05	T2 PBC	-0.021	-0.476	> 0.05
	T2 Experiential	**-0.194**	-3.356	= 0.001	T2 Intentions	**0.681**	15.295	< 0.001
	T2 Subjective Norms	-0.072	1.227	> 0.05				
	T2 PBC	0.127	2.153	< 0.05				
Purposeful	Final Model	$R^2_{\text{Adj}} = 0.069$, $F\ (4, 373) = 7.940$, $p < 0.001$			Final Model	$R^2_{\text{Adj}} = 0.295$, $F\ (2, 336) = 71.884$, $p < 0.001$		
	T2 Instrumental	0.110	1.939	= 0.05	T2 PBC	0.073	1.571	> 0.05
	T2 Experiential	**0.133**	2.369	< 0.05	T2 Intentions	**0.532**	11.520	< 0.001

Table 28 – Regression matrix, predicting standing breaks at work.

	Model A: AT + SN + PBC → INT			Model B: PBC + INT → BEH		
	β	*t*	*p*	β	*t*	*p*
T2 Subjective Norms	0.080	1.396	> 0.05			
T2 PBC	0.072	1.253	> 0.05			

Sufficiently vs. insufficiently active. Using the 150 minutes/week threshold, 192 (59.1%) of participants were classified as "insufficiently active" (IA), and 133 (40.9%) of participants were classified as "sufficiently active" (SA). ANOVA and chi-squared analysis indicated no significant between-group differences in demographic variables, including age, primary language spoken, and industry employed in, *p*s > 0.05. However, significant differences were observed in many variables related to participants' health and fitness, including BMI and diagnosis of a chronic disease, *p*s < 0.05. Additionally, significant between-group differences were observed in self-report sitting behaviours, $\Lambda = 0.894$, F (6, 215) = 4.271, $p < 0.001$, but not self-report standing behaviours, $\Lambda = 0.993$, F (3, 249) = 0.623, $p > 0.05$.

MANOVA and repeated-measures MANOVA was used to examine between-group differences in (1) sitting-related and (2) standing break-related attitudes, subjective norms, and PBC. Analyses indicated no significant between-group differences in either sitting- or standing break-related constructs, $\Lambda = 0.993$, F (3, 319) = 0.783, $p > 0.05$, and $\Lambda = 0.994$, F (4, 318) = 0.445, $p > 0.05$, respectively. Likewise, no significant between-group differences were observed in sitting or standing break intentions, $\Lambda = 0.963$, F (6, 228) = 0.1.453, $p > 0.05$, and $\Lambda = 0.998$, F (3, 295) = 0.228, $p > 0.05$.

Perceived fitness. As there was no consistent pattern of effects observed, results would suggest that LT-PA has little relation to perceptions of sedentary behaviour. However, studies of exercise identity suggest that individuals vary greatly in what they *personally* consider to be "active" (cf. Strachan et al., 2010). In other words, individuals' *perception of their exercise* – not some externally defined standard – helps to define one's view of oneself as an exerciser. In light of this, participants were asked to report their perceived activity level (i.e., whether they are or are not active on a regular basis) and perceived fitness (i.e., whether they are physically fit) in addition to their minutes of LT-PA. Exploratory Pearson's bivariate correlation was used to examine relationships between TPB variables and perceived activity/fitness.

Initial analysis examined the relationship between minutes of LT-PA, perceived level of fitness, and perceived activity level. A correlation of $r = 0.443$, $p < 0.001$, was observed between perceived fitness and minutes of LT-PA; and $r = 0.524$, $p < 0.001$ was observed between perceived activity level and minutes of LT-PA. Thus, while correlations were significant and positive, there was no redundancy (i.e., rs < 0.80), suggestive that individuals' perceptions of themselves as exercisers differs from their actual exercise engagement. Next, correlations were computed for three groups of variables: TPB constructs, intentions, and self-report behaviour. In terms of TPB constructs, small negative correlations were observed between perceived exercise and sitting-related cognitions (rs = -0.166 to -0.100, ps = 0.113 to 0.003), but not standing break-related cognitions (rs $\leq$ 0.103, ps $\geq$ 0.066). This pattern repeated itself for intention and self-report behaviour items.

Discussion

Question 1: The Effect of Health Messaging

Within the sedentary intervention literature, health education – including health messaging – is often used to motivate behaviour change (e.g., Kozey-Keadle, 2012). Similarly, mass media coverage provides multiple examples of anti-sedentary messaging (e.g., ParticipACTION, 2016; Reynolds, 2016; Ubelacker, 2015). Despite frequent use, no research has explicitly examined whether such messages are capable of producing behaviour change. Further, it remains unknown whether message content – for example, the health risks communicated – has a significant effect on subsequent behaviour.

Question 1 asked (1) whether the receipt of a simple sedentary behaviour health risk message can stimulate behaviour change, and (2) if the type of health risk information contained within the message has a significant impact on behaviour. Three messages were prepared and pilot tested (Study 3A, Appendix G), with preliminary results indicating that participants who received a health risk message perceived sedentary behaviour less-favourably than participants who received an attention-control message. No differences were observed between proximal or distal messages. In contrast, the results of the main Study Three did not suggest any significant between-group differences in TPB variables between (1) Risk and No-Risk participants or (2) Proximal or Distal participants.

There are several potential explanations for these conflicting results, one being timing. The pilot study was conducted approximately six months prior to Study Three. During this interlude, a number of sedentary behaviour stories were featured in the mass media. As a consequence, (1) Study Three participants may already have possessed strong sedentary behaviour beliefs and/or (2) the health messages did not communicate any novel information. It is also noteworthy that the pilot study and Study Three differed in their measures and design. The pilot study was focussed on risk, where participants were provided with face-value items on the goodness/badness of sedentary behaviour (e.g., “I think sedentary behaviour is a health risk to me”). In contrast, Study Three’s TPB items may have reflected less-malleable beliefs that are not easily swayed by a health message (e.g., “Sitting is part of our office culture”).

As this was an initial study to examine sedentary health risk messaging, many questions remain regarding the efficacy and role of messaging in sedentary behaviour intervention. Results of the current study suggest that a relatively short message – similar to what one would find on a health information website (e.g., Levine, 2015) – may be insufficient at producing cognitive (attitudinal) change on its own. Longer and more-intensive messages, or messages used in combination with concrete behaviour change instruction, may be necessary to stimulate clinically meaningful change. Alternatively, future research may find it beneficial to examine message characteristics: for example, the use of gain-frame versus loss-frame messages (Latimer, Brawley, & Bassett, 2009).

Questions 2/4: Using the TPB to Predict Occupational Sitting

Past sedentary behaviour psychology research provides preliminary evidence that the TPB might be a useful theory for understanding sitting behaviour; however, past research is also limited by methodological shortcomings (e.g., failure to elicit salient beliefs, cross-sectional designs). A number of methodological shortcomings were remedied in the present study. With these controlled, Question 2 asked whether the TPB is effective at prospectively predicting occupational sitting behaviour. Question 4 specifically examined whether the TPB's predictive capabilities differ across various sitting indicators (e.g., total sitting versus typical bout duration). It was broadly hypothesised that the basic tenets of the TPB would be supported, with (1) attitudes, subjective norms, and PBC collectively predicting intentions, and (2) intentions and PBC collectively predicting behaviour. Given the novelty of this research, no *a priori* hypotheses were made regarding whether the TPB's predictive abilities would differ across sitting indicators.

Predicting sitting intentions. Consistent with the TPB, attitudes, subjective norms, and PBC were found to significantly predict intentions (i.e., Model A; see pp. 124). All models that examined intentions toward sitting and standing breaks were statistically significant. Collectively, TPB constructs accounted for the greatest amount of variance in the intentions for (a) proportion of work time participants intended to spend sitting (18.1%), (b) minutes of work time (11.3%), (c) longest continuous sitting duration (5.4%), minutes of break time (5.1%), (d) proportion of break time (4.3%), and (e) typical continuous sitting duration (3.6%). In short, TPB constructs were better at predicting *work time* versus *break time* sitting, and were better at predicting *general measures* versus *specific measures* of sitting time. In comparison to the above results, a recent meta-analysis by McEachan and colleagues (McEachan, Conner, Taylor, & Lawton, 2011) found that TPB constructs typically accounted for 44% of the variance in intention to perform health behaviour. Thus, the above findings – while all statistically significant – are notably lower than the values found by McEachan et al for other health behaviour intentions. Methodological reasons for this difference seem less likely to be the explanation given best practices were followed in the questionnaire development and item conceptualisation in the present study(i.e., Ajzen, 2006). An examination of potential conceptual and measurement reasons for the difference between the present study and the studies reviewed by McEachan et al would be needed to determine if part of the discrepancy resided there.

In terms of individual predictor variables, the relative contribution of attitudes, subjective norms, and PBC were found to vary across sitting indicators. For *break time*, attitudes and subjective norms had the greatest beta weights. In contrast, for *work time*, PBC was strongly but negatively associated with sitting. Lastly, for duration of *continuous sitting*, attitudes had the greatest beta weight. Such findings raise a consideration for future research, as it suggests that different characteristics of sitting behaviour may be related to different social cognitive variables.

Predicting sitting behaviour. Also consistent with the TPB, intentions and PBC were found to significantly predict sitting behaviours (i.e., Model B; see pp. 124). However, in contrast to Model A, Model B accounted for relatively large amounts of variance in self-reported behaviour. Intentions and PBC collectively predicted the greatest amount of variance in (a) minutes of break time spent seated (63.1%), (b) typical continuous sitting duration (55.1%), (c) minutes of work time spent seated (53.3%), (d) proportion of break time spent seated (50.8%), (e) proportion of work time spent seated (44.2%), and (f) longest continuous sitting duration (41.9%). In all cases, intention was associated with relatively larger beta weights than PBC (i.e., βs = 0.620 to 0.797, versus βs = -0.105 to 0.026, respectively). In short, results indicate that *intentions* are a strong, consistent predictor of occupational sitting. Importantly, such findings suggest that individuals are able to consciously reflect on and anticipate about their occupational sitting, indicative of a cognitive component of the behaviour.

It is noteworthy that Model B (i.e., intentions predicting behaviour) was consistently associated with much greater variance accounted for than Model A (i.e., attitudes, subjective norms, and PBC predicting intentions). These results run opposite to many other TPB studies, which find Model A to be associated with greater variance accounted for than Model B. Though further research is required to understand this phenomenon, results may be partially attributable to correspondence between the intention and self-report behaviour measures.

Questions 3/4: Using the TPB to Predict Standing Breaks

Unlike sitting behaviour, little work has examined the psychological predictors of sedentary behaviour intervention, and no workplace research has attempted to apply the TPB relative to standing breaks. Thus, Question 3 asked whether the TPB is effective at predicting occupational standing breaks; and Question 4 examined whether the TPB's predictive capabilities differ across different standing break indicators (e.g., perceived effort, number of purposeful standing breaks). It was broadly hypothesised that the tenets of the TPB would be supported, with (1) attitudes, subjective norms, and PBC collectively predicting intentions, and

(2) intentions and PBC collectively predicting behaviour. Given a lack of past research, no *a priori* hypotheses were made regarding how the TPB's predictive capabilities would differ across standing break indicators.

Predicting intentions for standing breaks. Like sitting intentions, attitudes, subjective norms, and PBC were found to predict standing break intentions (i.e., Model A; see pp. 124). All analyses were statistically significant. Collectively, attitudes, subjective norms, and PBC accounted for the greatest amount of variance in (a) effort for standing breaks (33.1%), (b) percentage of purposeful standing breaks (6.9%), (c) standing break frequency (4.4%), and (d) number of sit-stand transitions (3.0%).

In short, TPB constructs are moderate predictors of intentions for effort about breaks, but are relatively poor predictors of intended break behaviour. Results may reflect the nature of standing breaks: the TPB assumes that intent toward behaviour is planned, purposeful, and guided by cognitions. In contrast, intentions for standing breaks may be an incidental and non-purposeful behaviour, such as being a function of work tasks (e.g., fetching documents from the printer) or less-conscious behavioural processes (e.g., individuals who naturally fidget more than others). If this is the case, we would not expect planned behaviour constructs to predict large amounts of variance in intentions for standing breaks. Likewise, if breaks are a less-conscious process, it is unlikely that individuals have intentions for some types of break behaviour (and, as such, "ball park" when reporting their number of sit-stand transitions). Alternatively, individuals may lack sufficient experience with standing breaks: that is, like efficacy beliefs, individuals require experience with behaviour in order to form accurate perceptions and intentions for the behaviour and about their abilities. This study may have been the first time participants have explicitly heard the term “standing break” and have been asked to purposefully reflect on the behaviour.

In terms of individual TPB constructs, the relative contribution of attitudes, subjective norms, and PBC were found to be relatively consistent across standing break intentions. Attitudes (instrumental and/or experiential) were associated with the greatest beta weights for intent to put effort toward standing breaks, number of sit-stand transitions, and proportion of purposeful standing breaks. The exception to this was standing break frequency, where subjective norms emerged as the strongest predictor variable.

Predicting standing break behaviour. In Model B (see pp. 124), intention and PBC were significant predictors of standing break behaviour. Intentions and PBC collectively accounted for the greatest amount of variance in (a) the number of sit-stand transitions (45.4%), (b) percentage of purposeful standing breaks (29.5%), (c) effort for standing breaks (27.0%), and (d) standing break frequency (13.4%). Intention was consistently associated with the greatest beta values, while PBC was a small and non-significant predictor variable.

Question 5: Sedentary Behaviour Psychology and LT-PA

In Studies One and Two, it was illustrated that more- and less-active individuals differed in their perceptions of sedentary behavior. For instance, in Study Two, physical activity was found to be associated with individuals’ self-efficacy and outcome expectancies. Building upon these results, Study Three examined whether physical activity level would influence individuals’ workplace sitting- and standing break-related TPB social cognitions.

Unlike Studies One and Two, few significant differences were observed between individuals based upon their physical activity level. When treated as a continuous variable, several significant correlations were observed between minutes of physical activity and sedentary cognitions; however, no significant between-group differences were observed between more-active and less-active individuals. Interestingly, however, a number of small-but-significant differences in perceived level of physical activity emerged. Individuals who perceived themselves as being more-active/more-fit tended to view sedentary behaviour differently than individuals who viewed themselves as being less-active/less-fit. Such findings complement past work on exercise identity, which has found that individuals vary greatly in what they *personally* consider to be “active” (cf. Strachan et al, 2010). For example, one individual might perceive “active” as a 10-minute walk after dinner; another might consider anything less than 12 training sessions a week as “inactive”; neither perception reflects national physical activity guidelines (Canadian Society of Exercise Physiology, 2011). In other words, it is individuals’ *perceptions of their exercise* that helps define their view of themselves. It is thus not entirely unsurprising that individuals’ perceptions of their exercise level – and not simply their reported minutes of physical activity – that is related to their perceptions of sedentary behaviour.

Current analyses examining the relationship between physical activity and sedentary behaviour perceptions considered *all* intensities of LT-PA: i.e., light, moderate, and vigorous. All intensities were considered in that discussion concerning sedentary behaviour reduction often emphasise light-intensity physical activity. In contrast, national physical activity guidelines (Canadian Society for Exercise Physiology, 2011) recommend that individuals engage in moderate-to-vigorous physical activity. As such, the current results may differ from those achieved by comparing insufficiently- versus sufficiently-active individuals. (Note, however, that 72% of respondents reported engaging in moderate- or vigorous-intensity physical activity.) Future research would benefit from explicitly contrasting individuals who acheive versus those who fail to achieve recommended levels of physical activity.

Strengths and Limitations

The current study makes many novel contributions to the sedentary behaviour psychology literature. It is one of the first to (a) examine the psychological predictors of workplace standing breaks; to (b) apply the TPB to occupational sedentary behaviour; and (c) conduct a theoretically driven prospective study within the workplace context.

In terms of Question 1, unique aspects were the examination of (a) health risk messages through pilot work and in the current study, (b) the effect of sedentary-specific health messages on sedentary-related cognitions, and (c) differences between proximal and distal health risks.

In their review of theory as applied to studies of health behaviour change, Painter and colleagues (2008) observed that only about one-third of studies used theory, and that a substantially smaller proportion rigorously applied theory. The current study avoided such a problem by systematically applying the TPB as per Ajzen's (2006) recommendations. The pilot elicitation study (Appendix H) was the first theory-guided qualitative study of sedentary behaviour. Results of this elicitation study add to the literature by providing insight into the psychological themes associated with sedentary behaviour in the workplace. As well, critics of the TPB have raised concerns regarding research methods used to "test" the theory, including a general failure to (1) engage in prospective research, (2) use experimental designs, (3) account for past behaviour, and (4) lack of congruence between measures. The current study addressed all these points by utilising a randomized four-week prospective design; and ensuring that TPB items were specific to behaviour (e.g., sitting attitudes predicting sitting intentions). Thus, the strength of the study lies in its application of TPB first principles and research design.

Participants for this study were purposefully recruited from a range of industries and professions, and the resulting sample was a highly diverse group of office workers. Limitations are that participants were primarily female, Caucasian, and well educated. As no statistics are available regarding office worker demographics, it is unknown whether this sample is truly representative of the general Canadian office worker population.

Future Directions

Based upon the results of the current study, several future directions may be particularly beneficial to extend the research. First, the sedentary behaviour self-report measure used in this study was developed for this dissertation and has not been verified against objective measures, such as triaxial accelerometers. In future research, objective measures may be useful for examining specific behavioural indicators (e.g., number of sit-stand transitions). These objective measures may help to confirm whether a relationship exists between social cognitions and facets of sedentary behaviours that may be challenging for individuals to accurately report (i.e., lack of accurate self-reporting may have “washed out” the relationship between cognitions and behaviour). It would also be valuable to compare self-report measures against objective measures of sedentary behaviour, to examine which aspects of sedentary behaviour can be accurately self-reported by individuals. This will be particularly important for the development of valid self-report tools.

Second, it may be useful to examine TPB social cognitive constructs in the context of other sedentary occupations. The office environment is a unique setting, in that it is one where there could be controlled implementation of changes to the built environment (e.g., installation of sit-stand desks) and where office workers are able to stand up and move if they so desire. In short, there is a degree of volition associated with office sedentary behaviour. In contrast, certain sedentary jobs – such as those associated with transportation and surveillance – likely have much less volitional control: bus drivers cannot safely stand up mid-route, and air traffic controllers cannot leave for a 10-minute walk while monitoring radar and directing pilots. In such professions, do social cognitive constructs manifest themselves differently in relation to sedentary behaviour?

Lastly, the observation that the TPB's predictive abilities varied across behavioural indicators raises an important question for future research: is the TPB the best theory to predict all aspects of sedentary behaviour? Overall, results suggest that the TPB is most effective when applied to general sedentary behavioural indicators, such as *total minutes* of sitting; and is less effective when applied to specific behavioural indicators, such as *longest duration of continuous sitting* (i.e., due to the salience or degree of behavioural intentionality). With this in mind, it will be important for future research to explore which aspects of sedentary behaviour are conscious/volitional versus non-conscious/non-volitional. Once established, such information may prove to be extremely valuable for our understanding of the different manifestations of sedentary behaviour with different types of activity in different contexts. For instance, the current research suggests that *attitudes* may be an important predictor of *overall intention to engage in standing breaks* in an office workplace. Thus, it may be useful to develop both studies and interventions that examine attitudes toward standing breaks. In contrast, cognitive constructs were generally not useful in predicting sit-stand transitions; in this case, the built and social environment (e.g., accessibility of sit-stand desks, overt managerial support) may be important for understanding behaviour.

GENERAL DISCUSSION

Background

Though often associated with office workers and couch potatoes, it is readily apparent that sedentary behaviour is an ubiquitous part of modern life (Hamilton et al, 2008; Katzmarzyk & Lee, 2012; Levine, 2004; Wilmot et al, 2012). Indeed, reflecting on technological advances, Levine (2010) has noted that a person can “order food, purchase a car, find a new life partner, … , reproduce, play, shop, and sleep without taking a step” (pp. 2751). Unfortunately, – though, perhaps not surprisingly – such chair dependency comes at a cost: a large body of evidence has associated sedentary behaviour to with increased risk of experiencing a deleterious health outcome.

Despite this growing body of research, the psychological aspects of sedentary behaviour have been largely under-investigated by the sedentary research community. The resultant lack of knowledge has been identified as a significant shortcoming in our quest to understand sedentary behaviour and to develop effective interventions (Biddle, 2011; Owen et al, 2011; Rhodes et al, 2012). As such, the purpose of this dissertation was to begin to address the psycho-social literature gap. Three studies were conducted: a mixed-methods exploratory study; a vignette-based questionnaire that examined posture, activity, and preferences; and a randomised prospective experiment. A summary of research hypotheses and outcomes can be found in Table 29 (findings relating to sedentary behaviour psychology) and Table 30 (findings relating to physical activity and sedentary behaviour).

Study One: Exploring Layperson Perceptions of Sedentary Behaviour

Study One examined four questions: (1) How do laypersons define and conceptualise sedentary behaviour?; (2) Do individuals associate sedentary behaviour with a set of health

Table 29 – Overview of research questions and hypotheses

Study	Research Question & Hypotheses	Result	
1	**How do individuals understand and define sedentary behaviour?**		
1	Participants’ definitions of sedentary behaviour would differ from the empirical definition of sedentary behaviour.	Supported	pp. 40
1	Participants’ will primarily conceptualise sedentary behaviour as insufficient physical activity.	Supported	pp. 40
1	**Do perceptions of sedentary behaviour change as a function of context?**		
1	No *a priori* hypotheses		pp. 44
1	**What outcomes do individuals associated with their personal sedentary behaviour?**		
1	Participants will primarily identify the risks of sedentary behaviour in terms of musculoskeletal conditions rather than chronic disease.	Partially supported	pp. 43
1	No *a priori* hypotheses regarding the benefits of sedentary behaviour.		pp. 43
2	**Do social cognitions differ by posture (sit/stand) and activity (TV/studying)?**		
2	SE Sitting > SE Standing	Supported	pp. 80
2	OE Sitting > OE Standing	Supported	pp. 80
2	No *a priori* hypotheses regarding the effect of activity.		pp. 80
2	**Do sedentary-related social cognitions follow theoretically-hypothesised relationships?**		
2	$\uparrow$ SE = $\uparrow$ OE	Supported	pp. 82
2	$\uparrow$ SE = $\uparrow$ Engagement	Supported	pp. 82
2	$\uparrow$ SE = $\uparrow$ Satisfaction	Not supported	pp. 82
2	$\uparrow$ OE = $\uparrow$ Engagement	Not supported	pp. 82
2	$\uparrow$ OE = $\uparrow$ Satisfaction	Supported	pp. 82

Table 29 – Overview of research questions and hypotheses

Study	Research Question & Hypotheses	Result	

Table 29 (continued) – Overview of research questions and hypotheses

Study	Research Question & Hypotheses	Result	
2	**Do individuals hold postural preferences? If so, do preferences differ between activities?**		
2	Sitting Preference > Standing Preference	Supported	pp. 85
2	No *a priori* hypothesis regarding between-activity differences		pp. 85
3	**What is the effect of sedentary health risk messages on sedentary-related cognitions, intentions, and behaviour?**		
3	AT/SN/PBC: Risk Message < Control Message	Not supported	pp. 123
3	Intentions: Risk Message < Control Message	Not supported	pp. 123
3	Behaviour: Risk Message < Control Message	Not supported	pp. 123
3	AT/SN/PBC: Proximal Message = Distal Message	Supported	pp. 123
3	Intentions: Proximal Message = Distal Message	Supported	pp. 123
3	Behaviour: Proximal Message = Distal Message	Supported	pp. 123
3	**Can the TPB prospectively predict occupational sedentary behaviour?**		
3	Sitting AT/SN/PBC $\rightarrow$ Sitting Intentions	Supported	pp. 129
3	Sitting AT/SN/PBC $\rightarrow$ Sitting Behaviour	Supported	pp. 129

Table 29 (continued) – Overview of research questions and hypotheses

Stud y	Research Question & Hypotheses	Result	
3	**Can the TPB prospectively predict occupational standing breaks?**		
3	Standing AT/SN/PBC $\rightarrow$ Standing Intentions	Supported	pp. 130
3	Standing AT/SN/PBC $\rightarrow$ Standing Behaviour	Supported	pp. 130
3	**Does the TPB's efficacy vary across different sedentary behaviour indicators?**		
3	No *a priori* hypotheses		pp. 129

Table 30 – Overview of research results relating to sedentary behaviour and physical activity.

Study	Research Question & Hypotheses		Result	
1	**Do individuals who engage in greater amounts of MVPA perceive sedentary behaviour differently than individuals who engage in lesser amounts of MVPA?**			
1	No *a priori* hypotheses			pp. 46
2	**Is there a relationship between sedentary-related social cognitions and BMI?**			
2	Sitting:	No relationship between BMI and sitting social cognitions	Supported	pp. 130
2	Standing:	$\uparrow$ BMI = $\downarrow$ Standing social cognitions	Not supported	pp. 130
2	**Is there a relationship between sedentary-related social cognitions and physical activity?**			
2	Sitting:	No relationship between PA and sitting social cognitions	Supported	pp. 130
2	Standing:	$\uparrow$ PA = $\uparrow$ Standing social cognitions	Supported	pp. 130
3	**Do sufficiently- and insufficiently-active individuals differ in their sitting-related TPB constructs?**			

Table 30 – Overview of research results relating to sedentary behaviour and physical activity.

Study	**Research Question & Hypotheses**		**Result**	
3	AT/SN/PBC:	↑ PA = ↓ Sitting attitudes/subjective norms/PBC	Not supported	pp. 130
3	Intentions:	↑ PA = ↓ Sitting intentions	Not supported	pp. 130
3	Behaviour:	↑ PA = ↓ Sitting behaviour	Not supported	pp. 130
3	**Do more- and less-active individuals differ in their sitting-related TPB constructs?**			
3	AT/SN/PBC:	↑ PA = ↑ Standing attitudes/subjective norms/PBC	Not supported	pp. 130
3	Intentions:	↑ PA = ↑ Standing intentions	Not supported	pp. 130
3	Behaviour:	↑ PA = ↑ Standing behaviour	Not supported	pp. 130
3	*A posterior: Significant correlations observed between TPB constructs and perceived fitness*			pp. 130

risks/benefits?; (3) Do perceptions of sedentary behaviour vary by context and activity?; and (4) Do more- and less-active individuals differ in their perceptions of sedentary behaviour?

In terms of Question 1, it was observed that approximately 40% of participants provided a definition of sedentary behaviour consistent with the empirical definition of sedentary behaviour: that is, as being the *presence of inactivity*. The remaining 60% of participants primarily defined sedentary behaviour as a lack of movement, including a lack of purposeful moderate-to-vigorous physical activity. It is noteworthy that many of the provided examples were leisure activities rather than occupational- or transportation-related tasks.

For Question 2, individuals were asked to describe the health benefits and/or risks associated with their personal sedentary behaviour. In terms of benefits, participants most frequently reported rest and relaxation, particularly in terms of mental health. Other reported benefits included mental stimulation and learning, entertainment, productivity, and positive social experiences. In contrast, the most commonly cited costs of sedentary behaviour were those related to overweight/obesity and insufficient physical activity. Thus, in sum, participants primarily identified *proximal benefits* and *distal risks* associated with their personal sedentary behaviour.

Question 3 asked whether perceptions of sedentary behaviour are moderated by context: that is, either environment or activity. In Part One of this question, participants were asked to reflect on whether (and, if so, why) certain sedentary activities are more- or less-sedentary than others. In Part Two, participants were presented with a series of seven photographs and were asked to describe each one along several domains. Collectively, participants' response patterns provide evidence that (1) different types of sedentary behaviour are perceived as being quite different from each other, (2) between-activity differences are both qualitative and quantitative, and (3) individuals are capable of articulating and thinking critically about the nature of these differences. Such findings caution against conceptualising sedentary behaviour as a singular, homogenous behaviour – indeed, even behaviours that appear to be similar in terms of form and function (e.g., reading for work versus leisure) may differ substantially. Rather, as emphasised by Pate et al (2008), research should aim to understand *specific types* of sedentary behaviour, and conclusions regarding sedentary behaviour should be specifically phrased in regards to that studied behaviour.

The final question examined whether more- and less-active individuals significantly differed in their perceptions of sedentary behaviour. Relative to less-active participants, more-active participants (1) viewed themselves as being low sedentary overall and being less sedentary than peers, and (2) viewed their sedentary behaviour as being less unhealthy. The fact that these differences emerged *despite no significant differences in self-reported sedentary behaviour* suggest that participants' responses are due to their *perceptions* of sedentary behaviour rather than objective differences in behaviour.

Study Two: Posture, Activity, and Preferences

The primary purpose of Study Two was to explore the conceptual definition of sedentary behaviour. Participants read four randomly-presented vignettes that differed along two domains: activity (studying, watching television) and posture (sitting, standing). After reading each, they provided reactions by answering questions about social-cognitions. Informed by Social Cognitive Theory (Bandura, 1986; 1997), it was hypothesised that standing would be associated with significantly lower self-efficacy and poorer outcome expectancies relative to sitting. Analysis supported this hypothesis, with sitting consistently perceived more favourably and being associated with greater self-efficacy than standing.

Given that little past work has applied Social Cognitive Theory to sedentary behaviour, a secondary objective was to examine whether social cognitive variables exhibit theory-predicted relationships. Significant and theory-congruent correlations were observed between self-efficacy, psychological outcome expectancies, and physical outcome expectancy. Hierarchical linear regression was used to examine the predictive power of social cognitions on three outcome variables: satisfaction, engagement, and self-efficacy for intervention. Consistent with the agency aspect of SCT, self-efficacy emerged as the dominant predictor of engagement, whereas psychological outcome expectancy was the dominant predictor of satisfaction.

In addition to the vignette items, participants completed a series of items on their explicit postural preferences. Overall, results provide evidence that individuals hold a preference for sitting. Likewise, individuals reported that sitting would be the best posture for achieving outcomes. Follow-up analysis indicated that posture preferences may vary by the *activity* in question: overall, individuals reported a stronger sitting preference for watching television versus studying. It may be that sitting is of greater importance to watching television than to studying.

Lastly, informed by Studies One and Two, Study Three's final objective was to examine the relationship between physical activity level and psychological aspects of sedentary behaviour. While physical activity level was not related to perceptions of sitting, sufficiently- and insufficiently-active individuals significantly differed in their perceptions of standing. Specifically, sufficiently-active individuals reported stronger self-efficacy, higher outcome expectancies, higher levels of engagement, and higher levels of satisfaction relative to insufficiently-active individuals.

Study Three: Predicting Occupational Sedentary Behaviour

Study Three consisted of three individual research projects: a pilot messaging study (Study 3A, Appendix G), a pilot elicitation study (Study 3B, Appendix H), and a prospective TPB experiment ("Study Three"). Collectively, the studies examined (1) whether health messages are effective at changing TPB responses to SB and (2) if TPB constructs can prospectively predict sitting and standing breaks. A secondary purpose of this research was to examine the effect of physical activity levels on perceptions and behaviour.

The purpose of the messaging pilot (Study 3A, Appendix G) was to develop and test three health messages for use in Study Three. In addition, preliminary measures were taken to assess the effect of the health message on individuals' perceptions of sedentary behaviour. Results indicated that individuals who received a health message perceived sedentary behaviour less-favourably than people who received an attention-control message. No significant differences were observed between participants who received a proximal or distal message.

Following Ajzen's (2006) recommendations for TPB research, the pilot elicitation study (Study 3B, Appendix H) explored salient beliefs associated with occupational sitting and standing breaks. Similar to Study One, results illustrated that individuals associated sedentary behaviour with a set of costs and benefits, such as getting work done (benefit) and low energy (cost). Additionally, results provide insight into the social factors and control beliefs associated with behavioural engagement. While several prominent themes emerged across sitting and standing behaviours (e.g., physical discomfort associated with both excessive sitting and excessive standing), participants also identified unique factors associated with each behaviour. Collectively, results suggest that sitting and standing are not simply perceived as being the opposite of one another, but are perceived as distinct behaviours. Importantly, participants' discussion of behavioural extremes – that is, both *too much* sitting or *too much* standing as being detrimental to health – suggests the need for a balanced approach to intervention: one in which occupational sitting might be complemented with standing/standing breaks, rather than the complete removal of sitting. Despite Study 3A's findings, Study Three found health messages to have no significant impact on participants' social cognitions, intentions, or behaviour.

Study Three – the primary research study – used the TPB to predict occupational sitting and standing breaks across a period of two weeks. The TPB was found to be an effective theory for predicting sitting and standing breaks. In particular, intentions consistently emerged as a strong predictor of behaviour. Attitudes, subjective norms, and PBC collectively predicted 3.6% to 18.1% of the variance in sitting intentions; and 3.0% to 33.1% of the variance in standing break intentions. Overall, the TPB was most effective at predicting *general* behaviours (e.g., proportion of work time spent sitting) rather than *specific* behaviours (e.g., number of sit-stand transitions). Intentions and PBC collectively predicted 41.9% to 63.1% of the variance in sitting behaviour; and 13.4 to 45.4% of the variance in standing break behaviour. For both sitting and standing breaks, intention emerged as the dominant predictor variable. Results raise three important implications for future research about the TPBs constructs relative to understanding the psychological aspects of sedentary behaviour. First, sedentary behaviour appears to be at least partially related to conscious social cognitions; second, that the TPB's utility as a predictive model appears to differ across various sedentary behaviour indicators.

Lastly, informed by Studies One and Two, Study Three examined the relationship between physical activity levels and TPB-related cognitions, intentions, and sedentary behaviour. While minutes of physical activity was not related to individuals' sedentary behaviour perceptions, significant relationships emerged when individuals' *perceived exercise* (i.e., fitness level, activity level) was taken into account: individuals with greater perceived exercise had more-favourable perceptions of standing breaks, and less-favourable perceptions of sitting.

Contributions to the Literature

The three studies in this dissertation approached sedentary behaviour from three distinct perspectives: that of bottom-up layperson perceptions; that of the agency aspect of Social Cognitive Theory (Bandura, 1987; 1997); and that of the Theory of Planned Behaviour (Ajzen, 1991). The purpose of selecting these varying approaches was to explore whether social cognitions are relevant to the study of sedentary behaviour, including different contextual manifestations of sedentary behaviour. Results of this research suggest a clear "Yes!" – Not only is sedentary behaviour associated with a set of social cognitions, but results indicate that social cognitions vary (1) across behaviours/contexts and (2) within and between individuals. Individuals' responses to photographs and their assessment of more- and less-sedentary activities (Study One) provide evidence that individuals distinguish between different types of sedentary behaviour; that these perceived differences exist across multiple characteristics of the behaviour; and that individuals can articulate and justify the nature of these differences. Particularly for researchers and interventionists, such findings caution against approaching sedentary behaviour as a homogenous behaviour, even when activities appear similar to each other. Meanwhile, Study Two found both strong preferences for sitting as well as lower self-efficacy and outcome expectancies for standing behaviours. Lastly, Study Three highlights the importance of conscious intentions as predictors of workplace sedentary behaviour; with intentions themselves being related to attitudes, subjective norms, and perceived behavioural control.

In terms of the larger sedentary behaviour field, results stress the importance of a rigorous, critical, and inquisitive approach to the psychology of sedentary behaviour. In much sedentary behaviour research, sitting is described as being a function of the environment. Similarly, in popular society, sitting is often associated with sloth and laziness: terms such as "couch potato" have a clear moral and judgemental underpinning. This dissertation challenges these assumptions. Rather than being a mindless, lazy, and/or passive response to environmental stimuli, results suggest that sedentary behaviour is an active process shaped by multiple contextual and motivational factors. Indeed, results from Studies One, Two, and 3B indicate that individuals associate sedentary behaviour with many positive outcomes, such as increased productivity and rest/relaxation. Sedentary behaviour is not "just sitting", but a highly complex and multi-faceted behaviour – one that sorely requires further research. Of particular importance to the broader field is the finding that multiple forms of sedentary behaviour – even behaviours that are conceptually similar to each other – can differ from each other psychologically. Thus, in an effort to understand, predict, and modify sedentary behaviour, it may be insufficient to conceptualise "sitting" as a homogenous class of behaviours. Rather, it may be necessary to increasingly diversify and embrace the concept of "sedentary behaviour*s*."

Contributions to the Psychology of Sedentary Behaviour Research Methodology

Prior to this dissertation, few investigators had developed sedentary-specific questionnaires or methods, such as how to ask individuals about their level of sedentary behaviour. Results of Study One suggest that many individuals do not define "sedentary" the same way as empirical researchers, and thus raised the possibility of significant miscommunication between researchers and participants. Informed by these results, all subsequent studies were either careful to use unambiguous terminology (e.g., "sitting" rather than sedentary) or provided participants with a clear definition of sedentary behaviour *at the start of the questionnaire*.

In terms of measurement, the three studies in this dissertation necessitated the development of several new questionnaires concerning sedentary behaviour psychology. These tools allowed for correspondence between measures: that is, sedentary-specific measures were used to measure sedentary behaviour/psychology. This approach differs from several past studies, such as that of Quartiroli and Maeda (2013), who correlated exercise-related cognitions against sedentary behaviour; or Biddle and Smith (1999), who correlated sedentary-related cognitions against physical activity (i.e., non-congruence between measures). It also differs from researchers who have modified general research tools to be sedentary-specific: for example, Conroy et al (2014), who modified the self-report habit index to measure overall sedentary behaviour; or Prapavessis and colleagues (2015), who modified a general TPB questionnaire. Ajzen (2006) reminds us of the use of the known investigated protocols for TPB measurement and has recommended the need for pilot research whenever examining a new population and/or new behaviour. In approaching sedentary behaviour as an *independent health behaviour requiring its own methods*, the current research identified novel themes and issues which may prove to be important for future research and intervention.

An additional methodological contribution was made by examining the relationship between physical activity level and sedentary behaviour. Research indicates that (1) sedentary behaviour is an independent health risk (e.g., Edwardson et al, 2012) and (2) engaging in sedentary behaviour does not prevent individuals from meeting physical activity recommendations (e.g., Biswas et al, 2015). However, just because sedentary behaviour exists relatively independent of level of physical activity does not mean that the experience of physical activity has no impact on the psychology of sedentary behaviour. Evidence from the dissertation indicates that more- and less-active individuals differ in their perceptions of their personal sedentary behaviour. For instance, in Study Two more-active individuals reported higher self-efficacy for standing. Likewise, in Study One, more-active participants viewed their sedentary behaviour as being less unhealthy *despite* not significantly differing from less-active participants in reported amount of sedentary behaviour. Lastly, in Study Three, individuals who perceived themselves as being *more active* and *more fit* differed in their sedentary behaviour-related beliefs (i.e., attitudes, subjective norms, and PBC). Such results suggest that physical activity level could be an important moderating variable for sedentary psychology. Physical activity might be a particularly important variable in terms of intervention: for instance, if more-active people see sedentary behaviour as (1) less-unhealthy and (2) a post-exercise recovery activity, they may not be motivated to engage in sedentary behaviour reduction.

Potential Contributions to the Science of Sedentary Behaviour Change Intervention

Results of Study One and Study Two provide clear evidence that individuals hold a strong preference for sitting over standing. Likewise, results of Study One suggest that sitting is a motivated and valued activity – not a mindless, passive response to environmental cues. Such findings raise a potential consideration for intervention design: it is well known that the pursuit of short-term outcomes can serve as a powerful motivation for behaviour (Bandura, 2004; Baumeister et al, 1994; Baumeister & Vohs, 2004). It is thus theoretically possible that individuals' pursuit of short-term sedentary behaviour benefits may take priority over the achievement of more-distal goals – especially if distal outcomes are perceived as being relatively abstract or unlikely to occur (e.g., the optimistic bias; Weinstein, 1989). Thus, not only might individuals be *motivated to engage in sedentary behaviour*, but the pursuit of associated desirable proximal outcomes of sedentary activities may *actively diminish* interest in pursuing distal outcome disease prevention interventions. For example, at the end of a long work day, individuals' immediate desire for rest and relaxation (e.g., via sitting and watching television) may override their interest in preventing diabetes (e.g., via stepping while watching commercials). Interest in intervention may be further dampened if individuals perceive the intervention itself as being associated with negative proximal outcomes, such as undesirable physical, social, and/or psychological states. Lastly, low self-efficacy for intervention – and/or the fear of negative social repercussions (e.g., at the workplace) – may actively prevent individuals from engaging in and persisting with intervention.

Research Methodology

Sample Size and Characteristics

Sample sizes across the three primary studies and three pilot studies ranged from 93 to 577. As per Ajzen and Fishbein's (1980) recommendations, 25 participants are required for elicitation work. The TPB elicitation study (Appendix H) featured 93 participants; as such, it is likely that the beliefs identified through research are reflective of those held by the general population of Canadian office workers. In terms of quantitative analysis, *post hoc* power analysis confirmed that all primary analyses were sufficiently powered, βs > 0.80.

Within the physical activity literature, participants are often considered ineligible for research if they do not have recent experience with physical activity. The rationale is that individuals require recent experience to have developed accurate psychological perceptions. Given the recognised prevalence of sedentary behaviour (Colley et al, 2011), the current research did not establish any "minimum criteria" regarding the amount of sedentary behaviour in which individuals must engage in to be considered eligible for participation. For all three studies, efforts were made to recruit a diverse and representative sample. This was accomplished by purposefully recruiting from a variety of sources/mediums, using social media, university announcements, community postings, and e-mails/conversations with corporations. Despite this, the resulting samples were primarily female, Caucasian, and well-educated. Future efforts could build on current research by conducting studies with more diverse samples.

Quality of the Research

A 2016 review conducted by Rollo et al examined sedentary behaviour psychology research quality with a modifie Downs and Black checklist (1998). The checklist was developed to assess *clinical intervention* research, with a particular focus on issues of quality of reporting, external validity, internal validity, and power. The original scale has 27 items and a maximum score of 32, with higher scores indicating higher-quality studies. In Rollo et al, study quality using the modified checklist ranged from 35% to 80%, with a mean score of 69% (SD = 9.15).

Because the Downs and Black (1998) checklist was developed for clinical intervention research, a number of items did not apply when the current dissertation research was reviewed. As such, irrelevant items were either removed or modified: for example, Item 27 was modified to address *statistical significance* rather than *clinical relevance*. A summary of items and scoring can be found in Table 31. In total, Study One achieved a score of 12/15 (80%); Study Two 13/15 (87%); and Study Three 21/25 (84%). Thus, relative to the average rating of studies included by Rollo et al (2016), the present dissertation research was deemed to be high quality.

Future Directions

The research studies that comprise the dissertation mark an early attempt to understand the psychological basis of sedentary behaviour. While the three studies possess many strengths, results are preliminary and speak to the great need to engage in further psychological research. A priority for future research should be understanding how sedentary behaviour differs by context

Table 31 – Dissertation research quality, as assessed by the modified Downs & Black (1998) checklist.

	Study One	**Study Two**	**Study Three**
Is the hypothesis/aim/objective of the study clearly described?	1/1	1/1	1/1
Are the main outcomes to be measured clearly described?	1/1	1/1	1/1
Are the characteristics of the participants included in the study clearly described?	1/1	1/1	1/1
Are inclusion and/or exclusion criteria given?	1/1	1/1	1/1
Are the interventions of interest clearly described?	–	–	1/1
Are the main findings of the study clearly described?	1/1	1/1	1/1
Does the study provide estimates of the random variability in the data for the main outcome? (Standard error, standard deviation, and/or confidence intervals.)	1/1	1/1	1/1
Have the characteristics of patients lost to follow-up been described?	–	–	0/1
Have actual probability values been reported? (e.g., p = 0.035 rather than $p < 0.05$)	0/1	0/1	0/1
Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	0/1	0/1	0/1
Was an attempt made to blind study subjects to the intervention they have received?	–	–	1/1
If any of the results of the study were based on "data dredging", was this made clear?	–	–	1/1
Is the time period between the intervention and outcome the same for cases and controls?	–	–	1/1
Were the statistical tests used to assess the main outcomes appropriate?	1/1	1/1	1/1
Were the main outcome measures valid and reliable?	0/1	1/1	1/1
Were the participants in treatment and control groups recruited from the same population?	–	–	1/1
Were study participants in treatment and control groups recruited over the same period of time?	–	–	1/1
Were study subjects randomised to intervention groups?	–	–	1/1
Was the randomised intervention assignment concealed from participants?	–	–	1/1
Was loss to follow-up taken into account?	–	–	0/1
Did the study have sufficient power to detect a clinically important effect?	5/5	5/5	5/5
Total	**12/15**	**13/15**	**21/25**

and activity: that is, rather than conceptualising sedentary behaviour as a single action (i.e., “global sedentary behaviour”), there is a need to study the diverse manifestations and motivations for sitting. Not only is such information important for understanding sedentary behaviour, but may also be crucial for informing effective behaviour change interventions.

A second potential research focus should be special populations, particularly populations that exhibit particularly high levels of sedentary behaviour: for example, older adults living in nursing homes, adults with chronic pain conditions, or individuals working in the transportation industry. Such research may present a unique view of sedentary behaviour, including the psychosocial and environmental factors that contribute to sedentary behaviour involvement. In terms of intervention, it may be particularly beneficial to target these low active populations in that they may serve to gain the most from reducing their sedentary behaviour (Biswas et al, 2015).

REFERENCES

Adams, M. M. (2012). On our feet: feasibility trial of an intervention to reduce sedentary behavior and increase physical activity (Doctoral dissertation). University of North Carolina, Greensboro. Retrieved from http://libres.uncg.edu/ir/unca/listing.aspx?id=8561

Aguinis, H., & Bradley, K. (2014). Best practice recommendations for designing and implementing experimental vignette methodology studies. *Organizational Research Methods, 17*, 351-371.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I. (2007). Constructing a TPB questionnaire. *Theory of Planned Behaviour*. Retrieved from people.umass.edu/aizen/tpb.html

Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Presseau, and Araújo-Soares. *Health Psychology Review, 9*(2), 131-137.

Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behaviour*. Englewood Cliffs, NJ: Prentice-Hall.

Alkhajah, T. A., Reeves, M. M., Eakin, E. G., Winkler, E. A., 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.

American Heart Association (2015). The price of inactivity. Retrieved from http://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/FitnessBasics/The-Price-of-Inactivity_UCM_307974_Article.jsp

American Heart Association (2017). American Heart Association recommendations for physical activity in adults. Retrieved from http://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/FitnessBasics/American-Heart-Association-Recommendations-for-Physical-Activity-in-Adults_UCM_307976_Article.jsp

Anderson, C. (2010). Presenting and evaluating qualitative research. *American Journal of Pharmaceutical Education, 74*(8), 141.

Anderson, D. R., Collins, P. A., Schmitt, K. L., & Jacobvitz, R. S. (1996). Stressful life events and television viewing. *Communication Research, 23*(3), 243-260.

Apostolopoulos, Y., Shattell, M., Sönmez, S., Strack, R., Haldman, L., & Jones, V. (2012). Active living in the trucking sector: Environmental barriers and health promotion strategies. *Journal of Physical Activity and Health*, *9*(2), 259-269.

Armitage, C. J. (2015). Time to retire the theory of planned behaviour? A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, *9*(2), 151-155.

Armitage, C. J., & Conner, M. (2000). Social cognition models and health behaviour: A structured review. *Psychology and Health*, *15*(2), 173-189.

Artinian, N. T., Fletcher, G. F., Mozaffarian, D., Kris-Etherton, P., Van Horn, L., Lichtenstein, A. H., ... , & Burke, L. E. (2010). Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults a scientific statement from the American Heart Association. *Circulation*, *122*(4), 406-441.

Atkin, A. J., Adams, E., Bull, F. C., & Biddle, S. J. (2012). Non-occupational sitting and mental well-being in employed adults. *Annals of Behavioral Medicine*, *43*(2), 181-188.

Atkin, A. J., Gorely, T., Clemes, S. A., Yates, T., Edwardson, C., Brage, S., ... , & Biddle, S. J. (2012). Methods of measurement in epidemiology: sedentary behaviour. *International Journal of Epidemiology*, *41*(5), 1460-1471.

Australian Bureau of Statistics (2013). Australians spend one month a year sitting watching TV. Retrieved from www.abs.gov.au/ausstats/abs@.nsf/mediareleasesbyCatalogue/19D9A81DC4ABD21BCA257BAC0016BBE9?Opendocument

Australian Government Comcare. (2014). Sedentary work. *Preventing Harm*. Retrieved from www.comcare.gov.au/preventing/hazards/physical_hazards/sedentary_work

Australian Government Department of Health (2014). *Australia's Physical Activity and Sedentary Behaviour Guidelines*. Retrieved from www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, *4*(3), 359-373.

Bandura, A. (1996). *Self-Efficacy: The Exercise of Control*. New York: Freeman

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, *31*(2), 143-164.

Barwais, F. A., Cuddihy, T. F., & Tomson, L. M. (2013). Physical activity, sedentary behavior and total wellness changes among sedentary adults: a 4-week randomized controlled trial. *Health and Quality of Life Outcomes*, *11*(1), 183.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing Control: How and Why People Fail at Self-Regulation*. San Diego, CA: Academic Press.

Biddle, S. J. H. (2011). Fit or sit? Is there a psychology of sedentary behaviour? *Sport & Exercise Psychology Review*, *7*(2), 5-10.

Biddle, S. J., Gorely, T., & Stensel, D. J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. *Journal of Sports Sciences*, *22*(8), 679-701.

Biswas, A., Oh, P. I., Faulkner, G. E., Bajaj, R. R., Silver, M. A., Mitchell, M. S., & Alter, D. A. (2015). Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: A systematic review and meta-analysis. *Annals of Internal Medicine*, *162*(2), 123-132.

Bradbury-Jones, C., Taylor, J., & Herber, O. (2014). How theory is used and articulated in qualitative research: Development of a new typology. *Social Science & Medicine*, *120*, 135-141.

Brawley, L. R., Gierc, M. S., & Locke, S. R. (2013). Powering adherence to physical activity by changing self-regulatory skills and beliefs: Are kinesiologists ready to counsel? *Kinesiology Review*, *2*, 4-16.

British Heart Foundation National Centre for Physical Activity and Health. (2012). *Sedentary Behaviour Evidence Briefing*. Retrieved from http://www.bhfactive.org.uk/resources-and-publications-item/40/328/index.html

Brown, W. J., Bauman, A. E., Bull, F. C., Burton, N. W. (2012). Development of Evidence-based Physical Activity Recommendations for Adults (18-64 years). Australian Government Department of Health. Retrieved from http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines/$File/DEB-PAR-Adults-18-64years.pdf

Brownson, R. C., Boehmer, T. K., & Luke, D. A. (2005) Declining rates of physical activity in the United States: What are the contributors? *Annual Review of Public Health*, *26*, 421-443.

Burton, N. W., Khan, A., Brown, W. J., & Turrell, G. (2012). The association between sedentary leisure and physical activity in middle-aged adults. *British Journal of Sports Medicine*, *46*(10), 747-752.

Busschaert, C., De Bourdeaudhuij, I., Van Cauwenberg, J., Cardon, G., & De Cocker, K. (2016). Intrapersonal, social-cognitive and physical environmental variables related to context-specific sitting time in adults: a one-year follow-up study. *International Journal of Behavioral Nutrition and Physical Activity*, *13*(1), 28.

Canadian Society of Exercise Physiology. (2011). *Canadian Physical Activity Guidelines and Canadian Sedentary Behaviour Guidelines.* Retrieved from http://www.csep.ca/english/view.asp?x=804

Canadian Cancer Society. (2017). Sedentary behaviour. Cancer 101: What is a Risk Factor? Retrieved from http://www.cancer.ca/en/cancer-information/cancer-101/what-is-a-risk-factor/sedentary-behaviour/?region=on

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.

Chang, A. K., Fritschi, C., & Kim, M. J. (2013). Sedentary behavior, physical activity, and psychological health of Korean older adults with hypertension: effect of an empowerment intervention. *Research in Gerontological Nursing*, *6*(2), 81-88.

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.

Chau, J. Y., van der Ploeg, H. P., Van Uffelen, J. G., Wong, J., Riphagen, I., Healy, G. N., ... & Brown, W. J. (2010). Are workplace interventions to reduce sitting effective? A systematic review. *Preventive Medicine*, *51*(5), 352-356.

Chen, T., Narazaki, K., Haeuchi, Y., Chen, S., Honda, T., & Kumagai, S. (2016). Associations of sedentary time and breaks in sedentary time with disability in instrumental activities of daily living in community-dwelling older adults. *Journal of physical activity & health*, *13*(3).

Chu, A. H. Y., Ng, S. H. X., Tan, C. S., Win, A. M., Koh, D., & Müller-Riemenschneider, F. (2016). A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers. *Obesity Reviews*, *17*(5), 467-481.

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. *Health Reports*, *22*(1), 7.

Conner, M., & Norman, P. (2005). *Predicting Health Behaviour*. McGraw-Hill International.

Conroy, D. E., Maher, J. P., Elavsky, S., Hyde, A. L., & Doerksen, S. E. (2013). Sedentary behavior as a daily process regulated by habits and intentions. *Health Psychology*, *32*(11), 1149.

Culos-Reed, S. N., Gyurcsik, N. C., & Brawley, L. R. (2001). Using theories of motivated behavior to understand physical activity. *Handbook of sport psychology*, *2*, 695-717.

Craig, R., Mindell, J., & Hirani, V. (2009). Health Survey for England 2008. Volume 1: Physical Activity and Fitness. *National Health Service*. Retrieved from http://content.digital.nhs.uk/pubs/hse08physicalactivity

Das, P., & Horton, R. (2012). Rethinking our approach to physical activity. *The Lancet*, *380*(9838), 189-190.

Das, P., & Horton, R. (2016). Physical activity--time to take it seriously and regularly. *The Lancet*, *388*(10051), 1254.

De Cocker, K., Duncan, M. J., Short, C., Van Uffelen, J. G., & Vandelanotte, C. (2014). Understanding occupational sitting: prevalence, correlates and moderating effects in Australian employees. *Preventive Medicine*, *67*, 288-294.

De Greef, K. P., Deforche, B. I., Ruige, J. B., Bouckaert, J. J., Tudor-Locke, C. E., Kaufman, J. M., & De Bourdeaudhuij, I. M. (2011). The effects of a pedometer-based behavioral modification program with telephone support on physical activity and sedentary behavior in type 2 diabetes patients. *Patient Education and Counseling*, *84*(2), 275-279.

De Greef, K., Deforche, B., Tudor-Locke, C., & De Bourdeaudhuij, I. (2010). A cognitive-behavioural pedometer-based group intervention on physical activity and sedentary behaviour in individuals with type 2 diabetes. *Health Education Research*, *25*(5), 724-736.

Deliens, T., Deforche, B., De Bourdeaudhuij, I., & Clarys, P. (2015). Determinants of physical activity and sedentary behaviour in university students: a qualitative study using focus group discussions. *BMC Public Health*, *15*(1), 201.

Dietz, W. H. (1996). The role of lifestyle in health: the epidemiology and consequences of inactivity. Proceedings of the Nutrition Society, 55, 829-840.

Downs, S. H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of Epidemiology and Community Health*, *52*(6), 377-384.

Edwardson, C. L., Gorely, T., Davies, M. J., Gray, L. J., Khunti, K., Wilmot, E. G., ... , & Biddle, S. J. (2012). Association of sedentary behaviour with metabolic syndrome: a meta-analysis. *PloS One*, *7*(4), e34916.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107-115.

Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science*, *196*(4286), 129-136.

Field, A. (2009). *Discovering Statistics Using SPSS*. London: Sage Publications.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behaviour: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Ford, E. S., & Caspersen, C. J. (2012). Sedentary behaviour and cardiovascular disease: a review of prospective studies. *International Journal of Epidemiology*, dys078.

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.

Gardner, B. (2015). A review and analysis of the use of 'habit' in understanding, predicting and influencing health-related behaviour. *Health Psychology Review*, *9*(3), 277-295.

Garriguet, D., & Colley, R. C. (2014). A comparison of self-reported leisure-time physical activity and measured moderate-to-vigorous physical activity in adolescents and adults. *Health Reports*, *25*(7), 3.

Gaston, A., De Jesus, S., Markland, D., & Prapavessis, H. (2016). I sit because I have fun when I do so! Using self-determination theory to understand sedentary behavior motivation among university students and staff. *Health Psychology and Behavioral Medicine*, *4*(1), 138-154.

Gierc, M. S., & Brawley, L. (2015, April). Is standing more depleting than sitting? The effect of posture on acute psychological outcomes. *Annals of Behavioral Medicine*, *49*, S200.

Gierc, M., Locke, S., Jung, M., & Brawley, L. (2016). Attempting to be active: Self-efficacy and barrier limitation differentiate activity levels of working mothers. *Journal of Health Psychology*, *21*(7), 1351-1360.

Gilson, N. D., Burton, N. W., van Uffelen, J. G., & Brown, W. J. (2011). Occupational sitting time: Employees' perceptions of health risks and intervention strategies. *Health Promotion Journal of Australia*, *22*(1), 38-43.

Gionet, N. J., & Godin, G. (1989). Self-reported exercise behavior of employees: a validity study. *Journal of Occupational and Environmental Medicine*, *31*(12), 969-973.

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

Gorman, E., Hanson, H. M., Yang, P. H., Khan, K. M., Liu-Ambrose, T., & Ashe, M. C. (2013). Accelerometry analysis of physical activity and sedentary behavior in older adults: a systematic review and data analysis. *European Review of Aging and Physical Activity*, *11*(1), 35.

Government of the United Kingdom Department of Health (2011). *UK Physical Activity Guidelines*. Retrieved from https://www.gov.uk/government/publications/uk-physical-activity-guidelines

Gray, P. O. (2006). *Psychology*. New York: Worth Publishers.

Gyurcsik, N. C., Brawley, L. R., Spink, K. S., & Sessford, J. D. (2013). Meeting physical activity recommendations: Self-regulatory efficacy characterizes differential adherence during arthritis flares. *Rehabilitation Psychology*, *58*(1), 43.

Hadgraft, N. T., Healy, G. N., Owen, N., Winkler, E. A., Lynch, B. M., Sethi, P., ... & Willenberg, L. (2016). Office workers' objectively assessed total and prolonged sitting time: Individual-level correlates and worksite variations. *Preventive Medicine Reports*, *4*, 184-191.

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.

Hamilton, M. T., Hamilton, D. G., & Zderic, T. W. (2004). Exercise physiology versus inactivity physiology: An essential concept for understanding lipoprotein lipase regulation. Exercise and Sport Sciences Reviews, 32, 161-166.

Hamilton, M. T., Hamilton, D. G., & Zderic, T. W. (2007). Role of low energy expenditure and sitting in obesity, metabolic syndrome, type-2 diabetes, and cardiovascular disease. *Diabetes*, *56*(11), 2655-2667.

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.

Hamlin, M., & Paterson, A. (2014). Sedentary behaviour and chronic disease. *Perspectives in Public Health*, *134*(3), 131-132.

Hankins, M., French, D., & Horne, R. (2000). Statistical guidelines for studies of the theory of reasoned action and the theory of planned behaviour. *Psychology and Health*, *15*(2), 151-161.

Hardy, L. L., Hills, A. P., Timperio, A., Cliff, D., Lubans, D., Morgan, P. J., ... , & Brown, H. (2013). A hitchhiker's guide to assessing sedentary behaviour among young people: Deciding what method to use. *Journal of Science and Medicine in Sport*, *16*(1), 28-35.

Healy, G. N., Dunstan, D. W., Salmon, J., Cerin, E., Shaw, J. E., Zimmet, P. Z., & Owen, N. (2008). Breaks in sedentary time. *Diabetes Care*, *31*(4), 661-666.

Health Canada (2011). Healthy living: Physical activity. *Government of Canada*. Retrieved from www.hc-sc.gc.ca/hl-vs/physactiv/index-eng.php

Health Canada and the Canadian Society for Exercise Physiology (1998). Canada’s physical activity guide to healthy active living. Cat. No. H39-429/1998-1E. Ottawa, ON: Health Canada.

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. *Journal of the American Medical Association*, *289*(14), 1785-1791.

Hughes, R. (1998). Considering the vignette technique and its application to a study of drug injecting and HIV risk and safer behaviour. *Sociology of Health & Illness*, *20*(3), 381-400.

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

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), e000828.

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.

King, A. C., Hekler, E. B., Grieco, L. A., Winter, S. J., Sheats, J. L., Buman, M. P., ... & Cirimele, J. (2013). Harnessing different motivational frames via mobile phones to promote daily physical activity and reduce sedentary behavior in aging adults. *PloS One*, *8*(4), e62613.

Knäuper, B., Rabiau, M., Cohen, O., & Patriciu, N. (2004). Compensatory health beliefs: scale development and psychometric properties. *Psychology & Health*, *19*(5), 607-624.

Kozey-Keadle, S., Libertine, A., Staudenmayer, J., & Freedson, P. (2011). The feasibility of reducing and measuring sedentary time among overweight, non-exercising office workers. *Journal of Obesity*, *2012*.

Kubey, R. W., & Csikszentmihalyi, M. (1990). Television as escape: Subjective experience before an evening of heavy viewing. *Communication Reports*, *3*(2), 92-100.

Latimer, A.E., Brawley, L.R. & Bassett, R. L. (2009). A systematic review of three approaches for constructing physical activity messages: What messages work and what improvements are needed? *International Journal of Behavioral Nutrition & Physical Activity*, *7*, 36.

Levine, J. A. (2004). Nonexercise activity thermogenesis (NEAT): Environment and biology. *American Journal of Physiology-Endocrinology and Metabolism*, *286*(5), E675-E685.

Levine, J. A. (2010). Health-chair reform. *Diabetes*, *59*(11), 2715-2716.

Levine, J. A. (2014, July 26). Sitting down is KILLING you! *Daily Mail*. Retrieved from http://www.dailymail.co.uk

Levine, J. A. (2015). What are the risks of sitting too much? Mayo Clinic. Retrieved from www.mayoclinic.org/healthy-lifestyle/adult-health/expert-answers/sitting/faq-20058005

Levine, J. A., Schleusner, S. J., & Jensen, M. D. (2000). Energy expenditure of nonexercise activity. *The American Journal of Clinical Nutrition*, *72*(6), 1451-1454.

Lowe, S. S., Danielson, B., Beaumont, C., Watanabe, S. M., Baracos, V. E., & Courneya, K. S. (2015). Correlates of objectively measured sedentary behavior in cancer patients with brain metastases: an application of the theory of planned behavior. *Psycho‐Oncology*, *24*(7), 757-762.

Mabry, R. M., Al-Busaidi, Z. Q., Reeves, M. M., Owen, N., & Eakin, E. G. (2014). Addressing physical inactivity in Omani adults: Perceptions of public health managers. *Public Health Nutrition*, *17*(03), 674-681.

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.

Maher, J. P., & Conroy, D. E. (2015). Habit strength moderates the effects of daily action planning prompts on physical activity but not sedentary behavior. *Journal of Sport & Exercise Psychology*, *37*(1), 97-107.

Maher, J. P., & Conroy, D. E. (2016). A dual-process model of older adults' sedentary behavior. *Health Psychology*, *35*(3), 262.

Marks, D. F., Sykes, C. M., & McKinley, J. M. (2003). Health psychology: Overview and professional issues. *Handbook of Psychology*.

Martin, A., Fitzsimons, C., Jepson, R., Saunders, D. H., van der Ploeg, H. P., Teixeira, P. J., ... & Mutrie, N. (2015). Interventions with potential to reduce sedentary time in adults: systematic review and meta-analysis. *British Journal of Sports Medicine*, *0*, 1-10.

Matthews, C. E., Chen, K. Y., Freedson, P. S., Buchowski, M. S., Beech, B. M., Pate, R. R., & Troiano, R. P. (2008). Amount of time spent in sedentary behaviours in the United States, 2003-2004. *American Journal of Epidemiology*, *167*(7), 875-881.

Matthews, C. E., George, S. M., Moore, S. C., Bowles, H. R., Blair, A., Park, Y., ... , & Schatzkin, A. (2012). Amount of time spent in sedentary behaviors and cause-specific mortality in US adults. *The American Journal of Clinical Nutrition*, ajcn-019620.

McAuley, E., & Blissmer, B. (2000). Self-efficacy determinants and consequences of physical activity. *Exercise and Sport Sciences Reviews*, *28*(2), 85-88.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, *5*(2), 97-144.

McGuckin, T., Sealey, R., & Barnett, F. (2017). Planning for sedentary behaviour interventions: office workers' survey and focus group responses. *Perspectives in Public Health.*

McKinlay, J., & Marceau, L. (2000). US public health and the 21st century: Diabetes mellitus. *The Lancet*, *356*(9231), 757-761.

Milton, K., Gale, J., Stamatakis, E., & Bauman, A. (2015). Trends in prolonged sitting time among European adults: 27 country analysis. *Preventive Medicine*, *77*, 11-16.

Neuhaus, M., Eakin, E. G., Straker, L., Owen, N., Dunstan, D. W., Reid, N., & Healy, G. N. (2014). Reducing occupational sedentary time: a systematic review and meta-analysis of evidence on activity-permissive workstations. *Obesity Reviews*, *15*(10), 822-838.

Ng, S. W., & Popkin, B. M. (2012). Time use and physical activity: a shift away from movement across the globe. *Obesity Reviews*, *13*(8), 659-680.

Ogden, J. (2015). Time to retire the theory of planned behaviour? One of us will have to go! A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, *9*(2), 165-167.

Olson, J. M., & Zanna, M. P. (1987). Understanding and promoting exercise: A social psychological perspective. *Canadian Journal of Public Health*, *78*(5), S1-7.

O'Neill, C., & Dogra, S. (2016). Different types of sedentary activities and their association with perceived health and wellness among middle-aged and older adults: A cross-sectional analysis. *American Journal of Health Promotion*, *30*(5), 314-322.

Otten, J. J., Littenberg, B., & Harvey-Berino, J. R. (2010). Relationship between self-report and an objective measure of television-viewing time in adults. *Obesity*, *18*(6), 1273-1275.

Owen, N. (2012). Sedentary behavior: understanding and influencing adults' prolonged sitting time. *Preventive Medicine*, *55*(6), 535-539.

Owen, N., Leslie, E., Salmon, J., & Fotheringham, M. J. (2000). Environmental determinants of physical activity and sedentary behaviour. Exercise and Sport Sciences Reviews, 28(4), 153-158.

Owen, N., Sugiyama, T., Eakin, E. E., Gardiner, P. A., Tremblay, M. S., & Sallis, J. F. (2011). Adults' sedentary behavior: determinants and interventions. *American Journal of Preventive Medicine*, *41*(2), 189-196.

Paddam, A., Barnes, D., & Langdon, D. (2010). Constructing vignettes to investigate anger in multiple sclerosis. *Nurse Researcher*, *17*(2), 60-73.

Parry, S., & Straker, L. (2013). The contribution of office work to sedentary behaviour associated risk. *BMC Public Health*, *13*(1), 296.

ParticipACTION (2016). How much you should (or shouldn't) sit at work. *Workplace Wellness*. Retrieved from https://www.participaction.com/en-ca/peptalk/workplace-wellness/how-much-you-should-or-shouldn't-sit-at-work

Pate, R. R., O'Neill, J. R., & Lobelo, F. (2008). The evolving definition of "sedentary". *Exercise and Sport Sciences Reviews*, *36*(4), 173-178.

Patel, A. V., Bernstein, L., Deka, A., Feigelson, H. S., Campbell, P. T., Gapstur, S. M., ... & Thun, M. J. (2010). Leisure time spent sitting in relation to total mortality in a prospective cohort of US adults. *American Journal of Epidemiology*, *172*(4), 419-429.

Pinto Pereira, S. M. P., Ki, M., & Power, C. (2012). Sedentary behaviour and biomarkers for cardiovascular disease and diabetes in mid-life: the role of television-viewing and sitting at work. *PloS one*, *7*(2), e31132.

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*, 23-32.

Prince, S. A., Saunders, T. J., Gresty, K., & Reid, R. D. (2014). A comparison of the effectiveness of physical activity and sedentary behaviour interventions in reducing sedentary time in adults: a systematic review and meta-analysis of controlled trials. *Obesity Reviews*, *15*(11), 905-919.

Quartiroli, A., & Maeda, H. (2014). Self-determined Engagement in Physical Activity and Sedentary Behaviors of US College Students. *International Journal of Exercise Science*, *7*(1), 10.

Reynolds, G. (2016, September 14). Why fidgeting is good medicine. New York Times. Retrieved from https://www.nytimes.com/2016/09/14/well/move/why-fidgeting-is-good-medicine.html?_r=0

Rhodes, R. E., & Blanchard, C. M. (2011). Time displacement and confidence to participate in physical activity. *International Journal of Behavioral Medicine*, *18*(3), 229-234.

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.

Reinecke, L. (2009). Games and recovery: The use of video and computer games to recuperate from stress and strain. *Journal of Media Psychology*, *21*(3), 126-142.

Rollo. S., Gaston, A., & Prapavessis, H. (2016). Cognitive and motivational factors associated with sedentary behavior: A systematic review. *AIMS Public Health, 3(4): 956-984.*

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.

Sedentary Behaviour Research Network (2012). Standardized use of the terms “sedentary” and “sedentary behaviours”. *Applied Physiology, Nutrition, and Metabolism*, *37*, 540-542.

Sieber, W. K., Robinson, C. F., Birdsey, J., Chen, G. X., Hitchcock, E. M., Lincoln, J. E., ... & Sweeney, M. H. (2014). Obesity and other risk factors: The National Survey of US Long-Haul Truck Driver Health and Injury. *American Journal of Industrial Medicine*, *57*(6), 615-626.

Shrestha, N., Kukkonen-Harjula, K. T., Verbeek, J. H., Ijaz, S., Hermans, V., & Bhaumik, S. (2016). Workplace interventions for reducing sitting at work. *The Cochrane Database of Systematic Reviews*, *2016*(3). doi: 10.1002/14651858.CD010912.pub3.

Shuval, K., Hébert, E. T., Siddiqi, Z., Leonard, T., Lee, S. C., Tiro, J. A., ... & Skinner, C. S. (2013). Impediments and Facilitators to Physical Activity and Perceptions of Sedentary Behavior Among Urban Community Residents: The Fair Park Study. *Preventing Chronic Disease*, *10*.

Sjöström, M., Oja, P., Hagströmer, M., Smith, B. J., & Bauman, A. (2006). Health-enhancing physical activity across European Union countries: The Eurobarometer study. *Journal of Public Health*, 14, 291-300.

Smith, R. A., & Biddle, S. J. H. (1999). Attitudes and exercise adherence: Test of the Theories of Reasoned Action and Planned Behaviour. Journal of Sports Sciences, 17, 269-281.

Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, *8*(1), 1-7.

Spence, J. (2014). Get up, stand up: A public health perspective on sedentary behaviour. 2014 Physical Activity Forum, University of Alberta, Edmonton, AB. Retrieved from https://www.youtube.com/watch?v=lJG4T5LpDzM

Steeves, J. A., Bassett, D. R., Fitzhugh, E. C., Raynor, H. A., & Thompson, D. L. (2012). Can sedentary behavior be made more active? A randomized pilot study of TV commercial stepping versus walking. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 95.

Stephens, B. R., Granados, K., Zderic, T. W., Hamilton, M. T., & Braun, B. (2011). Effects of 1 day of inactivity on insulin action in healthy men and women: interaction with energy intake. *Metabolism*, *60*(7), 941-949.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th Ed.). London: Pearson.

Tew, G. A., Posso, M. C., Arundel, C. E., & McDaid, C. M. (2015). Systematic review: height-adjustable workstations to reduce sedentary behaviour in office-based workers. *Occupational Medicine*, kqv044.

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.

Ubelacker, S. (2015, January 19). Sitting for too long can kill you, even if you exercise. Canadian Broadcasting Corporation. Retrieved from www.cbc.ca/news/business/sitting-for-too-long-can-kill-you-even-if-you-exercise-study-1.2918678

Uijtdewilligen, L., Singh, A. S., Chinapaw, M. J. M., Twisk, J. W. R., & Mechelen, W. V. (2015). Person-related determinants of TV viewing and computer time in a cohort of young Dutch adults: Who sits the most? *Scandinavian Journal of Medicine & Science in Sports*, *25*(5), 716-723.

Van der Ploeg, H. P., Chey, T., Korda, R. J., Banks, E., & Bauman, A. (2012). Sitting time and all-cause mortality risk in 222 497 Australian adults. *Archives of Internal Medicine*, *172*(6), 494-500.

Van Dyck, D., Cardon, G., Deforche, B., Owen, N., De Cocker, K., Wijndaele, K., & De Bourdeaudhuij, I. (2011). Socio-demographic, psychosocial and home-environmental attributes associated with adults' domestic screen time. *BMC Public Health*, *11*(1), 668.

Van Dyck, D., De Greef, K., Deforche, B., Ruige, J., Bouckaert, J., Tudor-Locke, C. E., ... & De Bourdeaudhuij, I. (2013). The relationship between changes in steps/day and health outcomes after a pedometer-based physical activity intervention with telephone support in type 2 diabetes patients. *Health Education Research*, *28*(3), 539-545.

Van Uffelen, J. G., Heesch, K. C., Hill, R. L., & Brown, W. J. (2011). A qualitative study of older adults' responses to sitting-time questions: Do we get the information we want? *BMC Public Health*, *11*(1), 1.

Vlachopoulos, S. P., & Michailidou, S. (2006). Development and initial validation of a measure of autonomy, competence, and relatedness in exercise: The Basic Psychological Needs in Exercise Scale. *Measurement in Physical Education and Exercise Science*, *10*(3), 179-201.

Wadsworth, D., Gleason, M., & Stoner, L. (2014). Can sedentary behaviour be considered a cultural maladaptation? *Perspectives in Public Health*, *134*(1), 20-21.

Wallander, L. (2009). 25 years of factorial surveys in sociology: A review. *Social Science Research*, *38*(3), 505-520.

Wallmann-Sperlich, B., Bucksch, J., Schneider, S., & Froboese, I. (2014). Socio-demographic, behavioural and cognitive correlates of work-related sitting time in German men and women. *BMC Public Health*, *14*(1), 1259.

Warner, V., & Biddle, S. J. H. (2011, July). Correlates of occupational and leisure-time sedentary behaviour in adults: The Theory of Planned Behaviour and habit strength [Abstract]. Paper presented to the European Federation of Sport Psychology Conference, Maderia, Portugal.

Weinstein, N. D. (1989). Optimistic biases about personal risks. *Science*, *246*(4935), 1232-1234.

Whitfield, G., Gabriel, P., Kelley, K., & Kohl III, H. W. (2014). Sedentary and active: self-reported sitting time among marathon and half-marathon participants. *Journal of Physical Activity & Health*, *11*(1), 165-172.

Williams, D. M., Anderson, E. S., & Winett, R. A. (2005). A review of the outcome expectancy construct in physical activity research. *Annals of Behavioral Medicine*, *29*(1), 70-79.

Wilmot, E. G., Edwardson, C. L., Achana, F. A., Davies, M. J., Gorely, T., Gray, L. J., ... , & Biddle, S. J. (2012). Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis. *Diabetologia*, *55*, 2895-2905.

Wilson, J., & While, A. E. (1998). Methodological issues surrounding the use of vignettes in qualitative research. *Journal of Interprofessional Care*, *12*(1), 79-86.

Wong, T. S., Gaston, A., DeJesus, S., & Prapavessis, H. (2016). The utility of a protection motivation theory framework for understanding sedentary behavior. *Health Psychology and Behavioral Medicine*, *4*(1), 29-48.

World Health Organisation (2003). *The Solid Facts*. Retrieved from http://www.euro.who.int/en/publications/abstracts/social-determinants-of-health.-the-solid-facts

World Health Organization (2010). *Global Recommendations on Physical Activity for Health*. Geneva, Switzerland: WHO Press. Retrieved from www.who.int/dietphysicalactivity/factsheet_recommendations/en/

World Health Organisation (2011). *Global Health Starts with Healthy Behaviour.* Retrieved from www.euro.who.int/__data/assets/pdf.../CorpBrochure_Good_health.pdf

World Health Organisation (2015). Health Impact Assessment: The Determinants of Health. Retrieved from www.who.int/hia/evidence/doh/en/

World Health Organization (2017). Health topics: Physical activity. Retrieved from www.who.int/topics/physical_activity/en/

Yates, T., Wilmot, E. G., Khunti, K., Biddle, S., Gorely, T., & Davies, M. J. (2011). Stand up for your health: Is it time to rethink the physical activity paradigm? *Diabetes Research and Clinical Practice*, *93*, 292-294.

Zwart, S. R., Hargens, A. R., Lee, S. M., Macias, B. R., Watenpaugh, D. E., Tse, K., & Smith, S. M. (2007). Lower body negative pressure treadmill exercise as a countermeasure for bed rest-induced bone loss in female identical twins. *Bone*, *40*(2), 529-537.

APPENDIXES

APPENDIX A:

DATA CLEANING AND DATA MANAGEMENT PROCEDURES

Quantitative Data Analysis

Data management procedures were used to address issues of missing data, the presence of outliers, and to assess for normality. All data management procedures were in accordance with recommendations made by Tabachnick and Fidell (2013) and Field (2009).

Missing Data

As per Tabachnick and Fidell (2013), two characteristics of missing data were taken into account: the amount of missing data, and whether missing data was randomly or non-randomly distributed. Missing data was assessed both visually and by using and using SPSS's Missing Values Analysis. When missing data was less than 5% *and* at random, data points were coded as missing and the data set left as-is. In cases where participants left a single item scale (e.g., gender, weight) blank, they were not excluded from analysis but rather their missing item was left blank. When one item was missing from a scale, the mean for the remaining items in that scale was used to replace the missing value.

Outliers

Outliers were identified using the benchmark of a standard score greater than 3.29, $p < 0.001$. However, as noted by Tabachnick and Fidell (2013), when the sample size is large, a few standardised scores in excess of 3.29 are expected. Thus, when an outlier was identified it was (1) visually examined via histograms and box plots, and/or (2) tested for impact on results via Cook's distances. When appropriate, influential outliers were made less-deviant by changing scores to one unit above or below the next-most-extreme score in the distribution.

Testing of Assumptions

Statistical assumptions were tested in accordance with Field’s (2009) recommendations prior to conducting analyses. Unless otherwise stated, assumptions underlying the use of a test (e.g., normality, homogeneity of variance, linearity, etc.) were met for each analysis.

In several instances, the homogeneity of variance assumption was violated. This occurred, for instance, in Study One when examining the differences between active and sedentary photographs (pp. 44). When this occurred, Welch’s ANOVA (Welch, 1951, as cited by Field, 2009) was conducted. Welch’s ANOVA does not assume equal variances and group sizes, and produces low Type I error.

Qualitative Data Analysis: Thematic Content Analysis

Qualitative data was analysed via thematic content analysis. The method is recognised as an effective tool for making replicable and valid inferences from qualitative data, including written, verbal, and visual communication methods (Krippendorff, 1980; Elo & Kyngäs, 2008).

Broadly, content analysis involves distilling words, phrases, and ideas into content-related categories: that is, grouping together words (etc.) that communicate the same meaning. The process can be either inductive or deductive, with an inductive approach being recommended if “there is not enough former knowledge about the phenomenon or if knowledge is fragmented” (Elo and Kyngäs, 2008, pp. 109). Given the current state of sedentary behaviour research, all dissertation analyses followed an inductive analysis procedure. Analysis took place in four steps. First, participants’ written responses were read to develop familiarity with the content. Second, responses were read individually and categorised by specific themes. Third, themes were reviewed and grouped together if deemed appropriate (e.g., “cardiovascular disease" and "diabetes" under "chronic disease"). Lastly, theme response frequency – defined as the number of participants reporting a given theme was tallied.

APPENDIX B:

STUDY ONE RESEARCH ETHICS CERTIFICATE

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB)

Certificate of Approval

PRINCIPAL INVESTIGATOR	DEPARTMENT	BEH#
Lawrence Brawley	Kinesiology	13-218

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED
University of Saskatchewan

STUDENT RESEARCHER(S)
Madelaine Gierc

FUNDER(S)
INTERNALLY FUNDED

TITLE
Defining Sedentary Behaviour

ORIGINAL REVIEW DATE	APPROVAL ON	APPROVAL OF:	EXPIRY DATE
20-Jun-2013	18-Jul-2013	Application for Behavioral Research Ethics Review Recruitment Script Part 1, 2 & 3 Letter of Information & Consent Form, Part 1, 2 & 3 Study Materials, Part 1 Debriefing Form, Part 1 and 3 Study Measures, Part 2 and 3 Transcript Release Form, Part 2	17-Jul-2014

Full Board Meeting ☐

Delegated Review ☒

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS

In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: http://www.usask.ca/research/ethics_review/

Beth Bilson

Beth Bilson, Chair
University of Saskatchewan
Behavioural Research Ethics Board

Please send all correspondence to: Research Ethics Office

APPENDIX C:

STUDY ONE QUESTIONNAIRE

Letter of Information and Consent

You are invited to participate in a research project on sedentary behaviour. Please read this page carefully, and feel free to ask any questions you may have.

Procedure – As a participant in this study, you will be asked to complete a 20 minute (approximately) online questionnaire.

Potential Risks and Benefits – There are no known risks associated with participation in this study. Results from this research will help in establishing the field of sedentary psychology.

Confidentiality – The questionnaire is completely anonymous. All information collected will be reported in group form. Confidentiality will be respected, and no individual identifying information will be released or published. The data will be kept for a period of five years, and will be securely stored in a locked office in our research laboratory. When the data is no longer required it will be destroyed.

Participation and Withdrawal – Your participation is entirely voluntary and anonymous. You can withdraw from the study at any time, or only answer questions with which you are entirely comfortable. There are no consequences if you choose to withdraw or leave questions blank.

Rights of Research Subjects – You may leave the study at any time during the online questionnaire simply by closing your browser. However, due to the anonymous nature of the data, you are unable to withdraw once the questionnaire has been submitted. If you have any questions concerning the research project, please feel free to contact the investigators at E-MAIL.

This project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board on July 18, 2013. Any questions regarding your rights as a participant may be addressed to the committee through the Research Ethics Office at E-MAIL, PHONE, or PHONE (toll-free).

Signature of Investigator – These are the terms under which we will conduct research. Thank-You for Your Participation! Larry Brawley, PhD, & Madelaine Gierc, MPH

1. **Consent** – By completing and submitting the following questionnaire your free and informed consent is implied and indicates that you understand the above conditions of participation in this study.

   [ ] I consent to participate
   [ ] I do not consent

Demographics

1. Current Age: ____ years
2. Gender: [ ] Male [ ] Female [ ] Transgender [ ] Other: _________
3. Ethnicity: [ ] Caucasian [ ] Black/African [ ] First Nations [ ] Hispanic/Latino [ ] Asian [ ] South-East Asian [ ] Middle Eastern [ ] Other: _________
4. What language do you speak at home? [ ] English [ ] Other: _________ [ ] French
5. What is your height? ____ meters
6. What is your weight? ____ kg
7. Have you been diagnosed with a chronic health condition? If so, please describe it briefly:
   ____
   ____
8. What is your highest level of education? [ ] High school or less [ ] College, trades school [ ] Some university, university
9. What is your current employment status? [ ] Employed [ ] Student [ ] Retired [ ] Other

Introduction

Thank-you for participating in our study!

This questionnaire is about sedentary behaviour. Some of the questions may seem strange, or ask you to think about things you wouldn't normally think about.

Please answer questions honestly and to the best of your ability. There is no right or wrong answer to any question – we are interested in learning about your thoughts and opinions!

Defining Sedentary Behaviour

1. Before this survey, had you ever heard the term "sedentary" before? 1-7 Definitely Not / Yes

2. Please describe what “sedentary” means to you. *For example, if we were asking about “being busy”, you might say “hurrying” or “getting lots done.” If you aren’t certain, give your best guess!*

   ____

   ____

3. What type of activities would you consider to be sedentary?

   ____

   ____

4. Thinking about the activities you just listed, do you think some are *more sedentary* than others? Why?

   ____

   ____

5. Thinking about the activities you just listed, do you think some are *less sedentary* than others? Why?

   ____

   ____

Sedentary Behaviour Engagement

1. Do you consider yourself to be sedentary or unsedentary? — 1-7 Highly Unsedentary / Sedentary
   a. Please describe why: ______________________________

2. Thinking about people who are similar to you in age and characteristics, are you more or less sedentary than others? — 1-7 More / Less Sedentary

3. What types of sedentary activities do you normally do?

   ____

   ____

4. Overall, do you think YOUR sedentary activities are healthy or unhealthy? — 1-7 Very Unhealthy / Healthy

5. What are some of the health and/or mental health **benefits** of your sedentary activity?

   ____

   ____

6. What are some of the health and/or mental health **risks** of your sedentary activity?

   ____

   ____

7. Would you like to increase or decrease your sedentary time? 1-7 Decrease / Increase

8. Is there a sedentary activity that you'd like to **increase** or **start doing**?

   ____

   a. What is one change that you'd make in order to do more of this activity?

      ____

      ____

9. Is there a sedentary activity that you'd like to **decrease** or **stop doing**?

   ____

   a. What would you do instead of this activity?

      ____

      ____

The Effect of Context and Environment – Instructions

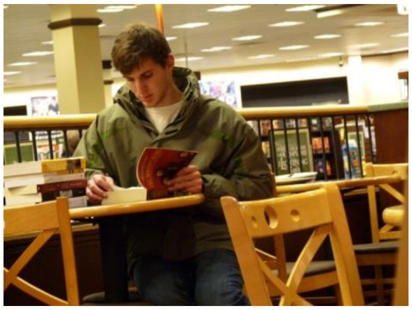
This next section will show you pictures of people doing certain activities.

Let's assume each person has been doing their activity for 30 minutes to 1 hour.

Each picture is followed by several short questions. There is no right or wrong answer – please give your honest opinion!

Photograph Stimuli

The following items were repeated for each of the photographs found on pp. 35



1. The man in this photograph is being …	1 = Unsedentary, 7 = Sedentary
2. The man in this photograph is being …	1 = Unhealthy, 7= Healthy
3. The man in this photograph is being …	1 = Unproductive, 7 = Productive
4. Would you like to do the same activity?	1 = No – Undesirable, 7 = Yes – Desirable

Sedentary Behaviour Self-Report – Instructions

The last part of this survey asks about how you spend a typical week day. We will list certain activities, and ask you to describe how much time you spend doing each one. If you do an activity for less than 15 minutes, do not count it. In the case where you do two activities at once (e.g., watching a movie and socialising), only count the main activity.

Because this might not be something that you usually think about, the questions may be a bit challenging. Feel free to use your agenda/calendar, or ask for help from the people around you.

There is no right or wrong response! Please answer honestly, and to the best of your ability!

Sedentary Behaviour Self-Report

1. Thinking about a typical week day, how many minutes per day do you normally spend …
    a. Eating meals _______ minutes
    b. Driving a car _______ minutes
    c. Sitting on the bus or subway _______ minutes
    d. Office or desk work _______ minutes
    e. Studying _______ minutes
    f. Leisure reading _______ minutes
    g. Watching TV or movies _______ minutes
    h. Playing video or computer games _______ minutes
    i. Using a computer, tablet, or phone _______ minutes
    j. Inactive socialising, like talking on the phone _______ minutes
    k. Hobbies, like puzzles or knitting _______ minutes
    l. Any other sedentary activity _______ minutes

2. On a typical weekday, for how many minutes are you physically active during leisure time? *Physical activity" means your body feels a bit warmer, your breathing increases, your heart pumps faster, and you might start to sweat.* ________ minutes

Debriefing Note

Thank-You for Participating! This questionnaire represents a first step in understanding sedentary behaviour.

Research has established a relationship between sedentary activities and poor health outcomes. However, because many activities (like sitting at a computer or the dinner table) are part of ordinary life, it is important to properly understand the behaviour before developing health interventions.

If you would like additional information on sedentary behaviour or this research, please feel free to contact us at E-MAIL.

Any questions regarding your rights as a participant may be addressed to the University of Saskatchewan Research Ethics Board at E-MAIL, PHONE, or PHONE (toll-free).

APPENDIX D:

STUDY TWO VIGNETTE PILOT

Overview

Prior to initiating Study Two, a pilot project was conducted to examine the quality and effectiveness of the experimental vignettes. A total of four vignettes were developed and subsequently tested: two vignettes described a *work* task (writing a paper for school), and two described a *leisure* activity (watching television in a dormitory common room). These activities were selected in that they were believed to (1) capture motivated behaviours that (2) are relevant to a university student audience, while (3) describing distinct behavioural domains. The vignettes also varied by posture: the student was described as either *sitting* or *standing* for the period of one hour.

Following the recommendations of Paddam et al (2010), vignettes were developed to be brief and easy-to-read with "enough contextual information to allow participants to understand the target situation, while remaining slightly ambiguous" (pp. 63). The vignettes were written in a second-person, with no reference to age, sex, academic program, or year of study. Additionally, no information on sedentary behaviour (e.g., its definition or health implications) was provided. Vignette reading level was estimated to be 4.6, (Flesch, 1944; Microsoft Word, 2010), suggestive that a university student audience would have little difficulty reading the text. The four pilot tested vignettes were as follows:

> **Studying/Sitting** – It's a weekday afternoon, and you have some time between classes. You have a paper due in a week, and want to make some progress on it. You head to the library. It's crowded, but you manage to find a seat at a table. You sit down and set-up your workstation. You plan on studying for the next hour.

> **Studying/Standing** – It's a weekday afternoon, and you have some time between classes. You have a paper due in a week, and want to make some progress on it. You head to the library. It's crowded, and all the seats are full. There is a free space at a standing-height desk, but no chair – you must stand up to work. You set-up your workstation. You plan on studying for the next hour.

Watching TV/Sitting – You live in an on-campus dormitory. You arrive home after a long day of classes and studying, eat dinner, and do some chores. One of your favourite TV shows is on tonight. You leave your room and walk down to the lounge. The room is crowded with other viewers, but you find a seat. You plan on watching TV for the next hour.

Watching TV/Standing – You live in an on-campus dormitory. You arrive home after a long day of classes and studying, eat dinner, and do some chores. One of your favourite TV shows is on tonight. You leave your room and walk down to the lounge. The room is crowded with other viewers, and you can't find a seat – you stand up instead. You plan on watching TV for the next hour.

Method

As the purpose of this pilot study was to assess the vignettes as a research tool, – and thus inform the design of Study Two – Research Ethics Board approval was not required (Article 6.11, Panel of Research Ethics, Government of Canada, 2015). That noted, study design followed established ethical practices: the survey was completed anonymously; participants were asked to read a Letter of Information and indicate electronic consent; participants were free to exit the study at any time and for any reason; and participants were provided with both a debriefing letter and researcher contact information if questions emerged at a later date.

Participants

Participants were recruited online via the University of Saskatchewan PAWS bulletin board system. Interested participants were automatically directed to the online survey via hyperlink. For maximum reach, no inclusion or exclusion criteria were set. A total of 242 individuals accessed the survey, of which 194 (79%) participants completed the survey in whole. The final sample had a mean age of 23.91 (SD = 7.47) years, was 67.2% female, and was primarily composed of undergraduate students (79.3%).

Measures

Demographic variables. Information regarding participant age, gender, and primary role at the University of Saskatchewan (undergraduate student, graduate student, faculty, staff, or other) were collected for descriptive purposes.

Manipulation salience. After reading each vignette, participants were asked to identify which activity and posture had been described in-text. These questions were used to assess participant attention to the vignette content and to judge whether the two experimental manipulations (i.e., posture and activity) were of sufficient strength so as to be reliably detected.

Vignette realism. Vignette realism was assessed with a single item, "This vignette describes a realistic scenario." Participants rated their level of agreement on a 1 (Strongly Disagree) to 10 (Strongly Agree) scale.

Vignette clarity. Vignette clarity was assessed with two items, "This vignette was easy to read," and, "This vignette was easy to understand." Participants rated their level of agreement on a 1 (Strongly Disagree) to 10 (Strongly Agree) scale.

Open-ended comments. After completing the scaled items, participants were provided with a comment box for any additional remarks or concerns.

Procedure

Participants were recruited online, and were able to access the survey directly via hyperlink. After indicating consent and completing the demographic items, participants were presented with the vignettes. The vignettes were presented individually, and with each vignette immediately followed by the manipulation check items (i.e., salience, clarity, realism, and open-ended comments). To reduce the risk of order effects, vignette order was randomised.

Analytical Plan

Data management strategies were used to address issues of missing data, the presence of outliers, and to assess statistical assumptions. Qualitative data was analysed using an inductive content analysis procedure. The same data management procedures were used for all studies in this dissertation, and are outlined in detail in Appendix A.

Data was analysed using SPSS version 22 (IBM, 2013). Analysis took place in three stages. First, descriptive statistics (means and standard deviations) were calculated for the five quantitative items, so as to assess (1) the salience of experimental manipulations and (2) vignette clarity and realism. Next, a two-way repeated measures multivariate analysis of variance (MANOVA) was conducted. The two independent variables were posture (sit/stand) and activity (studying/television); while the three dependent variables were vignette readability, understandability, and realism. Following statistical convention, results were deemed statistically significant and follow-up analyses run (ANOVA, Cohen's effect sizes) if $p < 0.05$. Lastly, qualitative responses were inductively analysed for further insight into how to improve vignettes.

Results

Statistical Assumptions

Statistical assumptions were examined prior to running primary analyses. No outliers were detected, and skew and kurtosis fell within an acceptable range. Examination of multivariate assumptions indicated that homogeneity of variance was violated for two of three dependent variables. Thus, Welch's ANOVA were used for follow-up analyses.

Descriptive Statistics

Across the four vignettes, participants reported high levels of vignette readability (M = 9.22/10, SD = 1.40) and understandability (M = 9.18/10, SD = 1.60), and generally agreed that

Table 32 – Vignette pilot responses

	Study/Sit	Study/Stand	TV/Sit	TV/Stand
Correct Activity	92.7%	91.1%	92.7%	91.7%
Correct Posture	94.3%	98.5%	95.3%	99.5%
Realism	8.4 ± 1.9	5.5 ± 3.1	8.4 ± 2.3	6.5 ± 3.0
Readability	9.4 ± 1.3	9.2 ± 1.4	9.3 ± 1.3	9.1 ± 1.6
Understandability	9.3 ± 1.6	9.2 ± 1.5	9.4 ± 1.3	8.9 ±1.8

the vignettes described a realistic scenario ($M = 7.19$, $SD = 2.919$). The majority of participants correctly identified each vignette's activity (92.1% correct responses) and posture (96.6% correct responses). Complete descriptive statistics can be found in Table 32.

Between-Vignette Differences

Repeated-measures MANOVA was conducted to examine whether vignettes significantly varied by activity type and posture. A significant main effect was observed for both posture and activity, $\Lambda = 0.822$, $F\ (3, 747) = 54.074$, $p < 0.001$, and $\Lambda = 0.988$, $F\ (3, 747) = 3.018$, $p < 0.05$, respectively. For activity type, analyses indicated that studying vignettes were seen as being less realistic than television vignettes, $p < 0.05$, $d = -0.16$. However, all values for realism were above the mean. There were no between-activity differences for vignette readability, $p > 0.05$, $d = 0.06$, or vignette understandability, $p > 0.05$, $d = 0.06$. For posture, significant differences were observed for vignette realism, $p < 0.001$, $d = 0.91$, and vignette readability, $p < 0.05$, $d = 0.14$. No significant postural differences were observed for vignette understandability, $p > 0.05$, $d = 0.014$.

Qualitative Results

Participants' open-ended responses fell under four major themes. First, in regards to standing, a number of participants noted that if they encountered a situation where no seats were available, they would leave, find a chair elsewhere, and/or sit on the floor. Such responses included, "Depending on the type of work, I might consider looking for a different location on campus at which to sit" (male, age 47), and "Do standing studying stations actually exist? And if so, who would use them? I'd rather just sit down on the floor, thanks" (male, age 19). Second, participants commented on the general realism of the described activity. For example, some participants noted that the studying scenario was unrealistic for them given a personal dislike for working in the library. Others focused on the realism of the television-watching scenario, such as having no experience living in dormitories. Third, participants made general comments regarding grammatical and stylistic issues, such as "The beginning is awkward" (female, age 20). Finally, participants reported inconsistency between the terms "studying" and "writing a paper", noting that they describe different classes of behaviour. For example, one participant wrote: "described as needing to work on a paper but then set up to study = confusing" (female, age 28).

Discussion

The purpose of this pilot study was to assess the general clarity, realism, and manipulation salience of Study Two's four experimental vignettes. To a large extent, participants' quantitative responses indicated that the vignettes were clear and perceived as being realistic, and that the intended manipulations were sufficiently salient.

While repeated-measures MANOVA indicated the occurrence of between-vignette differences, the decision was made to *not* significantly change the vignettes prior to launching Study Two. Rationale for this decision was two-fold. First, given that participants' rated the vignettes highly overall (i.e., 9/10), it seemed unlikely that a re-write would significantly improve vignette quality. Second, most of the calculated effect sizes fell below the threshold of a "small effect" (i.e., < 0.20; Cohen, 1988), suggestive that the differences between vignettes – though statistically significant – were not highly meaningful. The exception to this was perceptions of vignette realism between sitting and standing vignettes, which was associated with a large effect size, $d = 0.91$. However, participants' open-ended responses suggested that this was likely due to the novelty and/or dislike of standing *rather than* being a by-product of the vignettes themselves.

Informed by participants' open-ended responses, two minor changes were made to vignette content. First, the studying vignette was modified so that the student was described as studying for an upcoming examination rather than writing a paper. This was to ensure consistency between terms used. Second, the watching television vignette was reframed so that the student was described as watching television in an apartment with friends rather than in a dormitory common room. This was to ensure more students could relate to the television scenario. The final version of the four vignettes can be viewed under Study Two, Table 12, pp. 75.

APPENDIX E:

STUDY TWO RESEARCH ETHICS CERTIFICATE

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board

Certificate of Approval

PRINCIPAL INVESTIGATOR	DEPARTMENT	BEH#
Lawrence Brawley	Kinesiology	14-422

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED
University of Saskatchewan

STUDENT RESEARCHER(S)
Madelaine Gierc

FUNDER(S)
UNFUNDED

TITLE
Sedentary Activities in University Students

ORIGINAL REVIEW DATE	APPROVAL ON	APPROVAL OF:	EXPIRY DATE
25-Nov-2014	03-Dec-2014	APPLICATION FOR BEHAVIOURAL RESEARCH ETHICS REVIEW Recruitment Poster Survey Implied Consent Form Survey	02-Dec-2015

Full Board Meeting ☐

Delegated Review ☒

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS

In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: *http://www.usask.ca/research/ethics_review/*

Beryl Radcliffe for:

Jamie Campbell, Vice-Chair
University of Saskatchewan
Behavioural Research Ethics Board

APPENDIX F:

STUDY TWO QUESTIONNAIRE

Eligibility Screening

1. The purpose of this study is to examine two different behaviours - studying and watching TV - in post-secondary students. Are you currently a college, university, or post-secondary student?

   [ ] Yes, I am a student
   [ ] No, I am not a student

Letter of Information and Consent

Purpose – The purpose of this study is to examine the psychological factors associated with two common activities – studying and watching television – in university students.

Procedures – Participants will be asked to read and respond to four vignettes. In total, the questionnaire takes approximately 20 minutes to complete.

Potential Risks & Benefits – There are no known or anticipated risks to participation. This research will help identify some of the psychological elements associated with students' everyday behaviour.

Compensation – At the end of the survey, participants will have the opportunity to enter into a draw for 1 of 5 $20 gift certificates. If you choose to enter, your name and contact details will **not** be linked to your survey data.

Confidentiality – This survey is completely anonymous. All information collected will be reported in group form. Confidentiality will be respected, and no individual identifying information will be released or published. Data will be kept for a period of five years, and will be securely stored in a locked office in our research laboratory. When the data is no longer required it will be destroyed.

This survey is hosted by Fluid Survey, a USA owned company and subject to US laws and whose servers are located outside of Canada. The privacy of the information you provide is subject to the laws of those other jurisdictions. By participating in this survey you acknowledge and agree that your data will be stored and accessed outside of Canada and may or may not receive the same level of privacy protection.

Right to Withdraw – Your participation is entirely voluntary. You can withdraw from the study at any time simply by closing your browser. You may also omit questions that you are not comfortable answering. There are no consequences if you choose to withdraw or leave questions blank. Due to the anonymous nature of the survey, we are unable to withdraw data once the questionnaire has been submitted.

Questions & Results – If you have any questions, or wish to obtain a copy of results, please do not hesitate to contact Madelaine Gierc (MPH, E-MAIL) or Dr. Larry Brawley (PhD, E-MAIL).

Research Ethics – This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office at E-MAIL or PHONE. Out of town participants may call toll free at PHONE.

1. **Consent** – By completing and submitting the following questionnaire your free and informed consent is implied and indicates that you understand the above conditions of participation in this study	[ ] I consent to participate [ ] I do not consent

Demographics

1.	Current Age:	____ years	
2.	Gender:	[ ] Male [ ] Transgender	[ ] Female [ ] Other: _________
3.	What is your height?	____ meters	
4.	What is your weight?	____ kg	
5.	Ethnicity:	[ ] Caucasian [ ] First Nations [ ] Asian [ ] Middle Eastern	[ ] Black/African [ ] Hispanic/Latino [ ] South-East Asian [ ] Other: _________
6.	How many years have you been in university for?	________ years	
7.	What degree are you studying for?	[ ] Diploma / Certificate [ ] Undergraduate [ ] Master's [ ] PhD [ ] Professional Degree (MD, JD, etc.) [ ] Other: _________	
8.	Are you studying full- or part-time?	[ ] Part-time (1-2 classes) [ ] Full-time (3+ classes) [ ] Co-Op / Practicum / Work Term	

9. Do you work outside school?	[ ] Yes, full-time [ ] Yes, part-time [ ] No

Self-Report Physical Activity

1. Over the past two weeks, have you participated in any leisure-time physical activity? *e.g., hockey, volleyball, karate, weights, walking, running, swimming, swing dance, etc.*	[ ] Yes [ ] No

If "Yes" …

2. On average, how many times PER WEEK do you participate in leisure exercise?	________ times per week	
3. How long does your typical session	[ ] 0-14 min [ ] 15-29 min [ ] 30-44 min	[ ] 45-60 min [ ] 60+ min
4. What intensity do you normally exercise at?	[ ] Light – you can talk and sing [ ] Moderate – you can talk, but not sing [ ] Vigorous – you can only say a few Words	
5. My main motivation for exercising is:	___________________________________	

Vignette Introduction

You will now be presented with four short vignettes followed by a set of questions. Some of the vignettes are similar to each other, so please read them carefully!

The questions ask for your opinions, thoughts, and reactions - there is no right or wrong answer!

Studying Vignettes

Imagine yourself in the following situation ...

It's a weekday afternoon, and you have a gap between classes. Normally you'd spend your time relaxing – but today's different. You have a big exam coming up, and really want to do well on it. You head to the library to study ...

Sitting: *... It's crowded, but you manage to find a seat at a table. You sit down and pull out your notes. You plan on studying for the next hour.*

Standing: *… It's crowded, and all the seats are full. There is a free space at a standing-height desk, but no chair – you must stand up to work. You pull out your notes. You plan on studying for the next hour.*

1. In this situation, how confident are you that you will be able to …

i.	Study without distraction	0 = Not Confident, 100 = Very Confident
ii.	Engage with the material	0 = Not Confident, 100 = Very Confident
iii.	Make progress on your studying	0 = Not Confident, 100 = Very Confident
iv.	Keep your mind from wandering	0 = Not Confident, 100 = Very Confident
v.	Think critically	0 = Not Confident, 100 = Very Confident
vi.	Put good effort toward your work	0 = Not Confident, 100 = Very Confident
vii.	Avoid distractions	0 = Not Confident, 100 = Very Confident
viii.	Think creatively	0 = Not Confident, 100 = Very Confident
ix.	Focus on the task	0 = Not Confident, 100 = Very Confident

2. In this situation, I will be able to …

a.	Produce quality work	1 = Not Likely, 10 = Very Likely
b.	Work toward my academic goals	1 = Not Likely, 10 = Very Likely
c.	Find the time pleasurable	1 = Not Likely, 10 = Very Likely
d.	Be mentally stimulated	1 = Not Likely, 10 = Very Likely
e.	Finish what I need to	1 = Not Likely, 10 = Very Likely
f.	Enjoy my time studying	1 = Not Likely, 10 = Very Likely
g.	Be able to relax	1 = Not Likely, 10 = Very Likely
h.	Understand the material	1 = Not Likely, 10 = Very Likely
i.	Grasp tough concepts	1 = Not Likely, 10 = Very Likely

3. At the end of the 60 minutes, how will you expect to feel physically?
    a. Head & Neck -5 = Very Bad, +5 = Very Good
    b. Shoulders & Back -5 = Very Bad, +5 = Very Good
    c. Arms & Hands -5 = Very Bad, +5 = Very Good
    d. Trunk -5 = Very Bad, +5 = Very Good
    e. Hips & Butt -5 = Very Bad, +5 = Very Good
    f. Legs & Feet -5 = Very Bad, +5 = Very Good
4. Out of the 60 minutes, how many minutes would you be able to engage in productive work? 0 to 60 Minutes
5. At the end of the hour, how satisfied would you be with your progress? 1 = Very Unsatisfied, 10 = Very Satisfied

Television Vignettes

Imagine yourself in the following situation ...

You share an apartment with three other roommates. The four of you get along really well, and often hang out. One of your favourite activities is watching a TV show together once a week. This week, your roommates have invited some friends over to watch TV with you …

Sitting: … *Your apartment is crowded, but you manage to find a seat. You plan on watching TV for the next hour.*

Studying: … *Your apartment is crowded, and you can't find a seat – you stand up instead. You plan on watching TV for the next hour.*

1. In this situation, how confident are you that you will be able to …
    a. Watch without distraction 0 = Not Confident, 100 = Very Confident
    b. Think critically 0 = Not Confident, 100 = Very Confident
    c. Get into the show 0 = Not Confident, 100 = Very Confident
    d. Keep your mind from wandering 0 = Not Confident, 100 = Very Confident
    e. Think creatively 0 = Not Confident, 100 = Very Confident

f. Engage with the show — 0 = Not Confident, 100 = Very Confident

2. In this situation, I will be able to …

a. Have fun	0 = Not Likely, 10 = Very Likely
b. Be mentally stimulated	0 = Not Likely, 10 = Very Likely
c. De-stress	0 = Not Likely, 10 = Very Likely
d. Find the show pleasurable	0 = Not Likely, 10 = Very Likely
e. Relax	0 = Not Likely, 10 = Very Likely
f. Disconnect from the day	0 = Not Likely, 10 = Very Likely
g. Enjoy my time watching	0 = Not Likely, 10 = Very Likely

3. At the end of the 60 minutes, how will you expect to feel physically?

a. Head & Neck	0 = Very Bad, 10 = Very Good
b. Shoulders & Back	0 = Very Bad, 10 = Very Good
c. Arms & Hands	0 = Very Bad, 10 = Very Good
d. Trunk	0 = Very Bad, 10 = Very Good
e. Hips & Butt	0 = Very Bad, 10 = Very Good
f. Legs & Feet	0 = Very Bad, 10 = Very Good

4. Out of the 60 minutes, how many minutes would you be able to watch for?	0 to 60 Minutes
5. At the end of the hour, how satisfied would you be with your time?	1 = Very Unsatisfied, 10 = Very Satisfied

Posture Preferences – Studying

1. A number of different factors (like the ability to pay attention) are important for studying. Likewise, when we study, we might have multiple goals in mind (e.g., grasping a complex concept, passing a class).

   Think about studying for an hour. You're given the choice between studying while (1) sitting at a traditional desk or (2) standing at a standing-height desk. Which posture – sitting or standing – would best support the following outcomes?

   a. Concentration — -5 = Sitting, +5 = Standing

b. Ability to think creatively	-5 = Sitting, +5 = Standing
c. Preserving my energy	-5 = Sitting, +5 = Standing
d. Getting everything done	-5 = Sitting, +5 = Standing
e. Understanding the material	-5 = Sitting, +5 = Standing
f. Focusing on my work	-5 = Sitting, +5 = Standing
g. Producing quality work	-5 = Sitting, +5 = Standing
h. Helping me pass an assignment	-5 = Sitting, +5 = Standing
i. Ability to think critically	-5 = Sitting, +5 = Standing
j. Avoiding distractions	-5 = Sitting, +5 = Standing
k. Boosting my energy	-5 = Sitting, +5 = Standing
l. Aiding my memory	-5 = Sitting, +5 = Standing
m. Enjoying my work	-5 = Sitting, +5 = Standing
n. Being relaxed	-5 = Sitting, +5 = Standing
o. Helping me pass the class	-5 = Sitting, +5 = Standing
p. Engaging with the material	-5 = Sitting, +5 = Standing

2. What is the longest amount of time you'd consider **sitting** and studying for?	____ hours and ____ minutes
3. What is the longest amount of time you'd consider **standing** and studying for?	____ hours and ____ minutes
4. If given the choice, I'd prefer to study while …	-5 = Sitting, +5 = Standing
5. Most people expect me to study while …	-5 = Sitting, +5 = Standing

Posture: Sitting or Standing While Watching Television

1. Like studying, we sometimes approach TV with a goal or purpose in mind. Likewise, a number of different factors can affect our TV experience.

Think about watching TV for an hour. You're given the choice between watching while (1) sitting on a couch or (2) standing up. Which posture – sitting or standing – would best support the following outcomes?

a. Concentration	-5 = Sitting, +5 = Standing
b. Ability to think creatively	-5 = Sitting, +5 = Standing
c. Understanding the show's plot	-5 = Sitting, +5 = Standing
d. Preserving my energy	-5 = Sitting, +5 = Standing
e. Focusing on the show	-5 = Sitting, +5 = Standing
f. Helping me disconnect	-5 = Sitting, +5 = Standing
g. Avoiding distractions	-5 = Sitting, +5 = Standing
h. Aiding my memory	-5 = Sitting, +5 = Standing
i. Enjoying the show	-5 = Sitting, +5 = Standing
j. Being relaxed	-5 = Sitting, +5 = Standing
k. Boosting my energy	-5 = Sitting, +5 = Standing
l. Helping me de-stress	-5 = Sitting, +5 = Standing
m. Engaging with the show	-5 = Sitting, +5 = Standing
n. Helping me pass the class	-5 = Sitting, +5 = Standing
o. Engaging with the material	-5 = Sitting, +5 = Standing

2. What is the longest amount of time you'd consider sitting and watching TV for?	____ hours and ____minutes
3. What is the longest amount of time you'd consider **standing** and watching TV for?	____ hours and ____ minutes
4. If given the choice, I'd prefer to study while …	-5 = Sitting, +5 = Standing
5. Most people expect me to study while …	-5 = Sitting, +5 = Standing

Sedentary Behaviour Intervention

1. If your university offered an alternative lecture format, where students stood up during class, would you be interested in participating?	1 = Not Interested, 10 = Very Interested
2. If your university offered an alternative lecture format, where students could break-up their sitting time every 20 minutes (i.e., have a “standing break”), would you be interested in participating?	1 = Not Interested, 10 = Very Interested
3. Overall, would you be interested in learning about ways to reduce your sitting at school?	1 = Not Interested, 10 = Very Interested
4. Overall, would you be interested in learning about ways to reduce your sedentary behaviour at home?	1 = Not Interested, 10 = Very Interested
5. If you wanted to, how confident are you that you could reduce your sitting while studying?	0 = Not Confident, 100 = Very Confident
6. If you wanted to, how confident are you that you could reduce your sitting while watching TV?	0 = Not Confident, 100 = Very Confident
7. How would reducing your sitting affect your physical health?	0 = Many Costs, 10 = Many Benefits
8. How would reducing your sitting affect your mental health?	0 = Many Costs, 10 = Many Benefits
9. How would reducing your sitting affect your social life?	0 = Many Costs, 10 = Many Benefits

10. Do you have any other questions or comments about sedentary behaviour interventions?

____

____

APPENDIX G:

STUDY THREE MESSAGING PILOT

Overview

Public awareness of sedentary behaviour began to build in 2010 following a series of news media articles. Since then, journalists, health professionals, and sedentary behaviour researchers have relied heavily on health messages to both inform the public of the risks of sedentary behaviour and to prompt intervention. Despite this, research on the efficacy of sedentary health messages is limited and there are many methodological shortcomings: for instance, studies often compare sedentary behaviour and physical activity messages *rather than* specifically examining sedentary behaviour messages. Likewise, most publications have emphasised behavioural outcomes; few have examined psychological mediators. As such, a number of questions remain regarding sedentary behaviour messages. Are gain-frame or loss-frame more effective at increasing awareness? Does the type of health risk discussed matter? Which individuals/populations are most impacted by sedentary messages?

The primary purpose of the current pilot study was to develop and test three health messages for use in Study Three (pp. 100). Similar to Study Two's pilot work (Appendix D), it aimed to assess message readability, quality, and manipulation salience. A secondary purpose was to develop preliminary insight into the effect of the health messages on individuals' perceptions of sedentary behaviour. Two questions were asked: (1) Can a brief health message produce significant changes in individuals' perceptions of sedentary behaviour?; and, (2) Does the type of risk information communicated have a significant impact on individuals' perceptions of sedentary behaviour?

Three messages were developed: attention-control, proximal health risks ("proximal"), and distal health risks ("distal"). The *attention control* message discussed sedentary behaviour research methods, such as difficulty with measuring sedentary behaviour. It did not discuss health information. The *proximal message* focused on the short-term consequences of sedentary behaviour, such as “sore muscles”. Risk items were informed by Study One (see pp. 43 and pp. 51) and the ergonomics/occupational health literature. Lastly, the *distal message* described the long-term consequences of sedentary behaviour, as is emphasised in modern sedentary research (e.g., “diabetes” and “cardiovascular disease”). The three messages were developed to be brief and easy-to-read, and efforts were made to avoid technical jargon that may be confusing to the general audience (e.g., using “weak bones” rather than “bone mineral loss”). The messages had a mean word count of 263 words (control = 253, proximal = 272, distal = 264) and a mean Flesch-Kincaid reading leave of grade 7.6 (control = 7.3, proximal = 7.7, distal = 7.8; Flesch, 1994; Microsoft Word, 2010).

Method

As the purpose of this pilot study was to assess the messages as a research tool, – and thus inform the design of Study Three – Research Ethics Board approval was not required (Article 6.11, Panel of Research Ethics, Government of Canada, 2015). That noted, study design followed established ethical practices: the survey was completed anonymously; participants were asked to read a Letter of Information and indicate electronic consent; participants were free to exit the study at any time and for any reason; and participants were provided with both a debriefing letter and researcher contact information if questions emerged at a later date.

Participants

Participants were recruited online via the University of Saskatchewan PAWS bulletin board. Interested participants were automatically directed to the online survey via hyperlink. For maximum reach, no inclusion or exclusion criteria were set. The online survey was accessed by

210 individuals, with 175 (83.3%) participants completing the questionnaire in full. The final sample had a mean age of 26.9 (*SD* = 10.2) years, was 82.3% female, and 82.9% Caucasian.

Measures

Demographic and health information. Basic demographic information, including age, ethnicity, and employment status, were collected for descriptive purposes. Health status information included BMI (via self-reported height and weight), perceived health, and chronic disease diagnosis.

Self-report sedentary behaviour. After being presented with a definition of sedentary behaviour, participants were prompted to think about a typical work or school day. They were asked: “On a typical day, roughly what percentage of your time do you spend in sedentary behaviour?” Answers were scored on a 0% (None of My Time) to 100% (All of My Time) scale.

Baseline beliefs. After completing demographic and self-report items, participants were asked a series of questions on their baseline (1) knowledge and (2) perceptions of sedentary behaviour. Knowledge questions focused on factual information, such as: “True or false? Watching TV is the worst type of sedentary behaviour there is.” Perceptual items emphasised participants’ personal sedentary behaviour, such as “Are you worried about your level of sedentary behaviour?”

Message recall. Immediately following the sedentary behaviour messages, participants were asked three multiple choice questions on the material contained within the message. The purpose of these questions was to assess the degree to which participants attended to and retained their message.

Message clarity. Three items assessed message clarity: “The text was easy to read,” “The text was easy to understand,” and, “The text made sense.” All items were scored on a 1 (Strongly Disagree) to 10 (Strongly Agree) scale.

Message quality. Three items assessed message quality: “This message taught me something new,” “The information presented seemed factual,” and “The information presented seemed legitimate.” All items were scored on a 1 (Strongly Disagree) to 10 (Strongly Agree) scale.

Post-message beliefs. Nine final items examined participants’ perceptions of sedentary behaviour *after* receipt of the health message. Questions included whether sedentary behaviour was viewed as a public health risk (e.g., “I think most people should be worried about their sedentary behaviour”) and whether individuals viewed sedentary behaviour reduction as being beneficial (e.g., “Reducing sedentary behaviour is important to my short-term health”). All items were scored on a 1 (Strongly Disagree) to 10 (Strongly Agree) scale.

Procedure

The study followed a randomised between-group design. After completing the consent form, demographic and health information, and being presented with the definition of sedentary behaviour, participants were asked a series of questions to assess their baseline sedentary behaviour beliefs. Next, participants were randomised to receive one of three sedentary behaviour messages: attention-control, proximal, or distal. Immediately after receiving the message, participants completed items on message recall and quality, and post-message items on sedentary behaviour.

Analytical Plan

Data management strategies were used to address issues of missing data, the presence of outliers, and to assess statistical assumptions. Qualitative data was analysed using an inductive content analysis procedure. The same data management procedures were used for all studies in this dissertation, and are outlined in detail in Appendix A. Data were analysed using SPSS version 22 (IBM, 2013).

Primary analysis. Message quality was assessed in three stages. First, descriptive statistics (e.g., means and standard deviations) were calculated for quantitative items, so as to assess (1) message recall and (2) message quality. Next, multivariate analysis of variance (MANOVA) was conducted to examine the presence of between-message differences. Following convention, results were deemed statistically significant and follow-up analyses run (ANOVA, *T*-tests, Cohen's effect sizes) if $p < 0.05$. Lastly, qualitative responses were inductively analysed for further insight into how to improve the messages.

Secondary analysis. Follow-up describe analyses (means and standard deviations) was used to examine participants' baseline and post-message understanding of sedentary behaviour. To examine whether the health messages had a significant impact on participants' beliefs, two between-groups MANOVAs were conducted. The first MANOVA contrasted receiving versus not receiving health risk information: that is, proximal/distal ("Risk") versus attention-control ("No-Risk"). The second MANOVA specifically contrasted proximal and distal participants. Follow-up analysis included ANOVA and Cohen's effect sizes.

Results

Statistical Assumptions

Statistical assumptions were examined prior to running primary analyses. No outliers were detected, and skew and kurtosis fell in an acceptable range. Homogeneity of variance was violated when contrasting Risk versus No-Risk participants. However, this was anticipated due to non-equivalent sample sizes (i.e., a 1:2 ratio). Thus, Welch's ANOVA was used for follow-up analyses.

Group Equivalency

One-way ANOVA and chi-squared analysis was used to explore differences between the three health message groups. Analysis indicated no significant between-group differences in demographics, health status, or baseline sedentary behaviour beliefs, ps > 0.05.

Baseline Sedentary Behaviour Beliefs

Completive descriptive statistics regarding participants' baseline perceptions can be found in Table 33.

Definitional knowledge. Overall, participants reported being familiar with the term "sedentary" prior to beginning the research study, with a mean familiarity score of 7.37 (SD = 5.59) on a -10 to +10 scale. A total of 22 (12.57%) of participants reported a score below the midpoint. After receiving a definition of sedentary behaviour, participants reported having a high understanding of sedentary behaviour, with a mean score of 8.11 (SD = 3.82) on a -10 to +10 scale. A total of 10 (5.7%) participants reported a score below the midpoint.

Sedentary behaviour and health. Individuals reported spending 68.7% (SD = 19.9%) of a typical work/school day engaged in sedentary behaviour. When asked to compare their

Table 33 – Baseline perceptions of sedentary behaviour

		Total (N = 175)	Control (N = 64)	Proximal (N = 52)	Distal (N = 59)
1.	Had you heard of SB before this study?	7.37 ± 5.59	6.80 ± 6.25	7.54 ± 5.47	7.85 ± 4.93
2.	Do you understand what SB is?	8.11 ± 3.82	7.44 ± 4.55	8.19 ± 3.87	8.78 ± 2.67
3.	Are you more or less sedentary than peers?	-0.51 ± 4.86	-0.02 ± 4.67	-0.96 ± 4.96	-0.64 ± 5.02
4.	Does your SB affect your health?	-4.81 ± 4.23	-5.17 ± 4.33	-4.79 ± 3.83	-4.44 ± 4.64
5.	Are you worried about your SB?	-0.92 ± 5.72	-2.05 ± 5.42	1.15 ± 5.85	-1.53 ± 5.19
6.	Over the past 2 weeks, have you purposefully attempted to reduce your SB?	2.39 ± 6.21	1.39 ± 6.09	3.94 ± 5.53	2.12 ± 6.71

Note: All items fell on a -10 to +10 scale, with the following anchor points: 1. Definitely No/Yes; 2. Poor/Good Understanding; 3. Much Less/More; 4. Very Harmful/Beneficial; 5. Not/Very Worried; and 6. Definitely No/Yes.

sedentary behaviour to their peers, participants indicated that they were approximately average, reporting a mean score of -0.51 (*SD* = 4.86) on a -10 to +10 scale. In terms of health outcomes, participants viewed their sedentary behaviour as being moderately harmful to their health, with a mean score of -4.81 (*SD* = 4.23) on a -10 to +10 scale. That noted, participants reported relatively low concern regarding their sedentary behaviour (*M* = 0.92, *SD* = 5.72) and engaging in a few efforts to reduce their sedentary behaviour (*M* = 2.36, *SD* = 6.21).

Baseline knowledge of sedentary behaviour. Participants' pre-message knowledge was assessed with five questions. A detailed overview of participants' response patterns can be found in Table 34. Out of a possible score of 11, participants averaged 8.04 (*SD* = 1.08) correct answers (range = 4 to 11).

Table 34 – Baseline knowledge of sedentary behaviour

	Total (N = 175)	Control (N = 64)	Proximal (N = 52)	Distal (N = 59)
Correct Responses / 11	8.04 ± 1.08	8.25 ± 1.03	7.98 ± 0.89	7.85 ± 1.25
1. Not counting sleep, the average Canadian is sedentary for _____ each day.				
4 hours	4.6%	3.1%	3.8%	6.8%
8 hours	**34.3%**	29.7%	28.8%	**44.1%**
10 hours	33.1%	**40.6%**	**30.8%**	27.1%
12 hours	22.3%	23.4%	25.0%	18.6%
16 hours	2.3%	1.6%	5.8%	0.0%
I'm not sure	2.9%	1.6%	3.8%	3.4%
2. True or false? Watching TV is the worst type of sedentary behaviour there is.				
True	**50.3%**	**43.8%**	**57.7%**	**50.8%**
False	20.6%	20.3%	13.5%	27.1%
I'm not sure	28.6%	34.4%	28.8%	22.0%
3. Which of the following activities are sedentary? Check all that apply.				
Gentle walks	1.1%	1.6%	0.0%	1.7%
Using the computer	**98.9%**	**100%**	**100%**	**96.6%**
Reading	**95.4%**	**96.9%**	**94.2%**	**94.9%**
Yoga	1.1%	0.0%	0.0%	3.4%
Working at a desk	**99.4%**	**100%**	**100%**	**98.3%**
Gardening	2.3%	3.1%	1.9%	1.7%
Eating	**82.3%**	**85.9%**	**88.5%**	**72.9%**
4. Are men or women more sedentary?				
Men	14.3%	12.5%	11.5%	18.6%
Women	19.4%	20.3%	21.2%	16.9%
Both are equal	31.4%	32.8%	**34.6%**	27.1%
I'm not sure	**34.9%**	**34.4%**	32.7%	**37.3%**
5. True or false? It's OK to sit a lot, so long as you exercise regularly.				
True	25.1%	20.3%	26.9%	28.8%
False	**60.0%**	**64.1%**	**59.6%**	**55.9%**
I'm not sure	14.9%	15.6%	13.5%	15.3%

Primary Purpose: Development of Health Messages

Message retention. Immediately after reading the health message, participants' message retention was tested with three multiple-choice questions. Overall, participants averaged a score of 2.41 ($SD = 0.70$) out of 3 (range = 0 to 3). ANOVA indicated no significant between-group differences in number of correct answers, $p > 0.05$.

Message clarity and quality. Between-group differences in message clarity (i.e., whether the message was easy to read) and quality (i.e., whether the information was perceived as factual) were examined with MANOVA. While Wilk's statistic technically indicated no significant differences, $p = 0.053$. Given the importance of the health messages in information Study 4C, the decision was made to run follow-up analyses.

ANOVA indicated no significant differences between the three health messages in terms of readability, understandability, novelty of the message, and whether the message was seen as being convincing, *p*s > 0.05. Significant differences were found in whether the message was seen as being factual, $p < 0.01$, and the legitimacy of the message, $p < 0.001$. Follow-up *t*-tests indicated that the control message was seen as being significantly less factual ($p < 0.01$, $d = 0.71$) and less legitimate ($p < 0.01$, $d = 0.81$) than the proximal health message. Non-significant differences were found between the control and distal message, and the proximal and distal message.

Secondary Purpose: The Effect of Health Risk Communication

Two MANOVAs were conducted to assess the effect of health risk communication. The first contrasted the effect of receiving *any* health risk information (i.e., proximal *or* distal) compared to control participants. Wilk's statistic indicated a significant between-groups

Table 35 – Health message retention, readability, and quality

	Control (N = 64)	Proximal (N = 52)	Distal (N = 59)
Retention (Correct Responses /3)	2.51 ± 0.66	2.36 ± 0.73	2.34 ± 0.70
1. The text I read talked about …			
Sedentary behaviour and health	7.8%	**80.8%**	**69.5%**
Sedentary behaviour research	**92.2%**	19.2%	28.8%
Why exercise is important	0.0%	0.0%	1.7%
2. According to the text, the average Canadian is sedentary for ____ hours each day.			
4 hours	0.0%	1.9%	1.7%
8 hours	1.6%	7.7%	1.7%
10 hours	**89.1%**	**82.7%**	**88.1%**
12 hours	1.6%	0.0%	1.7%
I'm not sure	7.8%	7.7%	5.1%
3. According to the text, too much sitting can cause …			
Back pain	6.3%	**96.2%**	3.4%
Diabetes	1.6%	0.0%	**94.9%**
None of the above	**81.3%**	0.0%	0.0%
I'm not sure	10.9%	3.8%	1.7%
4. Message quality (/10 ± SD)			
The text was easy to read	8.08 ± 2.03	8.48 ± 1.83	8.41 ± 2.09
The text was easy to understand	8.52 ± 1.55	8.72 ± 1.68	8.58 ± 2.12
The text taught me something new	6.98 ± 2.23	7.14 ± 2.48	7.53 ± 2.39
The information made sense	8.65 ± 1.22	8.78 ± 1.62	8.66 ± 1.77
The information seemed factual	8.30 ± 1.00	9.00 ± 1.14	8.84 ± 1.31
The information seemed legitimate	7.92 ± 1.36	8.96 ± 1.96	8.64 ± 1.52
The information was convincing	7.87 ± 1.57	8.58 ± 1.44	8.46 ± 1.62

difference, $\Lambda = 0.847$, $F = 2.764$, $p < 0.01$. Follow-up ANOVAs indicated significant differences, $p < 0.05$, in two of the eight variables. Specifically, participants who received risk information viewed reducing SB as being more important to their short-term health ($p = 0.01$, $d = 0.42$) and as possessing the necessary skills and knowledge to reduce their SB ($p < 0.01$, $d = 0.51$).

The second MANOVA specifically contrasted participants who received proximal *versus* distal health risk information. Wilk's statistic indicated no significant between-group differences, $\Lambda = 0.925$, $F = 0.956$, $p > 0.05$.

Discussion

Primary Purpose: Development of Health Messages

Participants' message retention was examined with three multiple choice questions. Overall, participants averaged 2.41/3 (*SD* = 0.70) correct responses, indicative that they were attending to and comprehending the message. Analysis found no differences between the three messages in terms of retention, clarity, or readability. Significant differences were found in the perceived truthfulness and factual basis of the message (e.g., attention-control participants indicating the need for citations). Based upon participants' feedback, minor changes were made to the health messages to clarify wording and correct grammatical errors. Additionally, citations were added in-text to improve perceived message credibility.

Secondary Purpose: Messaging and Sedentary Behaviour Perceptions.

MANOVA analyses were used to examine between-group differences in sedentary behaviour perceptions. Prior to receiving the health messages, the attention-control, proximal, and distal groups did not significantly differ in their perceptions of sedentary behaviour. After receiving a health message, significant differences were found between individuals in the attention-control group and individuals who received a risk message (i.e., either proximal or distal). These preliminary results suggest that health messages may be a useful tool for changing individuals' perceptions of sedentary behaviour. No significant differences were found between individuals who received a proximal or distal message. Such results indicate that the specific content of health risk information (i.e., proximal distal risk outcome) may be less important than the receipt of a risk message.

HEALTH MESSAGING PILOT QUESTIONNAIRE

Letter of Information and Consent

The Study – The purpose of this questionnaire is to assess the readability and efficacy of a health message. Results will be used to inform a study on office workers' sedentary behaviour. In total, this questionnaire takes about 15 minutes to complete.

Risks – There are no known risks to completing this survey. There is no penalty for choosing not to participate.

Confidentiality – Your participation is **anonymous**. We will not ask you for any identifying information, such as your name and contact details. Your responses will only be used as part of a larger data set. The data will be kept for a period of five years, and will be securely stored in a locked office. When the data is no longer required, it will be destroyed.

Right to Withdraw – Your participation is completely voluntary. You can leave the questionnaire at any time for any reasons simply by closing the window. You may also skip questions without explanation or penalty. Due to the anonymous nature of the study, responses cannot be withdrawn after submission.

Researchers – This study is being conducted by Madelaine Gierc (E-MAIL) a doctoral candidate at the University of Saskatchewan, under the supervision of Dr. Larry Brawley (E-MAIL), College of Kinesiology.

1. **Consent –** By completing and submitting the questionnaire YOUR FREE AND INFORMED CONSENT IS IMPLIED and indicates that you understand the above conditions of participation in this study.

   [ ] I consent to participate
   [ ] I do not consent

Demographics

Before starting, we would like to ask you some basic demographic and health information questions.

Please remember that this questionnaire is **completely anonymous** – we will be unable to trace any information to your identity.

1. Current Age: ____ years

2. Gender: [ ] Male [ ] Female [ ] Transgender [ ] Other

3. Ethnicity:
   [ ] Caucasian [ ] Black/African American
   [ ] First Nations [ ] Hispanic/Latino
   [ ] Asian [ ] South-East Asian
   [ ] Middle Eastern [ ] Other

4. Employment:
   [ ] Student
   [ ] University Faculty or Staff
   [ ] Office Worker – Non-University
   [ ] Other

5. Overall, how would you rate your health?

   -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

   Very Poor Very Good

6. Overall, are you worried about your health?

   -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

   Not worried Very Worried

Defining Sedentary Behaviour

In health research, "sedentary behaviour" is the term for **low-effort activities** done **sitting** or **lying down**. The mind might be active – but the body is relatively still.

Popular examples of sedentary behaviour include working at a desk, using a computer, driving a car, and watching television. It also includes activities like eating meals, attending the theatre, or sitting in lecture

7. Prior to this survey, had you ever heard the terms "sedentary" or "sedentary behaviour" before?

   -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

   Definitely No Definitely Yes

8. Do you feel like you have a good understanding of what sedentary behaviour is?

   -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

   Definitely No Definitely Yes

9. Take a moment to think about your typical school or work day. Roughly what percentage of your time do you spend in sedentary behaviour? ____ %

10. Comparing your sedentary behaviour do your peers, do you think you are more or less sedentary?

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

Much Less Sedentary — Much More Sedentary

11. Do you think your sedentary behaviour affects your health?

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

Very Harmful — Very Beneficial

12. Are you worried about your level of sedentary behaviour?

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

Very Worried — Not Worried

13. Over the past two weeks, have you made a purposeful effort to reduce the amount of time you spend sitting?

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10

Definitely No — Definitely Yes

Factual Understanding of Sedentary Behaviour

The following questions are intended to assess your baseline knowledge of sedentary behaviour.

Please answer each question to the best of your ability. If you aren't certain, give your best guess.

14. Not counting sleep, the average Canadian is sedentary for _______ each day.

[ ] 4 hours [ ] 12 hours
[ ] 8 hours [ ] 16 hours
[ ] 10 hours [ ] I'm not sure

15. True or False? Watching TV is the worst type of sedentary behaviour there is

[ ] True [ ] I'm not sure
[ ] False

16. Which of the following activities are sedentary? *Check all that apply*.

[ ] Gentle walks [ ] Reading
[ ] Yoga [ ] Gardening
[ ] Eating

[ ] Using the computer
[ ] Working at a desk

17. Are men or women more sedentary?
[ ] Men [ ] Women
[ ] Both are equal
[ ] I'm not sure

18. True or False? It's OK to sit a lot, so long as you exercise regularly.
[ ] True [ ] I'm not sure
[ ] False

Randomisation & Health Messages

Participants were assigned to receive one of three health messages (control, proximal, or distal) based upon their month of birth.

Allocation occurred as followed:

Attention-Control	*January, April, July, October*
Proximal Message	*February, May, August, November*
Distal Message	*March, June, September, December*

The three health messages can be found in Table 26, pp. 122

Post- Message Manipulation Check

19. The text I just read talked about …
[ ] Why it's important to exercise regularly
[ ] Sedentary behaviour research
[ ] Sedentary behaviour and health
[ ] Stress management at work and school
[ ] How to cook healthy meals

20. According to the text, the average Canadian is sedentary for _____ each
[ ] 4 hours [ ] 12 hours
[ ] 8 hours [ ] 16 hours
[ ] 10 hours [ ] I'm not sure

21. According to the text, too much sitting can cause …
[ ] Lyme disease [ ] Back pain
[ ] Diabetes [ ] Kidney disease
[ ] None of the above – the text didn't talk about health

[ ] I'm not sure

22. Thinking about what you just read ...

		Strongly Disagree									Strongly Agree
a.	The text was easy to read	1	2	3	4	5	6	7	8	9	10
b.	The text was easy to understand	1	2	3	4	5	6	7	8	9	10
c.	The text taught me something new	1	2	3	4	5	6	7	8	9	10
d.	The information made sense	1	2	3	4	5	6	7	8	9	10
e.	The information seemed factual	1	2	3	4	5	6	7	8	9	10
f.	The information seem legitimate	1	2	3	4	5	6	7	8	9	10
g.	The information was convincing	1	2	3	4	5	6	7	8	9	10

23. Do you have any suggestions on how to improve this health message?

____

____

Sedentary Behaviour and Health

24. Thinking about sedentary behaviour ...

		Strongly Disagree									Strongly Agree
a.	I think sedentary behaviour is an important public health risk	1	2	3	4	5	6	7	8	9	10
b.	I think most people should be worried about their sedentary behaviour	1	2	3	4	5	6	7	8	9	10
c.	I think sedentary behaviour is a health risk to me	1	2	3	4	5	6	7	8	9	10
d.	I'm worried about my level of sedentary behaviour	1	2	3	4	5	6	7	8	9	10
e.	Reducing sedentary behaviour is important for my short-term health	1	2	3	4	5	6	7	8	9	10
f.	Reducing sedentary behaviour is important for my long-term health	1	2	3	4	5	6	7	8	9	10
g.	I'm motivated to reduce my sedentary behaviour at school/work	1	2	3	4	5	6	7	8	9	10

h.	I have the skills and knowledge needed to reduce my sedentary behaviour	1	2	3	4	5	6	7	8	9	10

25. Do you have any other comments or questions about sedentary behaviour?

____

____

Debriefing

Thank-You for Participating!

The purpose of this pilot work was to examine the readability and efficacy of a health education message. As a participant, you were randomised to one of three different conditions: (1) Information Control, (2) Short-Term Risks, or (3) Long-Term Risks.

The results of this study will be used to inform a larger project on sedentary behaviour in office workers.

If you have any questions about this research, are interested in results, or are curious about sedentary behaviour, please contact:: E-MAIL.

Thank-you once more!

APPENDIX H:

STUDY THREE ELICITATION PILOT

Background

Within the Theory of Reasoned Action (Ajzen & Fishbein, 1967) and the Theory of Planned Behaviour (TPB; Ajzen, 1991), salience beliefs – easily-accessible thoughts and feelings about an activity – serve as “the prevailing determinants of a person’s intentions and actions” (Ajzen, 1991, pp. 189). The TPB differentiates between three types of salient beliefs: *behavioural beliefs*, which influence attitudes toward behaviour; *normative beliefs*, which provide the basis for subjective norms; and *control beliefs*, which inform perceptions of behavioural control.

Given the central role of salient beliefs in the TPB, Ajzen (1991) has stated that “salient beliefs must be elicited by the respondents themselves, or in pilot work” (pp. 192) prior to initiating research. This is particularly the case when a new behaviour and/or new population is being studied. Failure to elicit salient beliefs – and thus relying on an arbitrary- or intuitively-selected set of belief statements – runs the risk presenting participants with an irrelevant set of TPB items that serve as poor predictors of behavioural intentions.

In terms of sedentary behaviour, none of the three existing TPB studies (Biddle & Smith, 1999; Prapevessis, 2016; Rhodes, 2009) report engaging in elicitation work prior to the primary research project. This is particularly disconcerting given the novelty of the field and our overall poor understanding of the behaviour (see Introduction, pp. 11, and Study One, pp. 26). Thus, the purpose of the current pilot study was to engage in TPB elicitation research in order to inform the design of Study Three (pp. 100). It is also the first qualitative sedentary behaviour study to utilise an explicit theoretical framework. A secondary purpose of this research was to examine the overall acceptability and feasibility of sedentary behaviour intervention strategies: specifically, different standing break strategies.

Method

Participants and Procedure

As the purpose of this pilot study was to assess the messages as a research tool, – and thus inform the design of Study Three – Research Ethics Board approval was not required (Article 6.11, Panel of Research Ethics, Government of Canada, 2015). That noted, study design followed established ethical practices: the survey was completed anonymously; participants were asked to read a Letter of Information and indicate electronic consent; participants were free to exit the study at any time and for any reason; and participants were provided with both a debriefing letter and researcher contact information if questions emerged at a later date.

Participants

Participants were recruited online via the University of Saskatchewan PAWS bulletin board and social media (e.g., Facebook). Interested volunteers were automatically directed to the online survey via hyperlink. For maximum reach, no inclusion or exclusion criteria were set save for being *currently employed as an office worker*.

Ajzen and Fishbein (1980) have recommended that 25 respondents are required for elicitation work. The current study was accessed by 142 individuals, of which 66.9% (N = 95) answered the survey either in full (N = 76) or part (N = 19). Of the 47 individuals who did not complete the survey, 26 were ineligible for participation and 21 left the survey prior to the first elicitation item. The final sample was 82.1% female and 83.2% Caucasian, with a mean age of 33.36 (SD = 11.00) years.

Measures

The complete elicitation study questionnaire can be found on page 243.

Demographic and health information. Basic demographic information, including age, ethnicity, and employment status, were collected for descriptive purposes. Health status information included BMI (via self-reported height and weight), perceived health, and chronic disease diagnosis.

Self-report sedentary behaviour. To broadly assess workplace sedentary behaviour, participants were prompted to think about a typical week at work. They were asked to designate (1) the number of days they work per week, (2) their average shift length (hours and minutes), and (3) work time spent on breaks (hours/minutes). Lastly, they were asked to indicate what percentage of work and break time was spent sitting.

TPB elicitation items. The open-ended elicitation questions presented to participants were directly informed by the work of Ajzen (2006). "Salient beliefs" were operationalised as those that come to mind when participants are asked open-ended questions relating to performing some behaviour (Fishbein & Ajzen, 1975; Ajzen, 1991; e.g., Armitage & Christian, 2004; e.g., Gierc et al, 2014).

Items prompted individuals to think of either sitting at work or taking standing breaks at work. For each behaviour, participants were asked to describe the beliefs, normative beliefs, or control beliefs associated with each behaviour. For instance, for sitting control beliefs, individuals were asked to "list any factors/circumstances that make it *easy for you* to sit at work" [emphasis in original]. Participants were provided with an open-ended space in which to respond.

Standing break strategies. The last section of the questionnaire presented participants with 12 different standing break strategies, such as "Standing up when you use the phone" and "Taking the 'long way around' your office". Specific strategies were informed by prior work by

Kozey-Keadle et al (2011) and a review of popular media coverage. Participants were instructed to rate each strategy according to two criteria: whether or not it was realistic, and whether they would be personally interested in trying it out. Responses were scored on a 1 (Strongly Disagree) to 10 (Strongly Agree) scale. A final open-ended question asked participants if they had any other ideas on how to reduce sitting at work.

Analytical Plan

Participants' qualitative responses were analysed with an inductive content analysis procedure, as outlined in Appendix A. In short, analysis involved reading participants' responses, identifying thematic areas, and, when appropriate, grouping themes into larger categories. Response frequency (percentage of participants reporting a theme) was calculated. *Modal salient beliefs* were defined as those themes listed by a large proportion of total respondents. While Ajzen and Fishbein (1980) recommend using either a 10% or 20% threshold (see Sutton et al, 2003, for an alternative selection strategy), no *a priori* selection threshold was set given the novelty of the sedentary behaviour research field.

Quantitative data was analysed using SPSS version 22 (IBM, 2013). Descriptive statistics (means and standard deviations) were calculated for participants' appraisals of standing break strategies.

Results

TPB Elicitation Items

Participants' qualitative results indicted an enriched and varied view of sedentary behaviour, with over one hundred individual themes identified. For example, in sitting-related behavioural beliefs, participants identified themes like *sitting as a way to avoid physical discomfort* (43.01% of respondents) and *sitting as a way to increase concentration/focus*

(24.73%). In contrast, for standing-related control beliefs, participants identified themes like *being too busy to take standing breaks* (45.83%) and *modifying tasks to allow standing breaks* (19.26%). Based upon the results of the content analysis, fifteen attitude items (N = 7 sitting, N = 8 standing breaks), fourteen subjective norm items (N = 7 sitting, N = 7 standing breaks), and thirteen PBC items (N = 6 sitting, N = 7 standing breaks) were developed. A summary of TPB items used in Study Three can be found in Table 36.

Standing Break Strategies

Participants responded favourably overall to the presented standing break strategies, rating strategies as being moderately realistic (M = 6.81/10, SD = 0.272) and expressing interest in trying the strategies (M = 7.19/10, SD = 0.357). In terms of realism, the highest-rated strategies were taking a 2-minute standing break every 60-minutes (M = 8.12, SD = 2.22) and walking during lunch/coffee breaks (M = 7.84, SD = 2.48). The lowest-rated items were holding standing/walking meetings (M = 4.74, SD = 3.05). In terms of expressed interest, the highest-rated strategies were using a standing/walking desk (M = 8.39, SD = 2.22) and taking a 2-minute standing break every 60-minutes (M = 8.22, SD = 2.28). The lowest-rated items were holding standing/walking meetings (M = 5.08, SD = 3.31).

Discussion

The primary purpose of the current study was to examine salient beliefs surrounding workplace sitting and standing breaks. Using Ajzen's (2006) TPB elicitation items, participants reported over 100 different themes. Items were distilled via thematic content analysis to produce 42 TPB questionnaire items. A secondary purpose of this research was to examine the realism and acceptability of standing break strategies. Participants had a moderate-to-positive response to the standing break strategies. Thus, it was deemed that the developed list of strategies would be appropriate for use in the Study Three questionnaire.

Table 36 – Study Three, pilot elicitation study. Overview of TPB items developed based upon the results of inductive content analysis.

Sitting Attitudes	**Sitting Subjective Norms**	**Sitting Perceived Behavioural Control**
1. Sitting at work is comfortable 2. Sitting at work lets me focus on the task 3. Sitting lets me be productive at work 4. I have good posture when I sit at work 5. Sitting at work makes me feel stiff and sore (R) 6. Sitting at work makes me feel bored and restless (R) 7. Overall, I think sitting is … a. Bad / Good b. Not useful / Useful c. Unpleasant / Pleasant d. Bad / Good for my body e. Bad / Good for my mental health	1. Not sitting would get me into trouble 2. It's normal for office workers like me to sit at work 3. It's expected that I sit at work 4. Sitting is part of our office culture 5. Most of my co-workers think I should sit at work 6. My supervisor thinks I should sit at work 7. My clients/customers think I should sit at work	1. I'm able to choose how much I sit at work 2. I need to sit to get my work done 3. I'm required to sit as part of my job 4. I have a health condition that makes it difficult to sit at work 5. It's easy to sit at work 6. I have a health condition that makes me have to sit a lot
Standing Break Attitudes	**Standing Break Subjective Norms**	**Standing Break PBC**
Taking a standing break would … 1. Help me be physically active 2. Help improve my posture 3. Help me feel less stiff and sore 4. Help refresh and energise me 5. Make me less productive (R) 6. Help improve my health 8. Overall, I think standing breaks are … a. Bad / Good b. Not useful / Useful c. Unpleasant / Pleasant d. Bad / Good for my body e. Bad / Good for my mental health	1. Taking standing breaks would disrupt my co-workers 2. Taking standing breaks would be socially awkward 3. It's normal for office workers like me to take standing breaks 4. People in my office would encourage my standing breaks 5. Most of my co-workers think I should take standing breaks 6. My supervisor thinks I should take standing breaks 7. My clients/customers think I should take standing breaks	1. I have a health condition that makes it hard to take standing breaks 2. I'm able to choose whether or not I take standing breaks 3. I'm normally too busy to take standing breaks 4. My desk/workspace makes it easy to take standing breaks 5. My work responsibilities restrict standing breaks 6. If I wanted, I could incorporate standing breaks into my work routine 7. If I wanted, I could take standing breaks and still be productive

PILOT ELICITATION STUDY QUESTIONNAIRE

Eligibility

1. The purpose of this study is to examine sedentary behaviour ("sitting") in office workers. Are you currently employed full- or part-time?
   [ ] Yes, full-time (30+ hrs/wk)
   [ ] Yes, part-time
   [ ] No, I do not work

2. If you are employed, would you consider yourself an office-based employee?
   [ ] Yes, I work in an office
   [ ] No

Letter of Information & Consent

The Study – The purpose of this elicitation study is to examine office worker's perceptions of sitting. Results will be used to inform a research study on sedentary behaviour. In total, this questionnaire takes about 20 minutes to complete.

Risks – There are no known risks to completing this survey. There is no penalty for choosing not to participate.

Confidentiality – Your participation is **anonymous**. We will not ask you for any identifying information, such as your name and contact details. Your responses will only be used as part of a larger data set. The data will be kept for a period of five years, and will be securely stored in a locked office. When the data is no longer required, it will be destroyed.

Right to Withdraw – Your participation is completely voluntary. You can leave the questionnaire at any time for any reasons simply by closing the window. You may also skip questions without explanation or penalty. Due to the anonymous nature of the study, responses cannot be withdrawn after submission.

Researchers – This study is being conducted by Madelaine Gierc (E-MAIL), a doctoral candidate at the University of Saskatchewan, under the supervision of Dr. Larry Brawley (E-MAIL), College of Kinesiology.

3. **Consent –** By completing and submitting the questionnaire YOUR FREE AND INFORMED CONSENT IS IMPLIED and indicates that you understand the above conditions of participation in this study.
   [ ] I consent to participate
   [ ] I do not consent

Demographics

Thank-you for participating in our study! We will start with asking some basic demographic and baseline questions.

Please remember that the survey is **entirely anonymous** and that **you may omit questions you are not comfortable answering**. Your demographic information will **only** be used for descriptive purposes, and will not be linked to your identity in any way.

4. Current Age: ____ years

5. Gender: [ ] Male [ ] Female [ ] Transgender [ ] Other

6. What field do you work in? ______________________________

7. What is your position? ______________________________
   e.g., faculty, manager, clerical, etc.

8. Briefly, what are some of your typical job duties? ______________________________

Sedentary Behaviour at Work

For the next set of questions, please think about a **typical work day over the past two weeks**.

9. How many days per week do you work? ____ days

10. How long is your typical work day? ____ hours and ____ minutes
11. How much of your work days is lunch/breaks? ____ hours and ____ minutes

12. **Excluding** breaks, what percentage of your work day do you typically spend sitting down? ____ %

13. What percentage of your breaks do you typically spend sitting down? ____ %

Thoughts About Sitting

The next set of questions will ask about sitting at work.

For each question, we are interested in your **ideas** and **opinions**. Even if an answer seems silly or obvious, we'd like to know!

Sitting at Work

For each the questions below, please list the thoughts that immediately come to mind. Press "ENTER" between thoughts, to show which thoughts are separate from each other.

There is no right or wrong response; we are interested in your personal opinion.

14. What do you see as the *advantages* of sitting at work?

____

____

15. What do you see as the *disadvantages* of sitting at work?

____

____

16. What else comes to mind when you think about sitting at work?

____

____

Our Co-Workers

When it comes to sitting at work, there might be individuals or groups who think you should (or should not) sit while you are working. This could range from a specific individual (e.g., your supervisor) to "everyone" at work.

Please list …

17. The individuals/groups who think you *should* sit at work.

____

____

18. The individuals/groups who think you should *not* sit at work.

____

____

Sometimes, when we are not sure what to do, we look to see what others are doing around us. With this in mind, please list …

19. The individuals/groups who are the *most likely to sit* in your workplace.

____

____

20. The individuals/groups who are the *least likely to sit* in your workplace.

____

____

Control Factors

21. Please list any factors/circumstances that make it *easy for you* to sit at work.

____

____

22. Please list any factors/circumstances that make it *easy for you* to sit at work.

____

____

23. Are there any circumstances or situations that make you *more likely* to sit at work?

____

____

24. Are there any circumstances or situations that make you *less likely* to sit at work?

____

____

Standing Breaks

For the next set of questions, I want you think about interrupting your sitting with a 2-minute standing break every 30 minutes. This means that, for every 30 minutes of continuous sitting, you stand up and move around for 2 minutes

25. What do you see as the *advantages* of taking standing breaks at work?

____

____

26. What do you see as the *disadvantages* of taking standing breaks at work?

____

____

27. What else comes to mind when you think about taking standing breaks at work?

____

____

Standing Breaks and Co-Workers

Please list …

28. The individuals/groups who think you *should* take standing breaks at work?

____

____

29. The individuals/groups who think you should *not* take standing breaks at work?

____

____

Sometimes, when we are not sure what to do, we look to see what others are doing around us. With this in mind, please list …

30. The individuals/groups who are the *most likely to* take standing breaks at work?

____

____

31. The individuals/groups who are the *least likely to* take standing breaks at work?

____

____

Control Factors

32. Please list any factors/circumstances that make it *easy for you* to take standing breaks at work.

____

____

33. Please list any factors/circumstances that make it *easy for you* to take standing breaks at work.

____

____

Types of Standing Breaks

Thank-you again for participating!

This final section asks about different strategies to reduce sitting at work. For each of the strategy, I would like you think about two things: (1) Is it **realistic**? (2) Would you be **personally interested** in trying it out?

34. Taking a 2-minute standing break every **30 minutes**

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

35. Taking a 2-minute standing break every **60 minutes**

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

36. Standing up when you talk on the phone

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

37. Talking to co-workers in person, rather than using the phone or e-mail

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

38. Using a garbage bin or printer farther away from your desk

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

39. Hold standing/walking meetings with **co-workers**

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

40. Hold standing/walking meetings with **clients/customers**

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

41. Use an active workstation

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

42. Walk during your coffee or lunch break

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

43. Take the "long way around" your office

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

44. Organise your workspace so that you have to stand-up more

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

45. Hold standing/walking meetings with **co-workers**

	Strongly Disagree									Strongly Agree
This strategy is realistic	1	2	3	4	5	6	7	8	9	10
I'd be interested in trying this out	1	2	3	4	5	6	7	8	9	10

46. Do you have any other ideas on how to reduce or break-up your sitting?

____

____

Thank-You for Participating!

The purpose of this elicitation study was to examine office workers' perceptions of workplace sitting.

As a participant, you were asked to share your thoughts on two behaviours (sitting, standing breaks) in three areas (attitudes, social norms, and perceived control). The results of this study will be used to construct a Theory of Planned Behaviour questionnaire.

If you have any questions about this research, are interested in results, or are curious about sedentary behaviour, please contact: E-MAIL.

Thank-you once more!

APPENDIX I:

STUDY THREE RESEARCH ETHICS CERTIFICATE

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board

Certificate of Approval

PRINCIPAL INVESTIGATOR
Lawrence Brawley

DEPARTMENT
Kinesiology

BEH#
15-160

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED
University of Saskatchewan

STUDENT RESEARCHER(S)
Madelaine Gierc

FUNDER(S)
INTERNALLY FUNDED

TITLE
Sitting in Office Workers: Can Health Education Make a Difference?

ORIGINAL REVIEW DATE	APPROVAL ON	APPROVAL OF:	EXPIRY DATE
29-Jun-2015	02-Jul-2015	Application Appendixes A-L	01-Jul-2016

Full Board Meeting ☐ Date of Full Board Meeting:

Delegated Review ☒

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS

In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month prior to the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: *http://research.usask.ca/for-researchers/ethics/index.php*

Scott Tunison, Vice-Chair
University of Saskatchewan
Behavioural Research Ethics Board

APPENDIX J:

STUDY THREE, TIME-1 QUESTIONNAIRE

Eligibility Screening

1.	Welcome! The purpose of this study is to examine sedentary behaviour ("sitting") in office workers. Are you currently employed full- or part-time?	[ ] Yes, full-time (30+ hrs/wk) [ ] Yes, part-time [ ] No, I am not employed
2.	If you are employed, do you have an office-based job?	[ ] Yes, I work in an office [ ] No
3.	Do you plan on being away from work for an extended period of time in the next 2-3 weeks? For example, for a conference or vacation?	[ ] Yes, I am going to be away [ ] No

If "Yes, I am going to be away" …

a. This study involves answering four surveys across the course of about two weeks.

   You have indicated that you are going to be away from work over the next little while. If you would like to participate in this study after returning to work, please enter your contact information and return date below. We'll e-mail a link to the survey about a week after you return.

   Thank-you!

   i. Name: ________________________________

   ii. E-mail address: ________________________________

   iii. Return date: ________________________________

Letter of Information & Consent

Purpose – The purpose of this study is to examine the psychological factors associated with sedentary behaviour ("sitting") in office workers.

Procedures – Participants will be invited to complete four online surveys over approximately two weeks. Each survey takes between 10 and 20 minutes to complete.

Potential Risks & Benefits – There are no known or anticipated risks to participation. This research will help identify some of the psychological factors associated with sitting.

Compensation – After completing each survey, participants will be automatically entered into a draw for 1 of 4 $50 gift certificates.

Confidentiality – Your participation in this survey is confidential. Your contact information will be deleted as soon as the study is complete. All information collected will be reported in group form. No individual identifying information will be released or published. Data will be kept for a period of five years, and will be stored in a locked office in our research laboratory. When the data is no longer required, it will be destroyed.

This survey is hosted by Fluid Surveys, a US-owned company and subject to US laws and whose servers are located outside of Canada. The privacy of the information you provide is subject to the laws of those other jurisdictions. By participating in this survey you acknowledge and agree that your data will be stored and accessed outside of Canada and may or may not receive the same level of privacy protection. Confidentiality may also be limited due to recruitment procedures: that is, you may have been directed to this research project through a person outside of the study, such as a manager, co-worker, or business acquaintance.

Right to Withdraw – Your participation is entirely voluntary. When answering, you may omit questions that you are not comfortable with. You can withdraw from the study by contacting the researchers. Your right to withdraw data will apply until results have been pooled (approximately late-July). After this time, it is possible that some form of research dissemination will have occurred. There are no consequences if you choose to withdraw or leave questions blank.

Questions & Results – If you have any questions, or wish to obtain a copy of results, please do not hesitate to contact Madelaine Gierc (University of Saskatchewan, E-MAIL) or Dr. Larry Brawley (University of Saskatchewan, E-MAIL).

Research Ethics – This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office E-MAIL or PHONE. Out of town participants may call toll-free at PHONE.

1. Consent – By completing and submitting the questionnaire your free and informed consent is implied and indicates that you understand the above conditions of participation in this study.	[ ] Yes, I consent [ ] No, I do not consent

Introduction

This study is one of the very first Canadian projects to look at sitting in office workers - and one of the first in the world to look at the psychology of sitting.

Because this is such a new area of research, there is a lot of uncertainty about how thoughts and feelings interact with sitting. Some of the questions we ask might seem strange or obvious - but, we ask that you bear with us and answer to the best of your ability!

This study involves answering four surveys across the course of about two weeks. The first two are a bit longer (15-20 minutes) - the second two are shorter (5-10 minutes).

Each time you complete a survey, we will enter your name into a draw for 1 of 4 $50.00 gift certificates.

Please remember that this survey is **confidential** - we won't share your work or personal information with anyone, and your results will only be reported with the larger group of volunteers.

Contact Details

Your name and e-mail address will be used to (1) send follow-up surveys, (2) to group your responses together, and (3) to contact you if you win the gift certificate draw!

This information will be **kept confidential** and will be **deleted as soon as research is complete**. We will not share your information with anyone.

1. Name: ____________________________________
2. E-mail address: ____________________________________
3. Would you like to receive a summary of research findings when this project is complete?   [ ] Yes, I would like a summary   [ ] No

Demographics

1. Current Age: ____ years
2. Gender: [ ] Male [ ] Female [ ] Transgender [ ] Other: _________
4. What language do you speak at home? [ ] English [ ] Other __________ [ ] French [ ] Prefer not to say
5. What is your height? ____ ft / meters
6. What is your weight? ____ lb / kg
7. Have you been diagnosed with a chronic health condition? [ ] No [ ] Prefer not to say [ ] Yes
8. Do you have a health condition that affects your ability to be physically active? [ ] No [ ] Prefer not to say [ ] Yes

Self-Report Physical Activity

1. Over the past two weeks, have you participated in any leisure-time physical activity? *e.g., hockey, volleyball, karate, weights, walking, running, swimming, swing dance, etc.*
   [ ] Yes
   [ ] No

If "Yes" …

2. On an average week …

   a. How many times per week do you exercise?
      [ ] 1/week [ ] 5/week
      [ ] 2/week [ ] 6/week
      [ ] 3/week [ ] 7/week
      [ ] 4/week [ ] 8+/week

   b. How long does a typical exercise session last for?
      [ ] 0-14 mins [ ] 45-59 mins
      [ ] 15-29 mins [ ] 60-74 mins
      [ ] 30-44 mins [ ] 75+ mins

   c. On average, what intensity do you exercise at?
      [ ] Light-intensity – You can talk and sing
      [ ] Moderate intensity – You can talk but not sing
      [ ] Vigorous intensity – You can only say a few words

3. Overall, would you consider yourself to be …

   a. [Perceived health] 1 = Poor Health, 10 = Good Health

   b. [Physical activity] 1 = Not Active, 10 = Very Active

   c. [Perceived fitness] 1 = In Poor Shape, 10 = In Good Shape

Work Information

Your work information is collected for statistical purposes only. Your workplace name will **not** be reported in any communication, and will be **deleted** as soon as analysis is complete.

1. What company do you work for? ________________

2. What industry do you work in? ________________

3. What is your position / job at work? ________________

4. How many days per week do you work? ____ days per week

5. How many hours do you work per day? ____ hours and ____ minutes

6. How much of your work day is break time? ____ hours and ____ minutes

Sitting at Work

For the next set of questions, I would like you to think about a **typical work day over the past two weeks**.

Please try to be as accurate as possible.

1. How much of your work day (excluding breaks) is spent sitting down? ___ % of the day

2. How much of your break time is spent sitting down? ___ % of break time

3. At work, how long do you TYPICALLY sit for before standing up? ____ hours and ____ minutes
   [ ] I'm not sure

4. At work, what is the LONGEST you sat for before standing up? ____ hours and ____ minutes
   [ ] I'm not sure

5. On a typical work day, how many times per day do you stand up from your desk? ____ times per day

6. Approximately what percentage of your standing-up is for the **primary purpose** of movement rather than work? *For example, taking stretching breaks, finding excuses to make an extra trip, etc.* ____ % of my standing-up

7. Overall, would you consider your activity level **at work** to be ….
   [ ] Sedentary – Sit most of the day the day
   [ ] Lightly Active
   [ ] Moderately Active
   [ ] Very Active – Strenuous activity most of the day

Attitudes: Sitting

For this set of questions, please think about sitting at work – specifically, continuous sitting for the **majority of the work day**.

There is **no right or wrong answer** to any question – we're interested in learning about your thoughts and feelings. Please answer honestly and to the best of your ability.

1.	Sitting at work is comfortable	1 = Strongly Disagree, 7 = Strongly Agree
2.	It's good to be comfortable at work	1 = Strongly Disagree, 7 = Strongly Agree
3.	Sitting at work lets me focus on the task	1 = Strongly Disagree, 7 = Strongly Agree
4.	It's good to be able to focus at work	1 = Strongly Disagree, 7 = Strongly Agree
5.	Sitting lets me be productive at work	1 = Strongly Disagree, 7 = Strongly Agree
6.	It's good to be productive at work	1 = Strongly Disagree, 7 = Strongly Agree
7.	I have good posture when I sit at work	1 = Strongly Disagree, 7 = Strongly Agree
8.	It's good to have good posture at work	1 = Strongly Disagree, 7 = Strongly Agree
9.	Sitting at work makes me feel stiff and sore	1 = Strongly Disagree, 7 = Strongly Agree
10.	It's good to feel stiff and sore at work	1 = Strongly Disagree, 7 = Strongly Agree
11.	Sitting at work makes me feel bored and restless	1 = Strongly Disagree, 7 = Strongly Agree
12.	It's good to feel bored and restless at work	1 = Strongly Disagree, 7 = Strongly Agree

13. Overall, I think sitting at work is …

a.	[Overall good/bad]	1 = Bad, 7 = Good
b.	[Usefulness]	1 = Not Useful, 7 = Useful
c.	[Pleasantness]	1 = Unpleasant, 7 = Pleasant
d.	[Physical health]	1 = Bad for my Body 7 = Good for my Body
e.	[Mental health]	1 = Bad for Mental Health, 7 = Good for Mental Health

Subjective Norms: Sitting

For this set of questions, please think about sitting at work – specifically, continuous sitting for the **majority of the work day**.

1.	Not sitting at work would get me into trouble	1 = Strongly Disagree, 7 = Strongly Agree
2.	It’s normal for office workers like me to sit at work	1 = Strongly Disagree, 7 = Strongly Agree
3.	It’s expected that I sit at work	1 = Strongly Disagree, 7 = Strongly Agree

4.	Sitting is part of our office culture	1 = Strongly Disagree, 7 = Strongly Agree
5.	Most of my co-workers think I should sit at work	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
6.	I care about what my co-workers think	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
7.	My supervisor thinks I should sit at work	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
8.	I care about what my supervisor thinks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
9.	My clients/customers think I should sit at work	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
10.	I care about what my clients/customers think	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

Perceived Behavioural Control: Sitting

For this set of questions, please think about sitting at work – specifically, continuous sitting for the **majority of the work day**.

1.	I'm able to choose how much I sit at work	1 = Strongly Disagree, 7 = Strongly Agree
2.	I need to sit to get my work done	1 = Strongly Disagree, 7 = Strongly Agree
3.	I'm required to sit as part of my job	1 = Strongly Disagree, 7 = Strongly Agree
4.	I have a health condition that makes it difficult to sit at work	1 = Strongly Disagree, 7 = Strongly Agree
5.	It's easy to sit at work	1 = Strongly Disagree, 7 = Strongly Agree
6.	I have a health condition that makes me have to sit a lot	1 = Strongly Disagree, 7 = Strongly Agree

Intentions: Sitting

At the start of the survey, we asked about how much you sat over the past two weeks.

Now, we'd like you to think about your **plans to sit** over the next week.

1.	Over the next week, I intend to …	[ ] Keep my sitting EXACTLY THE SAME – no changes. [ ] DECREASE my sitting – either a lot or a little [ ] INCREASE my sitting – either a lot or a little
2.	Over the next week, how much of your work day (excluding breaks) do you intend to sit down for?	___ % of the day
3.	How much of your break do you intend to sit down for?	___ % of break time
4.	Over the next week at work, how long will you TYPICALLY sit for before standing up?	____ hours and ____ minutes [ ] I'm not sure
5.	Over the next week at work, what is the LONGEST you would sit for before standing up?	____ hours and ____ minutes [ ] I'm not sure
6.	On a typical day over the next week, how many times will you stand-up from your desk?	____ times per day
7.	What percentage of your standing-up will be for the primary purpose of movement rather than work? *For example, taking purposeful stretching breaks, finding excuses to make an extra trip, etc.*	____ % of my standing-up

Closing

Thank-you for completing Survey One! We will e-mail you Survey Two in a few days!

If you have not already provided your name and e-mail address, please leave them below.

Your name and e-mail address will be used to (1) send follow-up surveys, (2) to group your responses together, and (3) to contact you if you win the gift certificate draw!

This information will be **kept confidential** and will be **deleted as soon as research is complete**. We will not share your information with anyone.

1. Name: ____________________________________
2. E-mail address: ____________________________________

APPENDIX K:

STUDY THREE, TIME-2 QUESTIONNAIRE

Participant Communication

Notification E-mail

Hello!

A couple days ago, you completed a baseline questionnaire on sitting at work. You reported that you sat for **XYZ% of your work day**.

This follow-up survey is approximately 15 minutes long. It includes both survey questions and information on health research.

- You can access the survey here: https://fluidsurveys.usask.ca/s/tpb2/
- **Your participant ID is: XYZ**

Every time you complete a survey, your name will be automatically entered into a draw for 1 of 4 $50 gift certificates!

Thank-you for participating!

Reminder E-mail

Hello!

A few days ago, we sent you a link to the second Sitting in Office Workers survey. We noticed you haven't completed it yet, and wanted to send a friendly reminder.

This follow-up survey is approximately 15 minutes long. It includes both survey questions and information on health research.

- You can access the survey here: https://fluidsurveys.usask.ca/s/tpb2/
- **Your participant ID is: XYZ**

Thank-you for participating!

Time-2 Questionnaire

Welcome Back!

1. My Name is: ________________________________
2. My participant number is: ________________________________

Today's Survey

Thank-you for joining us again!

Today's survey takes about 15-20 minutes to complete. It includes both (1) information on sitting research and (2) questions about sitting at work.

Some of the questions will be similar to Survey One. When this happens, try to think about how ***you're feeling right now***.

Please remember that this survey is **confidential**. There is no **right or wrong answer** to any question – we're interested in learning about your thoughts and feelings. Please answer honestly and to the best of your ability.

Sitting at Work

To start, we'd like to ask about your sitting over the past week. Thinking about a typical day at work over the past week …

1.	How much of your work day (excluding breaks) was s spent sitting down?	___ % of the day
2.	How much of your break time was spent sitting down?	___ % of the day
3.	At work over the past week, how long do you TYPICALLY sit for before standing up?	____ hours and ____ minutes [ ] I'm not sure
4.	At work over the past week, what is the LONGEST you sat for before standing up?	____ hours and ____ minutes [ ] I'm not sure
5.	On a typical work day, how many times per day do you stand up from your desk?	____ times per day
6.	Approximately what percentage of your standing-up is for the **primary purpose** of movement rather than work? *For example, taking stretching breaks, finding excuses to make an extra trip, etc.*	____ % of my standing-up

Health Messaging

Participants randomised to receive either a (1) control message, (2) proximal health risk message, or (3) distal health risk message. All three health messages can be found in Table 26.

Standing Breaks

A ***standing break*** is a way to interrupt long bouts of sitting. Just like it sounds, it involves purposefully standing up and moving around for a short period of time.

It is generally recommended that people take a 2-minute standing break for every 20-30 minutes of continuous sitting.

Different ways to incorporate standing breaks into your day are:

- Holding standing or walking meetings
- Standing up when you use the phone
- Using a washroom, printer, or garbage bin further from your desk
- Going for a gentle walk at lunch instead of sitting
- Talking with your co-workers in-person, rather than sending e-mails
- Standing-up to stretch when you finish a task
- Taking the “long way around” your office
- Setting a reminder on your mobile phone to stand-up and move around

Attitudes: Sitting

Think about work over the next three days. When it comes to **sitting at work** for the majority of the day, I think …

1.	Sitting at work is comfortable	1 = Strongly Disagree, 7 = Strongly Agree
2.	It's good to be comfortable at work	1 = Strongly Disagree, 7 = Strongly Agree
3.	Sitting at work lets me focus on the task	1 = Strongly Disagree, 7 = Strongly Agree
4.	It's good to be able to focus at work	1 = Strongly Disagree, 7 = Strongly Agree
5.	Sitting lets me be productive at work	1 = Strongly Disagree, 7 = Strongly Agree
6.	It's good to be productive at work	1 = Strongly Disagree, 7 = Strongly Agree
7.	I have good posture when I sit at work	1 = Strongly Disagree, 7 = Strongly Agree
8.	It's good to have good posture at work	1 = Strongly Disagree, 7 = Strongly Agree
9.	Sitting at work makes me feel stiff and sore	1 = Strongly Disagree, 7 = Strongly Agree

10. It's good to feel stiff and sore at work 1 = Strongly Disagree, 7 = Strongly Agree

11. Sitting at work makes me feel bored and restless 1 = Strongly Disagree, 7 = Strongly Agree

12. It's good to feel bored and restless at work 1 = Strongly Disagree, 7 = Strongly Agree

13. Overall, I think sitting at work is …

    a. [Overall good/bad] 1 = Bad, 7 = Good

    b. [Usefulness] 1 = Not Useful, 7 = Useful

    c. [Pleasantness] 1 = Unpleasant, 7 = Pleasant

    d. [Physical health] 1 = Bad for my Body 7 = Good for my Body

    e. [Mental health] 1 = Bad for Mental Health, 7 = Good for Mental Health

Attitudes: Standing Breaks

Think about work over the next three days. When it comes to taking **regular standing breaks** at work, I think …

1. Taking a standing break would help me be physically active 1 = Strongly Disagree, 7 = Strongly Agree

2. Being physically active at work is good 1 = Strongly Disagree, 7 = Strongly Agree

3. Taking a standing break at work would improve my posture 1 = Strongly Disagree, 7 = Strongly Agree

4. Having improved posture at work is good 1 = Strongly Disagree, 7 = Strongly Agree

5. Taking a standing break at work would help me feel less stiff and sore 1 = Strongly Disagree, 7 = Strongly Agree

6. Being less stiff and sore at work is good 1 = Strongly Disagree, 7 = Strongly Agree

7. Taking a standing break would help refresh and energise me 1 = Strongly Disagree, 7 = Strongly Agree

8. Feeling refreshed at work is good 1 = Strongly Disagree, 7 = Strongly Agree

9. Taking a standing break would make me less productive 1 = Strongly Disagree, 7 = Strongly Agree

10. Being less productive at work is good 1 = Strongly Disagree, 7 = Strongly Agree

11. Taking standing breaks would improve my health — 1 = Strongly Disagree, 7 = Strongly Agree

12. Being healthy at work is good — 1 = Strongly Disagree, 7 = Strongly Agree

13. Overall, I think taking **regular standing breaks** at work is …

    a. [Overall good/bad] — 1 = Bad, 7 = Good

    b. [Usefulness] — 1 = Not Useful, 7 = Useful

    c. [Pleasantness] — 1 = Unpleasant, 7 = Pleasant

    d. [Physical health] — 1 = Bad for my Body 7 = Good for my Body

    e. [Mental health] — 1 = Bad for Mental Health, 7 = Good for Mental Health

Subjective Norms: Sitting

Think about work over the next three days. When it comes to **sitting at work** for the majority of the day …

1. Not sitting at work would get me into trouble — 1 = Strongly Disagree, 7 = Strongly Agree

2. It's normal for office workers like me to sit at work — 1 = Strongly Disagree, 7 = Strongly Agree

3. It's expected that I sit at work — 1 = Strongly Disagree, 7 = Strongly Agree

4. Sitting is part of our office culture — 1 = Strongly Disagree, 7 = Strongly Agree

5. Most of my co-workers think I should sit at work — 1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

6. I care about what my co-workers think — 1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

7. My supervisor thinks I should sit at work — 1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

8. I care about what my supervisor thinks — 1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

9. My clients/customers think I should sit at work — 1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

10. I care about what my clients/customers think — 1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

Subjective Norms: Standing Breaks

Think about work over the next three days. When it comes to **taking regular standing breaks at work**, I think **…**

1.	Taking standing breaks would disrupt my co-workers	1 = Strongly Disagree, 7 = Strongly Agree
2.	Taking standing breaks would be socially awkward	1 = Strongly Disagree, 7 = Strongly Agree
3.	It’s normal for office workers like me to take standing breaks	1 = Strongly Disagree, 7 = Strongly Agree
4.	People in my office would encourage my standing breaks	1 = Strongly Disagree, 7 = Strongly Agree
5.	Most of my co-workers think I should take standing breaks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
6.	I care about what my co-workers think about standing breaks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
7.	My supervisor thinks I should take standing breaks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
8.	I care about what my supervisor thinks about standing breaks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
9.	My clients/customers think I should take standing breaks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A
10.	I care about what my clients/customers think about standing breaks	1 = Strongly Disagree, 7 = Strongly Agree [ ] N/A

Perceived Behavioural Control: Sitting

Think about work over the next three days. When it comes to **sitting at work** for the majority of the day …

1.	I’m able to choose how much I sit at work	1 = Strongly Disagree, 7 = Strongly Agree
2.	I need to sit to get my work done	1 = Strongly Disagree, 7 = Strongly Agree
3.	I’m required to sit as part of my job	1 = Strongly Disagree, 7 = Strongly Agree

4. I have a health condition that makes it difficult to sit at work — 1 = Strongly Disagree, 7 = Strongly Agree
5. It's easy to sit at work — 1 = Strongly Disagree, 7 = Strongly Agree
6. I have a health condition that makes me have to sit a lot — 1 = Strongly Disagree, 7 = Strongly Agree

Perceived Behavioural Control: Standing Breaks

Think about work over the next three days. When it comes to **taking regular standing breaks at work**, I think **…**

1. I have a health condition that makes it hard to take standing breaks — 1 = Strongly Disagree, 7 = Strongly Agree
2. I'm able to choose whether or not I take standing breaks — 1 = Strongly Disagree, 7 = Strongly Agree
3. I'm normally too busy to take standing breaks — 1 = Strongly Disagree, 7 = Strongly Agree
4. My desk/workspace makes it easy to take standing breaks — 1 = Strongly Disagree, 7 = Strongly Agree
5. My work responsibilities restrict standing breaks — 1 = Strongly Disagree, 7 = Strongly Agree
6. If I wanted, I could incorporate standing breaks into my work routine — 1 = Strongly Disagree, 7 = Strongly Agree
7. If I wanted, I could take standing breaks and still be productive — 1 = Strongly Disagree, 7 = Strongly Agree

Intentions: Sitting

At the start of the survey, we asked about how much you sat over the past week. Now, we'd like you to think about your **plans** to sit and take standing breaks over the **next three days.**

1. Over the next three days, how much of your work day (excluding breaks) do you intend to sit down for? — ___ % of the day
2. How much of your break do you intend to sit down for? — ___ % of break time

3. Over the next week at work, how long do you intend to TYPICALLY sit for before standing up? ____ hours and ____ minutes
[ ] I'm not sure

4. Over the next week at work, what is the LONGEST you will sit for before standing up? ____ hours and ____ minutes
[ ] I'm not sure

Intentions: Standing Break

1. Over the next week, do you plan on taking standing breaks at work?
[ ] No – Never
[ ] Yes – Rarely
[ ] Yes – Sometimes
[ ] Yes – Often
[ ] Yes – Always

Participants who responded "No" were immediately directed to the final page of the survey.

2. Over the next three days, how strong is your intention to take standing breaks? 1 = Very Weak, 7 = Very Strong

3. Over the next week, I would like to take 1 standing break for every _____ hours and _____ minutes of continuous sitting.

4. Overall, how many times per day do you plan on taking a standing break? ____ times per day

Which of the following standing breaks would you like to try? For each strategy, think about (1) whether it's realistic for your workplace, and (2) whether you're actually planning on trying it out.

5. Holding standing or walking meetings
1 = Not Realistic, 7 = Very Realistic
1 = Will Not Try, 8 = Will Try

6. Standing up when you use the phone
1 = Not Realistic, 7 = Very Realistic
1 = Will Not Try, 8 = Will Try

7. Using a washroom, printer, or garbage bin further from your desk
1 = Not Realistic, 7 = Very Realistic
1 = Will Not Try, 8 = Will Try

8. Going for a gentle walk at lunch instead of sitting down
1 = Not Realistic, 7 = Very Realistic
1 = Will Not Try, 8 = Will Try

9. Talking with your co-workers in-person, rather than sending e-mails
1 = Not Realistic, 7 = Very Realistic
1 = Will Not Try, 8 = Will Try

10.	Standing-up to stretch when you finish a task	1 = Not Realistic, 7 = Very Realistic 1 = Will Not Try, 8 = Will Try
11.	Taking the “long way around” your office	1 = Not Realistic, 7 = Very Realistic 1 = Will Not Try, 8 = Will Try
12.	Setting a reminder on your phone to stand-up and move around	1 = Not Realistic, 7 = Very Realistic 1 = Will Not Try, 8 = Will
13.	Other strategy: ___________________	1 = Not Realistic, 7 = Very Realistic 1 = Will Not Try, 8 = Will

Thank-You for Completing Survey Two!

APPENDIX L:

STUDY THREE, TIME-3 QUESTIONNAIRE

Participant Communication

Notification E-mail

Hello!

A couple days ago, you completed the second Sitting in Office Workers survey.

The third questionnaire focuses on your sitting / standing breaks over the past three work days. It shorter than the last survey, and only takes about **5 to 10 minutes** to complete.

- You can access the survey here: https://fluidsurveys.usask.ca/s/tpb3/
- **Your participant ID is: XYZ**

Every time you complete a survey, your name will be automatically entered into a draw for 1 of 4 $50 gift certificates!

Thank-you for participating!

Reminder E-mail

Hello!

A few days ago, we sent you a link to the third Sitting in Office Workers survey. We noticed you haven't completed it yet, and wanted to send a friendly reminder.

The third questionnaire focuses on your sitting / standing breaks over the past three work days. It shorter than the last survey, and only takes about **5 to 10 minutes** to complete.

- You can access the survey here: https://fluidsurveys.usask.ca/s/tpb3/
- **Your participant ID is: XYZ**

Thank-you for participating!

Time-3 Questionnaire

Welcome Back

1. My Name is: ________________________________
2. My participant number is: ________________________________

Hello!

We hope you're having a great day!

Today's survey takes about **5-10 minutes** to complete. Some of the questions are similar to past surveys. When this happens, try to think about ***the past three work days***.

Please remember that this survey is **confidential**! Please answer honestly and to the best of your ability.

Sitting at Work

To start, we'd like to ask about your sitting over the past three days. Thinking about a typical day at work over the past three days …

1.	How much of your work day (excluding breaks) was s spent sitting down?	___ % of the day
2.	How much of your break time was spent sitting down?	___ % of the day
3.	At work over the past week, how long do you TYPICALLY sit for before standing up?	____ hours and ____ minutes [ ] I'm not sure
4.	At work over the past week, what is the LONGEST you sat for before standing up?	____ hours and ____ minutes [ ] I'm not sure

Standing Breaks

A ***standing break*** is a way to interrupt long bouts of sitting. Just like it sounds, it involves purposefully standing up and moving around for a short period of time.

1.	Over the past three days, did you purposefully take standing breaks at work?	[ ] No – Never [ ] Yes – Rarely [ ] Yes – Sometimes [ ] Yes – Often [ ] Yes – Always

Participants who responded "No" were immediately directed to the final page of the survey.

2.	Over the past three days, how much effort did you put into taking standing breaks?	1 = No Effort, 7 = Lots of Effort
3.	On a typical work day, how many times per day do you stand up from your desk?	____ times per day

4. What percentage of your standing-up was for the purpose of taking a standing break? ____ % of my standing-up

5. On average, I took 1 standing break for every _____ hours and _____ minutes of continuous sitting.

6. Overall, how many times per day do you plan on taking a standing break? ____ times per day

Over the past three days …

7. Where you satisfied with taking standing breaks? -3 = Very Dissatisfied, 3 = Very Satisfied

8. Did standing breaks affect your work? -3 = Bad for Work, 3 = Good for Work

9. Did standing breaks affect your body? -3 = Bad for Body, 3 = Good for Body

10. Did standing breaks affect your mental health? -3 = Bad for / , 3 = Good for Mental Health

11. Do you intend to continue taking standing breaks next week? -3 = Definitely Not, 3 = Definitely Yes

12. Would you recommend that others try standing breaks? -3 = Definitely Not, 3 = Definitely Yes

13. Did you experience any immediate ***positive outcomes*** as a result of your standing breaks?

____

____

14. Did you experience any immediate ***negative outcomes*** as a result of your standing breaks?

____

____

Standing Break Strategies

Over the past three days, did you try any of the following standing breaks?

1. Holding standing or walking meetings? [ ] Yes
[ ] No

If a participant responded "Yes" to a question, the following items would appear on-screen:

a. On average, how many times per day did you try this strategy? [ ] 1/day [ ] 4/day [ ] 2/day [ ] 5/day [ ] 3/day [ ] Other: _________

b. When it comes to standing / walking meetings …

i. I liked this strategy 1 = Strongly Disagree, 7 = Strongly Agree

ii. I will try this again 1 = Strongly Disagree, 7 = Strongly Agree

2. Standing-up when you use the phone [ ] Yes [ ] No

3. Using a washroom, printer, or garbage bin further from your desk? [ ] Yes [ ] No

4. Going for a gentle walk at lunch instead of sitting down? [ ] Yes [ ] No

5. Talking with your co-workers in-person, rather than sending e-mails? [ ] Yes [ ] No

6. Standing-up to stretch when you finish a task? [ ] Yes [ ] No

7. Taking the "long way around" your office? [ ] Yes [ ] No

8. Setting a reminder on your phone to stand-up and move around? [ ] Yes [ ] No

9. Other strategy: _________________ [ ] Yes [ ] No

Thank-You for Completing Survey Three!

APPENDIX M:

STUDY THREE, TIME-4 QUESTIONNAIRE

Participant Communication

Notification E-mail

Hello!

This is the fourth and final survey of the Sitting in Office Workers Study!

Like the third survey, this one takes about **5-10 minutes** to complete and asks about sitting and standing breaks. At the end, your name will be automatically entered into a draw for 1 of 4 $50 gift certificates.

- The survey can be found at https://fluidsurveys.usask.ca/s/tpb4/
- **Your participant ID is: 470**

At the end of the questionnaire, we share a little bit of information about the goals of this research. If you have any extra questions, please feel free to e-mail me.

Thank-you for participating in this research!

Reminder E-mail

Hello!

A couple days ago, we sent you a link to the fourth (and final!) Sitting and Office Workers survey. We noticed that you haven't completed it yet, and wanted to send a friendly reminder.

This survey takes about 5-10 minutes to complete, and asks about sitting and standing breaks. At the end, your name will be automatically entered into a draw for 1 of 4 $50 gift certificates.

- You can access the survey here: https://fluidsurveys.usask.ca/s/tpb4/
- **Your participant ID is: XYZ**

Thank-you for participating in this research!

Time-4 Questionnaire

Welcome Back!

1. My Name is: ______________________________
2. My participant number is: ______________________________

Hello!

This is the fourth (and final!) survey of the Sitting in Office Workers Study. The questions are similar to the last survey - except this time, we'd like to you think about work **over the past week**.

Please remember that this survey is **confidential**. Please answer honestly and to the best of your ability.

Sitting at Work

Over the past week at work …

1.	How much of your work day (excluding breaks) was s spent sitting down?	___ % of the day
2.	How much of your break time was spent sitting down?	___ % of the day
3.	At work over the past week, how long do you TYPICALLY sit for before standing up?	____ hours and ____ minutes [ ] I'm not sure
4.	At work over the past week, what is the LONGEST you sat for before standing up?	____ hours and ____ minutes [ ] I'm not sure

Standing Breaks

A ***standing break*** is a way to interrupt long bouts of sitting. Just like it sounds, it involves purposefully standing up and moving around for a short period of time.

1.	Over the past week, did you purposefully take standing breaks at work?	[ ] No – Never [ ] Yes – Rarely [ ] Yes – Sometimes [ ] Yes – Often [ ] Yes – Always

Participants who responded "No" were immediately directed to the final page of the survey.

2.	Over the past week, how much effort did you put toward standing breaks?	1 = No Effort, 7 = Lots of Effort
3.	On a typical work day, how many times per day did you stand-up from your desk?	____ times per day

4. What percentage of your standing-up was for the purpose of taking a standing break? ____ % of my standing-up

5. On average, I took 1 standing break for every _____ hours and _____ minutes of continuous sitting.

6. Overall, how many times per day do you plan on taking a standing break? ____ times per day

Over the past week …

7. Where you satisfied with taking standing breaks? -3 = Very Dissatisfied, 3 = Very Satisfied

8. Did standing breaks affect your work? -3 = Bad for Work, 3 = Good for Work

9. Did standing breaks affect your body? -3 = Bad for Body, 3 = Good for Body

10. Did standing breaks affect your mental health? -3 = Bad for / , 3 = Good for Mental Health

11. Do you intend to continue taking standing breaks next week? -3 = Definitely Not, 3 = Definitely Yes

12. Would you recommend that others try standing breaks? -3 = Definitely Not, 3 = Definitely Yes

13. Did you experience any immediate ***positive outcomes*** as a result of your standing breaks?

____

____

14. Did you experience any immediate ***negative outcomes*** as a result of your standing breaks?

____

____

Standing Break Strategies

Over the past week, did you try any of the following standing breaks?

1. Holding standing or walking meetings? [ ] Yes
   [ ] No

If a participant responded "Yes" to a question, the following items would appear on-screen:

a. On average, how many times per day did you try this strategy? [ ] 1/day [ ] 4/day [ ] 2/day [ ] 5/day [ ] 3/day [ ] Other: _________

b. When it comes to standing / walking meetings …

i. I liked this strategy — 1 = Strongly Disagree, 7 = Strongly Agree

ii. I will try this again — 1 = Strongly Disagree, 7 = Strongly Agree

2. Standing-up when you use the phone [ ] Yes [ ] No
3. Using a washroom, printer, or garbage bin further from your desk? [ ] Yes [ ] No
4. Going for a gentle walk at lunch instead of sitting down? [ ] Yes [ ] No
5. Talking with your co-workers in-person, rather than sending e-mails? [ ] Yes [ ] No
6. Standing-up to stretch when you finish a task? [ ] Yes [ ] No
7. Taking the "long way around" your office? [ ] Yes [ ] No
8. Setting a reminder on your phone to stand-up and move around? [ ] Yes [ ] No
9. Other strategy: __________________ [ ] Yes [ ] No

Debriefing Note

Thank-You for Completing Survey Four!

Sedentary behaviour is increasingly being identified as a health risk behaviour. Modern research has linked it to many negative outcomes, like mortality and diabetes.

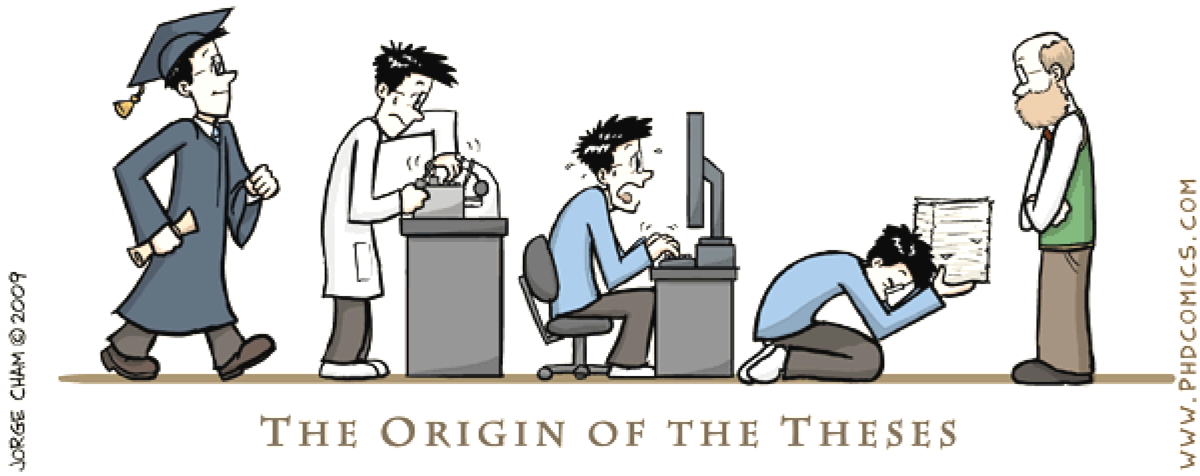
This is one of the first studies to look at the psychology of sitting. As a participant, you answered four surveys on sitting at work. Questions included (1) how much you sit, (2) your attitudes toward sitting / standing breaks (e.g., whether it's a good or bad thing), (3) the effect of the social environment (e.g., co-workers), and (4) perceptions of control (e.g., can you change the amount you sit?). From this information, we hope to better-understand why some people sit more (or less) than others.

In the second questionnaire, you were randomised to receive one of three health messages: (1) a control message, (2) a proximal message, and (3) a distal message. The purpose of these messages was to examine whether *type of information* matters in encouraging standing breaks. All three messages can be found on the next page. [cf. Table 26, pp. 122]

As some of your co-workers might still be participating in this research, we ask that you please keep study details confidential for the time being!

If you have any questions, comments, or thoughts, please feel free to contact us via e-mail or the comment box below!

Thank-you for participating!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