PREVALENCE AND CORRELATES OF LOW SEDENTARY TIME AMONG CANADIAN ADULT POPULATIONS

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DEDICATION

This Thesis is dedicated to my excellent wife Amber and newborn daughter Presley – I love you both. Their incredible sacrifice, love, and support was vital in allowing me to conduct this research, and motivating me complete this thesis. Also, a special dedication goes to my parents. My father Hal, who through his wisdom and example has provided me with the most important education I will ever receive. He will always be my hero. Also, my mother Donell, who consistently put my needs before her own, and has been my biggest fan throughout my entire life. I love you.

ABSTRACT

Sedentary behaviour is associated with an increased incidence of cardiovascular disease, diabetes, obesity, cancer, depression, and all-cause mortality. In Canada, little is known regarding the prevalence and correlates of sedentary time during leisure. The purpose of this study was to identify sociodemographic, behavioural, community, and health-related factors associated with low sedentary time. Using epidemiological data from the Canadian Community Health Survey, prevalence and correlates of sedentary time were identified among adults in the general population, First Nations adults, and Métis adults living outside Aboriginal communities. Findings indicate a strong association between sense of belonging to community and low sedentary time, and that low income is an important determinant of sedentary behaviour regardless of ethnic group. Use of intersectionality theory highlighted the complexity of this association, particularly among First Nations and Métis adults, and the need to consider the role of social inequities in health behaviour and intervention ideas.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

CCHS	Canadian Community Health Survey
HDL	High Density Lipoprotein
LPL	Lipoprotein Lipase
METS	Metabolic Equivalents
MVPA	Moderate to Vigorous Physical Activity
PA	Physical Activity
PUMF	Public Use Microdata File
RDC	Research Data Center
SB	Sedentary Behaviour
VIF	Variance Inflation Factor

CHAPTER 1: INTRODUCTION

Introduction

Prolonged sedentary behaviour (too much sitting) is a documented risk factor for adverse health outcomes.[1] Yet, more and more it is becoming the norm in society to engage in prolonged sedentary behaviour, both at work and during leisure time.[2] Those who choose non-sedentary leisure pursuits are often the minority in today's increasingly technological society. Yet, to date, we know little about the determinants that underlie the choice to be non-sedentary among adults outside of their working hours. The goal of this thesis is to shed light on the potential role that community, economic, health-related and demographic factors may play in shaping low sedentary behaviour among adults, both in the general population and among the rapidly growing First Nations and Métis populations in Canada.

Sedentary Behaviour

Sedentary behaviour (SB) is an important and modifiable determinant of health in developed countries like Canada. Longitudinal studies indicate SB is associated with an increased incidence of cardiovascular disease, diabetes, obesity, cancer, depression, and all-cause mortality.[1] Recent physiological studies have also identified that long-term muscular unloading during sedentary activities has negative physiological consequences, including the suppression of skeletal muscle lipoprotein lipase activity.[3,4] Interestingly, current research suggests that on average, adults spend over half their waking hours sitting.[2] As a result, sedentary lifestyles potentially place a major burden on population health in countries around the world.

It is important to note that SB is distinct from physical inactivity, which implies insufficient moderate to vigorous physical activity (MVPA).[5] Conversely, SB refers to prolonged periods of muscular unloading, such as sitting. The negative health outcomes associated with SB have been shown to be independent of physical activity.[6–10] Given the prevalence and health impact of SB in today's modern culture, this thesis generated information for future intervention techniques.

Thesis Overview

This thesis was written in paper format. Each of three papers includes its own introduction, methods, results, and discussion so that each may be submitted for publication.

Paper 1: The General Adult Population

The purpose of Paper 1 was to gain an understanding of the prevalence and correlates of low leisure time SB across the general adult population in Canada. While leisure SB research has previously been conducted in the general Canadian population, it has examined only a limited number of sedentary activities (ie, television viewing, or computer use) and has focused on the determinants of high SB during periods of leisure.[11,12] The purpose of this research was to examine the determinants of low SB during leisure, using an expanded range of leisure activities including reading, television, computer, and videogame use. Data for this paper were derived from the 2010 Canadian Community Health Survey: Public Use Microdata File (CCHS-PUMF). Access to the CCHS-PUMF was obtained through direct download from Statistics Canada. Regression techniques were used to examine the association between combined sedentary time and

six sociodemographic and five additional variables of interest. A list of these variables of interest can be found in Table 1-1. Three key objectives are presented in this paper:

1. Describe the sociodemographic characteristics of community-based adults who are the least sedentary during leisure.

2. Examine associations between perceived health, physical activity, and SB.

3. Examine the association between sense of community belonging and sedentary leisure time.

A major finding of this paper was the novel association between sense of belonging and low sedentary time. As this approach to sedentary research is still in its nascent stages, this paper was used as a guide by which hypotheses and research questions for the research presented in Papers 2 and 3 were formulated. The results of this research are presented in Chapter 3.

Paper 2: First Nations Populations in Canada

The purpose of Paper 2 was to gain an understanding of the prevalence and correlates of low leisure time SB among First Nation populations in Canada. The objectives of this paper were developed based on the unique findings of Paper 1, which reported a strong association between sense of belonging and low sedentary time. Data were derived from the 2012 CCHS Master File. Regression models examining the relationship between SB (ie, reading, television, computer, and videogame use) and six sociodemographic, three behavioural, and one community variable of interest were conducted (see Table 1-2). Paper 2 built upon the findings of Paper 1 by incorporating the theory of intersectionality to better understand the impact of combined social, cultural,

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and economic influences on the association between sense of belonging and SB. Three hypotheses were explored in this paper:

1. Alcohol consumption and smoking would have a positive association, and physical activity an inverse association with SB during leisure among First Nations adults.

2. Sense of belonging to community would be inversely associated with leisure sedentary time among First Nations adults after adjustment for relevant sociodemographic confounders and health.

3. The inverse association between community belonging and sedentary time in leisure will be stronger among higher-income First Nations groups.

This paper, which is presented in Chapter 4, reported a novel finding in relation to the power of intersectionality theory in SB research by building on the previous results found in Paper 1.

Paper 3: The Métis Populations

The purpose of Paper 3 was to gain an understanding of the prevalence and correlates of low leisure time SB among the Métis population in Canada. The objectives of this paper built upon the findings as presented in Paper 1 and Paper 2, which indicated a unique impact of intersectionality between social class and culture on the association between sense of belonging and low sedentary time. Data were derived from the 2012 CCHS Master File. Regression models examining the relationship between SB (ie, reading, television, computer, and videogame use) and six sociodemographic, three behavioural, and one community variable of interest were conducted. A summary of these variables can be found in Table 1-2. This study built upon the insights gained in

Paper 2 by similarly framing research findings using intersectionality theory. The results reported in Paper 3 are presented in Chapter 5. This paper explored two hypotheses and one research question:

1. Alcohol consumption and smoking would have a positive association and physical activity an inverse association with SB during leisure among Métis adults.

2. Sense of belonging to community would be inversely associated with leisure SB among Métis adults after adjustment for relevant sociodemographic confounders and health.

3. Is there a variation in the association between sense of belonging and sedentary behaviour within the Métis population based on gender?

Findings from this paper provided important and unique information concerning the association between sense of belonging and SB, when stratified by gender among the Métis.

Important to note, to gain access to the 2012 CCHS Master File for analysis of First Nations and Métis populations (see Paper 2 and Paper 3), I was required to submit an in-depth application to Statistics Canada. It was only through the Lethbridge Research Data Centre (RDC) on campus that I was permitted access to the secure variables that indicated Aboriginal participants. In addition, integrity of all statistical analyses for both Papers 2 and 3 were verified by Statistics Canada before the release of this data from the Lethbridge RDC.

Results and Significance of Research

Most SB research has focused on risk factors and subsequent negative health outcomes. In my thesis, I have identified those who were least sedentary during leisure based on their sociodemographic, behavioural, and community-based correlates. This thesis is the first set of studies to identify the prevalence of leisure time SB among the Canadian general population and among two key Aboriginal adult populations using a broad range of SB activities. It was also one of the first to frame findings in this field using sociologic theory. Through this thesis, I have contributed to the literature by reporting novel findings and generating hypothesis that will benefit future research and intervention strategies. It is my hope that these findings will be considered by policy makers and researchers to reduce SB in Canada and thus reduce the prevalence of this common behaviour.

Table 1-1. Paper 1: General Canadian Population - Key Exposure Variables

Sociodemographic Variables	Additional Variables of Interest
Age	Physical activity
Gender	Perceived life stress
Education	Perceived mental health
Marital status	Perceived health
Income	Sense of community belonging
Employment status	

Table 1-2. Papers 2 and 3: First Nations and Métis Populations - Key Exposure Variables

Sociodemographic Variables	Behavioural Variables	Community Variables
Age	Physical activity	Sense of community belonging
Gender	Smoking	
Education	Alcohol consumption	
Marital status		
Income		
Employment status		

CHAPTER 2: LITERATURE REVIEW

Sedentary behaviour (SB) is an important and modifiable determinant of health in developed countries. Longitudinal studies have indicated that SB is associated with an increased incidence of cardiovascular disease, diabetes, obesity, cancer, depression, and all-cause mortality.[1] Thus, sedentary lifestyles potentially place a major burden on population health in countries around the world. My research objective was to identify the prevalence of SB among several key populations in Canada. In addition, I examined the behavioural correlates associated with low amounts of SB among these populations. This knowledge will fill multiple gaps in the understanding of SB among Aboriginal and non-Aboriginal populations and facilitate future intervention strategies in these diverse groups.

Currently, a large amount of literature has focused on SB among children and youth. This review focused on the literature available for adult populations. Due to a limited amount of information regarding SB in Canadian populations, I will incorporate studies from other developed countries. My goal is to summarize the current understanding of SB research and to highlight current gaps in our knowledge about SB.

This review follows a thematic structure. I begin with a broad focus and progressively become more focused on research gaps and my specific research questions. I will begin with the current knowledge of SB and its association with negative health outcomes. Next, I will identify the current understanding of sociodemographic correlates of SB among adults. Finally, I will identify how my proposed research has addressed key gaps and contributed to future research questions.

Background

The Sedentary Behaviour Research Network defined SB as any waking activity that has an energy expenditure of ≤ 1.5 METS (metabolic equivalents) while in a sitting or reclining posture.[13] One MET represents resting energy expenditure or resting metabolic rate. Walking is 2-4 METS, and general bicycling requires 8 METS.[14] Although sleeping has a MET value of 0.9 METS, it is not considered a sedentary activity, as it is not a waking behaviour. SB includes activities such as sitting while watching television, using computers, reading, or driving.[15]

It is important to note that SB is distinct from physical inactivity, which implies insufficient moderate to vigorous physical activity (MVPA).[13] Conversely, SB refers to prolonged periods of muscular unloading, such as sitting. It is possible to engage in regular MVPA and still accumulate significant amounts of sedentary time. Those who are highly sedentary and participate in the recommended amount of physical activity also experience similar negative health outcomes as those who are not physically active.[6–10]

In today's modern culture, SB can be categorized into both leisure time and occupational SB. Leisure time SB involves behaviour outside of work and school, while occupational SB refers to behaviour during work and school. Technological advancements and an increased production of electronic devices have facilitated high amounts of occupational and leisure time SB. Objective measures have highlighted that on average, adults in developed countries spend more than half of all waking hours in sedentary activities.[2] Although SB is prominent within modern culture, there are many gaps in today's understanding of its influences. In particular, there is a dearth of research that has focused on factors that encourage the public to reduce their sedentary time

despite today's modern conveniences. This lack of knowledge is an area of concern given the current understanding of the negative physiological impact of SB.

Physiological Responses to Sedentary Behaviour

In 2003, Bey and Hamilton used a standard animal rat model to study the physiological implications of SB.[3] They identified that long-term muscular unloading has negative physiological consequences, including the suppression of skeletal muscle lipoprotein lipase (LPL) activity. LPL plays a central role in lipid metabolism and high-density lipoprotein (HDL) cholesterol production,[3,4] both of which are essential for maintaining good health. Lipids are structural components of all living cells. Lipid metabolism plays a number of critical roles within one's body.[16] HDL cholesterol enables reverse cholesterol transport, in which excess cholesterol in cells and the circulatory system is removed, avoiding health complications such as atherosclerosis.[17] On a functional level, LPL catalyses the rate-limiting step in the hydrolysis of multiple components present in circulating lipoproteins. This results in the production of non-esterified fatty acids, which are used as energy sources and increased HDL production.[18] Therefore, a decrease in lipid metabolism and HDL cholesterol induced by SB increases the chance of metabolic disorders, obesity, and cardiovascular disease.[19] Multiple studies have provided evidence that deregulation in the LPL pathway and/or LPL deficiency is associated with type 1 and 2 diabetes, insulin resistance, infection, and cancer.[1,18] Furthermore, integrity of LPL structure and function appears to also be associated with Alzheimer's disease.[20,21]

In 2007, Healy et al. conducted a cross-sectional observational study of human participants using accelerometers to explore the physiological consequences of SB.[22]

Objective data on sedentary time were obtained from 173 physically active adults (67 men and 106 women). After seven days of accelerometer use, 2-hour plasma glucose and fasting plasma glucose were recorded. Results showed that sedentary time was positively associated with higher 2-hour plasma glucose levels. Also, although all participants in this study were classified as physically active adults, the physiological effects of SB were independently significant. This finding added strength to the claim that the deleterious effects of SB are independent of physical activity. A major strength of this study was the use of accelerometers to generate objective measures of sedentary time compared to previous research, which has used more subjective measures. However, it is worth noting that although accelerometers provide objective measures, they too have limitations in measurement that may produce inaccurate recordings among individuals.[23] A major limitation to this study was its cross-sectional nature, which limited inference of causality.

These findings from Bey and Hamilton[3] and Healy et al.[22] provided interesting evidence regarding the negative physiological consequences of engaging in SB. Additional studies involving human models would further enhance the ability to understand how factors such as stretching, fidgeting, and other slight movements may reduce the negative physiological responses of SB.

Sedentary Behaviour and Negative Health Outcomes

The impacts of SB on physiological function have been shown to translate into adverse health over time as demonstrated by longitudinal and cross-sectional studies. The following population-based studies illustrate the identified risks for multiple negative health outcomes associated with SB.

All-Cause and Cardiovascular Disease Mortality

In 2009, Katzmarzyk et al. published a 12-year Canadian retrospective longitudinal study that investigated the relationship between sitting time and mortality rates.[24] The sample included 7,278 men and 9,735 women aged 18–90 years living in urban and rural areas across Canada. After controlling for confounders (ie, physical activity, smoking status, and alcohol consumption), Katzmarzyk et al. discovered a dose-response association between sitting time and both all-cause and CVD mortality. Specifically, in comparison to those who reported rarely sitting throughout the day to those who reported siting half, three quarters, and almost all of the time, these latter groups had a 11%, 36% and 54% higher increase in the odds of mortality, respectively. The longitudinal design and large representative sample allowed for inference concerning temporal sequence with minimal random error. A weakness in the study was the inability to screen for pre-existing diseases during the baseline measure, which may have skewed the findings. However, during the analyses, deaths that occurred during the first year of follow-up were eliminated in an attempt to reduce possible error from pre-existing conditions.

Building on these findings, in 2011, a prospective longitudinal study using the Scottish Health Survey was published.[25] Using a sample of 4,512 adults (1,945 men and 2,567 women), Stamatakis et al. examined the association between daily TV time, all-cause mortality, and CVD events (ie, myocardial infarction, coronary artery bypass, angioplasty, stroke, heart failure, or CVD-related death) among adults aged ≥ 35 years old. They found that TV time was positively associated with all-cause mortality and CVD events. Specifically, for every 1-hour increase in daily TV time, there was a 7% increase

in the risk of all-cause mortality. This association remained significant regardless of

physical activity. In fact, those who watched ≥ 4 hours of television/day and engaged in

regular physically active had a 54% higher risk of all-cause mortality and were 110%

times more likely to experience a CVD event than those who watched less than 2 hours

per day. In other words, a greater amount of sitting time increases the chance of suffering

from a CVD outcome and death, regardless of physical activity. Their findings were

supported by a similar prospective study from the United Kingdom, which also

concluded that television viewing time was an independent predictor of all-cause and

CVD mortality.[26] Strengths of the previously mentioned studies were the longitudinal

sample design, but a major limitation was the use of self-report measures of television

viewing time and physical activity. Interestingly, another study reported that the positive

association between SB and both CVD and all-cause mortality remains significant even

when stratifying by gender.[27,28]

Diabetes

Studies have also examined the association between SB and diabetes. Ford et al.

conducted an 8-year prospective study to investigate television viewing time as a risk

factor for type 2 diabetes incidence.[29] The study involved 23,855 German men and

women aged 35–65 from the European Prospective Investigation into Cancer and

Nutrition-Postdam Study. Ford and colleagues discovered that TV time was positively

associated with incidence of type 2 diabetes. In fact, those who watched ≥ 4 h/day of

television compared with those who watched < 1 h/day were 63% more likely to develop

type 2 diabetes, even after controlling for occupational activity, physical activity, food

intake and systolic blood pressure. In addition, the mean television viewing time of

participants who developed diabetes was 2.4 hours per week, compared to 2.0 hours per

week for those who did not. Thus, more television time was associated with a higher rate

of diabetes incidence. A similar study that examined males only, supported these findings

by reporting a similar association between TV time and diabetes.[30] A limitation to these

designs was the self-reported measures of television time.

Zhang, Solomon, Manson, and Hu explored the relationship between sedentary

time and the incidence of gestational diabetes.[31] Data were retrieved from the Nurses'

Health Study II, which included 21,765 women who had given birth at least once during

the 8-year study. Zhang et al. documented a total of 1,428 new cases of gestational

diabetes over the course of the study. Analyses revealed that women who spent ≥

20 h/week watching television were 30% more likely to develop gestational diabetes than

those who watched less than 2 hours per week. This is the only study that explored the

relationship between gestational diabetes and SB, and further research is necessary to

verify these results. Regardless of the need for future research, a clear positive

relationship exists between sedentary time and incidence of diabetes. Important to note is

that this association was reported as being independent of physical activity and food

intake. This highlighted a more direct relationship between SB and this negative health

outcome, independent of other key risk factors.

Cancer

A longitudinal study from Sweden highlighted the risk of developing endometrial

cancer as a result of high TV/sitting time.[32] Friberg and associates examined 56,030

females aged 43–79. During 7.25 years of follow-up, there were 199 new endometrial

cancer cases. Those who watched TV/sat for ≥ 5 hours daily had a 66% increased risk of

developing endometrial cancer. A major strength of this study was the ability to identify endometrial cancers cases with exceptional accuracy through Swedish cancer registries.

A larger longitudinal cohort in the United States involving 300,673 participants between the ages of 50 and 71 from the NIH-AARP Diet and Health Study found a positive dose response association between sedentary time (ie, watching television/videos) and colon and rectal cancer.[33] Over the 7-year study, 3,410 cases of colon and 1,312 cases of rectal cancer were identified. Interestingly, this association was stronger for males than for females. Although the massive sample size was useful in reducing random error, a weakness of both this study and that of Friberg and associates was the use of self-reported measures of sedentary time. In summary, research has suggested that SB is temporally associated with the incidence of endometrial, colon, and rectal cancer. Yet, more research is necessary regarding cancer and SB, due to the large quantity of different cancer types and in order to verify accuracy of previous findings.

Obesity

In 2008, Shields and Tremblay examined the association between SB and obesity.[12] Using cross-sectional data from the 2007 Canadian Community Health Survey (CCHS), they analysed the prevalence of obesity in association with sedentary time. The analysis consisted of 42,612 individuals (20–64 years old) who self-reported their hours of leisure time SB in watching television, using a computer, and reading. Using cross-tabulations of sedentary time and BMI, Shields and Tremblay identified that 25% of Canadians who watched 21 or more hours of television a week were classified as obese. Also, those who watched 21 hours or more of television per week were 80% more likely to be classified obese than those who watched 5 hours or less. Interestingly, when this

result was examined using multivariate modeling to control for leisure-time physical activity and diet, the strength of association remained. Leisure time computer use of more than 11 hours per week was also associated with a 20% increased risk of obesity for men and a 40% increased risk for women when compared to those who engaged in 5 hours or less. In summary, increased sedentary time, while watching television and using a computer, was associated with higher rates of obesity. A strength of this study was the use of the CCHS, a high-quality annual Canadian health survey that provides an accurate representation of the entire household population of Canada, making these findings generalizable. A major limitation to this study was the self-reported measures of BMI, SB, diet, and physical activity. Also, the cross-sectional design of the CCHS inhibits interpretation of temporal sequence or causality. Although the study contained many limitations, it is useful for generating hypotheses for potential cohort or intervention studies.

The findings of Shields and Tremblay were supported by an American longitudinal study, which used data from the Atherosclerosis Risk in Communities Study (ARIC).[34] The ARIC study was designed to examine risk factors for cardiovascular disease and mortality among men and women aged 45–64 years old in a number of States within the USA. In this study, 15,792 participants provided information on BMI during a baseline clinical visit. Information regarding SB was obtained by a questionnaire, where the respondents were asked to report television usage time. Those who reported high levels of TV time were 43% more likely to be overweight or obese than those who reported low TV time. When prospective data at follow-up were considered, television time was also significantly associated with the risk of obesity. These findings built on the

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previously mention Shields and Tremblay study by providing temporal information. A major limitation to this study was that the questions regarding television time were subjective. Yet, in a similar line of research, Raynor et al. also found that those who maintained weight loss were more likely to engage in minimal amounts of TV time.[35] As well, researchers have found that low amounts of sitting while watching TV are associated with weight maintenance and even a modest decrease in BMI.[36] Thus, it is clear that SB is positively associated with weight gain and obesity rates. Further research focused on the association between SB and obesity would help clarify the question of whether the association with obesity is due to poor dietary choices induced by advertisements while watching television/computer use, the physiological response to SB, or both.

Life Expectancy

In 2012, Veerman et al. conducted the first study to examine SB and life expectancy.[37] Data were derived from the 1999-2000 Australian Diabetes, Obesity and Lifestyle (AusiDiab) study, a national Australian population-based cross-sectional survey. Veerman and colleagues used TV viewing time information from the 11,247 participants aged $\geq$ 25 years (mean age 50 years) to estimate TV viewing time and its relation to life expectancy. The researchers concluded that every one hour of TV viewed after the age of 25, shortened life expectancy by 22 minutes. These findings quantified the negative effects of TV time on life expectancy and paralleled those found in similar studies on smoking, obesity, and lack of physical activity. While these results carry merit, they are limited in their focus on television viewing alone, which neglects other prominent types of SB. Also, the data for this study were retrieved from a cross-sectional,

self-report survey. Regardless of possible inaccuracies, these results illustrated that

sedentary time can reduce life expectancy.

Summary of Sedentary Behaviour and Health Associations

A recent systematic review of longitudinal studies from 1996 to 2011 illustrated

similar findings across multiple studies regarding the positive association between SB

and all-cause mortality, diabetes, cancer, and obesity.[1] Furthermore, some studies have

demonstrated an association between SB and an increased risk of gallstone disease,

mental disorders, and hypertension.[1] Based on current knowledge, it is safe to conclude

that there is a clear association between increased sedentary time and multiple negative

health outcomes, making SB an important health determinant. However, further research

aimed towards a stronger understanding of the magnitude of given associations would

still be beneficial.

The Burden of Sedentary Behaviour on Society

The negative health outcomes and heighted prevalence of SB in society also place

a major burden on population health around the world. The World Health Organization

has ranked cardiovascular disease, cancer, and diabetes among the top 10 leading causes

of mortality in high-income countries, and the risk of all three diseases is associated with

SB. It is important to note that cardiovascular disease is the number one leading cause of

death throughout the world, regardless of income.[38] SB and its associated negative health

outcomes not only affect health and life expectancy of populations, but these diseases also

place a huge economic burden on healthcare programs. For example, in Canada during

the year 2000 alone, cardiovascular diseases were the second most economically

burdensome major disease, producing both direct and indirect costs exceeding $22.2

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billion dollars.[39] The negative health outcomes and economic burden associated with SB must be considered seriously. In an effort to maintain sustainable healthcare and reduce chronic disease within Canada, more knowledge regarding SB is needed, especially regarding its impact within different sociodemographic and at-risk groups.

<div align="center">**Sociodemographic Correlates**</div>

As reviewed, many studies have examined the adverse health effects of SB in general populations. To further the understanding of SB and possible public health implications, researchers have also attempted to clarify an understanding of the prevalence of SB across sociodemographic strata; the findings of which will now be outlined.

Gender

Gender has been an area of particular interest given possible gender social norms. In 2013, Wallmann-Sperlich et al. examined the social correlates of overall daily sitting time among German adults.[40] Cross-sectional data were collected from 2,000 adults (967 men, 1,033 women). Findings indicated that median sitting time for men was one hour higher than women (5 vs. 4 hours/day). They found that young men (18–29 years old) reported the highest prevalence > 6 hours per day of sedentary time (48.6%). In contrast, only 41.2% of women aged 18–29 reported sitting > 6 hours per day.

In a large population-based Australian study using data from the Australian Diabetes, Obesity, and Lifestyle (AusiDiab) study, it was similarly reported that men engage in more TV viewing time than women.[41] Furthermore, Canadian research has indicated men are more frequent computer users during leisure time.[11] However, the same

Canadian study reported no significant difference in TV time and gender.[11] Although unclear, this current knowledge hints that men may be more sedentary than females. However, more research is warranted to understand the true relationship between SB and the underlying factors that may be influencing gender differences.

Age

In 2008, Shields and Tremblay investigated the prevalence of frequent leisure time television and computer usage among Canadians.[11] Using data from the 2007 CCHS, they obtained self-report TV and computer time from 57,367 Canadians aged 20 years or older. Frequent TV use was defined as 15 hours or more per week, and frequent computer use by 11 hours or more per week. While frequent television usage was positively associated with age, frequent computer usage was inversely associated with age. A similarly designed study in Australia by Clark et al. reported that age was only positively associated with sedentary time among females, but not males. Among males, those aged 25–44 years old were the most sedentary[41] These findings suggest that the association between age and sedentary time may differ based on the type of sedentary activity. Future research should investigate a broader range of sedentary activities and their association with age.

Income

The previously mentioned Australian study by Clark et al. also reported that both men and women with a low household income (0–$300/week), when compared to those with high household income (≥ $800/ week), were more likely to be high TV users.[41] These results were confirmed by Shields and Tremblay, who reported that higher household income is associated and less TV use.[11] Yet, household income had no

correlation with frequent computer use. These findings hint that perhaps lower income is associated with an increase in television use, but not computer use.

Marital Status

Regarding marital status, both Shields and Tremblay and Clark et al. reported that those who were never married or lived alone were more likely to be both frequent television and computer users than those who were married/living in common law.[11,41] However, both studies neglected to hypothesize a reason behind this correlation. In addition, other studies have reported no association between marital status and overall sitting time.[42] Further research is needed to understand the true relationship between marital status and SB.

Ethnicity

To date, there has been only a limited amount of information on SB within specific ethnic groups. In Canada, there is only one *youth* study that has examined exercise, diet, and TV time across Aboriginal and non-Aboriginal youth in Canada.[43] Data from the 2004 CCHS were used to contrast these behaviours between 198 Aboriginal and 4,448 non-Aboriginal youth aged 12–17 years old. Participants were categorized into two groups: low TV watchers ($\leq$ 14 hours per week) and high TV watchers ($\geq$ 15 hours per week). Findings indicated 46.6% of Aboriginal youth were high TV watchers, compared to 23.7% of non-Aboriginal youth. However, these findings did not control for differences in household income and parental education between the two groups, despite the significant socioeconomic gaps identified in the study. As previously outlined, associations between socioeconomic status and SB are well documented in the literature, calling into question the usefulness of studies that compare Aboriginal and

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non-Aboriginal populations on health behaviour without the key role that poverty may play in producing these behaviours.

It might be assumed that heightened poverty within Aboriginal populations in Canada places them at greater risk for SB; however, research is not yet available to substantiate this hypothesis. Thus, research is necessary to understand the prevalence and correlates of SB among this population, which then could provide insight into how SB is influencing poor health among Aboriginal people. Such research could also be useful in reducing current health inequalities faced by this population.[44,45]

Key Gaps in the Literature

The majority of sedentary research has examined the adverse effects of SB among youth or among the general adult population. Few studies have sought to further the understanding of the underlying factors that may be influencing leisure time SB within different populations. In Canada, the literature has been even sparser, leaving a large gap in the current understanding. Through this thesis research, I sought to understand the sociodemographic and behavioural correlates associated with low leisure SB within multiple populations and ethnic groups, including: Canadian adults, First Nations, and Métis adult populations. Given the influence SB has on poor health, this type of solution-oriented SB research is needed to generate hypotheses for future intervention techniques.

Sense of Community Belonging

In order to understand the underlying determinants of SB at a level beyond the individual, knowledge of the ecological factors associated with the choices adults make about their leisure activities is needed. In an effort to address this gap, in this thesis, I examined the association between SB and sense of belonging to the local community.

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Sense of belonging is a component of a larger construct called social capital, which also includes feelings of safety, trust, belonging, reciprocity, and civic participation.[46,47] A decrease in social capital has been associated with health inequalities and poor health;[48,49] however, some have argued that this may not be the case.[50] Although in this thesis I do not directly measure social capital, sense of belonging is a proximal concept of that more distal construct. Research suggests sense of belonging is influenced by three key factors: a belief that one will be accepted by the community, the community's response of acceptance, and having a willingness to sacrifice for the group.[51] This thesis is one of the first studies to examine associations between self-reported sense of belonging and SB. Findings suggest that this sense of belonging may play a major role in the prevalence of sedentary time.[52]

Intersectionality Theory

Another gap in current SB literature is the lack of a coherent theoretical framework that could be used to understand associations with SB in populations. This thesis was worked to address this gap by framing the findings of Paper 2 and 3 within the framework of Intersectionality Theory.[53] Intersectionality theory is best known for its use in clarifying that the marginalization of race and gender among African-American women could not be treated as separate subjects, nor were their experiences the sum of their parts.[53] Intersectionality theory recognizes that the factors affecting marginalized groups are multidimensional.[54] It also assumes a non-linear perspective, in which the intersection of multiple factors and their influences on each other are considered.[55] In other words, while an understanding of health impacts and social correlates of SB are important; an understanding of the intersectionality between behavioural, ethnic, and

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socioeconomic correlates sheds new light on *real world* influences of sedentary time. I used this theory to frame an examination of interactions between correlates of SB for First Nations and Métis adults.

Conclusion

SB is an independent risk factor for disease. Yet, it is extremely common among Canadians at work and at leisure. Currently, there is a need for research aimed towards understanding the determinants of low SB within the general Canadian adult population and within multicultural groups. The three research papers contained in this thesis examined associations between sociodemographic, health related, behavioural, and community variables and sedentary time. Also, the intersectionality between social, cultural, and economic influences and the impact that has on sense of belonging and SB was explored. In summary, the objectives of Paper 1 and the hypotheses of Papers 2 and 3 used to address current research gaps are outlined below:

Paper 1: The General Adult Population (Objectives, Presented in Chapter 3)

1. Describe the sociodemographic characteristics of community-based adults who are the least sedentary during leisure.

2. Examine associations between perceived health, physical activity, and SB.

3. Examine the association between sense of community belonging and sedentary leisure time.

Paper 2: First Nations Populations in Canada (Hypotheses, Presented in Chapter 4)

1. Alcohol consumption and smoking would have a positive association and physical activity an inverse association with SB during leisure among First Nations adults.

2. Sense of belonging to community would be inversely associated with leisure sedentary time among First Nations adults after adjustment for relevant sociodemographic confounders and health.

3. The inverse association between community belonging and sedentary time in leisure will be stronger among higher-income First Nations groups.

Paper 3: The Métis Populations (Hypotheses, Presented in Chapter 5)

1. Alcohol consumption and smoking would have a positive association and physical activity an inverse association with SB during leisure among Métis adults.

2. Sense of belonging to community would be inversely associated with leisure SB among Métis adults after adjustment for relevant sociodemographic confounders and health.

3. Is there a variation in the association between sense of belonging and sedentary behaviour within the Métis population based on gender?

CHAPTER 3: LOW SEDENTARY TIME AMONG ADULTS: THE ROLE OF COMMUNITY BELONGING (PAPER 1)

Introduction

Background

Sedentary behaviour (SB) is distinct from physical inactivity, which implies insufficient moderate to vigorous physical activity (MVPA).[1] Instead, SB refers to prolonged periods of muscular unloading, such as sitting. SB has negative health impacts that are independent of a lack of physical activity.[6–10] In other words, those who engage in regular MVPA and still accumulate significant amounts of sedentary time are still at an increased health risk of poor health. Given SB is an important and modifiable determinant of health, research focused on the key determinants that contribute to sedentary time among adults is important to inform intervention strategies.

Sedentary Behaviour and Health

To date, prospective studies have indicated sedentary time is associated with increased incidences of cardiovascular disease, diabetes, obesity, cancer, depression, and other disease, as well as all-cause mortality.[5,6] The World Health Organization has ranked three diseases associated with SB: namely, cardiovascular disease, cancer, and diabetes, among the top ten leading causes of mortality in high income countries.[7] Thus, sedentary lifestyles place a major burden on population health and life expectancy and an economic burden on healthcare systems. While research has shown that reducing sedentary time can result in reduced chronic disease,[8,9] adults in developed countries currently spend over half of all waking hours in sedentary activities; the frequency of these activities, particularly television viewing, increase with age.[10,11]

Findings from cross-sectional and longitudinal studies linking sedentary time to health risks are also supported by physiological studies. Research has shown that long-term muscular unloading during sedentary activities has negative physiological consequences, including suppression of skeletal muscle lipoprotein lipase (LPL) activity.[12] LPL plays a central role in lipid metabolism and high-density lipoprotein (HDL) cholesterol production,[12,13] both of which are essential in maintaining good health. HDL cholesterol enables reverse cholesterol transport, and low levels of HDL are associated with increased risk of atherosclerosis.[14] Some studies have also identified associations between LPL dysregulation and Alzheimer's disease.[15,16]

Research Gaps

Most SB research has focused on children and youth, leaving gaps in the understanding of SB among adults.[17] Generally, adult studies have focused on the prevalence and subsequent adverse health outcomes of SB. To inform effective intervention strategies, a better understanding of factors associated with low levels of leisure sedentary time among adults and a better understanding of sociodemographic factors associated with SB generally are needed.[6]

Study Contributions

This study used representative, population-based data to shed light on the ways in which community-related factors, health-related factors, and sociodemographic characteristics are associated with low levels of leisure SB among adults. The objectives were (a) to describe the sociodemographic characteristics of community-based adults who are the least sedentary during leisure; (b) examine associations between perceived

health, physical activity, and SB; and (c) examine the association between sense of community belonging and sedentary leisure time.

Methods

Study Design

Data for this study were derived from the 2010 CCHS: a national household health survey conducted annually in Canada. All respondents were residents of private dwellings. Excluded were persons living in institutions, Aboriginal communities, remote locations, military bases, and full-time members of the Canadian Forces. Dwellings were selected using a multistage stratified cluster design.[18] Information was collected using computer-assisted interviewing, both in person and over the phone from January 1 to December 31, 2010. This study was exempt from IRB review, as data were obtained in a de-identified form.

At the national level the overall response rate was 71.5%, ($N = 63,191$ individuals aged 12 years or older).[18] Content related to leisure time SB was provided to three provinces located in the west (British Columbia), east (Newfoundland), and in central Canada (Manitoba). The number of participants from each province was selected based on population density. Of the 11,980 eligible participants offered the optional SB component, 95% provided valid responses. Data were weighted to be representative of the household population. For the purposes of this study, analyses were limited to respondents 18 years and older.

Leisure-Time Sedentary Behaviour

During interviews, participants were asked to report their average weekly leisure time (outside of school or work) that was spent:

- On a computer, including playing computer games and using the Internet

- Playing video games, such as XBOX, Nintendo, and PlayStation

- Watching television or videos

- Reading

Total hours spent in these sedentary activities per week was calculated, and participants were classified in one of ten categories, beginning from < 5 hours of leisure sedentary time and increasing in 5-hour increments to a maximum of ≥ 45 hours per week.

Sociodemographic Factors

Socio-demographic characteristics examined were gender, age (18–24, 25–34, 35–49, 50–64, ≥ 65), education (less than secondary school graduate, secondary school graduate, some postsecondary education, and postsecondary graduate), household income (0–$19,999, $20,000–$39,999, $40,000–$59,999, $60,000–$79,999, ≥ $80,000), marital status (married/common-law, widowed/divorced/separated, or single/never married), and employment status (currently employed: yes or no).

Community, Stress, and Health-Related Variables

Sense of belonging to the local community was examined using one question on the following scale: 1 = very strong, 2 = somewhat strong, 3 = somewhat weak, and 4 = very weak.[18] Perceived life stress was examined using one question on the following scale: 1=not at all stressful to not very stressful, 2=a bit stressful, 3=quite a bit stressful to extremely stressful. Perceived mental health was examined using one question on the following scale: 1 = excellent to very good, 2 = good, 3 = fair to poor). Perceived overall health was examined using one question on the following scale: 1 = excellent to very

good, 2 = good, 3 = fair to poor. An index of leisure time and transport physical activity was created by calculating the average energy expenditure during active commuting and purposeful exercise in kcal/kg/day. This information was categorized into three groups: ≤ 1.5 = inactive, between 1.5 and 3 = moderately active, and ≥ 3 = active.

Statistical Analysis

All analyses were conducted on weighted data. Descriptive statistics were used to derive prevalence estimates for overall leisure time SB ($N = 11{,}494$). To categorize the SB variable, the average leisure time spent in sedentary activities was calculated and used as a reference point. Those with a total SB time that was greater than one standard deviation above the mean (≥ 35 hours per week) were considered the *high sedentary* group. Those with sedentary time that fell within one standard deviation of the mean (20–34 hours per week) were classified as the *moderate sedentary* group. Those with sedentary time less than one standard deviation below the mean (0–19 hours per week) were classified as the *low sedentary* group. This approach was chosen given there are no international guidelines on the amount of sedentary time that qualifies as high, moderate, or low among adults.

Multinomial logistic regression and 99% confidence intervals were used to assess the likelihood of low SB as a function of key sociodemographic, health-related and community-based variables. The high-sedentary group (≥ 35 hours per week) was used as the reference group, given the focus was to examine factors associated with reduced sedentary time. Multicollinearity between the independent variables was examined using variance inflation factors (VIFs) before main effects models were derived. Three multinomial logistic regression models were derived; the first without adjustment for

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confounders, the second adjusted for socioeconomic confounders selected a priori from the literature (age, gender, marital status, education, employment, and household income), and the third model adjusted for self-perceived mental and physical health. Additional adjustment for perceived health took place to clarify the nature of the relationship between sedentary leisure time and sense of community belonging independent of health. Potential confounders were tested for effect modification before entry into main effects models; none were indicated. Data were not replaced for participants with missing data (5%); these individuals were excluded from the analysis. All analyses were completed in 2013, and run using IBM SPSS Statistics 19.0 (SPSS Inc., Chicago, IL).

Results

Sample Description

Characteristics of the sample are outlined in Table 3-1. The sample ($N = 11,494$) was 44.4% male. The mean age range was 35–49 years. Most participants were married, employed, and had completed a post-secondary degree.

Sedentary Behaviour

On average, adults were sedentary 20–24 hours per week while at leisure (range = 0 to ≥ 45 hours). Across the sample, 39.0% of adults reported low SB (0–19 hours per week), 35.6% reported moderate SB (20–34 hours per week), and 25.4% reported high SB (≥ 35 hours per week). Watching television/videos was the most frequent sedentary activity outside working hours (6–10 hours per week), followed by computer use (3–5 hours per week), reading (3–5 hours per week), and playing video games (1-2 hours per week).

Sociodemographic and Behavioral Correlates of Sedentary Behaviour

Adults who reported high levels of sedentary leisure (≥ 35 SB hours per week) were used as the reference group for all analyses, given the research goal was to better understand adults who are the least sedentary while at leisure. Sociodemographic and behavioral correlates of low sedentary time are provided in Tables 3-2 and 3-3. In an adjusted model, those aged 35–49 were the least sedentary in this adult sample, while married adults were less sedentary than adults who were single or divorced/widowed. Female gender was weakly associated with low sedentary leisure time (OR = 1.22, 99% CI = 1.21–1.23). Increasing income resulted in decreased sedentary time during leisure. As shown in Table 3-2, those with a household income above $80,000 per year were 2.28 times more likely to be in the low SB group than those with an annual household income below $20,000 per year (99% CI = 2.26–2.31).

Community, Stress and Health-Related Variables

There was an inverse monotonic association between sedentary leisure time and sense of community belonging. Those who reported an enhanced sense of community belonging spent significantly less leisure time in sedentary activities. As shown in Table 3-3, adjustment for sociodemographics and perceived health did little to dampen the strength of this effect. Overall, adults in the low-sedentary group were 2.2 times more likely to report a very strong sense of community belonging than adults in the high sedentary group.

Adults who reported average levels of life stress were significantly less sedentary than adults who reported high or low levels of stress. Perceived mental and physical

health were each inversely and significantly associated with sedentary leisure time. There was also a weak inverse association between physical activity and sedentary leisure time.

Discussion

The overall average amount of sedentary leisure time reported by Canadian adults was low compared to other developed nations at 20–24 hours per week.[19,20] Yet, it is important to note that this study only collected self-report data on four common sedentary activities: namely, reading, watching TV, playing video games, and spending time on a computer during leisure. Studies in other countries have made use of daily journals that could incorporate other types of sitting. Thus, SB prevalence estimates across countries may not be directly comparable. Similar to other findings, television viewing was the most prevalent SB among adults.[21,22] As in other studies, we found adults with higher incomes were less sedentary during leisure.[23,24] To explain this finding, it has been premised that adults employed in higher-level occupations are more sedentary at work, and they may compensate for this by choosing non-sedentary activities during leisure.[23] Further research is needed to confirm this hypothesis.

Sense of Belonging to Local Community

A novel finding in this study is a documented association between levels of community connectedness and the SB of adults during leisure. Adults who reported a strong sense of belonging to their local community were significantly less sedentary during leisure. The strength of this association remained after control for sociodemographic confounders and perceptions of overall health, suggesting this association may be due in part to unique pathways linking connectedness to SB that are independent of the relationship these variables share with health, wealth and

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sociodemographics. One hypothesis is that those who feel an enhanced sense of belonging are motivated to participate in non-sedentary social events and community programs in their leisure time. Conversely, it may be that those who actively participate in their community consequently have both an enhanced sense of community and low levels of sedentary time. Overall, the findings speak to the theory of social capital, which posits that social networks have value and that those with a strong sense of connectedness, safety, and trust in their community are more likely to be productive members of society, in part through their increased engagement in healthy behaviour.[25,26] Studies to date have documented positive associations between physical activity and social capital.[27] [28] To my knowledge, this is the first study to document an association between SB and community belonging. Further research is needed to determine if these findings could be extended to associations between SB and social capital more generally (ie, levels of civic participation, safety and trust). The present findings have highlighted the potential impact that community programs designed to increase connectedness (eg, hobby clubs, community events, volunteer organizations) may have on reducing SB in populations.

Another interesting finding was that adults who were least sedentary were those who reported moderate amounts of stress in their lives, in models adjusted for income and other sociodemographic confounders. It has been hypothesized that adults who experience high levels of stress may cope by engaging in TV viewing, spending time on the Internet, and engaging in other sedentary-type behaviours that provide escape;[29] which is an idea that can fuel future research questions as work is done to better understand key drivers of leisure SB in populations. Further research is needed to gain a

better understanding of why low levels of stress may be related to high sedentary time during leisure.

The findings of this research have also suggested Canadians with strong perceived physical and mental health were less likely to engage in SB during their leisure hours after adjustment for sociodemographic confounders. Although the temporal sequence of these associations cannot be determined from the present study, this work has supported findings from longitudinal studies that have documented similar findings across countries.[5,30]

Consistent with previous studies, the results of this study revealed a weak inverse association between physical activity and leisure SB among Canadian adults.[31,32] It may be that individuals who use their leisure time to engage in physical activity have less time available for sedentary pursuits. Interestingly, a study examining one type of leisure SB (TV viewing), [24] and a study examining occupational SB[33] found no association between physical activity and SBs, suggesting these relationships are complex, and further research is warranted.

Limitations

Study limitations include use of a cross-sectional design, which has limited inferences about causation and temporal sequence. The use of self-report measures may have also introduced recall bias. In addition, specific sedentary activities examined were not exhaustive. For example, sitting while visiting with friends or during motorized transport were not included. A strength of this study was the use of a large representative sample, weighted analysis, and control for the effects of confounding variables.

Conclusion

In 2010, approximately one in four Canadian adults were sedentary for 35 hours or more each week during leisure, placing many at high risk for negative health outcomes. This study's results corroborated and extended the current understanding of SB among adults during leisure. Findings highlighted that good health, a moderate amount of life stress and a sense of belonging to the local community are positive factors associated with relatively low levels of sedentary leisure time among population-based adults. Of particular interest, it was found that a strong sense of community was monotonically associated with reduced sedentary time, and this effect remained significant after sociodemographic factors and perceived health were controlled in statistical models. These findings highlighted a modifiable factor that may reduce sedentary leisure time among adults in developed nations and provided information that can be used in the development of prevention strategies.

What is Already Known

Prolonged SB among adults is associated with a variety of adverse health outcomes. Research has highlighted that adults in developed countries spend over half their waking hours in sedentary activity. To date, there has been a limited understanding of the underlying determinants of SB at a level beyond the individual. A better understanding of ecological factors associated with the choices adults make about their leisure activities is needed. This study assessed associations between SB and community belonging, as well as sociodemographic factors in three regions of Canada.

What this Study Adds

      This study has added to the literature by demonstrating a large and significant association between sense of community belonging among adults and their engagement in sedentary activity during leisure. These differences in sedentary time were relatively independent of sociodemographic factors and current physical and mental health, suggesting this association may be due, in part, to unique pathways linking community connectedness to sedentary leisure behaviours.

Table 3-1. Characteristics of Sample[a]

Characteristic	Total *N* (%)
Total sample	11,494
Sex	
Male	5,107 (44.4)
Female	6,387 (55.6)
Missing	0
Age	
≥ 65	3,097 (26.9)
50–64	3,316 (28.8)
35–49	2,523 (22.0)
25–34	1,601 (13.9)
18–24	957 (8.3)
Missing	0
Marital Status	
Married/Common-law	6,445 (56.3)
Widowed/Divorced/Separated	2,464 (21.5)
Single/Never married	2,543 (22.2)
Missing	42
Education	
Less than secondary graduation	1,910 (17.1)
Secondary graduate	2,012 (18.0)
Some postsecondary	1,065 (9.5)
Postsecondary graduation	6,187 (55.4)
Missing	320
Household Income	
0–$19,999	1,206 (12.7)
$20,000–$39,999	2,176 (22.8)
$40,000–$59,999	1,856 (19.5)
$60,000–$79,999	1,393 (14.6)
≥ 80,000	2,892 (30.4)
Missing	1,971
Currently Employed	
Yes	7,204 (71.4)
No	2,882 (28.6)
Missing	1,408

[a] Numbers are based on unweighted data

Table 3-2. Prevalence and Adjusted Odds Ratio of Low SB by Sociodemographic Characteristics[a]

Characteristic	Low SB%[b]	Low SB OR (99% CI)	Average SB OR (99% CI)
Gender			
Male	37.7	1 [Reference]	1 [Reference]
Female	40.3	1.22 [1.21–1.23]	1.16 [1.16–1.17]
Age			
≥65	25.2	1 [Reference]	1 [Reference]
50–64	39.1	2.34 [2.32–2.36]	1.45 [1.44–1.47]
35–49	49.0	3.98 [3.94–4.02]	1.79 [1.77–1.81]
25–34	41.9	2.99 [2.95–3.02]	1.79 [1.77–1.81]
18–24	30.3	1.20 [1.19–1.22]	0.87 [0.86–0.88]
Marital Status			
Single/Never married	35.4	1 [Reference]	1 [Reference]
Widowed/Divorced/Separated	30.1	.79 [0.78–.80]	1.01 [1.0–1.02]
Married/Common-law	42.2	1.69 [1.67–1.70]	1.51 [1.49–1.52]
Education			
Less than secondary graduation	38.9	1 [Reference]	1 [Reference]
Secondary graduate	41.7	1.21 [1.20–1.22]	1.15 [1.13–1.16]
Some postsecondary	33.2	0.78 [0.77–0.79]	1.00 [0.98–1.01]
Postsecondary degree	38.9	1.18 [1.17–1.19]	1.33 [1.32–1.34]
Household Income			
0 - $19,999	30.9	1 [Reference]	1 [Reference]
$20,000 - $39,999	30.2	1.03 [1.02–1.05]	1.13 [1.12–1.15]
$40,000 - $59,999	41.2	1.88 [1.86–1.91]	1.40 [1.38–1.42]
$60,000 - $79,999	39.1	1.93 [1.90–1.96]	1.69 [1.67–1.71]
≥ 80,000	42.5	2.28 [2.26–2.31]	1.76 [1.74–1.79]
Currently employed			
No	27.4	1 [Reference]	1 [Reference]
Yes	43.6	2.73 [2.71–2.75]	[1.66–1.68]

[a] Outcome variable (sedentary behaviour) used the high SB group (≥ 35 h/week) as the reference point for analysis.
[b] Prevalence of sample participants in the low SB group

Table 3-3. Prevalence, Unadjusted, and Adjusted Odds Ratio of Low SB by Community, Stress, and Health Variables[a]

Characteristic	Low SB%[b]	Low SB OR [99% CI]	Average SB OR [99% CI]	Low SB AOR1[c] [99% CI]	Average SB AOR1[c] [99% CI]	Low SB AOR2[d] [99% CI]	Average SB AOR2[d] [99% CI]
Sense of community belonging							
Very weak	25.8	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Somewhat weak	36.2	1.77 [1.74–1.79]	1.16 [1.15–1.18]	1.49 [1.47–1.51]	1.10 [1.08–1.11]	1.38 [1.36–1.40]	1.04 [1.03–1.06]
Somewhat strong	40.5	2.36 [2.33–2.39]	1.40 [1.39–1.42]	2.16 [2.13–2.19]	1.44 [1.42–1.46]	1.95 [1.92–1.98]	1.35 [1.33–1.37]
Very strong	43.6	2.76 [2.73–2.80]	1.47 [1.45–1.49]	2.55 [2.51–2.59]	1.44 [1.42–1.47]	2.20 [2.16–2.23]	1.32 [1.30–1.34]
Self-perceived health							
Poor - Fair	28.5	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]		
Good	36.1	1.80 [1.78–1.82]	1.60 [1.58–1.61]	1.53 [1.51–1.55]	1.45 [1.43–1.47]		
Very good - Excellent	42.4	2.69 [2.66–2.71]	2.02 [2.00–2.04]	2.19 [2.16–2.22]	1.78 [1.76–1.80]		
Perceived mental health							
Poor - Fair	40.9	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]		
Good	35.9	1.83 [1.81–1.86]	1.57 [1.55–1.59]	1.67 [1.65–1.70]	1.50 [1.47–1.52]		
Very good - Excellent	27.8	2.44 [2.41–2.47]	1.78 [1.76–1.80]	2.24 [2.21–2.27]	1.61 [1.59–1.63]		
Perceived life stress							
Extremely stressful – Quite a bit	38.7	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]		
A bit stressful	42.5	1.29 [1.28–1.30]	1.18 [1.17–1.19]	1.34 [1.32–1.35]	1.21 [1.20–1.22]		
Not very stressful – Not at all	35.1	0.90 [0.90–0.91]	1.09 [1.09–1.10]	1.13 [1.12–1.14]	1.34 [1.33–1.35]		
Leisure and transport physical activity							
Inactive	35.2	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)		
Moderately active	40.8	1.41 (1.40–1.42)	1.21 (1.20–1.21)	1.35 (1.34–1.37)	1.07 (1.06–1.08)		
Active	41.9	1.50 (1.49–1.51)	1.24 (1.23–1.25)	1.51 (1.49–1.52)	1.19 (1.18–1.20)		

[a] Outcome variable (sedentary behaviour) used the high SB group (≥ 35 h/week) as the reference point for analysis.
[b] Prevalence of sample participants in the low-SB group.
[c] Adjusted for sociodemographic confounders including age, gender, marital status, education, employment and household income.
[d] Adjusted for sociodemographic confounders and perceived health.

CHAPTER 4: CORRELATES OF LOW SEDENTARY TIME AMONG FIRST NATIONS ADULT POPULATIONS IN CANADA (PAPER 2)

Introduction

Sedentary behaviour (prolonged sitting) is an important and modifiable determinant of health in developed countries. While the understanding of sedentary behaviour within mainstream populations is growing, little is known about the determinants of sedentary behaviour within multicultural groups. The purpose of this paper is to gain a better understanding of key determinants associated with sedentary behaviour among the rapidly growing First Nations populations in Canada.

Background

Sedentary behaviour (SB) is defined as any waking activity that has an energy expenditure of ≤ 1.5 METS (metabolic equivalents) while in a sitting or reclining posture.[13] Common sedentary activities include sitting while watching television, using computers, reading, or driving.[15] SB should not be misunderstood as physical inactivity, which implies insufficient moderate to vigorous physical activity (MVPA).[8] In fact, it is possible for someone to be physically active, while still engaging in large amounts of sedentary time during transport, work, or leisure.

Research has identified that sedentary activity results in prolonged muscular unloading, which promotes dysregulation of important biological markers, including suppression of skeletal muscle lipoprotein lipase (LPL) and increased fasting glucose levels.[3,22] Dysregulation of the LPL pathway and/or heightened blood glucose levels are associated with type 1 and 2 diabetes, insulin resistance, infection, vascular disease, and cancer.[1,18,56] Prospective studies also indicated that sedentary time is associated with an

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increased incidence of cardiovascular disease, diabetes, obesity, cancer, depression, and other disease, as well as all-cause mortality in populations.[1,57] In short, combined evidence from physiological and population-based studies strongly suggest that too much sitting is detrimental to our health.

Despite this evidence, current research suggests that on average, adults spend over half their waking hours sitting.[2] For many, this includes time spent sitting at work, which can be difficult to avoid in some professions. However, many adults also spend a large portion of their leisure time engaging in sedentary pursuits. For example, in Canada, 29% of adults watch more than two hours of television per day as a leisure activity.[11] Yet, little is currently known about risk and protective factors for sedentary behaviour among adults in North America, particularly among key ethnic minority groups.

Research Gaps

To date, the majority of sedentary research has examined the adverse effects of SB among youth or among the general adult population. Few studies have sought to further our understanding of the underlying factors that may be influencing sedentary time in other groups. Current research suggests that males generally engage in more sedentary time than females.[40] As well, those who are unemployed are more sedentary than those who are employed.[41] A key sedentary activity—watching television—is associated with low income.[11] It might be assumed that heightened poverty within Aboriginal populations in Canada places them at greater risk for SB; however, there is no current research to substantiate this hypothesis.

First Nations Population

The Aboriginal population in Canada is defined by three main groups: First Nations, Métis, and Inuit. This paper is focused specifically on First Nations people, who account for more than half of the total Aboriginal population in Canada.[58] This culturally and socially diverse group resides below the Arctic Circle and is represented by a number of distinct language groups.[59] Currently, the majority of First Nations Canadians live in rural and urban centres outside of Aboriginal communities. Also, they are one of Canada's fastest growing populations, with a reported 23% increase since 2006.[60,61]

Before colonization, First Nations in Canada were actively engaged in hunting, gathering, fishing, and farming pursuits.[62] First Nations populations also traveled great distances to engage in trade and to migrate with game. Colonization resulted in the forced relocation of First Nations people to small parcels of land, which stunted their traditionally active lifestyles and broke down their trade networks. The pass system instituted in some parts of Canada, which required government permission to leave designated Aboriginal land, further restricted mobility.[63] This involuntary sedentarization, combined with the attempt to suppress Aboriginal heritage through institutionalization and residential schools, increased sedentary activity. These hardships also resulted in negative emotional, physical, and cultural consequences that influenced behaviour patterns and health choices.[64,65] To inform prevention strategies, the focus of this paper is to gain a better understanding of factors that contribute to low levels sedentary time among First Nations adults living outside of Aboriginal communities in Canada and the intersections between these factors.

Theory of Intersectionality

Currently, the literature lacks a coherent theoretical framework that could enable us to better understand SB in populations. Intersectionality theory was first used in the late 1960s and is most recognized for its use to clarify that the marginalization of race and gender among African-American women could not be treated as separate subjects, nor were these experiences the sum of their parts.[53] Intersectionality theory assumes a non-linear perspective, in which the intersection of multiple factors and their influences on each other are considered.[55] In other words, while an understanding of health impacts and social correlates of SB are important, an understanding of the intersectionality between behavioural, ethnic, and socioeconomic correlates sheds new light on real world influences of sedentary time. For example, how does the relationship between First Nations heritage and social status influence sedentary time? Furthermore, how does awareness of how you are perceived or treated by others, due to social and ethnic status, influence one's sense of belonging? A key benefit of conducting SB research with an intersectionality approach is a clear recognition of the impact of privilege and marginalization on this important health behaviour across ethnic minorities. As a result, through this paper, the intersectionality of key variables to document inequalities through the use of unique research questions was explored.

Research Questions

In this paper, I have examined three behavioural variables that I hypothesized would be inversely associated with sedentary time: namely, smoking, alcohol consumption, and physical activity. Previous research has reported that smoking and alcohol consumption are associated with poor health,[66–68] and physical activity has

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demonstrated a negative association with sedentary time in other studies.[69,70] I asked: Are

these health-related behaviours also associated with low sedentary time among First

Nations populations?

A key research goal was a better understanding of the association between sense

of belonging to the local community and sedentary time. Sense of belonging is a

component of a larger construct called social capital, which also includes feelings of

safety, trust, belonging, reciprocity, and civic participation.[46,47] Although, in this paper, I

do not directly measure social capital, sense of belonging is a proximal concept of that

more distal construct. Previous research has suggested that sense of belonging is

strengthened by a combination of three main key influences: first, a belief that one will be

accepted by the community; second, the community's response of acceptance; and third,

a person's willingness to sacrifice for the group (ie, volunteering time or emotional

support).[51] In my previous paper, presented in Chapter 3, results indicated that sense of

belonging to one's local community is associated with low sedentary time in the general

population.[52] Thus, it was also hypothesized that a similar association would be reported

within First Nations populations.

Both sense of belonging and less sedentary behaviour are reported to be

associated with improved health.[1,68] Thus, the association between community belonging

and sedentary time may be confounded by the common association with improved health

among those who report less sedentary time and more connectedness. In order to control

for the influence of health on how sedentary one is, I adjusted for perceived overall

physical and mental health. This technique allowed me to examine the direct association

between sense of belonging and sedentary time, separate from the association each

variable has on or with health. I asked: Is sense of belonging associated with low sedentary time in First Nation populations independent of overall perceived health? Sedentary time was calculated using the sum of four common leisure time SBs outside of school and work, namely: television viewing, computer use, videogame use, and reading.

Intersections between social status and SB among adults who identify as First Nations were also analyzed. Income was used to operationalize social status, as it is a solid predictor of education and employment.[71] I asked: Will sense of belonging have a stronger association with sedentary time as social status increases among First Nation adults? It is documented that income and social context influence health behaviours.[72] In fact, in many cases those with lower income and social status are at a higher risk for negative health behaviours (ie, smoking).[72] As a result, it was hypothesized that community belonging would be most strongly associated with low sedentary time among those First Nations with higher household incomes. Thus, the sample population was stratified into three groups based on total household income: low income ($< \$20,000$), middle income ($\$20,000$ to $\$80,000$), and high income ($\geq \$80,000$). Associations between community belonging and SB were examined for each of the three income groups. Using this stratified approach, I analysed the influence of First Nations heritage and social class on the hypothesized relationship between sense of belonging and sedentary time. In summary, Paper 2 presented in this chapter had three main hypotheses:

1. Alcohol consumption and smoking would have a positive association, and physical activity an inverse association with SB during leisure among First Nations adults.

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2. Sense of belonging to community would be inversely associated with leisure sedentary time among First Nations adults after adjustment for relevant sociodemographic confounders and health.

3. The inverse association between community belonging and sedentary time in leisure will be stronger among higher-income First Nations groups.

Methods

Study Design

Data for this study were obtained from the 2012 Canadian Community Health Survey (CCHS). The CCHS is an annual nation-wide survey conducted by Statistics Canada. This cross-sectional survey collects data on health determinates and outcomes for persons 12 years or older in the country. Excluded from the survey's coverage are persons living in institutions, Aboriginal communities, remote locations, military bases, and full-time members of the Canadian Forces. Important to note, the goal of this study was to report on First Nations adults living outside of Aboriginal communities. Data were collected using computer-assisted interviewing, both in person and by phone between January 1 and December 31, 2012. The 2012 CCHS uses a multistage stratified cluster design to ensure samples collected are generalizable to the wider Canadian population. This design has been described in detail elsewhere.[73]

At a national level, the overall response rate was 68.4% ($N = 61,707$) among participants 12 years or older [73]. This study included only those participants who self-identified as First Nations adults (18 years or older). There were 1,304 individuals who met these criteria and provided valid responses related to outcome of interest for this

study of SB. This study was exempt from IRB review, as data were obtained in a de-identified form.

Survey Weights

Data were weighted to represent the general household population of First Nations adults living outside of Aboriginal communities in Canada. The weighting variable applied during all analyses was created by Statistics Canada. Information required for its creation was obtained by using a primary area frame, complemented by two additional frames of telephone numbers. Using advanced statistical techniques demonstrated elsewhere these frames allowed for the creation of a weighting variable.[73]

Outcome Variable

As part of the CCHS, respondents were asked to report average weekly leisure time (outside of school or work) spent in the following sedentary activities:

- On a computer, including playing computer games and using the Internet

- Playing video games, such as XBOX, Nintendo and PlayStation

- Watching television or videos

- Reading

Statistics Canada calculated total leisure sedentary activity time and provided the data in ten hour-based categories beginning at < 5 hours per week, increasing by increments of 5 hours to a maximum of ≥ 45 hours per week. This variable was used in the present analysis.

Sociodemographic Factors

Sociodemographic characteristics were examined including gender, age, education (ie, less than secondary school graduate, secondary school graduate, and

postsecondary graduate), household income (15 categories in total, ranging from $0 to

≥ $150,000) marital status (ie, married/common-law, widowed/divorced/separated, or

single/never married), and employment status (currently employed: yes or no).

Behavioural and Community Variables

Data were collected on physical activity, and a derived variable was created by

Statistics Canada of energy expenditure values of kcal/kg/day. Individuals were

categorized into three groups: 1 = active (> 3 kcal/kg/day), 2 = moderately active (1.5–3

kcal/kg/day), or 3 = inactive (< 1.5 kcal/kg/day). Smoking behaviour was examined by

asking the respondent if they smoke cigarettes 1 = daily, 2 = occasionally, or 3 = not at

all. Alcohol use was derived by calculating number of drinks reported per month, with

participants stratified into three groups: 1 = regular drinkers (at least once per month), 2 =

occasional drinkers (less than once per month), and 3 = did not drink in the last 12

months.

Participants' sense of belonging to their local community was examined by using

one question on a scale of 1 to 4 (1 = very strong, 2 = somewhat strong, 3 = somewhat

weak, and 4 = very weak). This method of measuring sense of belonging was also

common in other studies.[68,74,75] However, in the literature, different techniques to

measure sense of belonging have been used, including a larger 27-item self-report

instrument[76] or a measure combining higher scores of reported feelings of respect,

inclusion, and support of their social environment.[77]

Statistical Analysis

Prevalence estimates of overall sedentary leisure time were obtained. Also, the prevalence estimates of television viewing, computer use, videogame use, and reading among the sample population were calculated.

To examine Hypothesis 1, the associations between three behavioural factors (ie, smoking, alcohol consumption, and physical activity) and sedentary time were examined using linear regression models and 95% confidence intervals. Three multiple regression models were derived. The first was adjusted for age, and the second was adjusted for additional sociodemographic confounders selected a priori based on existing literature (ie, gender, marital status, household income, education, and employment status). In the third, additional controlling for overall self-perceived health was performed. In order to generate hypotheses for potential intervention studies, a specific focus was placed on identifying associations between the three behaviours and low amounts of sedentary time.

To examine Hypothesis 2, the associations between sense of belonging and sedentary time were analyzed using multiple linear regression models and 95% confidence intervals. Three regression models were derived. The first was adjusted for age, the second for sociodemographic confounders, and the third for self-perceived overall physical and mental health.

To examine Hypothesis 3, the associations between sense of belonging and SB among the First Nations population by income group were analyzed. Thus, the sample population was stratified into three large income groups based on household income: low income (< $20,000), middle income ($20,000–$80,000), and high income (≥ $80,000), in which smaller income groups were still present. Prevalence estimates were conducted for

each group individually, and three linear regression models were conducted, using 95% confidence intervals controlling for age, sociodemographic confounders, and overall health, respectively

Multicollinearity between the independent variables was examined using variance inflation factors (VIFs) before main effect models were derived. All potential confounding variables were examined for effect modification prior to entry into main effects models; none were found. In addition, all multivariate outliers were excluded from the analysis. All analyses were completed in 2014 and run using IBM SPSS Statistics 22.0 (SPSS Inc., Chicago, IL).

Results

Sample Description

Characteristics of the sample are outlined in Table 4-1. The sample ($N = 1,304$) was 47.6% male. The mean age range was 35−44 years. Most participants were married, employed, and had completed a post-secondary degree.

Sedentary Behaviour

On average First Nation adults were sedentary 25−29 hours/week during leisure (range = 0 to ≥ 45 hours/week). Watching television/videos was the most frequent sedentary activity outside working hours (11−14 hours/week), followed by computer use (3−5 hours/week), reading (3−5 hours/week), and playing video games (< 1 hour/week). When stratified by income groups, the low (< $20,000) and middle ($20,000−$80,000) income groups reported the highest prevalence of sedentary time with 25−29 hours/week, while the high income group (≥ $80,000) reported an average of 20−24 hours/week.

Sociodemographic Correlates

As shown in Table 4-2, First Nations adults who were female, employed, and not single were the least likely to be sedentary in their leisure time. The difference in sex resulted in females being associated with a .659 point decrease (3.3 hours/week) in sedentary time. Those with a higher income were also less sedentary when compared to those with lower incomes. In contrast, higher education was slightly associated with more sedentary time.

Hypothesis 1: Behavioural Correlates of Low Sedentary Behaviour

As shown in Table 4-2, physical activity was negatively associated with sedentary time. For every one point increase in physical activity rating, there was a .339 point decrease (1.7 hours) in weekly sedentary time, even after controlling for sociodemographic influences. Smoking was associated with high sedentary time. After controlling for age, being a non-smoker predicted a 1.6 hour/week decrease in sedentary time than those who smoked daily. This association became very small, although still significant, when controlling for other sociodemographic confounders. Higher alcohol consumption was associated with less sedentary time, where for every one point decrease in alcohol consumption, there was a .364 point increase (1.8 hours) in sedentary time.

Hypothesis 2: Community Belonging and Low Sedentary Behaviour

Sense of belonging was associated with low SB. For every one point increase in community belonging, there was a .066 decrease (20 minute) in sedentary time after controlling for sociodemographic factors. However, this association was diminished to only a slight association after controlling for overall health.

Hypothesis 3: Intersectionality of Community Belonging and Income

When stratified by income group, community belonging displayed a slight negative association with sedentary time in the low-income group and a moderate negative association for the middle-income group. However, within the high-income group, community belonging was strongly associated with less sedentary time. After controlling for sociodemographic factors and overall mental and physical health, every one point increase in community belonging predicted a .466 point decrease (2.3 hours/week) in sedentary time score (see Table 4-3). Thus, within the high-income group, reporting a very strong sense of belonging predicted 7 hours/week, or 1 hour per day, less sedentary time compared to those reporting a very weak sense of belonging.

<div align="center">

Discussion

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Overall, the average sedentary time reported by First Nations adults living outside of Aboriginal communities was 25–29 hours/week, which is slightly higher than the 20–24 hours/ week reported across the general population.[52] Given Aboriginal peoples generally report a lower income than the general population, this finding was consistent with the current understanding of the negative association between income and leisure time sedentary behaviour.[11,41] Interestingly, when stratified by income, those in the high-income group reported a similar amount of sedentary time as the general Canadian population. This finding contributes to the significant amount of evidence supporting the influence of income on health-related and sedentary behaviours.[71,78]

Behavioural Variables

As predicted by Hypothesis 1, physical activity was associated with less sedentary time, even after controlling for sociodemographic confounders. While these findings are supported by general population studies,[30,70] this is the first study to repeat this finding within an Aboriginal adult population. Smoking, when controlled for age, was associated with more sedentary leisure time. However, after controlling for sociodemographic confounders, this association decreased significantly to only about a half hour/week difference in sedentary time between smokers and non-smokers. As reported by other studies, smoking is associated with higher TV time, yet overall sitting appears to have no relationship with smoking.[42] In this paper, although there is a slight association, it does not stand out as a major contributor to sedentary time among First Nations adults.

Contrary to my hypothesis, an inverse association between alcohol consumption and sedentary time was documented. Although alcohol consumption has been linked to poor health and at-risk behaviours,[79] it appears that among First Nations adults, it is associated with decreased sedentary time. Research has identified a similar association between alcohol use and TV viewing for women in the general population; however, other studies have reported no association between alcohol consumption and general sitting.[42] This finding adds to the current literature showing an increase of multiple SBs among male and female First Nations adults. It is possible that the influence of social, cultural, and economic factors are at play in this association. Perhaps alcohol consumption in this population is associated with non-sedentary social activities, where adults engage in other activities outside of the scope of the SBs that were examined.

Further research aimed to investigate the social and cultural influences around alcohol consumption is needed.

Community Belonging

As predicted by Hypothesis 2, community belonging was associated with low SB, even after controlling for all relevant confounders and overall health. However, in the fully controlled model, the association was quite small. Given health was controlled for in the analysis, the reported association between community belonging and sedentary time was independent of the association that both sense of belonging and sedentary time share with health.[1,68] Previously, in Paper 1, as presented in Chapter 3, I also reported a statistically significant correlation between sense of belonging and SB across the general population. This repetition of association across ethnic groups validates previous findings; however, future research is needed to understand the temporal relationship of this association.

Intersectionality of Community Belonging and Income

As per Hypothesis 3, a novel finding in this study was the unique intersectional association between sense of belonging, income group, and SB. A strong sense of belonging among adults in the high-income group was associated with significantly low sedentary time. Among the low- and middle-income groups, increased sense of belonging expressed a small to moderate relationship with increased sedentary time. I hypothesized that these differences were likely due, in part, to the intersectionality of environmental and social influences.

It is important to note that in Canada, the average household income is approximately $80,000 per year.[80] Not surprisingly, the First Nations high-income group

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($\geq$ \$80,000) reported a similar association between sense of belonging and sedentary time as the general Canadian population. However, when the level of household income dropped below the national average (ie, First Nations low- and middle-income groups), the reported association between sense of belonging was with higher sedentary time. These results suggest that poverty is playing a key role in this association.

Poverty shares a strong association with a number of behaviours that negatively impact health.[72] Also, low-income groups normally display an increased prevalence of sedentary leisure time.[11,41] Perhaps, in lower income groups, sense of belonging is tied to engagement in sedentary leisure pursuits with peers. As outlined by the philosopher Pierre Bourdieu, individuals from similar social classes tend to act in a similar way as a result of the influence of their habitus.[81] Habitus refers to the acquisition of lifestyle, perception, and disposition through social processes.[82] In many ways, habitus is influenced by the economic, social, and cultural capital an individual or family has at their disposal.[81] I suspect it is through this linking of structure and agency in different income groups that sense of belonging displays a different association with SB between these groups. Previously, in Chapter 3, I hypothesized that the unique association of sense of belonging spoke to the theory of social capital.[52] These finding suggested that although this may be true, the benefits of such may be overpowered by the influence of poverty, among other social determinants. Although this study identified the existence of this unique intersectional association, further research is needed to better understand if this finding is unique to First Nations people. Similar investigations should be conducted across different ethnic groups and with different health-related predictors.

Limitations

This study was limited by the use of a cross-sectional observational design, which restricts inferences regarding causation and temporal sequence. Recall bias may have been introduced as a result of self-report measures. In addition, specific sedentary activities examined were not exhaustive, neglecting transport or occupational sedentary time. Another possible limitation was the possibility of residual confounding, in which sedentary activities and social factors not accounted for in this study are influencing the results. The strengths of this study included the use of a large representative sample, weighted analysis, and control for the effects of relevant confounding variables in a seldom examined population.

Conclusion

The present study stands as the first to examine multiple sedentary behaviours among First Nations adult populations in Canada. This unique population reported relatively high levels of sedentary time. Given the relationship SB shares with poor health, these findings indicated the importance of research aimed towards identifying associations with low sedentary time. This study's findings highlighted multiple factors associated with low sedentary behaviour among First Nations adults living outside of Aboriginal communities. These factors include employment, being physically active, abstaining from smoking, and having a strong sense of belonging to community. A novel finding was that sense of belonging expressed a strong positive association among the high-income group, but not within the low- and middle-income groups. In this paper, I have theorized that the intersectionality of the social and material influences of poverty among First Nations groups may inhibit the protective association that community

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belonging has in the general population. These findings add to current research aimed

towards decreasing sedentary time by emphasizing the importance of understanding the

interacting effects between behavioural and social influences of sedentary pursuits.

Table 4-1. Characteristics of Sample[a]

Characteristic	N = 1,304
Sex	
Male	47.6%
Female	52.4%
Age	
18–24	15.8%
25–34	21.8%
35–44	22.7%
45–54	19.2%
55–64	12.2%
≥ 65	8.3%
Marital Status	
Married/Common-law	54.6%
Widowed/Divorced/Separated	13.4%
Single	32.0%
Education	
Less than secondary grad	12.4%
Secondary grad	25.7%
Post-secondary graduation	61.9%
Household Income	
$0–$19,999	17.2%
$20,000–$39,999	22.1%
$40,000–$59,999	18.6%
$60,000–$79,999	11.3%
≥ $80,000	30.8%
Employed	
Yes	58.3%
No	41.7%

[a] Percentages are based on unweighted data

Table 4-2. Multiple Regression Models with 95% Confidence Intervals (CIs) for Overall Sedentary Leisure Time among the First Nations Population

	Adjusted Model 1[a]			Adjusted Model 2[b]			Adjusted Model 3[c]		
	B (95% CI)	SE	β	B (95% CI)	SE	β	B (95% CI)	SE	β
Community Belonging	.170 [.161,.179]	.005	.055	.066 [.057,.076]	.005	.022	.019 [.009,.028]	.005	.006
Alcohol Use	.263 [.253,.273]	.005	.081	.364 [.354,.374]	.005	.112	.351 [.341,.361]	.005	.108
Smoking	-.160 [-.168, -.151]	.004	-.055	-.057 [-.066,-.048	.005	-.020	-.024 [-.033,-.015]	.005	-.008
Physical Activity	.333 [.323,.342]	.005	.107	.339 [.330,.349]	.005	.109	.277 [.267,.287]	.005	.089
Sex (Female)				-.659 [-.676, -.643]	.008	-.123			
Age				-.003 [-.004, -.003]	.000	-.018			
Widowed/ Divorced/ Separated				-.059 [-.085, -.033]	.013	-.008			
Single				.902 [.881, .923]	.011	.156			
Education Level				.064 [.051, .077]	.007	.017			
Household Income				-.050 [-.053, -.047]	.001	-.070			
Employed				-.673 [-.692,-.655]	.010	-.125			

[a] Model is adjusted for age

[b] Model is adjusted for sociodemographic confounders including age, sex, marital status, education, household income, and employment status

[c] Model is adjusted for sociodemographic confounders including age, sex, marital status, education, household income, employment status, as well as overall mental and physical health

Table 4-3. Multiple Regression with 95% confidence Intervals (CIs) of First Nation Sedentary Time by Community Belonging Stratified by Low, Middle, and High Income Groups

	Adjusted Model 1[a]			Adjusted Model 2[b]			Adjusted Model 3[c]		
	B (95% CI)	*SE*	β	B (95% CI)	*SE*	β	B (95% CI)	*SE*	β
High Income	.634 [.619, .648]	.007	.230	.441 [.427, .455]	.007	.169	.466 [.452,.480]	.007	.178
Middle Income	-.236 [-.250, -.222]	.007	-.068	-.200 [-.215,-.185]	.008	-.058	-.301 [-.316,-.285]	.008	-.088
Low Income	.204 [.185, .223]	.010	.076	-.056 [-.077, -.035]	.011	-.021	-.174 [-.195,-.153]	.011	-.064

[a] Model is adjusted for age
[b] Model is adjusted for age, sex, marital status, education, household income, and employment status
[c] Model is adjusted for age, sex, marital status, education, household income, employment status, and overall mental and physical health

CHAPTER 5: CORRELATES OF LOW SEDENTARY TIME AMONG MÉTIS ADULT POPULATIONS (PAPER 3)

Introduction

The extent to which Canadians engage in sedentary behaviour outside of working hours is of growing concern in this country. While the understanding of sedentary behaviour within mainstream populations is growing, little is known about sedentary behaviour within multicultural groups. The purpose of this paper is to gain a better understanding of sedentary behaviour within the rapidly growing Métis populations in Canada.

What is Sedentary Behaviour?

Sedentary behaviour (SB) is defined as any waking activity that has an energy expenditure of ≤ 1.5 metabolic equivalents (METS) while in a sitting or reclining posture.[13] One MET represents resting energy expenditure or resting metabolic rate.[14] Walking is 2-4 METS, and general bicycling requires 8 METS.[14] Important to note, SB is distinct from physical inactivity, which implies insufficient moderate to vigorous physical activity.[13] Conversely, SB refers to prolonged periods of muscular unloading, such as sitting while watching television, using a computer, or reading.[15] This difference is important, as the physiological effects of SB on metabolism and health are distinct and independent of physical activity or inactivity.[6–10] SB is commonly categorized into different types, namely, leisure or domestic sedimentary time.[15] The focus of this study is *leisure time SB*, which includes sedentary time outside of work and school.

Sedentary Behaviour and Health

Studies investigating the physiological consequences of SB have reported that prolonged sitting induces the suppression of skeletal muscle lipoprotein lipase (LPL)[3,4] and increased 2-hour plasma glucose levels.[22] LPL and plasma glucose dysregulation are associated with a number of poor health outcomes, including type 1 and 2 diabetes, insulin resistance, infection, vascular disease, and cancer.[1,18,56] Longitudinal studies have also indicated that sedentary time is associated with an increased incidence of cardiovascular disease, diabetes, obesity, cancer, depression, and other disease, as well as all-cause mortality in populations.[1,57] These health outcomes were recently quantified by a study concluding that every one hour of television viewed after the age of 25, may shorten life expectancy by 22 minutes.[37] This is a major area of public health concern for Canada, as one in four Canadian adults report spending ≥ 5 hours per day engaging in sedentary activities outside of work and school.[52]

Gaps in the Literature

The current adult SB literature is predominantly focused on the previously mentioned associations with negative health outcomes. Additional studies have identified groups at the highest risk for SB, including males[40] and the unemployed.[12,41] Television viewing is a key activity contributing to high leisure sedentary time. Research has also suggested rural dwellers and those who are low income are more likely to engage in this form of SB.[41] Yet, despite the current understanding, knowledge of SB among multicultural groups in Canada is limited. Given the rapidly growing Métis population in Canada, a better understanding of behavioural determinants that promote Métis health is needed.

Who are the Métis in Canada?

The Aboriginal population in Canada is defined by three main groups: First Nations, Métis, and Inuit.[83] Métis heritage began with marriages between French, Scottish, or English fur traders and Indigenous women, mainly from the Red River basin of southern Manitoba in the seventeenth to eighteenth centuries.[84] As a result of this unique heritage, both historically and in recent times, the Métis have suffered from oppression and social exclusion from government and civil groups. In early years, this oppression included disputes over land claims and civil rights, and there have been multiple agitations between the Métis and the Canadian government over time.[59] As a result of these contentions, the Métis were dispersed across Canada, and many rural Métis communities exist today. After years of struggle for Métis rights, the Canadian government finally recognized the Métis as a distinct Aboriginal people in 2003,[85] and many Canadians are now reclaiming their Métis heritage. Census records indicate that between the years 1996 to 2006, the Métis population increased by 91%. A large part of this growth is tied to the reclamation of Métis identity, coupled with fertility rates that are somewhat higher than the general Canadian population.[60] Today, almost half a million individuals self-identify as Métis in Canada, representing nearly a third of all Aboriginal peoples in the country.[61] As this population grows so will its influence on society in Canada; yet to date, there is a lack of research that has focused on gaining a better understanding of health behaviours and determinants of health behaviours across Canadian Métis populations. The purpose of this paper is to shed light on the determinants of low sedentary time among adult Métis in Canada.

Theory of Intersectionality

Currently, the literature lacks a coherent theoretical framework that could enable us to better understand SB in populations with complex social identities and varied economic realities. The research paradigm used to address this gap in the literature in this paper is intersectionality theory.[55] This theory was first developed and used in the late 1960s and is most recognized for its later use to clarify that the marginalization of race and gender among African-American women could not be treated as separate subjects, nor were these experiences the sum of their parts.[53] Intersectionality theory assumes a non-linear perspective in which the intersection of multiple social and economic identities and their influences on one another are considered.[55] In other words, this theory allows for an exploration of the intersections that exist between a group's ethnic, social, and economic experiences in order to shed new light on the real-world influences of sedentary time. In this paper, I examine the ways in which Métis heritage, gender, and social belonging may intersect to explain SB. A key benefit of conducting SB research with an intersectionality approach is a clear recognition of the impact of privilege and marginalization on this important health behaviour within a specific ethnic group. Intersectionality theory provides a useful framework for exploring social complexity and allows for the development of unique research questions that further the understanding of the etiology of low SB within Métis populations in Canada.

Research Questions

In this paper, the association between sedentary time and behavioral, sociodemographic, and community factors among the Métis population was explored. Associations between SB and three behavioural factors were examined, including alcohol

consumption, smoking, and physical activity. Current literature was unclear on the relationship between alcohol consumption, smoking, and SB.[42] In the present paper, these factors were hypothesized to be positively associated with SB given their association with poor health.[66–68] Physical activity was hypothesized to be inversely associated with SB within the Métis population, as a similar association has been reported in the general population.[69,70] As a result, I asked: Are these health-related behaviours also associated with low SB in the Métis population?

Another key research goal was to explore the association between sense of belonging and SB within the Métis population. Sense of belonging is a proximal component of a larger, more distal construct called social capital, which also includes feelings of safety, trust, belonging, reciprocity, and civic participation.[46,47] Previous research has suggested that sense of belonging is strengthened by a combination of three main key influences: first, a belief that one will be accepted by the community; second, the community's reaction to and acceptance of a person; and third, a person's willingness to sacrifice for the group (ie, volunteering time or emotional support).[51] It is important to note that in the general population, sense of belonging was associated with low SB[52] Through the research presented in this paper, I sought to examine if this association was also present among Métis adults in Canada.

Given the variation of SB time between gender reported in multiple studies[11,40,41] and influence of gender on behaviour, I was unsure whether social belonging would have similar impacts on leisure SB across males and females. Intersections between gender, economic wellbeing, and social connectedness (ie, sense of belonging) were examined in relation to SB for Métis adults. It is worth noting that Métis women are more likely to

experience poverty and other forms of socioeconomic adversity than Métis men.[85,86] The

concept of habitus, as outlined by Bourdieu,[81] suggests these gender-based differences

may influence the impacts of social belonging on sedentary behaviour during leisure.

Thus, I sought to examine associations between social belonging and SB stratified by

gender, as I am interested in exploring and acquiring a deeper understanding of the

intersectional impact of gender on the association between sense of belonging and SB for

Métis men and women.

In summary, the research presented in this thesis chapter (Paper 3) had two main

hypotheses and one research question:

1. Alcohol consumption and smoking would have a positive association and

    physical activity an inverse association with SB during leisure among Métis

    adults.

2. Sense of belonging to community would be inversely associated with leisure

    SB among Métis adults after adjustment for relevant sociodemographic

    confounders and health.

3. Is there a variation in the association between sense of belonging and SB

    within the Métis population based on gender?

Methods

Study Design

Data for this study were obtained from the 2012 Canadian Community Health

Survey (CCHS). Conducted by Statistics Canada, the CCHS is an annual nation-wide

survey. This cross-sectional survey collects data on health determinates and outcomes for

persons 12 years or older in Canada. Excluded from the survey's coverage are persons

living in institutions, Aboriginal communities, remote locations, military bases, and full-time members of the Canadian Forces. All data were collected using computer-assisted interviewing; approximately 40% of interviews were in person and approximately 60% by phone. Interviews were conducted between January 1 and December 31, 2012. The 2012 CCHS used a multistage stratified cluster design to ensure samples collected were generalizable to the wider Canadian population, which is described in detail elsewhere.[72]

At a national level, the overall response rate of the CCHS was 68.4% (N = 61,707) among participants 12 years or older.[72] Included in this study are participants who self-identified as Métis adults. There were 1,169 individuals who met these criteria and provided valid responses related to outcome of interest for this study: sedentary behavior. This study was exempt from IRB review, as data were obtained in a de-identified form.

Survey Weights

Data were weighted to more accurately represent the general household population of Métis people living outside of Aboriginal communities in Canada. The weighting variable applied during the analysis of this study was created by Statistics Canada. Information required for its creation was obtained by using a primary area frame, which was complemented with two additional frames of telephone numbers. Using advanced statistical techniques demonstrated elsewhere these frames allowed for the creation of a weighting variable.[72]

Outcome Variable

As part of the CCHS, respondents were asked to report average weekly leisure time (outside of school or work) spent in the following sedentary activities:

- On a computer, including playing computer games and using the Internet

- Playing video games, such as XBOX, Nintendo and PlayStation

- Watching television or videos

- Reading

Statistics Canada calculated total leisure sedentary activity time and provided the data in ten hour-based categories beginning at < 5 hours per week, and increasing by increments of 5 hours to a maximum of ≥ 45 hours per week.

Sociodemographic Factors

Sociodemographic characteristics were examined, including gender, age, education (less than secondary school graduate, secondary school graduate, and postsecondary graduate), household income (15 categories in total, ranging from $0 to ≥ $150,000), marital status (married/common-law, widowed/divorced/separated, or single/never married), and employment status (currently employed: yes or no).

Behavioural and Community Variables

Data were collected on physical activity, and a derived variable was created by Statistics Canada of energy expenditure values of kcal/kg/day. Individuals were categorized into three groups: 1 = active (> 3 kcal/kg/day), 2 = moderately active (1.5–3 kcal/kg/day), or 3 = inactive (< 1.5 kcal/kg/day). Smoking behaviour was examined by asking the respondent if they smoke cigarettes 1 = daily, 2 = occasionally, or 3 = not at all. Alcohol use was derived by calculating number of drinks reported per month, with participants stratified into three groups: 1 = regular drinkers (at least once per month), 2 = occasional drinkers (less than once per month), and 3 = did not drink in the last 12 months.

Participants' sense of belonging to their local community was examined by using one question on a scale of 1 to 4 (1 = very strong, 2 = somewhat strong, 3 = somewhat weak, and 4 = very weak). This method of measuring sense of belonging was also common in other studies.[67,73,74] However, in the literature, different techniques to measure sense of belonging have been used, including a larger 27-item self-report instrument[75] or a measure combining higher scores of reported feelings of respect, inclusion, and support of their social environment.[76]

Statistical Analysis

Prevalence estimates of overall sedentary leisure time were obtained, which included the summed prevalence estimates of television viewing, computer use, videogame use, and reading time among the sample population. To examine Hypothesis 1, regression techniques using 95% confidence intervals were used to examine the associations between SB and alcohol consumption, smoking, and physical activity. Three regression models were derived. As shown in Table 5-2, the first model examined health-related behaviours adjusted for age alone. In the second model further adjustment for relevant sociodemographic confounders selected a priori based on existing literature (ie, gender, marital status, household income, education, and employment status) was conducted. In the third, additional controlling for overall self-perceived health was performed. The focus of this analysis was on identifying associations between these three behavioural variables and low sedentary time.

To examine Hypothesis 2, multiple linear regression techniques with 95% confidence intervals were used to measure the association between sense of belonging and SB. Three regression models were derived. The first adjusted for age, the second for

sociodemographic confounders, and the third for self-perceived overall physical and mental health (see Table 5-2).

To examine Hypothesis 3, the association between sense of belonging and SB was examined by gender (see Table 5-3). Thus, before analysis, the sample was stratified by males and females. Multiple regression techniques were conducted for each gender group by using three models that controlled for age, sociodemographic factors, and overall health, respectively.

Multicollinearity between the independent variables was examined using variance inflation factors (VIFs) before main effect models were derived. All potential confounding variables were examined, including income, for effect modification prior to entry into main effects models; none were found. In addition, all multivariate outliers were excluded from the analysis. All analyses were completed in 2014 and run using IBM SPSS Statistics 22.0 (SPSS Inc., Chicago, IL).

Results

Sample Description

The sociodemographic distribution of study participants is presented in Table 5-1. The sample of 1,169 participants was 47.5% male, and the mean age was 35–44 years. The majority of participants were married, employed, and had completed a post-secondary degree.

Sedentary Behaviour

On average, Métis adults were sedentary for 25–29 hours/week during leisure (range = 0 to ≥ 45 hours/week). Of the four sedentary activities reported, television viewing was the most common (11–14 hours/week), followed by computer use (3–5

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hours/week), reading (3–5 hours/week), and playing video games (< 1 hour/week). When the sample was stratified by gender, both males and females reported between 25–29 hours/week of sedentary time.

Sociodemographic Correlates of Low Sedentary Behaviour

The regression model for the association between sociodemographic variables of interest and sedentary time are presented in Table 5-1. The model predicted that those who were male, single, employed, and had a higher income were among the least sedentary in the Métis population. A positive association existed between age and SB, in which every one year increase predicted a .011 point increase (3.3 minute) in sedentary time. Thus, the association reported that those who were 20 years old were approximately 2 hours/week less sedentary than those who were 55 years old.

Hypothesis 1: Behavioural Correlates of Low Sedentary Behaviour

Physical activity was strongly associated with less SB. The magnitude of this association increased even after controlling for sociodemographic influence, inasmuch that every one point increase in physical activity score predicted a .364 point decrease (1.8 hours) in weekly sedentary time. Alcohol consumption reported a moderate association with low sedentary time when controlled for age alone. However, after controlling for relevant sociodemographic confounders, this association became very small (β = .049). Smoking was also examined and had only a small association with high sedentary time.

Hypothesis 2: Sense of Belonging and Low Sedentary Behaviour

Sense of belonging to community was associated with low sedentary time. After controlling for sociodemographic variables, the model reported that for every one point

increase in sense of belonging, there was a .077 point decrease in overall sedentary time. Even after controlling for overall physical and mental health, the strength of association remained. Thus, independent of sociodemographic influences and health, those who reported a very strong sense of belonging compared to a very weak sense were 1.1 hours/week less sedentary during leisure.

Hypothesis 3: Intersectionality of Community Belonging and Gender

Intersectionality of gender within Métis culture and its influence on the association between sense of belonging and sedentary time was examined. As displayed in Table 5-3, when the sample was stratified by gender, sense of belonging was strongly associated with low sedentary time among men, but not women. Within the male group, with control for age alone, an association of 8 hours/week less sedentary time was reported among those with a very strong sense compared to a very weak sense of belonging. After controlling for relevant sociodemographic factors and overall physical and mental health, the model reported that those with a very strong sense of belonging were associated with 3.7 hours/week less sedentary time than those with a very weak sense of belonging. Among women, the association was in the opposite direction; in fact, sense of belonging among women had a slight association with high sedentary time (β = .073).

Discussion

Average sedentary time reported by Métis adults was 25–29 hours/week, which is comparable with First Nations people in Canada. However, this was slightly higher than that reported by the general population.[52] Although in the regression model, being female

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was associated with more SB, when prevalence estimates were stratified by gender, both males and females reported between 25–29 hours/week of overall leisure SB.

Behavioural Correlates of Sedentary Behaviour

As predicted by Hypothesis 1, increased physical activity was associated with low sedentary time. This finding was consistent with findings reported in Chapters 3 and 4 of this thesis for the general Canadian population and First Nations adults. These findings were also consistent with previous studies.[30,69] Interestingly, after controlling for sociodemographic confounders, this association was strengthened, and the true strength of this association became clear. Even additional control for perceived health did little to diminish the strength of this association. Thus, these findings have added to the literature by supporting the inverse association between physical activity and leisure time sedentary activities among the Métis population. This association was likely due to time displacement, where leisure time spent exercising took away from time available to watch TV.

Abstaining from smoking was weakly associated with low sedentary time among Métis adults. A similar association was also reported among First Nations populations in Chapter 3 of this thesis. A recent systematic review of SB research reported that among the general population, results concerning the association between smoking and SB are mixed.[42] In the present study, the size of the association after additional control for socioeconomic confounders suggests smoking contributes little to explanations of leisure sedentary time among Métis adults.

Contrary to my hypothesis, alcohol consumption reported an inverse association with sedentary time. However, after controlling for sociodemographic confounders, the

strength of this association was greatly reduced and became very weak, which was contrary to findings reported in Chapter 3 among First Nations adults, where control for confounders strengthened the association between alcohol consumption and SB. Thus, the results of this study have suggested a much weaker direct association among Métis after adjustment for socioeconomic confounders than for First Nations. Similar to this study, previous studies have reported no association between alcohol consumption and general sitting; however, there may be an association between alcohol consumption and increased TV viewing among women in the general population.[42]

Sense of Belonging to the Local Community

As predicted by Hypothesis 2, sense of belonging was associated with low sedentary time among the Métis population. Similar findings have been repeated in Chapter 3 and Chapter 4 of this thesis, adding strength to this association.[52] Although the association between sense of belonging and sedentary time among the Métis population was relatively weak, it was still larger than that reported by the First Nations populations.[87] Given the median income for Métis people is slightly higher than that of the First Nations population, a possible theory could be that level of income is a contributor to this difference. This theory is consistent with findings in Chapter 4, where a similar effect was reported between income group and the association between sense of belonging and SB.

Intersectionality of Community Belonging and Gender

As stated by Hypothesis 3, there was an intersectional relationship between sense of belonging and SB based on gender. This was the first study to investigate the intersectional influence of gender in a Métis population on the association between sense

of belonging and SB. Findings have highlighted that among Métis men, even after controlling for sociodemographic confounders and perceived health, sense of belonging to their community was strongly associated with low SB. Conversely, among Métis women, sense of belonging was slightly associated with higher SB. These results hint that within the Métis population, there are some underlying factors associated with gender that are influencing this difference.

One possible contributor is that Métis women experience both social and economic determinants differently than Métis men. For example, Statistics Canada reported that the average income of a Métis woman in Canada is $22,706 per year, which is $12,000 per year less than their male conterparts.[86] Important to note, this is the largest gender-based disparity in income across all Aboriginal groups. In addition to these economic inequalities, there are nearly twice as many Métis women who are lone parents than the general population, many of whom are heads of large families in crowded housing.[85] As a result, in general, Métis women are at a higher risk of poverty due to lower socioeconomic status and higher economic burden than Métis men. Perhaps, in this marginalized group, sense of belonging is associated with more SB, which is common among low income groups.[11,41] This could be a likely influence, as poverty has been associated with a number of poor health behaviours, and a similar relationship was reported in Chapter 4 of this thesis.[71] This theory can be explained through the notion of habitus, which was theorized by the philosopher Pierre Bourdieu. Habitus refers to the acquisition of lifestyles, perceptions, and dispositions among particular social groups.[81] Key to Bourdieu's theory was that habitus is not created by individuals, rather it is acquired through socialization.[80] Thus, the habitus of low income and high economic

burden among marginalized Métis women is perhaps at the root of the gender differences in the association between sense of belonging and SB. However, further research into understanding this gender difference is warranted.

Limitations

This study was limited by the use of a cross-sectional observational design, which prevented inferences regarding causation and temporal sequence. Recall bias may have been introduced as a result of self-report measures. In addition, specific sedentary activities examined were not exhaustive, neglecting transport or occupational sedentary time. Another possible limitation was the possibility of residual confounding, in which sedentary activities and social factors not accounted for in this study were influencing the results. The strengths of this study included the use of a large representative sample, weighted analysis, and control for the effects of relevant confounding variables in a seldom examined population.

<div align="center">

Conclusion

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The present study stands as the first to examine multiple SBs among Métis adult populations in Canada. This unique population reported relatively high levels of sedentary time. Given the influence that SB has on poor health, these findings have indicated the importance of research aimed towards identifying associations with low sedentary time. Highlighted in this paper are multiple factors associated with low SB among Métis adults living outside of Aboriginal communities. These factors include employment, being physically active, abstaining from smoking and having a strong sense of belonging to community. A novel finding was that sense of belonging expressed a strong association with low SB among males, but not among females. In this reported

study by way of intersectionality theory, I have theorized that income disparities faced by Métis women may be responsible for the reported gender difference in the association between sense of belonging and SB. Findings have added to current research aimed towards decreasing sedentary time by emphasizing the importance of understanding the interacting effects between behavioral, ethnic, economic and social influences of sedentary pursuits.

Table 5-1. Characteristics of Sample

Characteristic	*N* = 1,169
Sex	
Male	47.5%
Female	52.5%
Age	
18-24	20.0%
25-34	20.6%
35-44	21.0%
45-54	17.1%
55-64	12.9%
≥65	8.4%
Marital Status	
Married/Common-law	58.0%
Widowed/Divorced/Separated	9.0%
Single	32.9%
Education	
Less than secondary grad	8.7%
Secondary grad	19.1%
Post-secondary graduation	72.2%
Household Income	
$0-$19,999	13.1%
$20,000-$39,999	16.0%
$40,000-$59,999	22.4%
$60,000-$79,999	12.1%
≥$80,000	36.4%
Employed	
Yes	59.4%
No	40.6%

[a] Percentages are based on unweighted data

Table 5-2. Multiple Regression Models with 95% Confidence Intervals (CIs) for Overall Sedentary Leisure Time Among the Métis Population

	Adjusted Model 1[a]			Adjusted Model 2[b]			Adjusted Model 3[c]		
	B [95% CI]	SE	β	B [95% CI]	SE	β	B [95% CI]	SE	β
Community Belonging	.199 [.190, .209]	.005	.064	.077 [.067, .087]	.005	.025	.072 [.062, .082]	.005	.061
Alcohol Use	.220 [.208, .232]	.006	.060	.049 [.036, .062]	.007	.013	.025 [.012, .038]	.007	.007
Smoking	-.040 [-.050, -.031]	.005	-.014	-.016 [-.026, -.006]	.005	-.005	.009 [-.001, .019]	.005	.003
Physical Activity	.270 [.260, .279]	.005	.088	.364 [.354, .374]	.005	.119	.356 [.346, .366]	.005	.117
Sex [Female]				.109 [.092, .127]	.009	.021			
Age				.011 [.010, .012]	.000	.061			
Widowed/ Divorced/ Separated				.048 [.016, .080]	.016	.005			
Single				-.100 [-.123, -.078]	.011	-.018			
Education Level				.182 [.166, .198]	.008	.042			
Household Income				-.096 [-.099, -.093]	.001	-.131			
Employed				-.715 [-.733, -.697]	.009	-.132			

a Model is adjusted for age
b Model is adjusted for sociodemographic confounders, including age, sex, marital status, education, household income and employment status
c Model is adjusted for sociodemographic confounders, including age, sex, marital status, education, household income, employment status, as well as overall mental and physical health

Table 5-3. Multiple Regression with 95% Confidence Intervals (CIs] of Métis Sedentary Time by Community Belonging Stratified by Gender

	Adjusted Model 1[a]			Adjusted Model 2[b]			Adjusted Model 3[c]		
	B [95% CI]	*SE*	β	B [95% CI]	*SE*	β	B [95% CI]	*SE*	β
Men	.536 [.522, .551]	.007	.164	.248 [.233, .263]	.008	.078	.243 [.228, .258]	.008	.076
Women	-.074 [-.087, -.060]	.007	-.024	-.070 [-.084, -.057]	.007	-.023	-.073 [-.086, -.059]	.007	-.024

a Model is adjusted for age
b Model is adjusted for age, sex, marital status, education, household income and employment status
c Model is adjusted for age, sex, marital status, education, household income, employment status and overall mental and physical health

CHAPTER 6: GENERAL DISCUSSION AND CONCLUSIONS

Sedentary behaviour (SB) is associated with an increased risk of cardiovascular disease, diabetes, obesity, cancer, depression and other diseases, as well as all-cause mortality in populations.[1,57] Despite this evidence, current research has suggested that on average, adults spend over half their waking hours sitting.[2] In Canada, many of the health outcomes associated with SB are responsible for the significant number of deaths and economic burden on society.[88,89] In fact, the phrase "sitting is the new smoking" has recently gained popularity in Canadian culture. Needless to say, there is a demand for research that can be used to generate intervention strategies for SB. This thesis has worked to address this need by using epidemiologic data to identify factors associated with low SB across multiple populations. Correlations between SB and sociodemographic, behavioural, community and health-related factors were examined. The overarching goal of this work was to uncover key determinants of low leisure sedentary time among adults in the general population, as well as those who identify as First Nations and Métis within the general population, so that targeted intervention strategies can be developed.

Prevalence of Sedentary Behaviour

This research was the first to examine the prevalence of a broad range of leisure time sedentary behaviours within the general Canadian population and within First Nation and Métis populations. On average, Canadian adults reported engaging in 20–24 hours of leisure sedentary time per week, with TV watching being the most common behaviour. In comparison, First Nations and Métis adults averaged 25–29 hours per

week, with TV watching also reported as the most common activity. This increase in sedentary time among Aboriginal adults appears to be dependent on household income. For example, First Nations adults with household incomes that met or exceeded the national average ($80,000/year or more) reported levels of sedentary time that matched those of the general population. Unfortunately, most First Nations adults reported household incomes far below that of the national average. In total, 30.8% lived in homes with a combined income of $\geq$ $80,000/year, while 69.2% lived in low-income homes with a combined income of $0 to $79,999. First Nations adults living in these low-income homes averaged 25–29 hours per week of sedentary time.

These findings highlight that, similar to the general Canadian population, average household income is associated with reduced leisure sedentary time among First Nations adults. Unfortunately, many First Nations adults live in households that earn far below the national average. From these data, it appears that improving the socioeconomic circumstances of First Nations adults would serve as the most effective intervention to counteract elevated leisure sedentary time within this group. These findings were consistent with the work of Frieden, who has argued that it is attention to improving the overall socioeconomic circumstances of a population that will have the greatest impact on their health and health behaviour.[90] Yet within Canada, there is evidence that structural barriers remain in place that prevent Indigenous peoples from achieving incomes equal to those of other Canadians. For example, data from Statistics Canada documented that high levels of income inequality persist no matter where Aboriginal adults live in Canada.[87] Disparities in income earned remain high, particularly in urban centres, despite rapid increases in educational attainment by Aboriginal Canadians over the past ten years.

Currently, an Aboriginal adult with a high school or college diploma earns 30% less than a non-Aboriginal adult with the same level of education in this country. This pay gap is reduced for those who achieve a university degree; however, the number of Aboriginal Canadians who complete university remains low relative to the national average. Yet, findings from this thesis suggest that continued work toward achieving income equality for First Nations adults is a key intervention that would do much to reduce sedentary behaviour, and its consequent health effects, within this population.

Sociodemographic Factors

Currently, we have a limited understanding of the ways in which sociodemographic factors correlate with leisure time SB in Canada. This thesis builds on Canadian studies that have, to date, examined only a limited range of leisure sedentary behaviours in general population studies: typically television time or computer use. In contrast, the present research has expanded to also include television time, computer use, videogame use, and reading, so that we can gain a better understanding of the ways in which a larger set of behaviours correlates with sociodemographic factors. Findings indicated that across the general Canadian population as well as First Nations and Métis populations, those with higher household incomes reported lower sedentary time. This association came as no surprise, as multiple studies reported similar results.[70,77] Thus, this thesis has added to the mounting evidence that highlights the powerful association between income and leisure SB.

Another consistent finding in the literature was that men generally report higher leisure SB than females.[42] Results reported in Chapter 3 and 4 of this thesis indicated that this gender-based trend is found across the general population and First Nations

population living off-reserve in Canada; in these groups, leisure sedentary time was consistently higher among men. In contrast, findings presented in Chapter 5 indicated that this trend is reversed among Métis Canadians. Among the Métis, leisure sedentary time was higher among women. This novel finding was of interest, particularly given that it is the first time sedentary behaviour has been examined among the Métis. Future research is warranted to better understand and demonstrate the repeatability of this trend.

The relationship between age and overall leisure sedentary activity has remained unclear in the literature. This thesis reported that in the general population, those between the ages of 35 and 49 years were the least sedentary. However, in the First Nations population, there was no significant association between age and SB, while among the Métis, there was a positive but weak association. These findings have contributed to existing literature by expanding the understanding of leisure SB within Indigenous population, and by highlighting a U shape association between age and sedentary time in the general population, that has yet to be reported by other studies. This unique finding might be attributed to factors such as the increased likelihood of children in the home among adults aged 35–49 years, which would reduce time available for leisure SB. Further research is needed to test this hypothesis.

The association between marital status and SB varied across all three populations examined in this thesis. Among First Nations adults, being single was associated with the most sedentary time, while being widowed/divorced/separated was associated with the least. Interestingly, these findings were reversed with the Métis population. In addition, within the general population, results were again mixed, where being widowed/divorced/separated was associated with the most sedentary time, while being

married/common-law was associated with the least. This variation in results across populations was not surprising, as the literature also reported mixed findings.[42] It is important to note that the size of these associations were weak across groups, suggesting marital status is not a key determinant of leisure SB among Canadian adults.

Behavioural Correlates

In an effort to identify modifiable risk factors for SB, associations between multiple behavioural correlates were examined. Physical activity across all three populations was consistently associated with low SB. These findings were largely supported by other studies.[42,68,69] A likely cause of this association is less available time for leisure SB when adults choose to invest in physical activity. The idea that physical activity is associated with low SB suggests programs aimed at increasing physical activity in populations could potentially decrease SB.

Associations between alcohol consumption and leisure sedentary time were also examined in this research. I had hypothesized that alcohol consumption would be positively associated with sedentary time. However, findings indicated an inverse association between alcohol consumption and leisure SB in both First Nations and Métis populations. That is, as alcohol consumption went up, leisure sedentary time went down. These findings are interesting given current literature has suggested alcohol consumption is not associated with SB.[42] It may be that within Aboriginal populations, alcohol consumption is correlated with non-sedentary social activities or events. It is worth mentioning that among the Métis, the association between alcohol consumption and SB became very weak after adjustment for sociodemographic confounders. Conversely, after adjustment for confounders, the strength of this association actually increased among

First Nations adults. That is, the confounding effects of socioeconomic confounders masked the strength of the association between alcohol use and leisure SB for First Nations adults living outside Aboriginal communities. Clearly, carefully controlled studies, and preferably prospective studies, are needed to better understand the association between alcohol use and SB within Indigenous populations in Canada.

Sense of Belonging and Intersectionality

Sense of belonging was a key variable examined in this thesis. In the dataset I used, participants were asked: "How would you describe your sense of belonging to your local community?" Responses fell on a 4-point scale from very strong to very weak. As reported in Chapter 3, a novel finding within the general population was that sense of belonging was strongly associated with low SB. I theorized that this association may be the result of an increase in social capital. The theory of social capital posits that social networks have value and that those with a strong sense of connectedness, safety and trust in their community are more likely to be productive members of society, in part through their increased engagement in healthy behaviour.[25,26] This finding is of particular importance, as it brought to light a potential ecological dimension to an area of research that has predominantly focused on individual-level associations. As a result, hypotheses and research questions aimed at exploring the association between sense of belonging and SB within Aboriginal groups emerged. I used intersectionality theory to frame the development and interpretation of these findings. Intersectionality theory highlights the unique interacting relationships between multiple different independent factors in understanding marginalization.[55]

Using this framework, I chose to examine associations between sense of belonging and SB for First Nations adults stratified by income group. Given the powerful influence of income on leisure SB in the general population[41,52] and low levels of average income across First Nations populations,[87] I was unsure whether social belonging would have similar impacts on leisure SB across income strata. Findings indicated that sense of belonging was strongly associated with low SB for First Nations adults with household incomes that matched the national average (> $80,000). In contrast, for those First Nations adults living in low-income ($20,000–$79,999 range) and very low-income homes (< $20,000 range), increased sense of belonging was associated with increased leisure SB. This highlighted the influence of habitus on behaviour. As outlined by Bourdieu, one's characteristics, dispositions, and lifestyles are acquired through one's habitus.[80] These results have indicated that the habitus acquired by these marginalized sub-populations has a potent impact on sense of belonging and how it is associated with SB.

An intersectional framework was also used to examine associations between sense of belonging and SB for Métis adults stratified by gender. Given the variation of SB time between gender reported in multiple studies[11,40,41] and the influence of gender on behaviour, I was unsure whether social belonging would have similar impacts on leisure SB across males and females. Findings indicated that sense of belonging was strongly associated with low SB for Métis adults who were male. However, for those Métis adults who were female, increased sense of belonging was associated with increased leisure SB. Important to note, Métis women experience greater gender-based income inequality than any other Aboriginal group, and compared to the general population, they are nearly

twice as likely to be lone parents of large families.[85,86] Thus, Métis women are more

likely to experience poverty and other forms of socioeconomic adversity than Métis men.

Similar to findings in the First Nations population, these results also suggest an influence

of habitus on the association between sense of belonging and SB. This is why future

research aimed toward developing intervention strategies for SB should consider the

significant impact of social inequalities and habitus on SB. While promoting individual

or ecological factors that influence a change in SB has merit, it is likely to have little or

no effect on SB if the overriding influence of socioeconomic determinants is ignored. As

stated by Rose,

> Personal lifestyle is socially conditioned. Young motorcyclists are happy to wear crash helmets if that is what their friends and role models are doing. Smokers are more likely to give up the habit if smoking brings disapproval within their section of society. Individuals are unlikely to eat very differently from the rest of their families and social circle. . . . It makes little sense to expect individuals to behave differently than their peers; it is more appropriate to seek a general change in behavioural norms and in the circumstances which facilitate their adoption.[91]

If effective intervention strategies are to exist, research must strive to address the

larger influence of social determinants on SB. This thesis has provided an example of

analyzing correlates of SB without neglecting the complexities of intersectional

identities. These findings have suggested sense of belonging may be an important

modifiable factor that could inform interventions designed to reduce leisure SB in

mainstream populations. The findings of this thesis research have also highlighted and

have begun to examine the role of complex and intersecting ethnic, gender-based and

income-based identities on the strength and direction of this association.

Strengths and Limitations

A major strength of this study was the use of a large generalizable dataset, which reduced the amount of random error across this research. Also, the multistage, stratified, cluster design used for collecting data prevented the influence of selection bias and ensured that samples collected were generalizable to the wider Canadian population. Another strength was the use of a broad range of leisure-time sedentary activities. Given that most leisure-time SB studies only examined one or two different behaviours, this approach provided a broader and more realistic understanding of leisure-time SB in the sample groups. Although a broad range of SBs was strength of this research, it is also worth noting that the range of SBs examined was not exhaustive. Thus, a potential limitation of this study is that perhaps other important forms of SB were not included in this analysis.

A limitation of this research was the use of a cross-sectional observational study design, which prevented inferences regarding causation and temporal sequence. In addition, survey information was based on self-report measures in which recall bias may have been introduced. It is likely that some participants may have overestimated or underestimated there total sedentary time or other variables measured in this study. However, objective measures of sedentary time for a large population-based study design were not feasible, making subjective measures the best alternative. Another possible limitation was the possibility of residual confounding, in which sedentary activities and social factors not accounted for in this study were influencing the results.

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Conclusion

The findings of this research highlighted income as an important determinant of leisure SB in populations. Finding also highlighted the role of a key modifiable factor, sense of belonging, that was associated with reduced leisure SB in the general population, which could be used to inform intervention strategies. These findings also highlighted the complexities of these associations. For example, among First Nations adults with low and very low incomes, sense of belonging to the community was associated with increased SB. Future research that embraces the complexities within the web of factors that shape leisure SB in various subpopulations is needed, and could provide valuable information for future intervention techniques.

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