PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR OF A GROUP OF ADULTS FROM RURAL NOVA SCOTIA

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Abstract

The influence of rural environments on physical activity and sedentary behaviours are not well known.

This was a cross-sectional pilot study of 58 participants aged 18-64 years who lived in Lunenburg County, NS. 7-day accelerometer data was measured to determine prevalence of moderate-to-vigorous physical activity (MVPA) and sedentary behaviour along with their relationship with each other, sex, age and household income.

Within the sample, 21% met the recommended 150 minutes of MVPA per week in bouts of $\geq$10 minutes. An average of 56% of awake time was spent in sedentary behaviour. There was a significant difference in total MVPA based on household income (p=0.009) but no other differences were found.

While this small sample does not allow for generalizability to the larger rural population, it does provide insight into the current state of these health-related behaviours, providing a springboard into future research on adult rural physical activity and sedentary behaviours.

List of Abbreviations Used

MVPA – moderate-to-vigorous physical activity

LTPA – leisure-time-physical activity

Non-LTPA – non-leisure-time-physical activity

MET – metabolic equivalent unit

CFS – Canadian Fitness Survey

NHANES – National Health and Nutrition Examination Survey

CHMS – Canadian Health Measures Survey

WHO – World Health Organization

CSEP – Canadian Society of Exercise Physiology

CMA – Census Metropolitan Areas

CA – Census Agglomerations

MIZ – Census Metropolitan and Census Agglomerated Influenced Zones

CSD – Census Subdivision

ANCOVA – Analysis of Variance

SD – Standard Deviation

Chapter 1: INTRODUCTION

1.1   Introduction

The study of physical activity and sedentary behaviour has evolved in both

significance and measurement capabilities over the past few decades. (1) The negative

health implications of a lifestyle absent of significant moderate-to-vigorous physical

activity (MVPA) and high in sedentary time have become more clear and therefore of

greater concern. (2) Additionally, the focus on increasing MVPA may not have a

significant influence on reducing sedentary behaviour. (3) The impact on quality of life

and health care budgets have shone the spotlight on these health-related behaviours and

made studying and measuring physical activity and sedentary behaviours a priority for

both researchers and policy makers. (4)

In Canada, there is a growing gap in health-related measures between those living

in rural and urban environments. A 2006 report, released by the Canadian Institute for

Health Information in conjunction with the Public Health Agency of Canada, entitled,

How Healthy are Rural Canadians? An Assessment of their Health Status and Health

Determinants concluded that there existed a "health disadvantage" for those living in

rural locales. However, insight into health-related behaviours like MVPA and sedentary

time was lacking for rural populations and the basis from which to make conclusions on

how "place" influences these behaviours was weak. (5)

The idea of "place" as a factor in health was well summarized by MacIntrye et al.

in 2002 as a complex concept that does not necessarily rely on physical environment

alone, if at all. The composition of individuals within a community, context of the

environment and collective norms, values and traditions may all have a role in how individuals from different locations may behave related to their health and wellbeing. Whether the differences in health between rural and urban populations is due to individual characteristics of their citizens or an encompassing factor such as the context or collective traits of a region is currently unclear and could be an interplay between all of these factors. (6)

In 2013, Nova Scotia was projected to dedicate 46% of its provincial budget to health spending, the most of any province and greatly outpacing the national average of 38%. (7) While there are many factors that can influence this statistic, the cost of a high prevalence of chronic disease influenced by low participation in MVPA and high levels of sedentary time, is certainly of great concern for the province. (4) Prevalence of chronic disease is even more drastic in rural Nova Scotia and limited self-reported data on adults from these regions suggests poor compliance to Canada's Physical Activity Guidelines and high levels if sedentary time as compared to urban areas. (8,9)

The purpose of this pilot study was to explore the physical activity and sedentary behaviours of a group of adults from rural Nova Scotia. The study used accelerometers to obtain an objective profile of the duration and intensity of physical activity and sedentary behaviour for the study sample. Information on some individual characteristics such as age, sex and household income was collected to allow insight into how these variables may influence differences within the group. By providing a descriptive snapshot and comparison of activity behaviours between groups within this sample, the hope is that it will provide a springboard for future research to guide policy makers in Nova Scotia.

1.2   Research Questions

The research questions that directed the proposed study were:

1.   What are the current physical activity and sedentary behaviours within this group of adults from rural Lunenburg County, Nova Scotia and is there a relationship between these behaviours?

2.   Within this sample of individuals, what is the relationship between physical activity, sedentary behaviour and:

   a. sex?

   b. age?

   c. income?

1. 3   Hypotheses

The directing hypotheses for this study were:

   H$_{1a}$: The proportion of participants meeting the recommended guidelines of 150 minutes of MVPA per week in bouts of at least 10 minutes will be a minority of participants.

   H1$_b$: The proportion time participants spend sedentary will be a majority of their mean awake minutes.

   H$_{1c}$: There will be no significant relationship between sedentary behaviour and either total MVPA or MVPA in bouts.

   H$_{2a}$: The relationships between physical activity and sex and sedentary behaviour

and sex will show that men engage in more total MVPA and MVPA in bouts; however, there will be no difference in sedentary time between men and women.

H₂b: The relationship between physical activity and sedentary behaviour with age will show that younger participants accrue significantly more total MVPA and MVPA in bouts along with significantly less sedentary time than do older participants.

H₂c: The relationship between physical activity and sedentary behaviour with household income will show that those who have a higher household income will have accrued more total MVPA and MVPA in bouts along with less sedentary time than those with lower household incomes.

1.4 Definition of Unusual or Specific Terms

There are no terms used in this proposed research study that would be considered unusual or specific.

1.5 Limitations

The limitations in this study focused primarily on resources, number of participants, timeframe and equipment. No funding was available for this study for recruitment of a representative sample; therefore, participants were recruited as a convenience sample. This limited the generalizability and therefore conclusions about the physical activity and sedentary behaviour of rural Nova Scotians. Participants were recruited during a specific period of time (August and September) so behaviours in other months cannot be definitively made. Finally, equipment used for the study was not

capable of picking up water-based activities and had limited use for biking and boating activities.

1.6   Chapter Summary

The role of "place" has been suggested as a significant and understudied factor in the understanding of physical activity and sedentary behaviours. The high prevalence of chronic disease in Nova Scotia and both the quality of life and cost burden associated with these rates makes understanding the behaviours that influence them, such as physical activity and sedentary time, of great importance. This pilot project sought to provide a snapshot of the physical activity and sedentary behaviours of a group of adults from rural Nova Scotia and to explore the influence of a few demographic characteristics on these behaviours.

Chapter 2: LITERATURE REVIEW

2.1   Physical Activity

2.1.1   Defining Physical Activity

Physical activity includes all movements that utilize skeletal muscle and increase energy expenditure above expenditures at rest. Activity is often classified into leisure-time physical activity (LTPA) and non-leisure-time physical activity (non-LTPA). Together they account for about 25% of energy expenditure in a sedentary individual and up to 50% of energy expenditure in a very active individual towards a measure known as total energy expenditure. (10-13) Exercise and sport are considered LTPA and have traditionally been the focus of population-level activity measurements. (10) Other non-discretionary activities, like those related to employment and daily living, fall under the non-LTPA category and have only recently been integrated into activity studies with the advancement of objective measurement techniques. (11,12) More recently, the definition of physical activity has referred to MVPA, which can now be more accurately measured in leisure and non-leisure time. Objective tools such as accelerometers provide valuable insight into the duration and intensity of physical activity behaviours. MVPA is also the basis for part of the Canadian Physical Activity Guidelines and the WHO recommendations on physical activity. (14,15)

Physical activity can also be measured based on metabolic equivalent units (METs), which are calculated based on the ratio of a metabolic rate for an activity divided by resting metabolic rate or $3.5\text{ml} \times 0_2 \times \text{kg}^{-1} \times \text{min}^{-1}$. (16) Ainsworth et al (2011) developed a compendium of physical activities that included MET intensities

based out of a desire to collect previous research done on quantifying activities into one uniform source. The majority of MET values have been established with oxygen testing through laboratory or field experiments. Some examples include: vigorous, uphill, mountain biking (14.0 METs), tap dancing (4.8 METs), crab fishing (4.5 METs) and slow, light effort cleaning and sweeping (2.8 METs). The compendium is described as a living document that will continue to reflect current research and practical activities of the modern world through regular updates. Importantly, it provides a basis for better translating new quantitative physical activity data into more meaningful and practical information. (17)

2.1.2 Physical Activity Research

In 1961, the Canadian government passed the Fitness and Amateur Sports Act (recently amended and renamed the Physical Activity and Amateur Sports Act), which established the goal of promoting fitness and physical health amongst Canadians. (18) The first national sample of physical activity behaviours in Canada was conducted in 1981 as part of the Canadian Fitness Survey (CFS). This data were collected through subjective self-report surveys and first demonstrated that most Canadians were not achieving LTPA levels of 3+ METS-hours/day, which was deemed to be the level of "sufficient activity" at the time of study. (19)

As physical activity research began to take shape in the late 20th Century, primarily subjective tools were used to assess national samples. In 2004, Craig et al physical activity trends over a twenty-year period including surveys, questionnaires, activity inventories and other self-reported physical activity data. (19) A 1985 review of

30 various methods of physical activity monitoring concluded that, with the technology available at the time, self-reporting methods were the most cost-effective way to assess large samples. (20) For national studies in Canada in 1985, it simply was not practical to employ objective techniques for countrywide conclusions that would inform policymakers on decisions related to physical activity. (20)

More recently, technology around physical activity has advanced considerably and changed the way modern day physical activity investigators carry out their data collection. In 2007, Esliger and Tremblay provided a comprehensive review on the evolution of available tools for physical activity measurement over the previous two decades. (1) Most significantly, they profiled the more practical objective measures that had been shown to provide both reliable and, at times, cost-effective data for large samples. In their presentation of these modern day objective measures, they highlighted the problems with self-reported methods, such as varied individual interpretation of physical activity intensity. They suggested these flaws may have become more pronounced as awareness of the importance of physical activity and the social stigma surrounding inactivity increased. (1)

Recently, there has been increased usage of the accelerometer, a device that can provide insight into the duration and intensity of physical activity over time. It can provide unprecedented access to objective data that would allow assessment of how activity is accumulated including MVPA and duration of activity bouts. (1) The first national physical activity study using accelerometry took place in the United States in 2003-2004 as part of the National Health and Nutrition Examination Survey (NHANES). The NHANES results were compared to those of previous self-report studies and showed

that while trends in patterns related to gender and age were comparable, the accumulation of MVPA was "substantially" lower when measured objectively with accelerometry. (21)

The 2007-2009 Canadian Health Measures Survey (CHMS) provided the first objectively measured national survey of physical activity in Canada. (22) It found that only 15.4% of all Canadian adults surpassed the minimum threshold of 150 minutes of MVPA per week in 10-minute bouts or more. (22) These results compare to the findings of the most recent Statistics Canada self-report study conducted in 2009 that suggested 52.5% of Canadians were achieving a significant amount of at least moderate intensity activity during their leisure time. (23)

2.1.3   Physical Activity and Sex, Age and Household Income

The proportion of individuals that participate in recommended amounts of MVPA varies based on sex. The 2007-2009 CHMS demonstrated a significant difference between men and women in relation to the amount of time spent participating in moderate-to-vigorous physical activity, 27 minutes/day to 21 minutes/day respectively. Further to this, when broken down by age group, men consistently showed higher levels of moderate-to-vigorous activity with the most pronounced differences existing within the 20 to 39 age group (33 minutes/day for men to 24 minutes/day for women). (22)

The subjective data in the 2004 twenty year review of physical activity trends in Canada by Craig et al. also showed that men aged 18+ exceeded moderate levels of physical activity more frequently than did women aged 18+. The differences between the sexes ranged from a gap of 5.8% in a 1995 study to 16.3% in a follow-up 2000 study. (19) Without fully understanding the potential flaws in the methods of subjective data

collection of physical activity levels that were used in these studies, it is difficult to determine if sex differences were actually amplified during this time period or if other factors led to an increased gap. The consistency of these reports that depicted men with higher levels of physical activity than women, along with the results from the 2007-2009 CHMS and 2009 Statistics Canada, presents fairly strong evidence that adult men tend to engage in more physical activity than adult women. (22,23)

The association between physical activity and age has an inverse relationship, with increased age leading to lower amounts of MVPA. (21,22,24) A review of global physical activity research by Hallal et al in 2012 showed that increased age consistently corresponded to increased levels of inactivity around the world citing a "biological basis." Hallal et al defined inactivity as not meeting minimum moderate or vigorous physical activity time thresholds or certain MET-min per week. (24) While much of this data is derived from self-report studies, objective data collected in the 2003-2004 NHANES and 2007-2009 CHMS shows a similar trend. (21,22) The worldwide study does note that there seems to be differences based on region and specifically notes that adults aged ≥60 years were less inactive than those in the youngest age groups in the Americas, Eastern Mediterranean and Western Pacific. (24) This suggests that there may be an effect from 'place', possibly explained by individual characteristics of regional residents, and certainly worth further consideration.

While income and physical activity has shown evidence of a positive relationship, the worldwide study by Hallal et al produced a conflicting picture. (24,25) While those in higher income countries tended to be more inactive, self-report studies in these countries that examined leisure-time physical activity tended to show that individuals

with higher incomes tended to also be less inactive. The authors suggested that a trend toward more sedentary occupations co-existed with an increase in self-reported leisure-time physical activity. As low-income earners were more likely to accrue physical activity at work and high income earners were more likely to accrue physical activity in their leisure time, this may demonstrate a shift in how income influences physical activity. (24) A review by Trost et al. in 2002 also concludes that research, based primarily on self-report data, supports a positive association between higher income and higher overall physical activity in adults. (25) If indeed there is a changing trend in physically activity based on socioeconomic status, such differences would be worthwhile to investigate further.

2.1.4   Current Recommendations

In 1995, a partnership between the Canadian Society of Exercise Physiology (CSEP) and Health Canada began to develop the Canadian Physical Activity Guidelines in response to the growing rates of obesity and chronic disease across Canada. (26) The purpose of this initiative was to determine guidelines for Canadians in regards to physical activity. In 1997, the Federal, Provincial and Territorial Ministers for sport, physical activity and recreation set a goal of a 10% reduction of inactivity by 2003. (18) To that end, Canada's Physical Activity Guide to Healthy Active Living was released in 1998 with guides specific for older adults (1999) and children/youth (2002) released later. (26)

Following the release of the original guidelines, a revision process was initiated to revisit the existing guidelines and update their relevance based on up to date research. This process began in 2006 and focused on building on the newly created guidelines,

highlighting existing knowledge gaps and asking key questions to stakeholders. A comprehensive strategy was undertaken to ensure the new guidelines reflected advances in physical activity research, especially in regard to dose-response. The new guidelines were completed in 2010 and unveiled to the Canadian public in early 2011 as the Canadian Physical Activity Guidelines for Adults. (27)

These new guidelines recommend that adults aged 18-64 years should achieve 150 minutes of MVPA per week in bouts of at least 10 minutes. MVPA in bouts less than 10 minutes is considered sporadic and therefore does not count toward the accumulation of 150 minutes. The guidelines also recommend at least 2 days per week of muscle and bone strengthening activities. (28) This definition is in line with the current recommendations of the World Health Organization (WHO), which also adds the option of achieving 75 minute of vigorous intensity-activity as part of adherence to the recommendations. (15) Both the Canadian and WHO recommendations indicate that additional health benefits can be accrued from further MVPA. (15,28)

2.2   Sedentary Behaviours

2.2.1   Defining Sedentary Behaviour

In the study of physical activity, sedentary time has traditionally been the term used to describe the absence of MVPA, sometimes undifferentiated from light physical activity. (29) In some cases, sedentary was used to describe an individual who had insufficient MVPA. (3) This definition suited previous self-report studies that were focused on assessing leisure-time physical activity (LTPA). However, as the detrimental effects of sustained sedentary time became more evident, a more comprehensive

definition was needed. In 2008, Pate et al described the evolution of understanding sedentary behaviour and provided a modern definition that characterized it as time spent in activities that do not raise one's energy expenditure much above what would be expended at rest. Examples like sleeping, watching TV and lying down were listed and distinguished from light activities such as slow paced walking, mild household chores and writing. (29)

Quantifying sedentary behaviour requires a more concrete distinction between sedentary and light intensity. The *2011 Compendium of Physical Activities* categorized sedentary as activities between 1.0 and 1.5 METs, while light intensity encompassed those between 1.6 and 2.9 METs. (17) This definition was also endorsed by the Sedentary Behaviour Research Network who published a letter in 2012 asking for the adoption of the standard definition of sedentary behaviour as awake time of $\leq$1.5METs with the additional condition that the individual be in a sitting or reclining position. (3) The activities listed under 'Inactivity' in the Compendium of Physical Activities demonstrate that all activities $\leq$1.5 METs are indeed spent sitting or reclining except for standing still which registers at 1.3 METs. (30)

2.2.2 Sedentary Behaviour Research

Prior to the wide use of objective measurement tools, such as accelerometers, sedentary time could only be estimated by self-reporting. Despite the lack of objective measurement, health risks associated with sedentary behaviour were flagged as a concern in the 1996 Surgeon General's report in the United States. (31) This conclusion was based primarily on the subjective reporting of screen time and sitting time. While these

provide some insight into profiling demographic, behavioural, cognitive and environmental variables, they are likely limited by recall bias of these passive behaviours. (32) The emergence of accelerometry has allowed unprecedented access to the sedentary behaviours of individuals. This has launched new opportunities for sedentary behaviour research.

The 2007-2009 CHMS allowed the first national objective study of sedentary behaviour in Canadian adults. It showed that an average of 9.5 hours, or 69%, of total waking hours, were spent in sedentary behaviour. (22) It should be noted that this study used an alternate definition of sedentary behaviour that included all activities below 2.0 METs. This may have inflated the result and an analysis of the raw data using the Sedentary Behaviour Research Network's definition of $\leq$1.5 METs would likely produce a different result. Regardless, with evidence of linkages between sedentary behaviour, obesity and many chronic conditions, these likely high rates of sedentary time raise significant concern about the long-term effects on the health of Canadians across the country. (33)

MVPA and sedentary behaviour may actually have little association according to the Sedentary Behaviour Research Network. The "Network" further explained that it is possible for individuals to accumulate high amounts of MVPA and sedentary time in a single day. As an independent risk factor, individuals who have low amounts of MVPA and too much sedentary time may be negatively influenced by both health-related behaviours (3). In 2014, Martin et al indicated that despite Chinese and Norwegian men having greater MVPA than women, they also had a greater proportion of sedentary time.

However, this trend was not found in the 2003-2004 NHANES, demonstrating that place may play a role in how MVPA and sedentary behaviour coexist. (34)

2.2.3   Sedentary Behaviour and Sex, Age and Household Income

The 2012 systematic review by Rhodes et al. attempted to characterize some of the demographic relationships with sedentary behaviour. Sedentary time based on gender, grouped as men and women, found few differences between the sexes except when considering video game usage, which tended to be higher in men. (32) The 2007-2009 CHMS also found that there was very little difference between men and women in regards to average sedentary time per day. Men registered about 9.6 hours or 68% of awake time as sedentary, while women had about 9.8 hours or 69% of awake time in the same category. (22) More objective study could better assess this relationship in the presence of other variables, such as place of residence.

Rhodes et al suggested that age and sedentary behaviour were positively related to TV viewing; however, the opposite was found to be true in regards to computer usage. (32) This created a mixed and unclear relationship between age and screen and sitting time. No relationship was found between age and reading time. (32) A relationship between age and sedentary time was a bit more clearly established in the 2007-2009 CHMS, which reported that adults aged 60-79 years of age had significantly more sedentary time than those in the reference age category of individuals aged 20-39 years. (22) More research could better characterize this relationship and the influencing factors that may cause sedentary time to increase with age.

Finally, the relationship between household income and sedentary behaviour is unclear according to Rhodes et al. While eight of the fourteen studies that they reviewed suggested higher income households were associated with less TV viewing, the remaining six studies showed no relationship. Additionally, no relationship was found between computer usage and household income. (32) The uncertainty of these results and limited available data on household income and sedentary behaviour leaves presents an opportunity to further explore the possible connections.

2.2.4   Current Recommendations

The Canadian Society of Exercise Physiology (CSEP) currently does not have published guidelines for sedentary behaviour for adults aged 18-64 years but indicates their release is forthcoming. (35) CSEP has released guidelines for early years aged 0-4 years, children aged 5-11 years and youth aged 12-17 years. Each set of guidelines outlines activities that should be limited and recommended maximum duration of some of those activities. They also provide suggestions on how to decrease sedentary time throughout the day. (14) As more insight is gained into characterizing sedentary behaviour, these guidelines may better advise Canadians on how best to limit the health risks associated with high amounts of sedentary time.

2.3   Rural Health

2.3.1   The Role of Place

Analyzing a group of individuals based on their geographical location presumes an influence of place on the outcome being studied. While a difference in health outcomes and health-related behaviours has been established between rural and urban

individuals, the reason for this is not entirely clear. (5) MacIntyre et al. (2002) further explored this concept by characterizing the influence of composition, context and the collective when analyzing place effects. The composition of individual characteristics including income, sex and age has been studied extensively and has varying influences on health in all settings. However, there may place effects related to the contextual environment and collective norms, values and traditions that cannot be explained by individual composition alone. (6)

A study by Haan et al. in 1987 demonstrated that low socioeconomic status of geographical units had a relationship with excess mortality independent of individual characteristics. (17) Therefore, an affluent individual living in a low-income neighbourhood may still be influenced by their environment and community norms, despite the assumed advantage awarded by their income status. Similarly, Patterson et al (2004) looked at physical activity and obesity in America, concluding that even when controlling for individual factors such as income, education and health status, there remained a rural deficit in leisure time physical activity as compared to all US adults. (17) These gaps could perhaps be explained by unexplored individual characteristics, but it is hard to ignore the correlation with place and the possible influence environment and collective social norms may have on health status. Where much of the literature on neighbourhood setting and health has focused on urban dwellings, future research should take into account what effect rural and sparsely populated regions may play on health outcomes and health-related behaviours. (6)

2.3.2   Defining Rural

The definition of "rural" as a place can be characterized based on various population criteria, creating an inconsistent division between those who fall on either side of the rural and urban line in comparative studies. Du Plessis et al. (2002) identified several methods by which to define a rural population in Canada, each attempting to fragment and label segments of the population based on available data. Depending on the definition being employed, the proportion of the Canadian population that can be described as rural can range anywhere from 22% to 38% or 39% to 74% in Nova Scotia. This discrepancy arises from the complex nature of deciding what classification of regions to employ and of defining the influence of large urban centres or metropolitan areas on surrounding communities. (36)

Statistics Canada uses an operational definition that divides the country into census subdivisions (CSD), which are defined municipal units. Urban CSDs are split into Census Metropolitan Areas (CMA) with an urban core population of more than 50,000 and total population of at least 100,000 and Census Agglomerations (CA) with an urban core population of at least 10,000 and total population of at least 100,000. The remainder of CSDs are termed Outside CMAs or CAs, formerly Rural and Small Town (RST), and are further subcategorized into Census Metropolitan and Census Agglomerated Influenced Zones (MIZs) based on the percentage of their total employed labour force that commutes to a CMA or CA. The MIZ classification ranges from 'Strong MIZ' with a commuting group of at least 30% of the total employed labour force to 'No MIZ' with fewer than 40 individuals from the resident labour force commuting to

a CMA or CA. Non-CMA/CA regions of the Canadian territories also have their own subcategory of 'Territories (outside CAs)'. (17)

Applying this operational definition to Lunenburg County, Nova Scotia reveals five CSDs, all of which fall into the category of 'Non CMA or CA' or what was previously recognized by Statistics Canada as, 'Rural and Small Towns". The town of Lunenburg and Municipality of Chester fall into the category of 'Moderate MIZ' with more than 5% but less than 30% of their total employed labour force commuting to a CMA or CA. The Municipality of Lunenburg County and towns of Bridgewater and Mahone Bay fall into the 'Weak MIZ' because more than 40 residents, but less than 5% of the total employed labour force, commutes to a CMA or CA. (17)

2.3.3 Rural Health in Canada

A 2006 overview of rural health in Canada entitled, "How Healthy Are Rural Canadians?" attempted to summarize the current state of rural health as it pertains to both outcomes and indicators of health as compared to national average and urban standards. This report suggested that although much of the previous work had been based on urban environments, there is an increasing interest in the role of place in understanding health. It presented a broad set of health measures in terms of rural versus urban comparisons and suggested that there was generally a health disadvantage associated with living in a rural region of Canada. While expected deficits existed in some rural indicators, such as hospital wait times and access to a family doctor, one of the most important conclusions drawn from the report is the paucity of health research that has been done on health-

related behaviours, such as physical activity and sedentary behaviours in the rural environment. (5)

A 2013 snapshot of health measures on the rural South Shore of Nova Scotia, entitled "Vital Signs", described a population with significant health deficits when compared to provincial or national populations. This report showed obesity rates in the South Shore and South West District Health Authorities, which comprise the greater rural South Shore region, of 31.4% as compared to 25.1% provincially and 18.4% nationally. Diabetes rates in those aged 12 and over were also higher (9.6%) in this region compared to Nova Scotia as a whole (8.6%) or national rates (6.5%). The higher rates of obesity and diabetes correlated with fewer (46.9%) of residents self-reporting at least some physical activity or moderate activity during leisure time as compared to 53.9% both provincially and nationally. (37)

Health-related behaviour as a field of study is a key component in the prevention and mitigation of negative health outcomes. For example, smoking is considered a modifiable health-related behaviour that has been named as a risk factor for numerous conditions including as a contributor to an increase in the lifetime risk of cardiac and stroke events. (38) Research has also shown that individuals in rural communities in Canada are more likely to be smokers compared to the average Canadian. (39,40) This has led to many rural-specific studies on smoking behaviours including comparisons between subsets of individuals within rural communities. (39-41) Similar studies could provide invaluable information on other modifiable health-related risk factors in the rural context such as physical activity and sedentary behaviour.

2.3.4   Rural Physical Activity

The 2006 report, "How Healthy Are Rural Canadians?" presented an uncertain picture as to what relationship a rural place may have on physical activity behaviours. They concluded that despite the limited data analyzing the effect of place on this behaviour in Canada, there is a suggestion that those in rural regions may accrue less beneficial physical activity than their urban counterparts. (5)

Although rural-specific results were not presented from the 2007-2009 CHMS, a comparison of differences between rural and urban participants in both the subjective and objective components of the 2003-2006 NHANES was published by Fan et al. in 2014. These results were inconsistent based on whether objective or subjective data were used, what thresholds were set for objective measures and what subcategories were analyzed in the subjective data. In fact, depending on the measure used, rural residents were deemed more active, less active or equally as active as their rural counterparts. (42) The unclear results from this analysis certainly build a strong case for future research on rural health-related behaviours that asks clear questions and collects data that would allow proper analysis of the possible influences of place as described by MacIntyre et al. (2002) including composition, context and collective norms. (6)

A 2002 report from GPIAtlantic suggested that increasing the amount of MVPA Nova Scotians accumulate may also translate to economic benefits. It pegged the cost of inactivity, defined as expending less than 1.5 kcal/kg/day, in Nova Scotia at an estimated $354 million when considering direct health care costs and indirect productivity losses. The report estimates that inactivity plays a significant role in the prevalence of chronic

disease with 36% of heart disease, 27% of osteoporosis, 20% of stroke, hypertension, type 2 diabetes mellitus, colon cancer and 11% of breast cancer attributed to this risk factor. (4) A follow-up report by GPI Atlantic in 2004 outlined that the urban Halifax Regional Municipality had the lowest prevalence of inactivity as compared to rural regions of the province, noting the region containing Lunenburg County as having the highest rates of inactivity. (8)

A 2010 report that analyzed various community parameters of rural Lunenburg County, Nova Scotia suggested that only 43.5% of residents of the South Shore District Health Region, which encompasses the county, were physically active or moderately active during leisure time. In this example, 'physically active' refers to being more vigorous than moderate activity in self-reporting. This information was derived from the 2009 Canadian Community Health Survey, which collected self-report data on Canadians across the country. In comparison to provincial and national results in the same survey, the South Shore District Health Region came in 16.0% below the Nova Scotian rate of 51.8% and 17.1% below the Canadian rate of 52.5%. The Health Region also showed an 8.0% percent decline from the same information collected in 2008 when 47.3% of residents reported being physically active or moderately active in their leisure time. (9)

Trivedi et al. (2013) suggested that lower rates of physical activity in rural areas may be attributed at least partially to various factors related to physical environment such as reduced access to recreational options, fewer sidewalks, uneven pavement and the travelling distance to available resources such as parks and fitness facilities. This study also concluded reinforcing the framework of MacIntyre et al (2002), citing "sociodemographic, structural and lifestyle differences" of place as complex and likely at

the heart of rural versus urban differences in health issues. (6,43) There is certainly room for better understanding of health-related behaviours such as physical activity, in rural environments.

2.3.5   Rural Sedentary Behaviour

Little research has been conducted on the effect of place and environment on sedentary behaviours. (32) A rural environment carries many unique characteristics that may influence an individual's activity of everyday life. For example, active transportation may be more difficult in sparsely populated areas because a motorized vehicle may be required for transport to destinations that may be accessible by walking, biking or by public transportation in a more densely populated area. (44,45) Behaviours related to television or computer screen time may also be influenced by place depending on the available activity options in a rural area. (46,47) The use of objective measurement tools, such as accelerometers, allow researchers unprecedented ability to quantify lifestyles in rural environments that could previously only be estimated from self-reporting. (1)

Spanier et al. (2006) not only highlighted the importance of examining sedentary behaviour as a unique factor in health, but also put out a call for more research in this field in order to better understand the effect that sedentary behaviour may be having on the overall health of Canadians. (48) Certainly, obtaining a quantitative measure of current sedentary behaviours within a rural sample, and the correlations of these measures with individual characteristics of participants within the sample, would be a step forward in that understanding.

2.5   Conclusion

The study of physical activity has been ongoing for decades, but with the emergence of objective measurement tools, such as accelerometers, researchers have unprecedented access to more accurate analysis of sedentary behaviour and MVPA, including accumulation in bouts. (1) The limited number of national studies that have been conducted using these tools has shown high prevalence of sedentary behaviour and that few adults meet or exceed the recommendation of 150 minutes of MVPA in bouts of at least 10 minutes per day, which has been endorsed by both Health Canada in Canada's Physical Activity Guidelines and the World Health Organization. (14,15,21,22)

The influence of 'place', specifically rural verses urban environment, has not been a focus of previous objective studies of physical activity and sedentary behaviour. Analysis that has been conducted from data collected in the United States has shown conflicting results despite evidence in subjective data and health outcomes that suggest disparities in rural physical activity and sedentary behaviours. (42) This leaves a large gap in the understanding of rural physical activity and sedentary behaviours. Increased understanding may lead to better rural-focused interventions and policies that can help to reverse apparent health disparities, especially in Nova Scotia where per capita health care expenditure has outpaced the rest of Canada. (7)

One component of 'place' that may be a contributing factor is that of the individual characteristics such as sex, age and household income. Because sex differences have been demonstrated in national studies and rural regions tend to have

overrepresentation of elderly and low-income individuals, the effect of all three of these

characteristics should be better understood in a rural context. (22,42)

Chapter 3: METHODS AND PROCEDURES

3.1   Research Questions

The research questions that directed the proposed study were:

1. What are the current physical activity and sedentary behaviours within a group of adults from the area of rural Bridgewater, Nova Scotia and is there a relationship between these behaviours?

2. Within this sample of individuals, what is the relationship between physical activity and sedentary time and:

   a. sex?

   b. age?

   c. household income?

3.2   Hypotheses

The directing hypotheses for this study are:

   H_{1a}: The proportion of participants meeting the recommended guidelines of 150 minutes of MVPA per week in bouts of at least 10 minutes will be a minority of participants.

   $H1_b$: The proportion time participants spend sedentary will be a majority of their mean awake minutes.

   H_{1c}: There will be no significant relationship between sedentary behaviour and either total MVPA or MVPA in bouts.

H₂ₐ: The relationships between physical activity and sex and sedentary behaviour and sex will show that men engage in more total MVPA and MVPA in bouts; however, there will be no difference in sedentary time between men and women.

H₂ᵦ: The relationship between physical activity and sedentary behaviour with age will show that younger participants accrue significantly more total MVPA and MVPA in bouts along with significantly less sedentary time than do older participants.

H₂c: The relationship between physical activity and sedentary behaviour with household income will show that those who have a higher household income will have accrued more total MVPA and MVPA in bouts along with less sedentary time than those with lower household incomes.

3.3 Overview of the Study Design

This study used a cross-sectional design to examine both the descriptive data of physical activity intensity and sedentary time integrated with demographic data to answer the study's questions. The period for data collection was August-September 2012.

3.4 Sources of Evidence

All sources of evidence to answer the proposed research questions were gathered by collection of primary observational data. Because no interventions were administered, experimentation did not act as a source of evidence.

3.5 **Study Site, Participants and Recruitment**

3.5.1 Site of Study

Lunenburg County was chosen as the site for this study because it fits the definition of rural according to the operational definition employed by Statistics Canada. The five census subdivisions (CSD) within Lunenburg County, which consists of the towns of Bridgewater, Lunenburg and Mahone Bay along with the Municipalities of Lunenburg County and Chester, were all considered 'non-Census Metropolitan Areas (CMA) and Census Agglomerations (CA) areas', previously known as Rural or Small Town (RST). (49) There were five recruitment sites, all based around the largest population centre, Bridgewater. Testing centers for this study were chosen for their convenience and agreement to assist in recruitment for the study. The specific sites for data collection were:

1. Bridgewater Farmers Market, King St., Bridgewater, NS

2. Indian Garden Farms, 15401 Hwy 3, Hebbville, NS

3. Dawson Centre, 197 Dufferin St., Bridgewater, NS

4. ACSBE Resource Centre, 215 Dominion St., Bridgewater, NS

5. Park View Education Centre, 1485 King St., Bridgewater, NS

3.5.2 Participants

Participants were adults living in Lunenburg County, NS with the requirement that they have a postal code beginning with B4V, B0J or B0R. The age range of

individuals allowed to participate was 18 to 64 years old to align with the definition of adult in Canada's Physical Activity Guidelines.

3.5.3   Recruitment

Recruitment occurred in advance of and/or during the testing period depending on the particulars of the testing location.

Bridgewater Farmers Market: Recruitment took place on site with a special community booth reserved in advance. Flyers were distributed the prior week so that potential participants were aware of the project.   The booth was set up for three Saturday mornings during the testing period and interested individuals could ask questions and review the consent form if they wished to consider participation. Those who agreed to participate began the study on-site.

Indian Garden Farms: Staff and customers of Indian Garden Farm Market and Beulah's Bloomers Greenhouses were invited to participate in the study. The information was posted on the farm website. Staff was contacted in-person given recruitment flyers. Those that wished to participate were asked to contact the investigators and they began the study on-site.

Dawson Centre: Employees of the various organizations within this office building were invited to participate in the study. An email was sent out on the employee server inviting people to participate. Those that wished to participate were asked to email the investigator. They were met at an agreed location or directed to the booth at the Bridgewater Farmers Market or Indian Garden Farms to begin the study.

ACSBE Resource Centre: Employees of ACSBE, Giant Tiger, nearby businesses and other interested individuals were invited to participate. Recruitment was through the use of posters and personal contact with local businesses to gauge how best to reach their employees/customers. Those that wished to participate were asked to email the investigator. They were met at an agreed location or directed to the booth at the Bridgewater Farmers Market or Indian Garden Farms.

Park View Education Centre: Recruitment targeted the staff of the school including teachers, administration, custodians and bus drivers. A notice and personal communication was sent to the staff in advance of the distribution day. A presentation was done on the day of accelerometer distribution to answer any questions potential participants may have had. Those who wished to participate began the study on-site.

3.6   Instrumentation

The following instruments, tools and measures were used to assess each of the study variables:

3.6.1   Accelerometers

Actigraph Accelerometers (Actigraph model GT1M) Manufacturing Technologies Inc. [MTI], Health Systems, Shalimar, FL, formerly known as Computer Science and Applications Inc., were used for the collection of objective measures of physical activity intensity levels during the collection period. The devices were distributed during the initial testing session and either collected in person at the end of the testing period or returned by mail. (50)

The device uses a uniaxial system to measure vertical accelerations and therefore capture locomotion-type activity, specifically duration and intensity. It distinguishes between normal human movement and outside forces that may cause vibrations to the Actigraph device, thereby filtering out the noise. Epochs of 5 seconds were captured in order to achieve maximum resolution for the desired duration. Additionally, steps taken were also captured, but subsequent analysis of this data is beyond the scope of this project. (50)

Prior to distribution, the devices were tested to ensure both durability and validity. To ensure the devices remained active for the testing period, their voltage levels were checked and ranked based on their readings. Accelerometers with the highest voltage levels were prioritized for data collection. A validity test was performed to test for devices that may not be providing accurate readings. Multiple devices were worn during a walk-jog-run test. The devices were placed at a similar position on the test subject during testing. Results were analyzed and devices with the greatest variance were marked and removed from the testing roster.

Upon deployment, the devices were fully charged and scheduled to initialize at midnight of the day they were distributed to participants. Distribution day is known as Day 0 and no data were collected on this day to standardize the start of collection. This may have helped to minimize the effect of a possible initial urge to change activity behaviours with monitoring.

Participants were asked to wear the device for 8 days after the day of distribution (Day 0). On Day 8, the device was collected (or mailed) and the data uploaded into the

accelerometer analysis program. Data for Day 8 were not used and therefore, upon analysis the remaining full 7 days (Day 1-7) were utilized.

Information related to data collection and analytical procedures related to accelerometer use can be found in Table 1.

Table 1: Accelerometry data collection and analytical procedures

Information	Details
Accelerometer Model	GT1M Actigraph
Sensor orientation	Uniaxial
Mode setup	Counts and Steps
Epoch	5 seconds
Deployment method	Delivered and attached by researcher (on Day 0)
Location worn	Right hip at mid-clavicular line (via adjustable waist belt)
Requested days of wear	8 d not including day 0
Initialization	Delayed until next day (i.e., day 1 at midnight 00:00 hrs.)
Wear instructions	Wear during waking hours, remove for sleeping*
Analytical	
Non-wear appropriation	60 min of consecutive 0s allowing for 2 min of interruptions
Valid day criteria	10h of wear
Valid file	At least 3 valid days
Missing data	No data modeling or imputation was performed
Cut-point reference(s)	From Toriano (21)
Sedentary	<100 counts per minute
MVPA	$\geq$2020 counts per minute

 *We also asked that the accelerometer be removed for all water-based activities

3.6.2 Demographic Surveys

Upon deployment of the accelerometer, participants were asked to fill out a demographic survey that included sex, age, income, postal code and occupation. For age and postal code participants were asked to fill in a response, while sex, household income

and occupation were chosen from options provided. The options for household income and occupation were taken from a survey used by the Maritime Heart Centre (Appendix A). Occupation was included in the questionnaire but not used for analysis because participants found the options confusing; they often selected multiple options or filled in their own answers. Most responses were unsuitable for analysis without making assumptions about the survey taker's intentions. Postal code was collected to ensure participants qualified for participation in the study.

3.6.3   Accelerometer Log

An accelerometer log was given to each subject along with a list of items for them to record.   In order to ensure the log was not a deterrent to participation, participants were told to prioritize the recording of biking and water-based activities. Participants were then told to record other items, such as purposeful activities and long bouts of sedentary time, at their leisure. Participants were not pressured to rigorously utilize the log to ensure it would not act as a barrier to participation. (Appendix A)

3.7   Data Collection and Management

All data were collected on a spreadsheet in Microsoft Excel with individuals coded and participant IDs used to maintain anonymity. A directory of subject names and participant IDs was kept during the testing period for the purposes of collecting the accelerometers at the end of the 7-day testing period. The directory entry for each subject was deleted upon receiving the accelerometer or after 60 days with unsuccessful contact.

This directory was stored electronically on a password secured external hard drive separate from the collected data. All other electronic information collected was stored

similarly on a separate password secured external hard drive. All information collected during the study is stored in a locked filing cabinet in the Kinesiology Suite of Dalhousie University's Dalplex for a minimum of seven years.

3.8   Data Analyses

Upon collection, data were compiled and stored in a Microsoft Excel spreadsheet for ease of entry. Once all the data had been retrieved from the field and placed in the spreadsheet, it was uploaded into the data collection software, SPSS, for further analysis.

Raw data were encrypted and sent to Dr. Dale Esliger at Loughborough University for processing utilizing the Kinesoft analysis program. (51) Cut points for the Actigraph accelerometer counts were modelled after those used by Troiano et al. (2008) for the 2003-2004 NHANES. Cut points for sedentary time (1.0-1.5 METs) were 0-99 counts per minute (CPM), light activity (2.0-2.9 METs) were 100-2019 CPM, moderate activity (3.0-5.9 METs) were 2020-5998 CPM and vigorous activity ($\geq$6.0 METs) $\geq$5999 CPM. (21) The resulting data set was analyzed using SPSS based on the research questions. The following analyses were conducted to answer each of the proposed questions:

1. What were the physical activity and sedentary behaviours within a group of adults from the area of rural Bridgewater, Nova Scotia?

Data related to physical activity behaviours were analyzed in order to characterize moderate-to-vigorous physical activity (MVPA) . Means and standard deviations quantified outcomes for the sample, broken down by available demographic descriptors,

and were used to determine the number of participants that achieved at least 150 minutes of MVPA in bouts of 10 minutes or more.

For sedentary time, means and standard deviations quantified outcomes for the sample, broken down by available demographic descriptors. Outcome data were normally distributed as confirmed by the Shapiro-Wilk ($p=0.072$) test and therefore were compared between those who had achieved at least 150 minutes of MVPA in bouts of 10 minutes or more and those that did not using Analysis of Covariance (ANCOVA) with covariates of raw age and wear time. Household income distribution was not equal among the two groups and therefore, was not a valid covariate.

2a. Within this sample of individuals, what were the relationships between physical activity and sex and sedentary time and sex?

For physical activity, outcome data for MVPA, both total and in-bouts, were not normally distributed as determined by scatterplot. Therefore, a Mann-Whitney non-parametric test was used to analyze the relationship of sex and physical activity.

For sedentary time, outcome data were normally distributed as confirmed by the Shapiro-Wilk test ($p=0.072$) and therefore were compared to sex using ANCOVA with covariates of wear time and income groups. Raw age distribution was not equal among the two groups (males and females) and therefore, was not a valid covariate.

2b. Within this sample of individuals, what were the relationships between physical activity and age and sedentary time and age?

For physical activity, outcome data for MVPA, both total and in-bouts, were not normally distributed as determined by scatterplot. Therefore, the Kruskal-Wallis non-parametric test was used to analyze the relationship between participants' ages and MVPA.

For sedentary time, outcome data were normally distributed as confirmed by the Shapiro-Wilk test ($p=0.072$) and therefore were analyzed by age using ANCOVA with covariates of wear time and income groups.

2c. Within this sample of individuals, what were the relationships between physical activity and income and sedentary time and income?

For physical activity, outcome data for MVPA, both total and in-bouts, were not normally distributed as determined by scatterplot. Therefore, a Mann-Whitney non-parametric test was used to analyze the relationship between participants' household incomes and physical activity.

For sedentary time, outcome data were normally distributed as confirmed by the Shapiro-Wilk test ($p=0.072$) and therefore were compared to household income using ANCOVA with covariates of wear time and raw age.

3.9   Ethical Considerations

The proposed study was a fairly low-risk investigation. At no time during the testing session were the participants subjected to any procedures that put them at any increased risk of disrupting their current state of health and wellbeing. Also, because the study recruitment required potential participants to volunteer and offer their consent, at

no point did individuals feel pressured to undergo testing without their willing participation. It was made clear from the beginning that should an individual wish to cease participation in the project that they were able to do so at any time. All recruitment strategies, presentations and posters were distributed following ethics approval to ensure potential participants did not experience any degree of coercion.

Any publications arising from this proposed investigation will employ the data as a whole and not provide isolated details on any individual subject in order to uphold confidentiality and anonymity of the participants.

3.10   Dissemination

The results of this pilot study may further strengthen the case for greater emphasis on developing rural-focused research to better understand the influence of place on physical activity and sedentary behaviours, especially in rural Nova Scotia. The dissemination of the results from this pilot study have involved this thesis along with platform and poster presentations of regional conferences. No further dissemination is anticipated.

CHAPTER 4: RESULTS

4.1   Introduction

A total of 58 participants were recruited, completed the demographic survey and accepted an accelerometer and activity log. Of these, 4 did not meet the wear time requirement of 3 valid wear days (10 or more hours of wear time/day) and 7 devices were not returned. This left 47 (81% of total) participants who provided sufficiently valid data sets for analysis. The majority of this valid sample (77%) had at least six valid wear days with 21 (45%) registering seven valid days. The average wear time in the valid sample was 852 minutes (14h12min) per day. Table 2 outlines the full details of participant study compliance.

Table 2: Descriptive data of participant compliance

Sample location	Lunenburg County, NS
Data Collection Period	Aug-Sept 2012
Original Sample	58
Failed to initialize	0
Device not returned	7
Not enough wear time	4
Viable sample	47
Seven valid days	21
Six valid days	15
Five valid days	6
Four valid days	3
Three valid days	2
Average daily wear minutes (SD)	852 (61)
Average daily non-wear minutes (SD)	588 (61)

Descriptive data of the valid sample for age, sex, income and postal code are shown in Table 3. Most participants were female (74.5%), over the age of 35 (87.3%),

had a household income >$50,000 (61.7%) and most lived within the B4V (Bridgewater

town area) postal code (65.9%).

Table 3: Descriptive data of the study sample

N		47
	Male	12 (25.5%)
	Female	35 (74.5%)
Age (yrs.)		
	18-34	6 (12.8%)
	35-54	20 (42.6%)
	Over 55	21 (44.7%)
Household Income		
	< $30,000	8 (17.0%)
	$30,000-$49,999	10 (21.3%)
	$50,000-$79,999	10 (21.3%)
	>$80,000	19 (40.4%)
Postal Code		
	B4V	31 (65.9%)
	B0R	3 (6.4%)
	B0J	13 (27.7%)

4.2   Physical Activity Behaviour

Table 4 shows physical activity intensity in groupings based on moderate-to-

vigorous physical activity that was accumulated in bout of any duration and also in bouts

of at least 10 minutes. MVPA for the entire sample averaged approximately 32 minutes

per day with any duration and 12 minutes per day if only bouts of 10 minutes or longer

were included.

Table 4: Summary of total MVPA and MVPA in bouts

Variable	Total MVPA mean min/day (SD)		MVPA In Bouts mean min/day (SD)	
Sample	32 (19)		12 (13)	
Sex				
Male	44 (32)		10 (9)	
Female	28 (18)		12 (14)	
Age (yrs.)				
18-34	36 (20)		8 (7)	
35-54	35 (28)		13 (15)	
Over 55	28 (20)		12 (13)	
Income ($)				
<30,000	23 (13)		9 (11)	
30,000-49,999	20 (13)		5 (8)	
50,000-79,999	31 (14)		12 (12)	
>80,000	42 (30)		17 (16)	
Postal Code				
B4V	35 (25)		13 (14)	
B0R	20 (18)		9 (16)	
B0J	29 (20)		10 (11)	

(SD) = standard deviation
*MVPA in-bouts includes MVPA in at least 10 minute bouts

In order to meet the recommendation of Canada's Physical Activity Guidelines of 150 minutes per week an individual in the study would need to have achieved 21.4 minutes per day. In total, 10 of the 47 participants with valid data (21%) achieved the recommended 150 minutes of MVPA per week in at least 10-minute bouts. Table 5 outlines the profile of those whom met the MVPA recommendations. Females were much more successful at achieving recommendations (26% of participants) as compared to males (8% of participants). No participants from the lowest age group, aged 18-34 years, achieved partial compliance, as compared to 5 from each of the older groups. There was approximately equal percentage of participants achieving partial compliance in three of the four household income groups as opposed to no participants doing so in the $30,000-

$49,999 group. Overall, the higher household income groups were more compliant than the lower two groups. Finally, the group in the B0R postal code seemed to have greater partial compliance based on percentage, but the number of participants in that group was quite small (4 participants).

Table 5: Profile of those who achieved partial guideline compliance*

		Number (%)
N		10 (21%)
	Male	1 (8%)
	Female	9 (26%)
Age (yrs.)		
	18-34	0 (0%)
	35-54	5 (25%)
	Over 55	5 (24%)
Household Income		
	< $30,000	2 (25%)
	$30,000-$49,999	0 (0%)
	$50,000-$79,999	3 (30%)
	>$80,000	5 (26%)
Postal Code		
	B4V	6 (20%)
	B0R	2 (50%)
	B0J	2 (15%)

*Partial compliance based on achieving 150 minutes of MVPA per week in 10-minute bouts or more

4.3   Sedentary Behaviour

Table 6 depicts sedentary time broken down by demographic characteristics showing minutes, standard deviation and percentage of wear time spent sedentary for each grouping. The sample registered an average of 56% of awake time per day in sedentary activity. The groupings based on demographic characteristics had roughly the same percentage plus or minus 3%. The groups with the greatest sedentary time (59% of

awake time) were those aged 18-34 years and those with the lowest household income, <$30,000. The grouping with the lowest amount of sedentary time (54% of awake time) were those with a household income of $50,000-$79,999.

Table 6: Summary of sedentary time

Variable	Mean mean min/day (SD)	Percentage* %
Sample	484 (93)	56
Sex		
Male	493 (86)	57
Female	481 (97)	56
Age (yrs.)		
18-34	494 (60)	59
35-54	481 (110)	56
Over 55	483 (87)	56
Income ($)		
<30,000	524 (79)	59
30,000-49,999	465 (93)	55
50,000-79,999	463 (139)	54
>80,000	492 (71)	57
Postal Code		
B4V	480 (63)	57
B0R	537 (112)	58
B0J	475 (140)	56

(SD) = standard deviation
*Percentage of awake hours during the day

When the sample was divided into those who achieved partial compliance of the guidelines and those who did not, there was no significant difference in sedentary time between the two groups (Table 7). This was determined using an ANCOVA univariate analysis taking into account age and wear time per day as co-variables. Those who achieved the recommended MVPA in at least 10-minute bouts had an insignificantly greater number of minutes of sitting term per day while awake.

Table 7: Sedentary time based on partial guidelines compliance

Variable	Compliance* mean min/day (SD)	Non-compliance mean min/day (SD)	p
Sedentary	508 (89)	477 (94)	0.697**

(SD) = standard deviation
*Partial compliance based on achieving 150 minutes of MVPA per week
in 10 minute bouts or more
**ANCOVA with age and wear time per day covariates

4.4   Comparisons Based on Demographic Characteristics

The results in this section serve to answer the second research question regarding

physical activity and sedentary behaviours related to characteristics collected on

demographic surveys. In Table 8, male and female participants showed no significant

differences in sedentary time, total MVPA or MVPA in bouts. Males in the study

showed higher amounts of total MVPA than females; although this difference was not

significant, the p-value of 0.097 suggests a trend in this small data set. The differences in

sedentary time were tested using ANCOVA univariate analysis with co-variables of

household income and wear time per day. Age was not similarly distributed between the

two groups and, therefore, did not meet the assumptions needed to use it as a co-variable.

Differences in MVPA between males and females were determined using Mann-Whitney

non-parametric analysis given that the outcome data was not normally distributed. Don't

repeat Methods; state results.

Table 8: Sedentary time and MVPA differences based on sex

Variable	Male mean min/day (SD)	Female mean min/day (SD)	p
Sedentary	493 (86)	481 (97)	0.653*
Total MVPA	44 (32)	28 (18)	0.097**
MVPA in Bouts	10 (9)	12 (14)	0.970**

(SD) = standard deviation
*ANCOVA with household income and wear time per day covariates
**Mann-Whitney non-parametric analysis

In Table 9, comparisons based on the three age groupings show no significant differences in sedentary time, total MVPA or MVPA in bouts. While the lowest age group, aged 18-34 years, had the highest number of total MVPA minutes per day, they had the lowest MVPA in bouts. The differences in sedentary time were tested using ANCOVA univariate analysis with the co-variables of household income and wear time per day. Differences in MVPA between males and females were determined using Kruskal-Wallis non-parametric analysis given that the outcome data was not normally distributed.

Table 9: Sedentary time and MVPA based on age

Variable	18-34 yrs. mean min/day (SD)	35-54 yrs. mean min/day (SD)	55-65 yrs. mean min/day (SD)	p
Sedentary	494 (60)	481 (110)	483 (87)	0.336*
Total MVPA	36 (20)	35 (28)	28 (20)	0.554**
MVPA in Bouts	8 (7)	13 (15)	12 (13)	0.953**

(SD) = standard deviation
*ANCOVA with household income and wear time per day covariates
**Kruskal-Wallis non-parametric analysis

In Table 10, a comparison in sedentary time between those who had household incomes less than $50,000 versus those equal to or more than $50,000 showed no significant differences. The same comparison for MVPA in-bouts showed a trend (p=0.086) towards higher income participants completing more MVPA in bouts. However, the opposite seemed true for total MVPA, with those in households who made less than $50,000 accruing more total MVPA than those with household incomes greater than or equal to $50,000 (p=0.009). The differences in sedentary time were tested using ANCOVA univariate analysis with co-variables of raw age values and wear time per day. Differences in MVPA between the two household income groups were determined using Mann-Whitney non-parametric analysis given that the outcome data was not normally distributed.

Table 10: Sedentary time and MVPA based on household income

Variable	<$50,000 mean min/day (SD)	>$50,000 mean min/day (SD)	p
Sedentary	493 (86)	481 (97)	0.679*
Total MVPA	44 (32)	28 (18)	0.009**
MVPA in Bouts	10 (9)	12 (14)	0.086**

(SD) = standard deviation
*ANCOVA with age and wear time per day covariates
**Mann-Whitney non-parametric analysis

CHAPTER 5: DISCUSSION

5.1   Introduction

The purpose of this pilot project was to begin to provide a better understanding of the physical activity and sedentary behaviours of a group of adults from rural Nova Scotia. While the scope of the project did not allow for comparison to an urban sample, the results provide some insight into who met the recommendation of Canada's Physical Activity Guidelines of 150 minutes of MVPA per week in bouts of 10 minutes or more and the prevalence of sedentary behaviours among the sample. Comparisons were done based on the sedentary behaviour between those who were compliant with the MVPA recommendation and those who were not along with the individual characteristics of sex, age and household income.

5.2   Physical Activity Behaviour

The Canadian Physical Activity Guidelines for Adults recommendation of at least 150 minutes of MVPA per week in 10-minute bouts or more was only met by a minority of participants. Of the 47 valid participants in this study, only 10 (21.3%) achieved the minimum MVPA recommendation for Canadian adults. However, this compares favourably to the 15.4% of Canadians found to meet the recommendations in the 2007-2009 CHMS. (22) One reason for the higher percentage of participants achieving the recommendation over the national findings may be that the age range of the CHMS sample, which included participants aged 20-79 years, was older than the sample for this project, aged 18-64 years. The CHMS study itself demonstrates how increasing age corresponds to decreasing levels of MVPA. (22) Another likely reason for this difference

is that the convenience sample included some very active individuals interested in measuring their own physical activity intensity levels. Observation during recruitment raised suspicion that the incentive for participants of receiving a report of their results following the completion of the study seemed to draw those whom already included at least some MVPA in their lives and deterred those whom thought they had very little. The comment was made on multiple occasions by potential participants that they did not feel active enough to participate in the study, despite the explanation of the study premise.

The recommended MVPA accumulation outlined in the Canada's Physical Activity Guidelines and the WHO includes the requirement of bouts of at least 10 minutes. This was due to evidence that these sustained bouts were influential in long-term maintenance of weight loss. (52) However, measurement of these bouts can vary as suggested by Ayabe et al in 2014. They indicate that adding in allowance of interruption of 1 or 2 minutes can add significantly more frequent bouts of eligible MVPA and a greater number of MVPA minutes per day. (52) Reanalysis of this sample could yield increased number of participants meeting the recommended 150 minutes of MVPA per day if interruptions were included and therefore, future studies will need to be careful how they interpret their bout delimitations. It may be worthwhile to look at the benefit accrued from a 10 minute bout with no interruptions as compared to those with interruptions to see if there is actually any difference between them. If not, it creates the possibility of significant variability in results and would likely require an agreed upon standard for future research.

The choice of epoch size can also change the interpretation of MVPA across various studies. Ayabe et al in 2013 demonstrated that as the length of an epoch increases, the frequency and time of MVPA bouts also increased. (53) Therefore, it is possible that this sample could have yielded higher amounts of MVPA and more participants meeting the recommended 150 minutes of MVPA in bouts per week if the data had been collected in epochs larger than the 5-second periods that was chosen. The study selected 5-second epochs in the interest of maximizing the resolution of data collection while not compromising the duration of battery life in the device. The 2007-2009 CHMS study used epochs of 1-minute duration meaning that it is possible that the results of the national study would have shown even less MVPA if smaller epochs such as the 5-second periods used in this study had been selected. (22,53)

The male subjects in our sample engaged in more total MVPA than did females, although this difference was not statistically significant. Similarly, men in the 2007-2009 CHMS demonstrated a significantly greater amount of time spent participating in total MVPA than their female counterparts, 27 minutes/day to 21 minutes/day respectively. (22) Interestingly, in terms of MVPA in bouts, female participants in the study actually registered more minutes than males (12 min/day vs. 10 min/day respectively), although this difference was not statistically significant. This indicates that male participants had more sporadic MVPA in bouts less than 10 minutes. While the scope of the data collected does not allow any further insight into why this may be the case, a 2014 study by Martin et al suggests that employed men and women seem to have different patterns of occupation-related physical activity. When men and women are employed in a sedentary job, men tend to be more active and less sedentary than women. (34) This occupation-

related activity, which is more likely to produce sporadic rather than long bout MVPA, may play a role in explaining why men may have more total MVPA than women.

Females had much higher compliance with the recommendation of at least 150 minutes of MVPA per week in 10-minute bouts or more. Of the 10 participants that achieved the recommended level of MVPA, 9 were female. In total, 25.7% of female participants met this recommendation as compared to only 8.3% of males. This contrasts with the 2007-2009 CHMS data that showed 17% of men and 14% of women met the recommendation. (22) Self-report data used in the 2006 report, "How Healthy are Rural Canadians?" does suggest that women in more rural 'Strong MIZs' and 'Weak MIZs' reported greater leisure time physical activity than their more urban CMA/CA counterparts. (5) Although the possibility of a place effect cannot be concluded based on this limited data but does warrant further study.

There were no significant differences between age groups when analyzing total MVPA and MVPA in bouts. However, the ten participants that met the recommendation of 150 minutes of MVPA per week in at least 10 minute bouts were primarily older with 5 from the group aged 35-54 years and 5 from the group aged 55-64 years. Although no participants from the aged 18-34 years group met that recommendation, this group only had 6 participants compared with 41 split amongst the remaining two groups. A larger sample from the younger group may have presented a different result.

Participants in this cohort who reported an annual household income of $\geq$\$50,000 or more also accrued more time in total MVPA than did those who lived in households with <\$50,000. Both Hallal et al and Trost et al suggested that income has a positive

effect on physical activity. The reason for the lack of significance in this result is unclear but may have resulted from the inclusion of some participants who were recruited from a site with low paying manual labour employment. This could have led to significant occupation-related physical activity in lower income participants. However, without more reliable information on occupation-related practices, this is only speculation.

5.3   Sedentary Behaviour

The 56% of the time spent in sedentary behaviour in this sample compared favourably to the Canadian average of 68.5% reported in the 2007-2009 CHMS. (22) The difference between these two studies may be explained by the use of different definitions of sedentary behaviour. While this study employed the Troiano (2008) cut points that estimated sedentary behaviour as 1.0-1.5 METs, Colley et al. (2011) designated sedentary behaviour in the CHMS as 1.0 to under 2.0 METs. (21,22) This means that more time would qualify as sedentary in the CHMS study, possibly explaining the discrepancy between the CHMS results and this study. Regardless, the proportion of sedentary time in both studies was substantial and is an emerging contributor to obesity and other negative related health outcomes. Increased daily sitting time was shown to be associated with an elevated risk of all-cause mortality and cardiovascular disease even within a group of adults who were considered physically active (defined as ≥ 7.5 MET.h/week). (54)

Among the sample in this study, sedentary behaviour had no relationship with total MVPA or MVPA in bouts. Participants who met the minimum MVPA guidelines actually had a statistically insignificant greater number of daily sedentary minutes than

those that did not (508 min/day vs. 477 min/day respectively). This amounts to 57.9% of awake sedentary time for those meeting the guidelines and 55.9% of awake sedentary time for those not meeting the guidelines. This similarity in sedentary time between groups who achieved recommended MVPA and those who did not was also reported by Schuna et al., who analyzed data from over 3700 participants in the NHANES 2005-06 Survey (55). The systematic review of sedentary behaviour conducted by Rhodes et al also reported that the relationship between sedentary behaviour and MVPA was not clear. (32) MVPA minutes alone do not necessarily determine whether an individual is leading a non-sedentary lifestyle. While those in the sample who achieved the recommended MVPA minutes may be adding purposeful activity into their routine, they do not seem to have integrated additional movement into their regular activities of daily living when compared to those who did not achieve the recommended MVPA minutes.

There was no significant relationship between sedentary behaviour and sex or age within the sample. Martin et al. analyzed accelerometry data from nearly 6000 adults in the NHANES Survey and reported that as men aged, they increased both their sedentary time and daytime MVPA whereas women increased their sedentary behaviour and light PA levels (34). This might explain why men and women had similar sedentary behaviours, but does not explain why they sample did not show a difference in sedentary time with increased age. Similarly, in the Canadian sample, men and women were found to have similar proportions of sedentary time, with 68% for men and 69% for women but the amount of sedentary time significantly increased with age. (22) This difference could be explained by the age range of the CHMS, which was older than the sample from this project. The only significant difference in sedentary time that was found in the CHMS

study was between the aged 60-79 years group and the reference group, which was aged

20-39 years. (22) As this study only included participants up to age 64, many of those in

the oldest and more sedentary CHMS group were not eligible for this study, which may

have accounted for the majority of the difference based on age.

There were no significant differences in sedentary time between those with a

household income ≥$50,000 and those <$50,000. The research on household income and

sedentary behaviour is fairly light at this time. (32) With the ability to measure sedentary

behaviour using objective tools in its infancy, there is still much to be discovered about

the factors influencing this behaviour and whether household income may play a role in

how much time an individual may spend sedentary.

5.4   The Sample

Given the limited scope of this pilot study and the intention to see future research

build on the work of this project, a discussion of who participated is warranted. All

recruitment was done with the goal of maximizing the number of individuals

participating, meaning that anyone who met the age and residency requirements was

allowed to take part. A representative sample, while ideal, was not actively sought out.

A comparison of demographic data for the forty-seven individuals whom were included

in the final analysis to the actual demographic data of Lunenburg County is outlined

below.

The most stark difference between the sample and population it was drawn from

was the difference in sex. The study sample skewed heavily female (74.5% of valid

participants) in a population that, as expected, has close to an even division between

males (48.8% of residents in Lunenburg County) and females (51.2%). (56) It was evident during recruitment that males were more resistant to participation than females. The incentive to receive a breakdown of personal results following completion of the study did not seem to appeal to a large portion of the males that approached recruitment booths. This difficulty recruiting men was also cited in the 2007-2009 CHMS limitations as a challenge in their own data collection using accelerometry. (22) A 2015 study by Gavarkovs et al explored what barriers may exist for rural male participation in physical activity, noting that the top reasons were related to personal time and motivation and the least cited reason was availability of facilities. (57) It is possible that men are less motivated to become more physically active and were not enticed by the report of their physical activity and sedentary behaviours promised by participation in this study. During in person recruitment for this study at a booth at the local farmers market, men and women often approached in equal numbers, but women were much more likely to agree to participate than men. No log was kept of the number of individuals that decided not to participate after hearing about the project.

The age of the study sample tended to be older than the population of adults in Lunenburg County. The youngest group, aged 18-34, were underrepresented in the study sample (12.8% of participants) as compared to the population of Lunenburg County (24.5% of residents). The reverse was true in the oldest group, aged 55-64, whom were overrepresented in the sample (44.7% of participants) compared to the population (28.2% of residents). The middle group, aged 35-54 were only slightly underrepresented in the sample (42.6%) as compared to the population (47.3%). (56) Once again, the 2007-2009

CHMS reported a similar pattern of younger participants being more likely to be non-respondents. (22)

Household income was measured in four broad categories in the study sample and showed a stark overrepresentation in the highest household income earners, those making over $80,000, in the sample (40.4% of participants as compared to residents in Lunenburg County (23.4% of residents). The lowest household income group was somewhat underrepresented in the sample (17.0% of participants) as compared to the population (28.1% of residents). The middle two groups were only slightly underrepresented in the sample with those with a household income between $30,000 and $50,000 making up 21.3% of the sample compared to the 23.9% of population of Lunenburg County and those with a household income between $50,000 and $80,000 also composing 21.3% of the sample as compared to 24.1% of the population. (58)

While the breakdown of those that were included in the study provides important insight into those that agreed to participate and their physical activity and sedentary behaviours, it is also noteworthy to look at those that did not make it into the final study analysis. Eleven people were initially recruited to take part in the study but did not have their datasets included in the final analysis because they either did not return their device or did not have enough valid days with sufficient wear time (3 days or more with at least 10 hours of wear time).

The seven individuals did not return their devices did not diverge greatly from the demographics of the study sample in sex or household income. However, age did show a difference with those not returning their devices being exclusively from the aged 18-34

years (2 individuals) and 35-54 years (6 individuals) groups. As the sample tended to have an overrepresentation of those in the highest age group, aged 55-64 years, it is a notable skew towards younger adults as being those not returning their device. The four individuals that returned their devices with insufficient wear time showed a lean toward males (3 participants vs. 1 female) and younger individuals (4 participants all from the group aged 18-54 years). The sample sizes of both of these groups is far too small to draw meaningful conclusions, but does give some insight into what one might expect to see in a larger study. This may be especially important if a future study is designed with the intention of obtaining a representative population sample.

5.5   Limitations

This study was meant to be a pilot project and, as such, did not have the resources to purposely recruit a representative sample of participants from rural Nova Scotia. The existing sample may have suffered from significant selection bias given that recruitment methods provided an incentive. The size of the sample was adequate for the purposes of a pilot project, but for analysis involving the interaction between sex, age brackets, income levels and other more specific demographic categories, a much greater sample size would be ideal.

The recruitment materials were sent broadly to many organizations, including a local triathlon club whose members would be expected to have significantly more purposeful activity than the average resident in the area. Recruitment at the local farmers market may have skewed the sample toward a more health conscious group that may have been attending a venue with fresh, local foods because they were more observant of

their own health and wellbeing. Overall, the recruitment was set up to maximize the number of participants without consideration of the demographic breakdown of the region. Future studies hoping to achieve a better understanding of rural physical activity and sedentary behaviours would benefit from resources that would allow targeted recruitment of a demographically representative sample through incentives that may provide more enticement for men as well as younger and lower income participants.

The equipment used was limited by its inability to capture water-based activities and underestimation of biking intensity. Biking and swimming are common activities that can be integrated into both purposeful physical activity and active transport. Participants kept an activity log for monitoring of missed activities. Of the 50 logs returned, 17 participants indicated at least one episode of swimming during the week and 12 participants recorded at least one episode of biking (indoor or outdoor). Many participants also noted "boating" in various forms (e.g.: canoeing, pedal boating, sailing), which could entail a substantial amount of physical challenge on the body depending on the type. This indicates that a substantial amount of physical activity may have been missed by the accelerometers. Information from the activities logs was not converted to METs and integrated into the results due to the unreliability of utilizing subjective self-report data and the possibility that it would not provide equivalent comparison to the existing objective data.

Finally, data collection for this study took place during the months of August and September, which tend to be warmer, summertime months in this region of the country. These seasonal results cannot be extrapolated into what activity levels would be like during colder winter months or a year-long average for this group of adults. A review of

weather conditions as a factor in physical activity behaviour, authored by Chan and Ryan in 2009, demonstrated variances in physical activity depend on rain, snow, wind and temperature levels. (59) In 2011, Spinney and Millward published a report based in Halifax, Nova Scotia that explored the impact of weather conditions on leisure activity. They found that weather condition influenced how individuals participated in physical activity, affecting the type, rate, frequency and duration of leisure activities. (60) Given the likelihood of less severe weather events in the summer, it may be likely that this study overestimated MVPA and underestimated sedentary behaviour compared to what would be expected in a year-round average. The data for this study was collected over a 6-week period in August and September of 2012. While outside the scope of this study, an analysis of the data collected on each calendar day, along with weather conditions on those specific days could be a worthwhile output.

5.6   Future Research

This pilot study was meant to open the door to future research on physical activity and sedentary behaviours in rural Nova Scotia. Such projects could include:

1. Expanding the current study and conducting a rural vs. urban comparison in Nova Scotia to determine if there is a difference in physical activity and sedentary behaviours between the two settings. Information on the physical and social environment, along with broader demographic details could be collected to look for a better understanding of how any differences based on place may be influenced by the individual and the environment.

2. Given the interest by many participants in learning their own physical activity intensity profile, a study to look at the effectiveness of distributing accelerometers in the setting of a primary care practice may help individuals better understand where they stand in relation to Canada's Physical Activity Guidelines MVPA recommendations and what proportion of their day is spent in sedentary behaviour.

CHAPTER 6: CONCLUSION

This pilot study was intended to analyze the physical activity and sedentary behaviours in a group of people from rural Nova Scotia. A small minority of participants (21%) met the recommended 150 minutes of MVPA per week in bouts of at least 10 minutes and the majority of their mean awake time (56%) was spent in sedentary behaviour. There were no differences in MVPA and sedentary behaviours in regards to sex, age and household income except for significantly more total MVPA found in those with a household income <$50,000 compared to those with a higher household income.

The small sample size in this study was older, more often female and had a higher household income than does the population of Lunenburg County; therefore, results from this study cannot be generalize to that of Lunenburg County or another rural population. However, this study does corroborated the results from the CHMS that the majority of adults accrued little time in MVPA and spent a substantial proportion of their waking hours in sedentary behaviour. Given that both of these behaviours are known correlates with poor health, these results should be concerning enough for researchers and policy-makers to consider undertaking further studies.

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APPENDIX A

APPLICATION FOR SUBMISSION TO

THE DALHOUSIE UNIVERSITY HEALTH SCIENCES RESEARCH ETHICS BOARD

THIS FORM SHOULD BE COMPLETED USING THE FOLLOWING DOCUMENT:

'GUIDANCE FOR SUBMITTING AN APPLICATION FOR RESEARCH ETHICS REVIEW'

SECTION 1. ADMINISTRATIVE INFORMATION

Project Title
Physical Activity and Sedentary Behaviours of a Group of Adults from Rural Nova Scotia

1.1 Local Principal Investigator [Lead researcher affiliated with Dalhousie University]			
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	Degree Program	MSc (Kinesiology)	

Co-investigator(s)	

Names and affiliations	

1.2 Signature of Local PI attesting that:
a. All co-investigators have reviewed the ethics submission and are in agreement with it.
b. All investigators have read the TriCouncil Policy Statement *Ethical conduct for Research*   *Involving Humans* and agree to abide by these guidelines
Signature   Date   ---   ------------------------------------ ----

Other ethics reviews (if any)		Where	NA	
		Status	NA	
Funding (if any)	Agency		NA	
	Award Number		NA	
Peer review (if any)	NA			
Planned start date	August 2012		Planned end date	September 2012
Contact person	Name			
for this submission	Email		Phone	
(if not PI)				

SECTION 2.   PROJECT DESCRIPTION

2.1 INTRODUCTORY SUMMARY **[250 words max]**

    2.1.1 briefly describe the rationale, purpose, study population and methods

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2.1.1

The body of knowledge on physical activity and sedentary behaviours in a rural environment is quite limited. Even less is known when considering behavioural differences between males and females in these rural settings.

Advancing technology in objective physical activity monitoring has allowed for unprecedented access to activity intensity and duration, including sedentary time. Most previous research has relied on self-report surveys that limited its focus to leisure activities, such as exercise and sport.

The purpose of this pilot study is to analyze the quality and quantity of overall physical activity and sedentary behaviour in a group of adults from the rural Bridgewater area of Nova Scotia.

Accelerometer devices will be worn by a convenience sample of participants for a week-long collection period. These measurement tools are capable of producing an activity profile for the individual being studied by measuring the duration and intensity of their activity. The output will include the amount of time spent in sedentary, light, moderate and vigorous activity during the study period. An analysis of this information will provide a descriptive overview of the behaviours within this group of adults, as well as differences based on sex. This will build a foundation for future research in the area of physical activity and sedentary behaviours in a rural setting.

2.2 BACKGROUND AND PURPOSE - In this section discuss   **[3 pages max, not including**
   references]

   2.2.1   why there is a need to undertake the study (including a brief literature
           review)

   2.2.2   what new knowledge is anticipated as an outcome of the study

   2.2.3. if this is intended to be a pilot study, or a fully developed project

2.2.1

Rural Health

A 2006 overview of rural health in Canada entitled, *How Healthy Are Rural Canadians?*, attempted to summarize the current state of rural health as it pertains to both outcomes and indicators of health. One of the most important conclusions drawn from the report is that the amount of research being done on health-related behaviours in a rural environment is somewhat lacking. (1) While rural health encompasses a wide variety of fields including health delivery, policy, and determinants, health-related behaviours carry important consideration in relation to prevention and mitigation of negative health outcomes.

Physical Activity

Physical activity is a modifiable health-related behaviour that has been given increased attention over the past few decades. While the amount of research on the subject has been light, there is evidence that suggests individuals in rural communities may not be achieving the same levels of physical activity as the national average. (1,2,3) While measurement of physical activity has been a challenge for researchers, new and cost-effective tools have begun to emerge, providing a much clearer picture on the current state of physical activity and sedentary behaviour within the larger population. (4) Shockingly low rates of activity and high levels of sedentary time coupled with the growing consensus the associated negative health outcomes have

created a new urgency in the need to better understand this crucial health-related behaviour. (5)

Physical activity includes all movements that utilize skeletal muscle and increase energy expenditure over what would normally be used at rest. Activity is normally classified into leisure-time physical activity (LTPA) and non-leisure-time physical activity (non-LTPA). Exercise and sport, which are often associated with physical activity, are considered LTPA and have traditionally been the focus of population-level activity measurements. (6) Other non-discretionary activities like work and daily living fall under the non-LTPA category and have only recently been integrated into activity studies with the advancement of objective measurement techniques. (7,8)

Research in Physical Activity

In 1961, the Canadian government passed the Fitness and Amateur Sports Act (more recently amended and renamed the Physical Activity and Amateur Sports Act), which established the goal of promoting fitness and physical health amongst Canadians. (9) The first national sample of physical activity behaviours was conducted in 1981 as part of the Canadian Fitness Survey (CFS). This data was collected through subjective self-report surveys and first demonstrated that most Canadians were not achieving LTPA levels of 3+ METS-hours/day, which was deemed to be the level of "sufficient activity" at the time of study. Similar national surveys over the next few decades continued to show high levels of the population not meeting minimum standards for healthy, active living. (10)

The recent Canadian Health Measures Survey (CHMS) took place between 2007 and 2009 and provides the first objectively measured national survey of physical activity in Canada. (5) It was found that only 15.4% of all Canadians surpass the minimum standard of 150 or more minutes (of 10-minute bouts or more) of moderate-to-vigorous physical activity (MVPA) per week. Even fewer meet the suggested 30 minutes of MVPA at least 5 days per week, with only 4.8% of Canadians achieving this goal. (5)

Sex Differences

The proportion of individuals that participate in moderate-to-vigorous levels of physical activity has generally been shown to vary based on sex. The previous mentioned report based on the Canadian Health Measures Survey (CHMS) demonstrated a significant difference between men and women in relation to the amount of time spent participating in moderate-to-vigorous physical activity, 27 minutes/day to 21

minutes/day respectively. (5) However, no information was given on differences based on sex in a rural setting and previous self-report surveys shed little-to-no light on whether, and to what extent, these differences exist in sparsely populated area.

Sedentary Behaviour

The study of sedentary behaviour has only recently lifted out of broader physical activity studies as a unique area of interest. A 2006 Canadian Journal of Public Health article not only highlighted the importance of looking at this behaviour as a unique factor in the study of health-related behaviours, but also put out a call for more research in this field to better understand the effects sedentary behaviour may be having on the health of Canadians. (11)

The most recent data collected on a national Canadian sample showed that total waking hours for men and women were 68% and 69% sedentary, respectively. (5) Given the evidence of linkages between this behaviour, obesity and many chronic conditions, it raises significant concern over the long-term effects and high rates of sedentary time may have on the health of Canadians across the country. (12)

Little research has been conducted on the effect of place on sedentary behaviours. A rural environment carries many unique characteristics that may influence an individual's activity of everyday life. For example, active transportation may be more difficult in sparsely populated areas as a motorized vehicle may be required to move to various destinations of necessity that may be accessible by walking/biking in a more densely populated, well-connected area. (13,14) Behaviours related to television/computer screen time may also be influenced by place depending on the activity options in a rural area. (15,16) The use of objective measurement tools, such as accelerometers, allows researchers unprecedented access to lifestyles in rural environments that could previously only be estimated from self-reporting. (4)

Physical Activity Monitoring

As physical activity research began to take shape in the late 20th Century, primarily subjective tools were used to assess national samples including Canadian studies analyzed in the 2004 twenty-year trends study by Craig et al. These included surveys, questionnaires, activity inventories and any form of data collection that relied on self-reported physical activity data. (10) A 1985 review of 30 various methods of physical activity monitoring concluded that, with the technology available at the time, self-reporting methods were the most cost-effective way to assess larger samples. (17)

For national studies in Canada in 1985, it simply was not practical to employ objective techniques for country-wide conclusions that would inform policymakers on decisions related to physical activity. (17)

More recently, technology around physical activity has significantly advanced and changed the way modern day physical activity investigators carry out their data collection. In 2007, Esliger and Tremblay provided a comprehensive review on the evolution of available tools for physical activity measurement over the previous two decades. Most significantly, they profiled the more practical objective measures that have been shown to provide both reliable and, at times, cost-effective data for large samples. In the presentation of these modern day objective measures, they highlighted the problems with self-reporting methods. They suggested these flaws may have become more pronounced as awareness of the importance of physical activity and the social stigma surrounding inactivity increased. (4)

As Esliger and Tremblay (2007) summarized in their review of advances in objective physical activity measurement, devices such as pedometers, heart rate monitors, Global Positioning Systems (GPS) and accelerometers now provide methods to assess a large sample of people. It was the accelerometer that Esliger and Tremblay focused much of their attention and provided a detailed assessment of the devices' many advantages and noteworthy flaws that leave room for future technological improvements. Notably, they identified the accelerometer's ability to provide an objective measure of a time-stamped intensity profile of a subject's physical activity level. The quantitative nature of the data allows for greater comparison and generalizability to other objective measures such as pedometers, heart rate monitors and GPS. (4)

Conclusion

The current body of knowledge on physical activity behaviours in a rural environment does not adequately provide a picture of how individuals in these areas are moving and what proportion of their time can be considered sedentary. Further to this, while research shows that differences between the sexes exist in physical activity participation, the discrepancy and behavioural comparison in a rural environment has not been sufficiently studied.

The existence of new physical activity monitoring tools such as accelerometers allow for unprecedented access to the lifestyles of a larger numbers of individuals, providing objective data on a topic that was once only measurable by unreliable, subjective self-

reporting. (4,17) This new technology coupled with the possible contribution of knowledge to the field of rural health provide the basis for the proposed research study.

2.2.2

The study will provide new objective insights into the quality and quantity of physical activity and sedentary behaviours of adults in a rural setting. It will also go further in analyzing possible differences in physical activity and sedentary behaviours between men and women in a rural setting.

2.2.3

This is intended to be a pilot study to build a foundation for future research on physical activity and sedentary behaviours in a rural setting.

References

(1) Canadian Population Health Initiative. How Healthy Are Rural Canadians? An Assessment of Their Health Status and Health Determinants Ottawa: Canadian Institute for Health Information; 2006.

(2) Parks SE, Housemann RA, Brownson RC. Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States. J Epidemiol Community Health 2003 Jan;57(1):29-35.

(3) National Center for Health Statistics. Health, United States, 2010: With Special Feature on Death and Dying. Hyattsville, MD: National Center for Health Statistics; 2011.

(4) Esliger DW, Tremblay MS. Physical activity and inactivity profiling: the next generation. Can J Public Health 2007;98 Suppl 2:S195-207.

(5) Colley RC, Garriguet D, Janssen I, Craig CL, Clarke J, Tremblay MS. Physical activity of Canadian adults: accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. Health Rep 2011 Mar;22(1):7-14.

(6) Tremblay MS, Esliger DW, Tremblay A, Colley R. Incidental movement, lifestyle-embedded activity and sleep: new frontiers in physical activity assessment. Can J Public Health 2007;98 Suppl 2:S208-17.

(7) Levine JA, Eberhardt NL, Jensen MD. Role of nonexercise activity thermogenesis in resistance to fat gain in humans. Science 1999 Jan 8;283(5399):212-214.

(8) Westerterp KR, Kester ADM. Physical activity in confined conditions as an indicator of free-living physical activity.

(9) Sharratt MT, Hearst WE. Canada's physical activity guides: background, process, and development. Can J Public Health 2007;98 Suppl 2:S9-15.

(10) Craig CL, Russell SJ, Cameron C, Bauman A. Twenty-year trends in physical activity among Canadian adults. Can J Public Health 2004 Jan-Feb;95(1):59-63.

(11) Spanier PA, Marshall SJ, Faulkner GE. Tackling the obesity pandemic: a call for sedentary behaviour research. Can J Public Health 2006 May-Jun;97(3):255-257.

(12) Shields M, Tremblay MS. Sedentary behaviour and obesity. Health Rep 2008 Jun;19(2):19-30.

(13) Steinman L, Doescher M, Levinger D, Perry C, Carter L, Eyler A, et al. Master Plans for Pedestrian and Bicycle Transportation: Community Characteristics. Journal of Physical Activity & Health 2010 03/02;7:S60-S66.

(14) Saelens BE, Handy SL. Built Environment Correlates of Walking: A Review. Medicine & Science in Sports & Exercise 2008 07/02;40:S550-S566.

(15) Salo J. Screen Time Replacing Physical Activity Time. Physical & Health Education Journal 2009 Winter2009;74(4):28-29.

(16) Moore JB, Jilcott SB, Shores KA, Evenson KR, Brownson RC, Novick LF. A qualitative examination of perceived barriers and facilitators of physical activity for urban and rural youth. Health Educ Res 2010 Apr;25(2):355-367.

(17) LaPorte RE, Montoye HJ, Caspersen CJ. Assessment of physical activity in epidemiologic research: problems and prospects. Public Health Rep 1985 Mar-Apr;100(2):131-146.

2.3 STUDY DESIGN – In this section

2.3.1   state the hypotheses <u>or</u> the research questions <u>or</u> research objectives

2.3.2   describe the general study design and how it will address the hypotheses / questions /
objectives

2.3.3   describe how many participants are needed and how this was determined

2.3.4   describe the plan for data analysis in relation to the hypotheses/questions/objective

2.3.5   if a phased review is being requested, describe why this is appropriate for this study, and which phase(s) are included for approval in this application

2.3.1

1.   What are the current physical activity and sedentary behaviours within this group of adults from the rural Bridgewater area of Nova Scotia?

2.   Within this sample of individuals, what is the relationship between physical activity and sex and sedentary behaviour and sex?

2.3.2

The general study design is a mix of a descriptive and analytical study. The first research question will employ a descriptive design of physical activity and sedentary behaviours in a rural setting, while the second question will be an analytical comparison of physical activity and sedentary behaviours between men and women.

2.3.3

As this is a pilot study, a convenience sample will be used and it is expected that 40-50 participants will be recruited in the target timeframe.

2.3.4

Data collected from the accelerometer devices will be processed into the categories of Sedentary, Light, Moderate, Vigorous and MVPA (moderate-to-vigorous physical activity) using a computer software program called Kinesoft. Categories are based on a conversion of counts from the accelerometer into METS as outlined in a report based on the first national accelerometer study in the United States. (1) These results

will be entered into the statistical analysis software, SPSS, and will form the basis for the descriptive findings for the first research question.

Once the demographic information, collected with the initial demographic surveys (Appendix D), is also entered into SPSS, a between groups t-test will be completed between self-identified males and females. Statistical significance will be achieved at a p value of less than or equal to 0.05.

2.3.5

A phased review is not being requested.

References

(1) Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc 2008 Jan;40(1):181-188.

2.4 RECRUITMENT – In this section, for each type of participant to be recruited, describe

2.4.1 the study population

2.4.2 any social / cultural / safety considerations

2.4.3 and justify all specific inclusion / exclusion criteria of participants

2.4.4 any recruitment instruments (attach copies)

2.4.5 who will be doing the recruitment and what actions they will take

2.4.6 any screening measures, and how they will be used (attach copies)

2.4.7 any permissions that are needed and attach letters

2.4.1

The study population will include both males and females, aged 18-64, who reside in the Bridgewater area of Nova Scotia.

2.4.2

This study is considered low risk and does not have any social or cultural considerations associated with it. The only safety consideration may be the small risk of chaffing from the accelerometer strap that will be warn around the waist. This will be mitigated by proper instruction on how to wear the device including suggestions for minimizing the risk the chaffing, such as wearing the device on a belt or over a layer of clothing.

2.4.3

Inclusion criteria will be:

As the study question is focused on adults, the Canadian Society of Exercise Physiology definition of adult will be used for selection; individuals aged 18-64. (1)

As the study question is focused on individuals who reside in the Bridgewater area of Nova Scotia, a participant's postal code will be used to determine if they meet this criteria.

2.4.4

A recruitment poster (Appendix B) will be used in public sites, bulletin boards and consenting private businesses in the Bridgewater area to recruit participants.

A recruitment poster board (Appendix C) will be used in recruitment booths set up at Indian Garden Farms and the Bridgewater Farmers Market to recruit participants. Potential participants will be invited to take a consent form and read more information about the study and participation. Should they wish to participate immediately, they will go through the initial distribution session as outlined in Section 2.6.2.

2.4.5

The Principal Investigator will be responsible for participant recruitment. This will happen in three ways:

1. Poster (Appendix B) at various public sites and bulletin boards in the Bridgewater area.

2. Poster board/Booth (Appendix C) at two events in the Bridgewater area.

3. Word of mouth from the previous two methods and from individuals known to the Principal Investigator.

2.4.6

The demographic survey (Appendix D) will be used to screen individuals for age and area of residence (see Section 2.4.3).

2.4.7

Permissions (Appendix F and G) have been given for a recruitment/information booth at two venues:

Indian Garden Farms

15401 Hwy 3

Hebbville, NS B4V 6X7

Bridgewater Farmers Market

685 King St.

Bridgewater, NS B4V 1B5

References

(1) Canadian Society for Exercise Physiology. Canadian Physical Activity Requirements - Background information. 2012; Available at: http://www.csep.ca/english/view.asp?x=587. Accessed 03/28, 2012.

2.5 INFORMED CONSENT PROCESS – In this section

2.5.1 describe the informed consent process (<u>attach a copy of all consent forms</u>)

2.5.2 if oral consent is desired, describe why it is necessary and how it will be done (<u>attach a</u>
<u>copy of the script</u>)

2.5.3 if a waiver of informed consent is sought, explain why and describe how the four criteria
needed for this are met

2.5.4 for third party consent (with or without assent), describe how this will be done

2.5.5 describe plans (if any) for on-going consent

2.5.6 if community consent is needed, describe how it will be obtained

2.5.1

Upon recruitment, potential participants will be given a copy of the informed consent form (Appendix A) and given the option of reviewing the form immediately or taking it and reviewing it at home. After review, if the potential participant wishes to continue with the study, they will be asked to sign the consent form and given the option of having a final report sent to them following data analysis. See Section 2.13 for more details on the final report.

For those who chose to take the forms home, my contact info will be included on the form so any questions or concerns that potential participants may have before giving their consent can be addressed directly to me.

2.5.2

Oral consent is not required.

2.5.3

A waiver of informed consent will not be sought.

2.5.4

Third party consent will not be sought.

2.5.5

There are no plans for on-going consent.

2.5.6

Community consent is not needed.

2.6 DETAILED METHODOLOGY - In this section describe

2.6.1   where the research will be conducted

2.6.2   what participants will be asked to do and the time each task will take (plus total time)

2.6.3   what data will be recorded and what research instruments will be used

(attach copies)

    2.6.4   the roles and qualifications of the study investigators / research staff

    2.6.5   how long the participant will be involved in each part of the study

    2.6.6   any blinding or randomization measures, or if placebos are to be used.

2.6.1

The research will be conducted in the rural Bridgewater area of Nova Scotia. Upon recruitment, the participants will be given the option of completing the initial distribution session, including informed consent (Appendix A), demographic survey (Appendix D) and handing out accelerometer/log (Appendix E) at one of the below locations, or at another, location of their convenience and choosing.

Three pre-determined locations that will be used for distribution:

Indian Garden Farms

15401 Hwy 3

Hebbville, NS B4V 6X7

Bridgewater Farmers Market

685 King St.

Bridgewater, NS B4V 1B5

Park View Education Centre

1485 King Street

Bridgewater, NS, B4V 1C4

See attached letters (Appendix F,G and H) to confirm the booking of these sites and

awareness of the details of the study.

2.6.2

Research participants will be asked to do the following:

Informed Consent (5-15 minutes)

Review, and have time to consider, the informed consent for participation in the study. (Appendix A)

Demographic Survey (2-3 minutes)

Answer 5 questions in reference to sex, age, family income range, postal code and occupation. (Appendix D)

Accelerometer/Log Distribution (5-10 minutes)

Be assigned an accelerometer, review proper procedure for wearing the device, and be informed for what activities it should and should not be worn. The activity log (Appendix E) will also be reviewed, discussing the type of activities that should be recorded and how.

Testing Period (8-9 Days)

The accelerometer will be attached to the participant immediately and will be worn (when applicable) for the following 8 days.

Total time required: 8-9 Days

2.6.3

For the demographic survey (Appendix D), sex, age, family income range, postal code and occupation will be collected.

For the accelerometer (Actigraph GT1M), duration (time) and intensity (vertical acceleration counts) of activity in 5-second epochs will be collected. In addition, steps will also be collected by the device.

For the activity log (Appendix E), information related to water-based activities, biking activities and sedentary time will be collected. This will include the activity, duration of activity and RPE (rate of perceived exertion).

2.6.4

The Principal Investigator, who is an MSc (Kinesiology) candidate, will conduct most of the work during the distribution, collection and analysis of this study. He has received training from committee member, Dr. Esliger, who has considerable experience working with the accelerometer devices. (1,2) He also has related coursework in the area of physical activity and health.

Two research assistants will be recruited from the undergraduate Kinesiology program at Dalhousie. Both individuals will be given background reading on the accelerometer devices and will participate in a training session with the Principal Investigator. They will primarily be responsible for collecting the devices and uploading data following the testing periods. They will participate in one accelerometer distribution session under the supervision of the Principal Investigator. They will be required to ensure timely retrieval and uploading of the accelerometer data.

2.6.5

The participant will require 15-30 minutes for the initial distribution phase.

The participant will require 8-9 days for the testing period, but will not be prevented from proceeding with their regular daily activities.

No further time commitment is needed.

2.6.6

There will be no randomization measures or placebos used. As participants will not be able to read the accelerometer data without proper software, they will be unintentionally blind to the measurement until they receive the optional report following data analysis (see Section 2.13).

References

(1) Esliger DW, Tremblay MS. Physical activity and inactivity profiling: the next generation. Can J Public Health 2007;98 Suppl 2:S195-207.

(2) Tremblay MS, Esliger DW, Tremblay A, Colley R. Incidental movement, lifestyle-embedded activity and sleep: new frontiers in physical activity assessment. Can J Public Health 2007;98 Suppl 2:S208-17.

2.7 DECEPTION / INCOMPLETE DISCLOSURE (if applicable) - In this section describe

    2.7.1   what misdirection will be used (if any) and discuss its justification

    2.7.2   what information will not be disclosed to participants and discuss its justification

    2.7.3   how participants will be debriefed and given the opportunity to withdraw

2.7.1

There will be no misdirection used.

2.7.2

No information will be withheld from the participants.

2.7.3

As participation is voluntary, participants will be informed at the start of the research process as outlined in the consent form that at any point during the data collection process they will be able to withdraw from the study by contacting the principal investigator or his supervisor and that any data collected up until that point will be destroyed.

2.8 RISK ANALYIS – In this section describe

    2.8.1   what risks or discomforts are anticipated for participants

    2.8.2   the estimated probability of these risks (e.g., low, medium, high or more precisely if
          possible)

    2.8.3   what steps will be taken to mitigate the risks

    2.8.4   what risks might exist for communities that are involved in the study

2.8.1

One anticipated discomfort for the participant would be the possibility of chaffing from wearing the accelerometer device. It is worn at the waist either on an existing belt or a provided strap, which over time has a minimal risk of causing a rash if worn improperly.

Another anticipated discomfort would be the time required to participate and having to remember to wear and remove the accelerometer when appropriate. As well, tracking activities in the log, as outlined in section 2.6.3, may seem inconvenient.

2.8.2

This study is estimated to be low risk.

2.8.3

Upon distribution of the accelerometer, proper technique to attach the device will be demonstrated and suggestions for minimizing chaffing will be given. To minimize the risk of chaffing from the strap, the participant will be encouraged to wear the device over a layer of clothing.

2.8.4

There will be no associated risks for communities involved in the study.

2.9 BENEFITS - In this section describe

    2.9.1   the direct benefits (if any) of participation to participants (not compensation)

    2.9.2   the indirect benefits of the study (i.e., contribution to new knowledge)

2.9.1

Participants in this study will be given the option of receiving a final report of their physical activity and sedentary behaviour following data analysis. They will also receive a copy of Canada's Physical Activity Guidelines and a one-pager of local physical activity resources. See section 2.13 for more details.

2.9.2

The study may provide indirect benefits to the research participants in that the project will deliver insights into the quality and quality of physical activity and sedentary behaviour in a rural environment. As this is a pilot study, the purpose is to build a foundation for future research on these behaviours, which could indirectly benefit the rural research participants.

2.10 CONFIDENTIALITY and ANONYMITY - In this section describe

2.10.1 whether the data to be collected is of a personal or sensitive nature

2.10.2 how the data will be collected, stored and handled in a confidential manner

2.10.3 how long the data will be retained, and what the plans are for its destruction

2.10.4 if it is possible for participants to remain anonymous, and how it will be achieved

2.10.5 how a 'duty to disclose' abuse or neglect of a child, or adult in need of protection, will be   handled

2.10.6 if a waiver of confidentiality is to be sought from participants, and why

2.10.1

The accelerometer data being collected will not be of a personal or sensitive nature. The demographic information being collected will include family income range, which could be considered information of a personal nature.

2.10.2

Consent forms and original demographic surveys will be kept in a locked filing cabinet in the Dalplex Kinesiology Suites. As the demographic surveys will not contain identifying information and the consent forms will not be linked to the surveys in any way, they will be stored together.

All participants will be given an ID number, a directory of which will be stored on a password protected memory stick in a locked cabinet within the lab of Dr. Jo Welch. This information will be stored separate from the paper documents.

All accelerometer data and demographic information will be entered into SPSS and stored on a separate password protected memory stick in a separate locked cabinet within the lab of Dr. Jo Welch. This information will be associated with the participant ID number, but no participant names will be kept on this device.

2.10.3

Data will be retained for a minimum of 5 years following the completion of the final thesis submission.   Following this time, all paper copies will be shredded using the Dalhousie University Shredding Program and the electronic data will be destroyed using triple overwrite software (i.e. Darik's Boot and Nuke Disk or recommended equivalent at this time).

2.10.4

Participants will all be assigned ID numbers, which will be used in association with their accelerometer data and demographic information. Participant names, associated with ID numbers, will be kept in a password-protected directory separate from the collected information. These will be accessed following the data analysis if the participant expressed interest in receiving their physical activity results during the informed consent. Only the Principal Investigator will see the participant's name associated with the results in developing and sending the physical activity report to the participant. See Section 2.13 for more details.

2.10.5

No children will act as participants for this study.

2.10.6

Participants will be given the option of waiving confidentiality only to receive a final report of their physical activity and sedentary behaviour following the data analysis (See Section 2.13). This option will be given during the informed consent process and

will extend only to the Principal Investigator for the purpose of preparing and sending the final report to the participant following data analysis.

2.11 USE OF QUOTATIONS – In this section describe

2.11.1 whether participants will be quoted in the final report, and if so

2.11.2 describe how permission will be obtained for this

2.11.3 describe whether the quotes be attributed, how permission for this will be obtained and
how participants will be given the chance to see how the quotes are used

2.11.1

Participants will not be quoted in the final report.

2.11.2

Participants will not be quoted in the final report.

2.11.3

Participants will not be quoted in the final report.

2.12 COMPENSATION - In this section describe

2.12 1   what compensation will be offered to participants (if any), how it will be done and how

it will be handled for participants who do not complete the study

2.12.2   whether participants are likely to incur any additional expenses

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2.12.1

Compensation will be offered to participants in the form of a draw that will take place following data collection. All participants will be eligible for the draw. Four $25 gift certificates to a local business will be awarded to four participants whose names are drawn randomly from a hat.

2.12.2

Participants are not likely to incur any additional expenses. Should participants wish to return the accelerometers and logs by mail, addressed envelopes with postage will be provided.

2.13 PROVISION OF RESULTS TO PARTICIPANTS   - In this section, describe

2.13.1   plans to provide results of the study to participants

2.13.2   whether individual results will be provided to study participants, and how

2.13.3   how participants will be informed of results that may indicate they may be at risk, where
            diagnostic measures are used in screening or data collection

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2.13.1

The principal investigator will prepare and mail a final report of an individual participant's physical activity and sedentary behaviour should they request so during the informed consent process. A copy of Canada's Physical Activity Guidelines, summary of the study results and one-pager on local resources for increasing one's

physical activity will also be included.

2.13.2

Individual results will be provided to study participants. This will be done with a final report that includes their minutes per week of Sedentary, Light, Moderate and Vigorous physical activity and percentage of time spent in each category. They will also receive a combined MVPA (moderate-to-vigorous physical activity) result in minutes per week. See Section 2.3.4 for more information on the determination of these categories.

2.13.3

Overall physical activity results will not be interpreted and all participants will instead be encouraged to take the report to their family physician for discussion and interpretation.

2.14 COMPLIANCE WITH PRIVACY LEGISLATION – In this section,

2.14.1   state what software (if any) you will use to collect (e.g., survey software), store (e.g.,
database software) or analyze your data.

2.14.2   state whether a survey company will be used to assist in data collection, management
storage or analysis

2.14.3   describe what provisions (if any) of the University policy on the *Protection of Personal*
Information from Access Outside Canada apply and how they have been met.

2.14.1

Kinesoft will be used to process accelerometer data into the desired categories for

analysis.

SPSS version 17 software will be used to analyze data.

2.14.2

No survey company will be used to assist in data collection, management storage or analysis.

2.14.3

Accelerometer data will be encrypted using the program True Crypt and sent electronically to thesis committee member, Dr. Dale Esliger, at Loughborough University in the United Kingdom. Dr. Esliger will process the data through his Kinesoft program and return to the Principal Investigator in Canada for analysis.

Following the use of Kinesoft and the results being sent back to the Principal Investigator, Dr. Esliger will destroy his copies of both the original and processed accelerometer data.

The participant directory will not be sent along with the accelerometer data and therefore, only the participant ID's will be sent and associated with the information.

2.15 CONFLICT OF INTEREST – In this section

   2.15.1   whether any conflict of interest exists for any member of the research team in relation to
            the sponsor of the study

   2.15.2   whether any conflict of interest exists for any member of the research team with respect
            to their relationship to the potential research participants (e.g., teacher /

student)

2.15.1

No conflict of interest exists for any member of the research team.

2.15.2

No conflict of interest exists for any member of the research team.

HOW PHYSICALLY ACTIVE

ARE YOU?

HAVE YOUR PHYSICAL ACTIVITY MEASURED OVER A WEEK-LONG PERIOD WEARING A SMALL ACCELEROMETER DEVICE.

IF YOU ARE:

- **BETWEEN THE AGES OF 18 AND 64, AND**
- **LIVE IN BRIDGEWATER OR THE SURROUNDING AREA**

YOU ARE ELIGIBLE TO PARTICIPATE IN A PHYSICAL ACTIVITY BASED STUDY AND RECEIVE A REPORT ON YOUR PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOURS

YOU WILL ALSO BE ENTERED INTO A DRAW FOR 1 OF 4 $25 GIFT CERTIFICATES TO A LOCAL BUSINESS.

WANT TO KNOW MORE? PLEASE CONTACT COLIN HEBB AT CGHEBB@DAL.CA **OR (902) 476-1307**

PHYSICAL ACTIVITY IS ABOUT MORE THAN JUST EXERCISE AND SPORT. WE MOVE AROUND AT HOME, WORK AND SCHOOL. ALL OF THESE CONTRIBUTE TOWARD OUR OVERALL PHYSICAL ACTIVITY AND HEALTH. THIS STUDY SEEKS TO FIND OUT HOW ACTIVE YOU ARE IN THE BRIDGEWATER AREA!

HOW DO WE DO IT?

- **AN ACCELEROMETER IS LIKE A PEDOMETER, EXCEPT THAT IT MEASURES BOTH DURATION AND INTENSITY OF YOUR PHYSICAL ACTIVITY (ALONG WITH NUMBER OF STEPS)**

WHAT DOES IT TELL US?

- **APPROXIMATELY HOW MANY MINUTES PER WEEK YOU ARE SEDENTARY AS WELL AS HOW MUCH TIME YOU SPENT IN LIGHT, MODERATE AND VIGOROUS PHYSICAL ACTIVITY.**

HOW PHYSICALLY ACTIVE ARE YOU?

HAVE YOUR PHYSICAL ACTIVITY MEASURED OVER A WEEK-LONG PERIOD!

SIGN UP TO PARTICIPATE TODAY!

WANT TO KNOW MORE? PLEASE FEEL FREE TO ASK HERE OR CONTACT COLIN HEBB AT CGHEBB@DAL.CA OR (902) 476-1307

ARE YOU:

- **BETWEEN THE AGES OF 18 AND 64, AND**
- **HAVE A POSTAL CODE THAT BEGINS WITH B4V, B0R OR B0J**

IF SO, YOU ARE ELIGIBLE TO PARTICIPATE IN A PHYSICAL ACTIVITY BASED STUDY AND RECEIVE A REPORT ON YOUR PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOURS

ALL YOU NEED TO DO IS:

- **FILL OUT A 2 MIN SURVEY**
- **WEAR THE ACCELEROMETER FOR 8 DAYS**
- **LOG SOME OF YOUR ACTIVITIES**

ALONG WITH YOUR INDIVIDUAL ACTIVITY REPORT, YOU WILL ALSO BE ENTERED INTO A DRAW FOR 1 OF 4 $25 GIFT CERTIFICATES TO A LOCAL SMALL BUSINESS.

Physical Activity and Sedentary Behaviours of a Group of Adults from Rural Nova Scotia

DEMOGRAPHIC SURVEY

PARTICIPANT ID #: _____

Please answer the following five questions:

1. Sex: (please circle)

Male   Female   Other

2. Age:

_____ years old

3. Family Household Income (Your name will not be identified with this information and it will only be used for research purposes):

❑ < $30,000   ❑ $50,000 – 79,999
❑ $30,000 – 49,999   ❑ >$80,000

4. Occupation:

❑ agriculture   ❑ forestry, fishing, mining, oil, gas
❑ utilities   ❑ construction
❑ manufacturing   ❑ trade
❑ transportation, warehousing   ❑ finance, insurance, real estate
❑ professional, scientific, technical   ❑ management, admin., support
❑ educational services   ❑ health care and social assistance
❑ information, culture, recreation   ❑ accommodation, food services
❑ public administration   ❑ other _____

5. Postal Code

_____ - _____

ACTIVITY LOG

PARTICIPANT ID #: _____

This log should include the following activities:
-Any sedentary activity (such as watching TV, sitting at the computer)
-Water-based activities (such as showering, swimming)
-Cycling activities (such as outdoor cycling, indoor biking)
-Any time you removed the device (such as sleeping)

For each activity please record the following:
-Time activity started the activity and time finished
-Rate of Perceived Exertion (RPE) based on the following 1-10 scale

Very Easy		Easy		Moderate		Hard		Very Hard	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Example	Date: April 11, 2012				
	Activity	**Time Start**	**Time Finish**	**RPE**
1	Shower	7:30AM	7:45AM	2
2	Sleep	11:00PM	7:00AM	1

Day 1	Date:				
	Activity	**Time Start**	**Time Finish**	**RPE**
1				
2				
3				
4				
5				

Day 2	Date:			
	Activity	Time Start	Time Finish	RPE
1				
2				
3				
4				
5				

Day 3	Date:			
	Activity	Time Start	Time Finish	RPE
1				
2				
3				
4				
5				

Day 4	Date:			
	Activity	Time Start	Time Finish	RPE
1				
2				
3				
4				
5				

Day 5	Date:			
	Activity	**Time Start**	**Time Finish**	**RPE**
1				
2				
3				
4				
5				

Day 6	Date:			
	Activity	**Time Start**	**Time Finish**	**RPE**
1				
2				
3				
4				
5				

Day 7	Date:			
	Activity	**Time Start**	**Time Finish**	**RPE**
1				
2				
3				
4				
5				

Day 8	Date:			
	Activity	**Time Start**	**Time Finish**	**RPE**
1				
2				
3				
4				
5				

*If at any time you require more space, please use the backside of this sheet.