LIFE STYLES, OUT-OF-HOME PARTICIPATION, AND ACTIVITY DEPENDENCE AMONG ELDERLY CANADIANS WITH MOBILITY DISABILITIES

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Life styles, out-of-home participation, and activity dependence among elderly Canadians with mobility disabilities

by

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ABSTRACT

The Canadian population is aging and will continue to age until the year 2031. Subsequently, both the size of the elderly population and the number of people with mobility related disabilities in this country are expected to increase in the next two decades. Their lifestyles and daily activities both affect and are affected by their disability. This thesis aims to explore the inter-relationships between lifestyles, including smoking and alcohol consumption, barriers associated with out-of-home social participation, and the level of mobility disability in elderly Canadians aged 65 years or older.

This study used data from both the 2001 Canadian Participation and Activity Limitation Survey (PALS) and the 2003 Canadian Community Health Survey (CCHS). Data analyses included descriptive analyses, multivariate logistic regressions, factor analysis, and structural equation modeling. The results suggest that smoking prevalence was similar in people with and without mobility disability. However, an inverse relationship was observed between the levels of disability and the alcohol drinking behavior with the prevalence of regular drinking varying from 48.08% in the general elderly Canadians, 19.37% and 12.85% in people with less severe and severe mobility disability, respectively. Environmental barriers in home design also significantly contributed to restrictions in out-of-home social participation (OR = 1.36, 95% CI = 1.10 - 1.69). Results from structural equation modeling further suggest that the effect of people's disability can be completely mitigated by environmental facilitators.

This thesis adds new evidence that reducing environmental barriers can significantly lead to enhanced out-of-home social participation in elderly Canadians with mobility disability.

Key words

Mobility disability, Elderly, PALS, ICF, Smoking, Alcohol Consumption, Environmental Factors, Personal Factors, Pain, Out-of-home Social Participation, Activity Dependence

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ABBREVIATIONS

CCHS	Canadian Community Health Survey
CFI	Bentler Comparative Fit Index
CI	Confidence Interval
ICF	International Classification of Functioning, Disability and Health
NL	Newfoundland and Labrador
OR	Odds Ratio
PALS	Participation and Activity Limitation Survey
PPS	Probability Proportional-to-size Sampling
PSU	Primary Sampling Unit
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modeling
TLI	Tucker-Lewis Index
WHO	World Health Organization
WRMR	Weighted Root Mean Square Residual

GLOSSARY

Activity: The performance of a task or action by an individual.

Activity Limitation: Difficulty encountered by an individual in executing a task or action.

Assistive Aids and Devices: Any item, piece of equipment, or product system, whether obtained commercially off of the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities, such as wheelchairs, prostheses, and hearing aids.

CCHS: Canadian Community Health Survey, a cross-sectional survey conducted by Statistics Canada which collected information related to health status, health care utilization and health determinants for the Canadian population. Prior to 2007, data was collected every two years. Data are available for the 2001, 2003, 2005, and 2007 periods.

CFA: Confirmatory factor analysis, which applies a multivariate technique to test (confirm) a pre-specified relationship. It is a sub-type or part of structural equation modeling.

CFI: The comparative fit index, also known as the Bentler Comparative Fit Index. CFI compares the existing model fit with a null model which assumes the indicator variables (and hence also the latent variables) in the model are uncorrelated (the "independence model"). A recommended value of CFI is 0.9 or greater.

Contextual Factors: The complete background of an individual's life and living, including environmental factors and personal factors that may have an impact on the individual with a health condition and that individual's functional state.

Cronbach's Alpha: A measure of internal reliability of consistency of the items in an index. Cronbach's alpha ranges from 0 to 1.0. Scores toward the high end of that range suggest that the items in an index are measuring the same thing. It is also called "alpha coefficient" and "coefficient alpha".

Disabilities: An umbrella term covering impairments, activity limitations, and participation restrictions. In the ICF model, disability is defined as the negative outcome of the interaction between a person's health condition and contextual factors.

Environmental Factors: Consists of physical, social and attitudinal environment in which people live and conduct their lives. The factors are external to individuals and can have a positive or negative influence on the individual's participation as a member of society, on performance of activities of individual or on the individual's body function or structure.

Factor Loading: The correlation of the original variable and its factor, with higher loadings make the variable representative of the factor. Factor loadings greater than 0.3 are

considered to meet the minimal level; loadings of 0.4 are considered more important; and if the loadings are 0.5 and greater, they are considered practically significant.

Goodness of Fit: How well a model, a theoretical distribution, or an equation matches actual data.

ICF: International Classification of Functioning, Disability and Health, a classification of health and health-related domains, endorsed by World Health Organization in the Fifty-fourth World Health Assembly on May 22, 2001. The ICF is WHO's framework for measuring health and disability at both individual and population levels.

Impairments: Problems in body function or structure as a significant deviation or loss.

Indicators: Observed value for a specific item or question, obtained either from respondents in response to questions or from observations by a researcher. Sometimes they are also called manifest variables or reference variables. By convention, indicators should have pattern coefficients (factor loadings) of 0.7 or higher on their latent factors.

Latent Variable: An underlying characteristic that cannot be observed or measured directly; it is hypothesized to exist so as to explain variables, such as behavior, that can be observed (manifest variables).

Mediating Variable: A variable that occurs in a casual pathway from an independent to a dependent variable. It causes variation in the dependent variable, and itself is caused to vary by the independent variable. Such a variable is statistically associated with both the independent and dependent variable. Synonyms are intervening variable, mediator variable, intermediate variable, and contingent variable.

Mobility: Moving by changing body position or location or by transferring from one place to another, by carrying, moving or manipulating objects, by walking, running or climbing, and by using various forms of transportation.

PALS: Participation and Activity Limitation Survey, a post-censal cross-sectional survey conducted by Statistics Canada in 2001 and 2006 to look at Canadians (adults and children) whose day-to-day activities may be limited because of a condition or health problem.

Participation: An individual's involvement in life situations in relation to health conditions, body functions and structures, activities, and contextual factors.

Participation Restriction: A problem experienced by an individual that may have in the manner or extent of involvement in life situations.

Personal Factors: Contextual factors that relate to the individual such as age, gender, social status, life experiences and so on, and comprise features of the individual that are not part of a health condition or health state.

RMSEA: Root Mean Square Error of Approximation, a measure of the discrepancy per degree of freedom in the model. Values less than 0.05 indicate an excellent fit.

SEM: Structural equation modeling, a multivariate technique combining aspects of multiple regression (examining dependence relationships) and factor analysis (representing unmeasured factors with multiple variables) to estimate a series of interrelated dependence relationships simultaneously.

TLI: Tucker-Lewis Index, also known as Non-normed fit index (NNFI), a recommended value of TLI is 0.9 or greater.

WRMR: Weighted root mean square residual, a relatively new fit index that is believed to be better suited to categorical data. WRMR values less than 1.0 depict a good fitting model.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

The elderly represent a sizable proportion of the Canadian population with an increase projected in the following decades. With the first baby boomer generation reaching the age of 65 in the year 2011, the aging trend of the Canadian population will continue to accelerate until 2031 when seniors will account for 25% of the total population, almost double the current proportion (StatisticsCanada, 2007). The prevalence of many health conditions, such as cancer, diabetes and cardiovascular disease, increases with age. Consequently, the number of people with chronic health conditions in Canada is expected to rise and which suggests a need for approaches to improve the wellbeing of older adults.

Mobility disability is one of the chronic health conditions and is strongly associated with the declining of physical function as people age. A Statistics Canada report suggested that increases in the size of the elderly population is one of the main factors for the increased prevalence of mobility disabilities (Statistics Canada., 2007a). Disability and impairment are more pronounced among the aging population (aged 65 and over) with disabilities, 76.4% reported a mobility limitation, comparing to less than 2% between the ages of 15 and 24 (Statistics Canada., 2006). Among elderly Canadians who self-reported disabilities in 2001, approximately 70% reported having mobility limitations. Unlike epidemiological studies of chronic health conditions, which are largely concerned with causal factors that lead to these conditions mostly at individual level, disability research often focuses on the consequences of chronic health conditions and the implications at both societal and individual levels. It is believed that disabilities often result from complex interactions

between health conditions, individual and environmental factors. Consistent with this, disability research has a strong emphasis on conceptualization, theory, and theoretical modeling. Since the Nagi disability model was first introduced in the 1960s (Nagi, 1965), the last four decades have seen rapid growth of theoretical research on disabilities (Nagi, 1965; Pope & Tarlow, 1991; WHO, 1980). Subsequently, this led to the eventual fruition of the International Classification of Functioning, Disability and Health (ICF) conceptual framework. The ICF was officially endorsed by WHO on May 22, 2001 and is now internationally adapted for disability research and clinical practice. According to the ICF, disability encompasses three inter-related components: function impairments, activity limitation and participation restrictions, which interact with contextual factors. These concepts and their relationships to disabilities will be described further in following chapters of thesis.

According to the ICF conceptual model, mobility disability, socioeconomic status, and life styles are intricately related. Examining how these factors are related is not only scientifically important, but also have important public health implications. Furthermore, despite rich literature on the possible health effects of various life styles and health habits, such as smoking and alcohol drinking, little is known whether people actually change their life styles due to their disabilities. Although it is commonly believed that the type of housing one lives in and certain structural features (such as wheelchair accessible ramps and elevators) affect those with mobility disability, there is little literature examining how and to what degree people's out-of-home participation is affected.

Thus, there is a knowledge gap in understanding how mobility limitations impact lifestyle patterns including smoking and alcohol consumption, and whether the behaviors of mobility impaired individuals are different than those of the general elderly population. In addition, I was interested in exploring how contextual factors, including personal and environmental factors, contribute in participation restrictions and activity limitations in this specific study population; which remained scant in prior research. The exploration of this research allows for further implications for public health concerns, including health policies and strategies to improve well-being and the quality of life which are believed to decrease due to the decline of physical function caused by both mobility limitation and aging.

1.2 OBJECTIVES

Based on the WHO ICF framework, this study used the 2001 Canadian Participation and Activity Limitation Survey (PALS) data to examine the health status of Canadians aged 65 and over, with mobility disabilities. First, using smoking and alcohol consumption as examples, the aim of this thesis was to examine the lifestyles and the associated factors in the elderly population and to compare them with the general Canadian population of the same age range. Secondly, the aim was also to assess environmental factors and barriers that affect out-of-home participation in elderly Canadians with mobility disabilities. Finally, based on the ICF conceptual framework and findings derived from the first two objectives, this thesis posited and tested a theoretical model on how contextual factors, especially environmental factors, would affect the disablement process from activity limitations to participation restrictions.

I hypothesize:

Smoking and alcohol consumption patterns among elderly Canadians with mobility disabilities would be different from those in the general older population, considering smoking and alcohol could be used as a coping strategy for depression as mobility restrictions may limit both their personal and social behaviors.

Individuals with higher levels of mobility disability who experience environmental barriers in their daily life might be more likely to have restrictions in out-of-home social participations. For example, function and structure impairment was found associated with social participation restrictions among samples of community-dwelling older adults in North America. Overall, out-of-home participations inversely relate to the severity in the level of disability. People with more severe disabilities were less likely to engage in out-of-home participation. However, such an association is modified by other factors, including pain level, living status and socioeconomic factors.

Lacking environmental factors would be positively related to activity dependence and severity level of mobility limitations. The severity of mobility limitation would also be significantly related to activity dependence while such relationships would be mediated by lacking environmental facilitators.

1.3 ORGANIZATION

This is a manuscript format thesis consisting of three stand-alone, but related chapters. To make this thesis as a coherent piece of work, necessary additional information was provided in four other chapters and an appendix. Chapter 1, the current chapter, is an overall introduction to the background, objectives and organization of this research

project. Chapter 2 is a literature review that introduces health issues related to mobility disabilities and aging, discusses associated health factors in this study population, and introduces the ICF conceptual framework. Chapter 3 reviews the data source of the study including PALS 2001 and CCHS 2003. Chapter 4 focuses on lifestyle patterns and compares smoking and alcohol consumption patterns among elderly Canadians with mobility disabilities. More specifically, it describes the prevalence of smoking and alcohol consumption behaviors and compares this with the general elderly population. Factors and potential determinants associated with the two lifestyle patterns are also explored. Chapter 5 investigates environmental factors and their impact on out-of-home social participation using multivariate logistic regressions to identify multivariate associations. Moreover, it describes the patterns of out-of-home social participation and examines how environmental factors, including various structural barriers and facilitators affect out-of-home social participation. Chapter 6 examines the mediating effect of environmental facilitators on level of mobility disability and activity independence in the elderly population. Specifically, it evaluates the internal consistency of eight environmental facilitators listed by PALS 2001, and investigates the mediating effect using Structural Equation Modeling. The three manuscripts based chapters – Chapter 4, 5, 6 – are composed for both this thesis and future publication in peer-reviewed journals. To make them integrated and readable as separate manuscripts, overlapping contents and sentences may exist. Chapter 7 sums up the discussions and conclusions of this research project.

1.4 REFERENCES

Nagi, S. (1965). Some conceptual issues in disability and rehabilitation. Washington D.C.: American Sociological Association.

Pope, A., & Tarlow, A. (Eds.). (1991). Disability in America: Toward a National Agenda for Prevention. Washington D.C.: National Academy Press.

Statistics Canada. (2006). Participation and Activity Limitation Survey.

Statistics Canada. (2007). The Daily, Monday, December 3, 2007. Participation and Activity Limitation Survey.

StatisticsCanada (2007). Portrait of the Canadian Population in 2006, by Age and Sex: Provincial/Territorial populations by age and sex.

WHO (1980). International classification of impairments, disabilities, and handicaps : a manual of classification relating to the consequences of disease. Geneva: World Health Organization.

CHAPTER 2 LITERATURE REVIEW

Given the broad scope of my thesis, my literature review is confined in the areas that are directly related to my study: 1) introduction to mobility disabilities; 2) aging trend in Canada and its health outcomes; 3) the WHO ICF framework that this study is based on; and 4) health determinants relevant to the study population.

2.1 THE SCOPE OF MOBILITY DISABILITIES

Based on the definition of WHO ICF, disability is an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; and a participation restriction is a problem experienced by an individual in involvement in life situations. In scientific research, researchers tend to use the term disability within a biomedical health framework, but impairment within a social health framework (WHO, 2001b). Disability is the result of negative interactions that take place between a person with impairment and his or her social environment.

An estimated 10% of the world's population experience some form of disabilities or impairment (WHO, 2006). In Canada, the most recent statistics in 2006 indicate an estimated 4.4 million Canadians (14.3% among total population) reported some form of disability, with an increase of over 0.75 million people in the past five years (Statistics Canada., 2007a). In addition to its medical aspects, disability is also a costly social, public, and moral issue affecting individuals, families, and communities in our society. Disability associated with arthritis alone accounts for $15.3 billion in indirect costs to the

Canadian economy annually (Katz & Yelin, 2001). The number of people with disabilities is increasing due to population growth, aging, emergence of chronic diseases and medical advances that preserve and prolong life. These increasing trends are creating overwhelming demands for health and rehabilitation services, strategies and policies.

In 2006, WHO implemented a new six-year action plan from 2006 to 2011, which directed its effort to enhance the quality of life, well-being, promote and protect the rights and dignity of people with disabilities or impairments through local, national and global efforts. The main version of the plan is that all persons with impairments live in dignity, with equal rights and opportunities (WHO, 2006). The plan has eight missions to achieve this vision: 1) raise awareness about the magnitude and consequences of disability; 2) facilitate data collection and analyze or disseminate disability-related data and information; 3) support, promote and strengthen health and rehabilitation services for persons with disabilities and their families; 4) promote community based rehabilitation; 5) promote development, production, distribution and servicing of assistive technology; 6) support the development, implementation, measuring and monitoring of policies to improve the rights and opportunities for people with disabilities; 7) build capacity among health and rehabilitation policy makers and service providers; and 8) foster multi-sectoral networks and partnerships.

Health outcomes and public health aspects vary significantly with different disability types. In PALS 2001, seven types of disabilities including mobility, agility, seeing, hearing, speech, pain and others were taken into consideration. Mobility disabilities are

any condition that affects the ability to move, ranging from lack of coordination to complete paralysis. Specifically, they affect moving by changing body position or location; by transferring from one place to another; by carrying, moving or manipulating objects; by walking, running or climbing; and by using various forms of transportation (WHO, 2001b). The level and consequences of mobility can be assessed with respect to capacity, including the ability to execute a task or action, and performance such as what an individual can do in relation to his or her environment.

People with mobility-related disabilities are usually the most visible among the disabled. Causes of mobility disabilities can be permanent, intermittent or temporary. Arthritis and musculoskeletal disabilities were the most common reported among the permanent mobility disorders, which include partial or total paralysis, amputation or severe spinal injury, muscular dystrophy, multiple sclerosis, cerebral palsy and osteoarthritis (Banwell, 1984; Hakkinen, et al., 2005; Lachmann, 1993; Wright, 1982). Considering the complex facets in individual, medical, community-based and societal concerns, the management of mobility disabilities requires a multifaceted interdisciplinary approach.

2.2 AGING POPULATION AND ITS IMPACT ON MOBILITY DISABILITY IN CANADA

According to the population projections from 2005 to 2031 performed by Statistics Canada, Canada's population is aging fast and older adults will outnumber children in about a decade (Statistics Canada., 2005). The population aging, which has already begun, would accelerate in 2011 when the first baby-boom (born in 1946 after the Second World War) reaches the age of 65 and is projected to last until 2031, when seniors would account

for 25% of the total population, almost double the current proportion (Statistics Canada., 2007b). The trend is more pronounced in the Atlantic Provinces including New Brunswick, Newfoundland and Labrador (NL), Prince Edward Island and Nova Scotia. For example, currently, the fertility rate in NL has reached its lowest recorded level and there are more deaths than births. By the year 2036, the proportion of older adults in NL will be 30%, the highest in Canada (Statistics Canada., 2005). The NL government's Provincial Health Aging Policy Framework also called for the urgency of coping with the aging population transition. Age always serves as the most significant risk factor in population health and impacts quality of life and well-being. For example, the prevalence of many health conditions, such as cancer, diabetes, disability and cardiovascular disease, increase with age. Consequently, specific attentions and approaches are called for to improve the wellbeing of older adults.

Information on disability is a key to understanding and responding to population aging (Verbrugge & Jette, 1994). Disability is also a particularly useful concept in assessing the health of elderly people (Melzer & Parahyba, 2004). Impairment and disability were more pronounced among the elderly: in 2006, among seniors aged 65 and over with disabilities, 76.4% reported a mobility limitation, compared to less than 2% of Canadians between the ages of 15 and 24. A Statistics Canada report also suggested the increase of the elderly population is one of the main factors for the increased prevalence of disabilities (Statistics Canada., 2007a).

and community services (Kahn, et al., 2002). Those active in physical activities were also proved to have lower risk of chronic diseases and deaths (Blair, et al., 1996; Paffenbarger, et al., 1993). Understanding lifestyle patterns of this study population could contribute to coping with negative outcomes of mobility disability and provide implications for health education.

2.4.4 PHYSICAL ENVIRONMENT

Environmental factors, including availability of assistive aids and devices, built environment, and environmental barriers, are significant contextual factors based on the ICF model among those having health limitations (World Health Organization, 2001). Based on report from Statistics Canada in 2006, roughly six out of every ten Canadian adults aged 15 and over with impairments used or needed technical aids or specialized equipment to help them perform one or more daily activities. The percentage is much higher among elderly adults - about 28.9% reported needed more technical aids or specialized equipment (Statistics Canada, 2008). A recent longitudinal study in Canada indicated that the use of assistive devices while doing basic activities of daily living may increase the ability of the fall-efficacy scale to distinguish between participants with varying degrees of mobility or health impairment (Edwards & Lockett, 2008). That is, using assistive devices increased individuals' confidence that they would not fall while participating in daily life activities. Certain kinds of assistive aids and devices, such as canes and walkers, have been confirmed to improve balance and mobility through clinical and biomechanic evaluations (Bateni & Maki, 2005). Equipment assistance was also proved to have great efficacy in reducing disability (Verbrugge, Rennert, & Madans,

As people's physical function declines with increased age, mobility disability is more common in seniors. Age is a significant risk factor in body function limitations related to mobility. For example, prior literature reported that the normal or usual changes of aging often have significantly greater impact on an individual whose disability has limited his or her physical or socioeconomic reserves (Vandenakker & Glass, 2001). Among the elderly population, mobility disabilities were well established as early markers of the disablement process, being predictive of severe disability and mortality (Guralnik, et al., 2000; Penninx, et al., 2000). Seventy percent of those with mobility disabilities were found to have difficulty with activities of daily living, including dressing, walking across the room, bathing or showering, eating such as cutting up food, getting in or out of bed, and using the toilet. Thus, this specific group is of considerable importance in terms of population morbidity and potential need for clinical care (Melzer, Gardener, & Guralnik, 2005). However, a general assessment of community health issues involved in elderly Canadians with mobility disabilities remains scant.

2.3 THE WHO ICF FRAMEWORK

ICF works as a tool to describe health and disability at both individual and population levels from 2001. It is widely used in social policy, international and national disability reporting, and clinical and epidemiological research. The aims of the ICF are: 1) to provide a scientific basis for consequences of health conditions; 2) to establish a common language to improve communications; 3) to permit comparison of data across countries, disciplines, services, and time; and 4) to provide a systematic coding scheme for health information systems.

ICF provides a standard for the description of disabilities in three main components: body function and impairments; activity limitations; and participation restrictions, all of which could be represented in the umbrella term of "disability" (World Health Organization, 2001). Impairments are problems in body function or structure as a significant deviation or loss. Activity limitations are difficulties an individual may have in the performance of activities. Participation restrictions are problems an individual may have in the manner or extent of involvement in life situations. Thus, for an individual with mobility disabilities, their impairment may be muscle weakness in lower limbs; the activity limitation being unable to walk further than 2 blocks outdoors; and the participation restriction being unable to complete a sponsored walk with friends.

Contextual factors, including personal factors and environmental factor, are also integral components of ICF. Personal factors are the particular background of an individual's life and living, and comprise features of the individual that are not part of a health condition or health state. Environmental factors consist of the physical, social, and attitudinal environment in which people live and conduct their lives. Examples of contextual factors for seniors with mobility disabilities are income level for personal factor and grabbing bar for environmental factor. Contextual factors and three main components of ICF are correlated as shown in Figure 2-1.

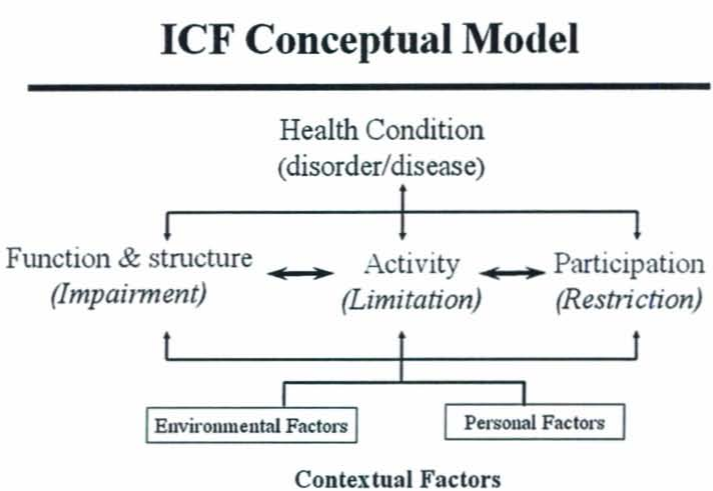

Figure 2 - 1 Three main components, contextual factors and their correlations in ICF

2.4 HEALTH DETERMINANTS RELEVANT TO DISABLEMENT

A large body of literature suggests that the process of disability and its consequences are a complicated interplay among level and the nature of disability, personal factors, and biopsychosocial environment. This section reviews the roles of the following factors that are directly relevant to my thesis on disablement: socioeconomic status, social support, health behaviors, physical environment, and social environment (health protection and health promotion).

2.4.1 SOCIOECONOMIC STATUS

Higher socioeconomic status is positively associated with better overall health. Having a low income can lead to certain health consequences. Based on PALS 2001, 90% of elderly

Canadians with mobility limitations reported an annual income of lower than $30,000 from all sources (Statistic Canada, 2001). Older adults with mobility limitations and in a lower income status might have problems in affording the expenses of purchasing assistive aids and devices to support mobility, failing to access some leisure activities, and limited health care. Such problems can impact on activity limitations, and prohibits social and physical participation which benefit their well-being. There was also scientific evidence that financial resources contribute to promote mobility adaptations among elderly people (Mathieson, Kronenfeld, & Keith, 2002).

Gender also has a significant impact on income and social status. Among elderly Canadians with self-reported mobility disabilities, females presented a large majority. Considering women have a comparatively lower income than men, this population could be different from those without disabilities in terms of social status and income. Health status also increases with job rank (Health Canada, 1994), and thus income. Failure to provide access for individuals with disabilities in the work place, such as handicap buttons, lowered grab bars, and automatic doors, prevented such population from employment as well (Davis, 2005).

Besides income and social status, education also performs as an important socioeconomic determinant. Individuals having severe level of mobility disabilities require special accommodation and specialized features to enter school. This population requires different kinds of educational aids and supports to get full involvement in the education system. Accommodations were shown necessary to remove barriers presented by a disability so a

person can have equal access to that of a person without a disability (Helms & Helms, 1994). Those having mobility limitations were also found associated with higher odds of low education (Clarke, et al., 2009; Melzer & Parahyba, 2004). Furthermore, education is also one of the important determinants in social behaviors, such as different patterns of participations (Lee, Jang, Lee, Cho, & Park, 2008; Lindstrom, Moghaddassi, & Merlo, 2004). Thus, this is a significant factor attributing to the health and behaviors of mobility limited individuals.

2.4.2 SOCIAL SUPPORT

Social support is the physical and emotional comfort given to us by our family, friends, co-workers and communities and is believed to associate with better health (Aquino, Russell, Cutrona, & Altmaier, 1996). Evidence indicates that loss of functional abilities was significantly associated with social services and social support (Iliffe, et al., 1993). For families with members who reported mobility disabilities, other family members tend to work few hours or make arrangements with their work hours in order to provide family support. Functional limitations impede mobility limited population from developing a social network outside of the family unit such as social network among colleagues and community based services. The lack of social network may lead to changes of lifestyle patterns and reduced self-perceived satisfaction in health and well-being (Bullers, Cooper, & Russell, 2001). Social network, which is a social structure made up of individuals such as friendship, common interest or relationship of beliefs, can act as a buffer against health problems (Dormann & Zapf, 1999); however, elderly with mobility disabilities seem to lack the strong social support and thus its buffer effect on health. Network size and social

interaction showed significant negative associations with disability risks, which did not vary by race or as a function of time (de Leon, Gold, Glass, Kaplan, & George, 2001).

2.4.3 HEALTH BEHAVIORS

The older adult population with mobility disabilities has significantly different health behaviors compared to the general population due to two main reasons: age and mobility limitations. This is a significant area of research considering that certain health behavior factors over the life course have been found to be associated with physical decline as one ages (Strine, Chapman, Balluz, & Mokdad, 2008). Previous studies indicated smoking and alcohol consumption were associated with chronic health conditions, including mouth and oropharyngeal cancer, liver cancer, lung cancer, breast cancer, hypertensive disease, hemorrhagic stroke, high blood pressure and serum cholesterol levels (Doll & Hill, 1956; Kozararevic, et al., 1980; Rehm, et al., 2003). Therefore, it is important to consider various health behaviors among older adults with mobility disabilities that may put them at risk for additional chronic health issues or further functional decline. There is evidence considering alcohol consumption has been found to be used as coping strategies to deal with the health problems (Johnson & Pandina, 2000) while smoking was associated with stress, negative emotions and ineffective coping (Vollrath, 1998). Therefore, one could speculate that older adults with mobility disability would have higher rates of alcohol consumption but lower rates of smoking compared to their peers without disabilities. Physical activity is another important health determinant in this population; it varies with the severity level of disabilities, forms of mobility limitations (Miller, Rejeski, Reboussin, Ten Have, & Ettinger, 2000), and various confounding factors including urban/rural area, home design

1997). The need of assistive aids was found to vary with severity level of functioning impairments (Tomey & Sowers, 2009). Meeting the assistive device needs is important as this can offset constraints to full participation in everyday activities by reducing the impact of barriers and activity limitations. Considering a large group of elderly Canadians with mobility disabilities may be in need of assistive aids and devices, research on exploring such equipments may contribute to community health decisions. For example, lacking grab bars in wash rooms possibly leads to an unexpected fall and injury. Such possibly existing environmental hazards would also cause a change in their health behaviors, such as failure in maintaining active physical activities, and change of diet patterns and lifestyle behaviors due to the lack of assistive equipments.

Assistive devices contribute to increasing functioning, health and quality of life of older adults with mobility disabilities. Besides, the characteristics of the built environment can also greatly impact these outcomes within this population. Results from the data of Urban Chicago Community Adult Health Study indicated that certain poorly built environmental characteristics on pathways, evaluated by rating street and sidewalk quality in the block surrounding each respondent's residence, also had negative impact among adults aged 45 years or more who had severe impairment in neuromuscular and movement-related functions (Clarke, Ailshire, Bader, Morenoff, & House, 2008). A study conducted among community-dwelling American adults also suggested that the built environment could exacerbate mobility difficulties for the elderly (Clarke, et al., 2009). Among adults aged 75 years and over, living in neighborhoods characterized by more motorized travel was associated with an odds ratio for mobility disability that was 1.5 times higher from 1986 to

2001 than for older adults living in environments that were more pedestrian friendly. Thus, it is important to consider how environmental barriers can reduce the independence, functioning, health and quality of life of older adults with mobility disabilities in order to develop interventions and policies to alleviate the effect of these barriers.

Neighborhood is another important aspect of environmental factors. Perception of safety hazards due to crime or living in high crime neighborhoods was also found associated with increased risk of incident mobility disability among elders at retirement age whose incomes were below the federal poverty line in a US longitudinal research (Clark, et al., 2009). Although one may expect that disability would affect people's mobility in a same manner, it was found that arthritis patients living in a rural area were more mobile than their urban counterparts despite the same degree of functional disability (Cornelissen, Rasker, & Valkenburg, 1988): they were more able to walk longer distances, to use their bicycles, and to attend active hobbies although they have fewer number of outings. The investigation of a neighborhood environment would benefit in the test of interventions designed to enhance mobility among diverse populations of older adults in both rural and urban settings.

2.4.5 HEALTH PROMOTION AND HEALTH PROTECTION

To improve the well-being and quality of life among elderly Canadians with mobility disabilities at a societal level, health promotion and health protection are essential to address. Health promotion can be defined as an approach that is intended to help people meet emerging health challenges, which complements and strengthens the existing health

care system (Epp, 1986a). In contrast, health protection is defined as legal or fiscal controls, regulations and policies, and voluntary codes of practice, aimed at the enhancement of positive health and the prevention of ill-health (Graham, Corso, Morris, Segui-Gomez, & Weinstein, 1998). Health protection measures have been employed to create safer environments where we live, work, play and are educated. Health promotion and protection are preliminary concerns in public health decision making, thus perform as social contexts of health.

Literature indicated the importance of environmental factors in health promotion of the older adult population with mobility disabilities. If certain built environmental characteristics could be improved, even somewhat, for those adults at greatest risk for impairment in outdoor mobility, the disablement process could be slowed or even reversed (Clarke, et al., 2008). Safe and properly designed environmental facilitators at homes, schools, roads and public places contribute to the health of elderly people with mobility problems by: 1) improving the engagement of daily activities and enhanced mobility which both leads to greater health promotion and 2) preventing the risk of injuries and further impairment for elderly people with mobility problems. Reducing environmental hazards by providing sufficient and safe environmental facilitators is an important primary health protection concern.

Besides the concern of environmental factors, health promotions in the study population also address the three national health challenges, including reducing inequities, increasing prevention efforts, and enhancing people's capacity to cope (Epp, 1986b). Health public

policies should implement regulations and strategies to deal with the disparities caused by the health determinants of mobility limitations. For example, this population is also among a low-income group which is in itself a health determinant (Harry, 1992). Additionally, older adults with mobility disabilities are more likely to die as a result of accidental falls, chronic respiratory disease and pneumonia (Myers, Palmer, Engel, Warrenfeltz, & Parker, 1996; Rubenstein, 2006). Thus, by reducing these inequities, health promotion and prevention efforts can be more effective. For Canada's older population, coping with chronic conditions and the impairments to which they give rise, is a particular concern as the increasing number of aging population and prevalence of mobility limitations. New and more effective strategies need to be explored in terms of preventing the occurrence of further injuries, illness and related chronic conditions among elderly adults who already reported mobility impairments. Finally, health promotion and prevention efforts need to be developed to increase the coping capacity of older adults with mobility disabilities. However, we have tended to focus much on coping research and interventions, but greater emphasis needs to be made on reducing inequities and prevention efforts.

2.5 REFERENCES

Aquino, J. A., Russell, D. W., Cutrona, C. E., & Altmaier, E. M. (1996). Employment status, social support, and life satisfaction among the elderly. *Journal of Counseling Psychology, 43*(4), 480-489.

Bateni, H., & Maki, B. E. (2005). Assistive devices for balance and mobility: benefits, demands, and adverse consequences. *Arch Phys Med Rehabil, 86*(1), 134-145.

Bullers, S., Cooper, M. L., & Russell, M. (2001). Social network drinking and adult alcohol involvement - A longitudinal exploration of the direction of influence. *Addictive Behaviors, 26*(2), 181-199.

Clark, C. R., Kawachi, I., Ryan, L., Ertel, K., Fay, M. E., & Berkman, L. F. (2009). Perceived neighborhood safety and incident mobility disability among elders: the hazards of poverty. *BMC Public Health, 9*, 162.

Clarke, P., Ailshire, J. A., Bader, M., Morenoff, J. D., & House, J. S. (2008). Mobility disability and the urban built environment. *Am J Epidemiol, 168*(5), 506-513.

Cornelissen, P. G., Rasker, J. J., & Valkenburg, H. A. (1988). The arthritis sufferer and the community: a comparison of arthritis sufferers in rural and urban areas. *Ann Rheum Dis, 47*(2), 150-156.

Davis, L. (2005). Disabilities in the workplace: recruitment, accommodation, and retention. *AAOHN J, 53*(7), 306-312.

Dormann, C., & Zapf, D. (1999). Social support, social stressors at work, and depressive symptoms: Testing for main and moderating effects with structural equations in a three-wave longitudinal study. *Journal of Applied Psychology, 84*(6), 874-884.

Edwards, N., & Lockett, D. (2008). Development and validation of a modified falls-efficacy scale. *Disabil Rehabil Assist Technol, 3*(4), 193-200.

Epp, J. (1986a). Achieving Health for All - a Framework for Health Promotion. *Canadian Journal of Public Health-Revue Canadienne De Sante Publique, 77*(6), 393-407.

Epp, J. (1986b). *Achieving health for all: A framework for health promotion.* Ottawa: Health and Welfare Canada.

Graham, J. D., Corso, P. S., Morris, J. M., Segui-Gomez, M., & Weinstein, M. C. (1998). Evaluating the cost-effectiveness of clinical and public health measures. *Annu Rev Public Health, 19*, 125-152.

Harry, B. (1992). Making sense of disability: low-income, Puerto Rican parents' theories of the problem. *Except Child, 59*(1), 27-40.

Health Canada (1994). *Federal/Provincial/Territorial Advisory Committee on Population Health.* Ottawa: Health Canada.

Helms, L. B., & Helms, C. M. (1994). Medical education and disability discrimination: the law and future implications. *Acad Med, 69*(7), 535-543.

Iliffe, S., Tai, S. S., Haines, A., Booroff, A., Goldenberg, E., Morgan, P., et al. (1993). Assessment of elderly people in general practice. 4. Depression, functional ability and contact with services. *Br J Gen Pract, 43*(374), 371-374.

Johnson, V., & Pandina, R. J. (2000). Alcohol problems among a community sample: Longitudinal influences of stress, coping, and gender. *Substance Use & Misuse, 35*(5), 669-686.

Katz, P. P., & Yelin, E. H. (2001). Activity loss and the onset of depressive symptoms: do some activities matter more than others? *Arthritis Rheum, 44*(5), 1194-1202.

Lee, H. Y., Jang, S. N., Lee, S., Cho, S. I., & Park, E. O. (2008). The relationship between social participation and self-rated health by sex and age: a cross-sectional survey. *Int J Nurs Stud, 45*(7), 1042-1054.

Lindstrom, M., Moghaddassi, M., & Merlo, J. (2004). Individual self-reported health, social participation and neighbourhood: a multilevel analysis in Malmo, Sweden. *Prev Med, 39*(1), 135-141.

Melzer, D., Gardener, E., & Guralnik, J. M. (2005). Mobility disability in the middle-aged: cross-sectional associations in the English Longitudinal Study of Ageing. *Age Ageing, 34*(6), 594-602.

Melzer, D., & Parahyba, M. I. (2004). Socio-demographic correlates of mobility disability in older Brazilians: results of the first national survey. *Age Ageing, 33*(3), 253-259.

Miller, M. E., Rejeski, W. J., Reboussin, B. A., Ten Have, T. R., & Ettinger, W. H. (2000). Physical activity, functional limitations, and disability in older adults. *Journal of the American Geriatrics Society, 48*(10), 1264-1272.

Statistic Canada (2001). Participation and Activity Limitation Survey.

Statistics Canada (2001). Participation and Activity Limitation Survey.

Statistics Canada (2008). *The Daily, Tuesday, June 3, 2008. Participation and Activity Limitation Survey.*

Statistics Canada. (2005). *Population Projections for Canada, Provinces and Territories.*

Statistics Canada. (2007a). *The Daily, Monday, December 3, 2007. Participation and Activity Limitation Survey.*

Statistics Canada. (2007b). *Portrait of the Canadian Population in 2006, by Age and Sex: Provincial/Territorial populations by age and sex.*

Strine, T. W., Chapman, D. P., Balluz, L., & Mokdad, A. H. (2008). Health-related quality of life and health behaviors by social and emotional support. Their relevance to psychiatry and medicine. *Soc Psychiatry Psychiatr Epidemiol, 43*(2), 151-159.

Tomey, K. M., & Sowers, M. R. (2009). Assessment of physical functioning: a conceptual model encompassing environmental factors and individual compensation strategies. *Phys Ther, 89*(7), 705-714.

Vandenakker, C. B., & Glass, D. D. (2001). Menopause and aging with disability. *Phys Med Rehabil Clin N Am, 12*(1), 133-151.

Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. *Soc Sci Med, 38*(1), 1-14.

Verbrugge, L. M., Rennert, C., & Madans, J. H. (1997). The great efficacy of personal and equipment assistance in reducing disability. *Am J Public Health, 87*(3), 384-392.

Vollrath, M. (1998). Smoking, coping and health behavior among university students. *Psychology & Health, 13*(3), 431-441.

WHO (2001). *International Classification of Functioning, Disability and Health (ICF).* Geneva: World Health Organization.

WHO (2006). *Disability And Rehabilitation WHO Action Plan 2006-2011.* Geneva: World Health Organization.

Wilkie, R., Peat, G., Thomas, E., & Croft, P. (2007). Factors associated with participation restriction in community-dwelling adults aged 50 years and over. *Qual Life Res, 16*(7), 1147-1156.

World Health Organization (2001). *International Classification of Functioning, Disability and Health: ICF.* Geneva: WHO.

CHAPTER 3 DATA SOURCES

To examine the health status of older adults with mobility disabilities, the study used the secondary data from PALS 2001. Although the most recent PALS was conducted in 2006 at the time when the research was conducted, the Public Use Microdata File (PUMF) data of PALS 2006 was not released to the public until the very end of my study. Because replacing the 2001 PALS by the 2006 one would prolong my program, after discussing with my supervisor and research committee members I have decided to continue to with the 2001 data. However, I compared selected results from both data sets for selected variables and they are very similar.

CCHS 2003 was applied in examining the lifestyle patterns among general Canadian older adults. Considering CCHS 2001 did not provide adequate information as it required in the study, this particular cycle was selected because it was conducted almost at the same time as PALS 2001 and could support this proposed study.

3.1 PALS 2001

PALS 2001 is a post-censual survey designed to collect information on adults and children with disabilities, that is, those whose everyday activities are limited because of a condition or health problem(Statistics Canada, 2001). It was funded by Human Resources Development Canada. A sample of approximately 35,000 adults and 8,000 children who responded having a disability to the census question in the 2001 Census Survey were selected to participate in the survey from September 2001 to January 2002. An overall response rate of 82.5% was obtained. The population targeted by PALS represents 18.6%

of Canada's adult population and 5% of the children (aged 14 or younger) population. However, for operational reasons, persons living in Yukon, Nunavut or the Northwest Territories on an Indian reserve or in an institutional collective dwelling were excluded from the sampling frame.

For the sampling method, Primary Sampling Unit (PSU) is made up geographically of one or more Census Enumeration Areas and is defined within a severity and age group stratum. At the first stage, PSUs are sampled using probability proportional-to-size (PPS) sampling. In the second stage of the sample design, all Census long-form respondents in a selected PSU are included in the 2001 PALS sample. Estimation weights were adjusted by post-stratification to bring to a census-based population estimated for the strata and groups based on province, age and sex. The survey methodology was designed to control both sampling and non-sampling errors to reduce their potential effects. But errors from incomplete coverage, non-response, response errors and data processing may still exist. Data was collected directly from respondents from September 2001 to January 2002. Interviews were conducted by telephone with interviewers completing a paper and pencil questionnaire. Interviews by proxy were allowed. In some special cases, face-to-face interviews were conducted. Respondents were interviewed in the official language of their choice.

Disabilities were classified into seven main categories in the questionnaire of PALS: seeing, speech, hearing, agility, mobility, pain and other impairments. For the degree of disability severity, PALS constructed a scale measuring the overall severity according to

the intensity and frequency of the activity limitations reported by respondents. The disability severity scale for adults is divided into four levels: mild, moderate, severe, and very severe. For each of the seven types of disability, this scale is developed using the same model as for the overall index, except that they contain only two levels of severity: less severe and more severe. There are seven sections in the adult questionnaire focusing on different aspects of health conditions of the population, including: 1) the filter questions asked in the 2001 Census, which identify the PALS target population, are repeated at the start of the PALS interview; 2) types of activity limitations; their severity; the use of, need for and costs of medications, aids and specialized equipment; and underlying health problems and their causes; 3) the use of, need for and costs of help with everyday activities and disability-related health needs; 4) education, the use of and need for supportive measures, and the impact of the disability on the educational profile and experience; 5) the employment profile, the use of and need for supportive measures, and the impact on employment status and experience; 6) impact on social participation in terms of adaptability and accessibility of leisure and recreation, transportation and housing; and 7) income-related characteristics, such as insurance plans, tax credits and income sources.

Specifically, the questionnaire of PALS 2001 listed a number of possible environmental factors that individuals with mobility limitations may confront with. For instance, lacking specialized equipments including wheelchair, scooter, lifts or lift type devices and grab bars or bathroom aids; barriers in exit and entrance in home-design; specialized features to move around, such as a ramp or street level entrance, automatic or easy to open doors (includes lever handles), widened doorways or hallways, elevator or lift device, visual

alarms or audio warning devices and lowered counters in the kitchen; and lacking adequate space in car or public transportations for wheelchairs and support devices. The frequencies of smoking and alcohol consumption are also provided by PALS 2001.

Although PALS 2001 had its strength in data sources and methodology, some key information required in my study was missing. For example, education is one of the important determinants in social behaviors (Lee, Jang, Lee, Cho, & Park, 2008; Lindstrom, Moghaddassi, & Merlo, 2004); however, PALS 2001 did not provide any education information for individuals aged 65 and over. Cognitive functions were also found to affect the wellbeing of individuals with disabilities (Wilkie, Peat, Thomas, & Croft, 2007), but the availability of the data was not provided in PALS 2001.

Another limitation came from the PUMF data of PALS 2001. In the questionnaire, there were a series of mobility screening questions, such as "Do you (Does . . . . .) have any difficulty walking half a kilometer or a quarter mile, that is, about three city blocks, without resting?", "Do you (Does . . . . .) have any difficulty walking up and down a flight of stairs, about 12 steps, without resting?", and "How much difficulty"? Individuals' response to such screening questions on the intensity and frequency of the activity limitations was summed up as a score of the respondent's degree of severity of disability. In the PUMF data available for research use, only a derived score of severity level of disability was provided, but not the mobility screening questions, which are important indicators to examine the participation restriction and activity limitations. In addition, provincial information and rural/urban classification were asked in the questionnaire but not provided

in the PUMF data. Thus, we could not assess certain geographic based environmental factors which would limit the study.

3.2 CCHS 2003

CCHS is a cross-sectional survey that collects information related to health status, health care utilization and health determinants for the Canadian population. It is conducted at sub-provincial levels of geography (health region or combined health regions) across Canada; it relies upon a large sample of respondents; and it is designed to provide reliable estimates at the health region level. The target population covers all Canadians aged 12 and over; individuals living on Indian Reserves and on Crown Lands, institutional residents, full-time members of the Canadian Forces and residents of certain remote regions are excluded from the sampling frame. Its coverage in the range is 98% in the provinces, while 90% in the Yukon, 97% in the Northwest Territories, and 71% in Nunavut are due to the fact that some remote regions are excluded (Statistics Canada, 2001).

The CCHS questions are designed for computer-assisted interviewing. Sample units selected from the area frame are interviewed using the computer-assisted personal interviewing method while units selected from the random digit dialing and telephone list frames are interviewed using the computer-assisted telephone interviewing method. It has three content components: the common content, the optional content and the rapid response content. The common content is collected from all survey respondents. Some modules are collected every year and remain relatively unchanged over several years. Other common modules are collected for one or two years and rotate every two or four

years. The optional content fulfils the need for data at the health region level. This content, while often harmonized across the province, is unique to each region or province and may vary from year to year. The rapid response component is offered to organizations interested in national estimates on an emerging or specific issue related to the population's health. The rapid response content may be included in the survey in each collection period, that is, in every two month period.

For the sampling method, households came from an area frame, 50% came from a list frame of telephone numbers and the remaining 2% came from a random digit dialing. The sampling frame is a multistage stratified cluster design in which the dwelling is the final sampling unit. In the first stage, homogeneous strata are formed and independent samples of clusters are drawn from each stratum. In the second stage, dwelling lists are prepared for each cluster, and dwellings, or households, are selected from the lists. Each province is divided into three types of regions: major urban centers, cities, and rural regions. Geographic or socio-economic strata are created within each major urban centre. Within the strata, between 150 and 250 dwellings are regrouped to create clusters. Some urban centers have separate strata for apartments or for census enumeration areas in which the average household income is high. In each stratum, six clusters or residential buildings (sometimes 12 or 18 apartments) are chosen by a random sampling method with a method of PPS, the size of which corresponds to the number of households. The other cities and rural regions of each province are stratified first on a geographical basis, then according to socio-economic characteristics. In the majority of strata, six clusters are selected using the PPS method. Where there is low population density, a three-step plan is used whereby two

or three PSUs are selected and dividing each PSU into clusters. The selection is made at each step using the PPS method.

This research applies CCHS cycle 2.1 conducted from January 2003 to November 2003. In the questionnaire of this cycle, detailed information on smoking and alcohol consumption is provided, e.g., the number of cigarettes taken, smoking cessation and history, the volume of alcohol beverage consumed. However, to keep parallel with the study outcomes in PALS 2001 and to make a consistent comparison, we focus on current smoking status and the frequency of alcohol consumption to identify regular alcohol consumptions.

CHAPTER 4 SMOKING AND ALCOHOL CONSUMPTION PATTERNS AMONG ELDERLY CANADIANS WITH MOBILITY DISAIBLITIES

4.1 ABSTRACT

Background

Despite the prevalence of lifestyle factors having been widely evaluated among the general population, this area of study continues to remain scant in terms of examining the smoking and alcohol consumption patterns among older adults with mobility disability. Determining differences in the prevalence of these lifestyle factors among the elderly with varying degrees of mobility disability may provide further insight into the development of interventions to assist older adults to cope with their mobility disabilities.

Objectives

The objectives of this study were: 1) to describe the prevalence of smoking and alcohol consumption behaviors among elderly Canadians (aged 65 years and older) with mobility disabilities and compare it to the general elderly population; and 2) to examine factors associated with these two lifestyle patterns in those with disabilities.

Methods

This study is a secondary analysis using data from the 2001 Participation and Activity Limitation Survey (PALS) and the 2001 Canadian Community Health Survey (CCHS 2.1). Individuals (N=6,038) 65 years of age and older from both surveys were included in this study. Smoking status (non-smoker versus regular/occasional smoker) and alcohol consumption (once a week or more versus once a month or less) (Voigt, et al., 2009; J. Wang & Patten, 2001) were collapsed into dichotomous variables. Participants in the

2001 PALS were further classified into two levels of disability severity (less-severe and more-severe). Multivariate logistic regressions using the PALS data were conducted to examine the relationship between disability severity and smoking, as well as alcohol consumption while controlling for potential confounding socioeconomic factors.

Results

The prevalence of current smokers among individuals with less-severe and more-severe mobility disabilities and individuals in the general population was 12.55%, 11.57% and 11.93% separately. The proportion of alcohol consumption significantly decreased with the increase of severity relating to mobility disabilities. Approximately 50% of elderly Canadians in the general population consumed alcohol at least once a week, compared to only 12.85% of the elderly population with more-severe mobility disabilities. After adjusting for potential confounders, no significant association was shown between the severity level of mobility disabilities and smoking with an Odds Ratio (OR) of 0.90 and corresponding 95% Confidence Interval (CI) of 0.75- 1.08. However, elderly individuals having more-severe disability levels were less likely to consume alcohol regularly (OR = 0.76, 95% CI 0.65 to 0.89). Other study variables including age, gender, income, living status (living alone or living with others) and social participation also impacted these lifestyle patterns in the study population.

Conclusions

The results suggest that the severity level of mobility disability may not be significantly associated with smoking status, but is associated with alcohol consumption. These differences may be explained in part by their involvement in social behaviors (i.e. socialization).

Keywords

Mobility Disability, Aging, Smoking, Alcohol Consumption, PALS

4.2 INTRODUCTION

The rapidly increasing aging population is becoming a worldwide health issue in the first half of the 21st century. According to population projections from 2005 to 2031, Canada's population is aging rapidly and is projected that senior citizens will outnumber children in the next ten years (Statistics Canada, 2005). As a result of declining physical function, mobility disabilities are more pronounced among older adults: among seniors aged 65 and over with disabilities.,76.4% Canadians report mobility limitations, compared to less than 2% between the ages of 15 and 24 (Statistics Canada., 2007a). Existing studies have also identified mobility limitations as a major adverse health outcome associated with aging and an impediment to older adults' well-being and social behaviors in activities (Katz & Yelin, 2001). Disability is also a particularly useful concept in assessing the health of elderly people (Melzer & Parahyba, 2004)

Lifestyle factors describe the way people live their lives, which include behavioral and social issues. For example, smoking, food, nutrition, sedentary lifestyle, alcohol and substance misuse. A significant area of research has examined unhealthy lifestyle factors over the life course which have been found to be associated with physical decline as one ages (Strine, et al., 2008). Literature shown that lifestyle was affected by movement impairment among a significant number of people worldwide (Sivan & Bhakta, 2008). Having two or more unhealthy lifestyle factors was found to be a strong predictor of

mobility limitation among non-obese older adults (Koster, et al., 2007). In addition, smoking and alcohol consumption were found to be directly correlated with the current socioeconomic resources of individuals (Lindstrom, Hanson, & Ostergren, 2001), while individuals with mobility disabilities had different socioeconomic patterns compared to the general population (Adamson, Hunt, & Ebrahim, 2003; Avlund, 2004; Melzer & Parahyba, 2004). Current research also indicates lifestyle factors, including smoking and alcohol drinking patterns, have been found to be used as coping strategies to deal with the negative impact including personal stress among patients with mobility-limited symptoms, such as fibromyalgia syndrome (Bernard, Prince, & Edsall, 2000; Johnson & Pandina, 2000). Taking into consideration that lifestyle modifications were considered as potential interventions to reduce mobility limitations (Yeom, Fleury, & Keller, 2008), determining patterns of these behaviors among individuals with varying degrees of mobility disabilities may provide further insight into the negative impact of mobility disabilities on lifestyle and the development of interventions to assist individuals to cope with their disabilities. Providing insight into the various dimensions of lifestyle behaviors is essential to setting up public health programs that deal with mobility issues. Therefore, based on a review of the literature, I hypothesized: 1) mobility disability could impact on selected lifestyle patterns - people were more likely to report unhealthy lifestyle patterns as the severity level of disability increased considering that smoking and alcohol consumptions have been found to be used as coping strategies; and 2) several potential factors may be associated with such lifestyle behaviors including income, gender, age, living status, self-perceived health, social participation and education.

The objectives of this study were: 1) to describe the prevalence of smoking and alcohol consumption behaviors among a sample of Canadians aged 65 and over with mobility disabilities and compare them to the general elderly population; and 2) to measure factors and potential determinants associated with these two lifestyle patterns.

4.3 METHODS

Study population and study design

This study is a secondary analysis of data from the 2001 Participation and Activity Limitation Survey (PALS) and the 2003 Canadian Community Health Survey (CCHS) conducted by Statistics Canada. PALS 2001 provides information on demographic factors, activity limitations, assistance with daily activities, education, employment, social participation, and economic characteristics. CCHS 2003 is a cross-sectional survey that gathers information related to health status, health care utilization and health determinants for the Canadian population. Probability proportional-to-size sampling method was used in both data collections. Smoking and alcohol consumption patterns in the general Canadian population aged 65 and over were calculated using CCHS 2003 with a sub-sample of 21,170 individuals aged 65 and over. The two lifestyle patterns in Canadians with mobility disabilities aged 65 and over were calculated using PALS 2001. From the total sample of 20,710 records, a sub-sample of 6,038 among individuals 65 years of age and older with mobility disabilities was selected for the study.

Study variables and measurements

Self-reported smoking and alcohol consumption patterns were used as the outcome

variables separately. In both PALS and CCHS, these variables were dichotomously collapsed. For smoking patterns, two groups were defined: current smokers and non-current smokers at the time when participants were doing the survey. In CCHS, current and non-current smoking data was obtained directly from the derived variables by Statistics Canada. In PALS, participants were asked to report their current smoking patterns. In the current study, those individuals who answered "not at all" in connection to smoking were considered as non-current smokers; those who answered "regularly" and "occasionally" were considered as current smokers; other answers including "Don't know", "Refusal" and "Not Stated" were treated as missing values. For alcohol consumption patterns, two alcohol consumption groups were created (i.e., regular and non-regular alcohol consumers) were created based on the self-reported alcohol consumption status during the past 12 months at the time of data collection. In this study, those who consumed alcohol at least once per week were classified as regular alcohol drinkers and those who reported consuming alcohol less than once per week as non-regular alcohol drinkers; other responses were treated as missing values.

With respect to independent variables, annual personal income was categorized as "low" and "high" with the breaking point of low income as $30,000, which included the total money income received during the calendar year of 2000 from all resources including wages, all kinds of benefits, income from government sources, interests and investment income and other money income. Considering the importance of having other partner (s) accompanying with those with mobility disabilities, the variable "living status" was considered rather than "marital status" in the study. The corresponding question in PALS

is "Numbers of persons in household"; those who answered "one person" were considered as living alone, while other answers were considered as living with partner (s). Social participation was also taken into account, which was self-derived from 8 categories of social participation (visiting family or friends, walking or playing sports, doing hobbies, shopping, attending sports or culture events, taking courses, visiting museums/libraries/parks, and traveling) for which participants were asked to indicate how often they participated in these activities in a typical week on an ordinal scale (everyday/ at least once a week/ at least once a month/ less than once a month/ never/ refusal/ don't know). Those who self-reported in engaging in activities listed above at least once per week were considered as active in social participation; those engaged less than once per week were considered as non-active.

Other independent variables included age (65-70/70-75/75-80/80+), sex (male/female), self-perceived health (excellent/very good/ good/ fair/ poor), and the severity level of mobility disability. The severity level of mobility disability was an index scale dichotomized into less-severe and more-severe, and constructed on participants' answers to the survey questions, which were essentially based on intensity and frequency of the limitations. All the variables with values of nonresponse, refusal or blank were counted as missing values.

Statistical Analyses

The study performed both descriptive analyses and multivariate logistic regressions using the statistical software of SAS version 9.1. ORs and corresponding 95% CIs, as the

results from logistic regressions, were used to estimate the effects; alpha levels of 0.05 were used to examine the statistical significance. Potential interactions between the study variables were tested by adding interactions in the logistic regression models. Each record containing more than two missing values was deleted. Estimation weights were adjusted to bring PUMF data into line with the census-based population in order to taking into account the unequal distribution for the strata and groups based on province, age and sex. The rescaled weight, achieved by dividing the original weight by the mean of weight among selected sub-samples, was used to produce descriptive estimates.

Ethical Issues

As the micro data used in the study were a secondary data collected by Statistics Canada for research and public use, there were no ethical considerations directly related to data collection in this study. No individual or personal identifiable information was released from Statistics Canada. The study was also approved by Memorial University Human Investigation Committee.

4.4 RESULTS

Table 4-1 describes the prevalence of smoking and alcohol consumption among elderly Canadians. As previously discussed, data for the general older adult population without disabilities came from CCHS 2003; while the data on older adults with mobility disability came from PALS 2001. Thus, comparisons are not from the same data sets and are provided for descriptive purposes rather than to make statistical inferences. The prevalence of current smokers among individuals having less-severe and more-severe

mobility disabilities was 12.55% and 11.57% respectively. Similar prevalence was found among older adults in the general population with a proportion of 11.93%. That is, smoking status was relatively the same regardless of whether an older adult had a disability or not, and regardless of the severity of the mobility disability. However, the patterns of alcohol consumptions were significantly different. The proportion of alcohol consumption significantly decreased with the increase of severity level of mobility disabilities - approximately 50% of elderly Canadians in the general population consumed alcohol at least once per week, but only 12.85% among elderly with more-severe mobility disabilities. Thus, as severity of disability increases, weekly alcohol consumption decreases with the older adult population.

Table 4-2 summarized the results of the univariate and multiple logistic regressions which analyzed how the independent variables affected the odds of older adults' smoking status among elderly Canadians with mobility disabilities. Unadjusted results showed increased levels of disability were negatively associated with smoking with an OR and 95% CI of 0.84 (0.72 - 0.99). However, after adjusting for potential confounders, no statistically significant association was found between disability levels and smoking. As anticipated, being female, higher income and increased age were negatively associated with smoking status status in both the univariate analysis and after adjusting for potential confounding variables (multivariate analysis). Similarly, living with someone else and being active in social participation also decreased the likelihood of smoking among the study population. For the consideration of self-perceived health, the poorer people rated their health, the more likely they smoked, with an OR of 1.14 (95%CI: 1.05, 1.23) with every decreased

level in self-perceived health ratings. Effect modifications for living alone, the severity level of disabilities, social participation were tested by adding interaction terms in logistic models, but none of the interactions were significant at a level of 0.05.

Table 4-3 summarizes the results of the univariate and multiple logistic regressions which analyzed how the independent variables affected the odds of older adults' alcohol consumption as the outcome variable. Using less-severe mobility disability as the baseline, both adjusted and unadjusted odds ratios indicated that increased level of disability impeded regular alcohol consumption. This increased likelihood was found as both a univariate relationship (ORs of 0.57 (95CI%: 0.50, 0.66) and after adjusting for the effects of other predictor variables 0.76 (95CI%: 0.65, 0.89). Unlike smoking patterns, living alone had statistically significant association with alcohol consumptions. Individuals who were active in social participation and those with a higher income tended to have a higher likelihood of consuming alcohol; a reverse effect compared to that of smoking status. The poorer people rated their health, the less likelihood that they consumed alcohol regularly. Being female and increased age were negatively associated with drinking alcohol. Effect modifications were also tested for alcohol consumption model for living alone, the severity level of disabilities and social participation, but none of the interactions were significant at a level of 0.05.

4.5 DISCUSSION

The primary objective of this study was to investigate the association of mobility disability with lifestyle patterns in terms of smoking status and alcohol consumption.

After comparing the prevalence of the three groups - general elderly Canadians, elderly Canadians with less-severe mobility disabilities and elderly Canadians with more-severe mobility disabilities, it was found there were no significantly differences in prevalence of smoking. In contrast, the prevalence of alcohol consumption is negatively associated with the severity level of mobility disabilities – the prevalence of alcohol consumption among elderly population with more-severe level of mobility disability is approximately 1/4 that of the general elderly population. Odds ratios, after adjusting for possible potential confounders were consistent with the results from descriptive statistics and unadjusted results. This study found that mobile disabilities impacts alcohol consumption more significantly than smoking in elderly Canadians.

Lifestyle factors including smoking and alcohol drinking patterns have been found to be used as coping strategies and are strong predictors of mobility limitations (Bernard, Prince, & Edsall, 2000; Johnson & Pandina, 2000). Therefore, it was assumed that mobility disabilities would be positively related to increased smoking and alcohol consumption. We hypothesized that people were more likely to report unhealthy lifestyle patterns as the increasing of the severity level of disability. However, based on the results of the study, there was no evidence indicating the two lifestyle patterns were used as coping strategies in the study.

Research indicates that smoking and alcohol consumption patterns are often positively correlated with each other (Budd, Eiser, Morgan, & Gammage, 1985). That is, individuals who smoke tends to have increased alcohol consumption and vice versa. However, in the

current study smoking status and alcohol consumption were not related; after controlling for confounding variables, increased severity of mobility disability was not associated with the likelihood of smoking but did increase the likelihood of alcohol consumption. Thus, this study suggested that these two lifestyle patterns can be inversely associated and should be evaluated separately in terms of health issues for individuals with mobility disability. Other factors, beside disability status, could shed light onto these results. One possible explanation of this finding could be involvement in social behaviors. In the current study greater social participation was associated with a decreased likelihood of smoking but an increased likelihood of consuming alcohol. As generally believed, social behaviors are affected and impeded by mobility disability due to the limitations and restrictions in daily life (Lan, Melzer, Tom, & Guralnik, 2002). In addition, lower socio-economic status, such as low employment rate, low income and low education, also accounts for the lack of involvement in social behaviors of these segments within this specific population compared with general population (Lee, et al., 2008; Lindstrom, et al., 2004). Compared to smoking, alcohol consumption is more likely to involve a social context and is more likely to occur among a group of people (Heim, et al., 2004). Long-term disability was found to be accompanied by a substantial effect on social isolation, which limited social behavior (Badley, 1995). Thus, severity of mobility disability is related to reduced social participation and thus reduced alcohol consumption. In contrast, social participation may be a protective factor against smoking due to its decreased social acceptance in current Canadian culture (Asbridge, 2004; Carlson, Goodey, Bennett, Taenzer, & Koopmans, 2002). Although the analyses were adjusted for social participation to minimize this effect, however, the era of social behaviors was too

broad to be measured by participation for specific events only. Thus, the lack of social behavior of individuals with mobility disabilities could be used to partially explain why mobility disability has a pronounced role in affecting alcohol consumption patterns than smoking. Another possible explanation considers that because limitation of mobility in the study population, it would be much easier for them to physically purchase and carry cigarettes than it would be to carry alcohol bottles due to size and weight.

The strength of the study is that it used a national population-based study with a relatively large sample size (N=6,038), weighted to take into account the unequal distribution for the strata and groups based on province, age and sex. It also provides further insight for examining interventions or strategies to improve the population health of older adults with mobility disabilities.

This study also has several limitations. First, the study relied on self-reported data, which might lead to over-estimation and under-estimation due to inaccurate recall. While alcohol consumption was measured for a period of 12-months, smoking was measured only at the point of conducting the survey. This could possibly cause information bias in the misclassification of the outcome. Second, although alcohol consumption was found to be associated with mobility limitations, the nature of the cross-sectional study design could not provide us with a temporal relationship, which means, the causal effect of this relation could not be determined. Third, the public use micro data file of PALS 2001 failed to provide some important information. For example, education level, depression, and job position have been found to be associated with mobility disabilities (Melzer, et al.,

2005; Mottram, Peat, Thomas, Wilkie, & Croft, 2008; Odding, Valkenburg, Stam, & Hofman, 2001); however, the education information was missing for individuals aged 65 and over. Geographical information and the duration of doing social participation were also not provided, which causes more residual confounding (Mocellin & Foggin, 2008). Third, failure in classifying personal alcohol consumption and social alcohol consumption made it impossible to evaluate the impact of alcohol consumption as coping strategies to deal with loneliness and depression.

In summary, the results indicate that smoking and alcohol patterns present different associations with the severity level of mobility disabilities. Compared with the general population, elderly Canadians with mobility disabilities had similar smoking prevalence but differ significantly in alcohol consumption. Being female, higher income, increased age, living with someone else and being active in social participation were negatively associated with smoking after adjusting to potential confounders. For the consideration of alcohol consumptions, individuals who were active in social participation and those have higher income tended to have a higher likelihood of consuming alcohol, which showed a reverse effect compared to that of smoking status. Thus, it is important that factors associated with smoking and alcohol consumption are identified and could further contribute to public health issues involved in those with mobility disability. Moreover, it is essential to continue to explore knowledge of mobility disability, health behaviors in their population and their impact on the elderly population.

4.6 TABLES

Table 4 - 1 Prevalence of smoking and alcohol consumption among elderly Canadians with respect to various severity levels of mobility disabilities

	Prevalence of Smoking (%)	Prevalence of Alcohol Consumption (%)
General elderly population*	11.93	48.08
Elderly population with less-severe mobility disabilities**	12.55	19.37
Elderly population with more-sever mobility disabilities**	11.57	12.85

*Data came from CCHS 2003.

** Data came from PALS 2001.

Table 4 - 2 Summary statistics on study variables and weighted odds ratios for smoking status among elderly Canadians with mobility disabilities (N=6,038)

Variable and level	Total (100%)	Odds ratios with 95% confidence intervals	
		Univariate	Multivariate
Severity of disabilities			
Less-severe	58.97%	1.00	1.00
More-severe	41.03%	0.84 (0.72, 0.99)	0.90 (0.75, 1.08)
Gender			
Male	37.40%	1.00	1.00
Female	62.60%	0.61 (0.52,0.71)	0.581 (0.49, 0.69)
Age			
65-69	20.20%	1.00	1.00
70-74	22.75%	1.41 (1.18, 1.68)	0.65 (0.52, 0.79)
75-79	23.83%	0.85 (0.71, 1.03)	0.42 (0.33, 0.52)
80 and over	33.22%	0.30 (0.24, 0.37)	0.19 (0.14, 0.24)
Annual Income			
<=30,000	84.42%	1.00	1.00
>30,000	15.58%	0.81 (0.64, 1.01)	0.67(0.52, 0.85)
Living status			
Living with others	32.75%	1.00	1.00
Living alone	67.25%	1.13 (0.96, 1.34)	1.67 (1.40, 2.00)
Self-perceived health			
Every decreased scale		1.14 (1.05, 1.23)	1.10 (1.01, 1.19)
Social Participation			
No	21.48%	1.00	1.00
Yes	78.52%	0.93 (0.77, 1.13)	0.70 (0.56, 0.86)

Table 4 - 3 Summary statistics on study variables and weighted odds ratios for alcohol consumption among elderly Canadians with mobility disabilities (N=6,038)

Variable and level	Total (100%)	Odds ratios with 95% confidence intervals	
		Univariate	Multivariate
Severity of disabilities			
Less-severe	58.97%	1.00	1.00
More-severe	41.03%	0.57 (0.50, 0.66)	0.76 (0.65, 0.89)
Gender			
Male	37.40%	1.00	1.00
Female	62.60%	0.33 (0.29,0.37)	0.35 (0.31, 0.41)
Age			
65-69	20.20%	1.00	1.00
70-74	22.75%	1.23 (1.06, 1.43)	0.86 (0.71, 1.05)
75-79	23.83%	1.01 (0.87, 1.18)	0.76 (0.63, 0.93)
80 and over	33.22%	0.56 (0.48, 0.65)	0.50 (0.41, 0.60)
Annual Income			
<=30,000	84.42%	1.00	1.00
>30,000	15.58%	1.87 (1.59, 2.19)	1.40 (1.18, 1.67)
Living status			
Living with others	32.75%	1.00	1.00
Living alone	67.25%	0.83 (0.72, 0.95)	1.13 (0.97, 1.32)
Self-perceived health			
Every decreased scale		0.83 (0.78, 0.89)	0.85 (0.79, 0.91)
Social Participation			
No	21.48%	1.00	1.00
Yes	78.52%	1.79 (1.49, 2.15)	1.31 (1.07, 1.61)

4.7 REFERENCES

Adamson, J., Hunt, K., & Ebrahim, S. (2003). Association between measures of morbidity and locomotor disability: diagnosis alone is not enough. *Soc Sci Med, 57*(8), 1355-1360.

Asbridge, M. (2004). Public place restrictions on smoking in Canada: assessing the role of the state, media, science and public health advocacy. *Soc Sci Med, 58*(1), 13-24.

Avlund, K. (2004). Disability in old age. Longitudinal population-based studies of the disablement process. *Dan Med Bull, 51*(4), 315-349.

Badley, E. M. (1995). The effect of osteoarthritis on disability and health care use in Canada. *J Rheumatol Suppl, 43*, 19-22.

Bernard, A. L., Prince, A., & Edsall, P. (2000). Quality of life issues for fibromyalgia patients. *Arthritis Care Res, 13*(1), 42-50.

Budd, R. J., Eiser, J. R., Morgan, M., & Gammage, P. (1985). The personal characteristics and life-style of the young drinker: the results of a survey of British adolescents. *Drug Alcohol Depend, 16*(2), 145-157.

Carlson, L. E., Goodey, E., Bennett, M. H., Taenzer, P., & Koopmans, J. (2002). The addition of social support to a community-based large-group behavioral smoking cessation intervention: improved cessation rates and gender differences. *Addict Behav, 27*(4), 547-559.

Heim, D., Hunter, S. C., Ross, A. J., Bakshi, N., Davies, J. B., Flatley, K. J., et al. (2004). Alcohol consumption, perceptions of community responses and attitudes to service provision: results from a survey of Indian, Chinese and Pakistani young people in Greater Glasgow, Scotland, UK. *Alcohol Alcohol, 39*(3), 220-226.

Johnson, V., & Pandina, R. J. (2000). Alcohol problems among a community sample: Longitudinal influences of stress, coping, and gender. *Substance Use & Misuse, 35*(5), 669-686.

Katz, P. P., & Yelin, E. H. (2001). Activity loss and the onset of depressive symptoms: do some activities matter more than others? *Arthritis Rheum, 44*(5), 1194-1202.

Koster, A., Penninx, B. W., Newman, A. B., Visser, M., van Gool, C. H., Harris, T. B., et al. (2007). Lifestyle factors and incident mobility limitation in obese and non-obese older adults. *Obesity (Silver Spring), 15*(12), 3122-3132.

Lan, T. Y., Melzer, D., Tom, B. D., & Guralnik, J. M. (2002). Performance tests and disability: developing an objective index of mobility-related limitation in older populations. *J Gerontol A Biol Sci Med Sci, 57*(5), M294-301.

Lee, H. Y., Jang, S. N., Lee, S., Cho, S. I., & Park, E. O. (2008). The relationship between social participation and self-rated health by sex and age: a cross-sectional survey. *Int J Nurs Stud, 45*(7), 1042-1054.

Lindstrom, M., Hanson, B. S., & Ostergren, P. O. (2001). Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in shaping health related behaviour. *Soc Sci Med, 52*(3), 441-451.

Lindstrom, M., Moghaddassi, M., & Merlo, J. (2004). Individual self-reported health, social participation and neighbourhood: a multilevel analysis in Malmo, Sweden. *Prev Med, 39*(1), 135-141.

Melzer, D., Gardener, E., & Guralnik, J. M. (2005). Mobility disability in the middle-aged: cross-sectional associations in the English Longitudinal Study of Ageing. *Age Ageing, 34*(6), 594-602.

Melzer, D., & Parahyba, M. I. (2004). Socio-demographic correlates of mobility disability in older Brazilians: results of the first national survey. *Age Ageing, 33*(3), 253-259.

Mocellin, J., & Foggin, P. (2008). Health status and geographic mobility among semi-nomadic pastoralists in Mongolia. *Health Place, 14*(2), 228-242.

Mottram, S., Peat, G., Thomas, E., Wilkie, R., & Croft, P. (2008). Patterns of pain and mobility limitation in older people: cross-sectional findings from a population survey of 18,497 adults aged 50 years and over. *Qual Life Res, 17*(4), 529-539.

Odding, E., Valkenburg, H. A., Stam, H. J., & Hofman, A. (2001). Determinants of locomotor disability in people aged 55 years and over: the Rotterdam Study. *Eur J Epidemiol, 17*(11), 1033-1041.

Sivan, M., & Bhakta, B. (2008). Restoring mobility: theories, technologies and effective treatments. *Clin Med, 8*(6), 596-600.

Statistics Canada (2005). *Population Projections for Canada, Provinces and Territories*.

Statistics Canada. (2007). *The Daily, Monday, December 3, 2007. Participation and Activity Limitation Survey*.

Strine, T. W., Chapman, D. P., Balluz, L., & Mokdad, A. H. (2008). Health-related quality of life and health behaviors by social and emotional support. Their relevance to psychiatry and medicine. *Soc Psychiatry Psychiatr Epidemiol, 43*(2), 151-159.

Yeom, H. A., Fleury, J., & Keller, C. (2008). Risk factors for mobility limitation in community-dwelling older adults: a social ecological perspective. *Geriatr Nurs, 29*(2), 133-140.

CHAPTER 5 ENVIRONMENTAL FACTORS AND THEIR IMPACT ON OUT-OF-HOME SOCIAL PARTICIPATION AMONG ELDERLY CANADIANS WITH MOBILITY DISABILITIES

5.1 ABSTRACT

Background

Social participation is an important determinant for increased life expectancy and maintaining independence among older adults. Older adults with mobility disabilities are more likely to experience restrictions in their daily out-of-home social participation in activities such as exercise, hobbies, and contact with family and friends.

Objectives

Based on the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) conceptual framework, the objectives of this study were: 1) to describe the patterns of out-of-home social participation among elderly Canadians with mobility disabilities; 2) to investigate how environmental factors in home design, including various structural barriers and facilitators, affect out-of-home social participation in this particular population.

Methods

The study included a sample of 6,038 individuals 65 years of age and older and self-reported mobility disabilities from the 2001 cross-sectional Canadian Participation and Activity Limitation Survey (PALS). Out-of-home participation was derived from 8 self-reported activities within the past 12 months, and dichotomized participation as no-restrictions (engaging in participations for at least once a week) and restrictions (less than once a week). Measures of environmental barriers in home design included the lack

of specialized features, and self-perceived barriers in the design and layout of home. Other variables included the severity level of disability, income, age, gender, and living status. Univariate and multivariate logistic regressions were conducted to examine the association between environmental barriers and social participation.

Results

Environmental barriers in home design significantly contributed to restrictions in out-of-home social participation (Odds Ratio (OR) = 1.36, 95% Confidence Interval (CI) = 1.10 - 1.69, $p<0.01$). As well, people with severe level of disability (OR = 3.12, 95% CI = 2.73 - 3.56, $p<0.01$) were less likely to report engagement in such behaviors. Living status greatly modified the impact of study variables on the social participation among the study population.

Conclusions

This study suggests the severity level of disability, environmental barriers in home design and living status are significant factors affecting out-of-home social participation among elderly Canadians with mobility disabilities. Thus, reducing environmental barriers is expected to enhance social participation and therefore mobility in this population.

Key words

Mobility, Disability, Elderly, Social Participation, Environmental barriers, PALS

5.2 INTRODUCTION

The aging population is the fastest-growing cohort in Canada and will accelerate in 2011, when the first baby-boom generation reaches the age of 65. This trend is projected to last until 2031, when seniors will account for 25% of the total Canadian population (Statistics

Canada, 2005). The effect of health behaviours are generally exaggerated in the elderly population. Social participation, among one of the important health behaviours, is a significant determinant for increased life expectancy, maintaining quality of life, and independence among older adults (Hsu, 2007; Rowe & Kahn, 1997; WHO, 2002). Older adults with mobility limitations are more likely to experience restrictions in their daily "out-of-home" social participation in activities such as exercises, hobbies, shopping, and contact with family and friends (P. P. Wang & Badley, 2002; Wilkie, et al., 2007). Based on the WHO International Classification of Functioning, Disability and Health (ICF) conceptual framework, function and structure impairment, environmental factors and personal factors are intercorrelated with restricted participation. Existing research indicates that disability severity, which reflects function and structure impairment, has been found to be associated with restriction in participation. These relationships were found in social participations among samples of community-dwelling older adults in North America (Clarke, et al., 2008; Clarke, Ailshire, & Lantz, 2009; Levasseur, Desrosiers, & St-Cyr Tribble, 2008) and among samples of older adults with specific types of mobility disabilities (Gignac, Cott, & Badley, 2000). Urban built environmental barriers have also been found to impede out-of-home mobility for the elderly population in a sample of American adults over 45 years of age (Clarke, et al., 2009). However, scientific evaluations specifically examining the potential associations among mobility disability, environmental factors, and participation in out-of-home social activities within the Canadian older adult population remain scant. Consequently, the aims of this study include: 1) describing the patterns of out-of-home social participation among elderly Canadians with mobility disabilities; and 2) examining how environmental factors,

including various structural barriers and facilitators affect out-of-home social participation in this population.

5.3 METHODS

Study population and study design

The study applied a secondary data analysis using the 2001 cross-sectional Participation and Activity Limitation Survey (PALS) conducted by Statistics Canada. The target population, which represented 18.6% of Canada's adult population, consisted of individuals living in private households and some noninstitutional collective households who were identified with disabilities. The sampling method used by Statistics Canada was probability proportional-to-size sampling. Interviews were conducted over the telephone by interviewers completing a paper-and-pencil questionnaire. Interviews by proxy were allowed. In some special cases, face-to face interviews were conducted. From the total sample of 20,710 records, a sub-sample was selected for the current study consisting of 6,038 individuals 65 years of age and older who self reported having mobility limitations. The information collected involved social participation, environmental barriers, personal factors (pain and severity of disability) and sociodemographic information (gender, age, income, living status).

Analysis and measurement

The outcome variable for this study was self-reported out-of-home social participation with the last year. PALS 2001 asked participants to indicate how frequently (every day, at least once a week, at least once a month, less than once a month or never) they

participated in the following eight activities out of their home in the past 12 months: 1) visiting family or friends; 2) doing physical activities (e.g., exercise, walking, sports); 3) doing hobbies outside home; 4) shopping; 5) attending sporting or culture events (e.g., hockey game, play or movie); 6) taking personal interest courses; 7) visiting museums, libraries or parks; and 8) traveling for business or personal reasons. A social participation variable was derived from the eight activity indicators from the micro data file and was dichotomized into active and non-active. If a participant attended participating any of the eight activities at least once per week, this individual was classified as active in out-of-home social participation. Other participants were classified as non-active.

Participants who reported lack of specialized features, and self-perceived barriers in design and layout of home were classified as having environmental barriers in home design. Within the original PALS dataset, respondents were asked to indicate whether they currently needed, but did not have, eight specialized accessibility features in their daily life. These indicators were: 1) ramps or street level entrances; 2) automatic or easy to open doors; 3) widened doorways or hallways; 4) elevator or lift device; 5) visual alarms or audio warning; 6) grab bars or a bath lift; 7) lowered counters in the kitchen; 8) other special features. Based on responses to all eight indicators, a dichotomous score was created for indicating whether or not participants had environmental barriers (yes/no). Participants who reported lack of specialized features, and self-perceived barriers in design and layout of home were also classified as having environmental barriers. Those who did not response to the questions were classified as missing value.

Personal factors examined in the analysis included pain level and the severity level of mobility disability. Pain level was based on a 3-point ordinal level self-reported response (no pain, less-severe of pain, and more-severe). A dichotomous pain score was calculated based on whether or not pain was reported (yes/no). The severity level of mobility disabilities was derived from PALS 2001 based on individual's responses to the mobility screening questions. It represented a score of the respondent's degree of severity of mobility disability. The levels of severity were: less severe and more severe. Sociodemographic variables examined in this study included age, gender, income, and living status. The impact of age was considered using a three category classification of 10-year interval (65-75/75-85/85+). Income was dichotomized by a cutoff of $30,000 received in the calendar year 2000 from the following sources: wages and salaries, self-employment income, Canada Child Tax Benefits, Old Age Security pension and Guaranteed Income Supplement, benefits from Canada/Quebec Pension Plans, benefits from Employment Insurance, other income from government sources, dividends, interest and other investment income, retirement pensions, superannuation and annuities, and other money income. Thus income consisted of two categories: over $30,000 and under $30,000. Living status was based on the whether there were any partners living with the study individual (living alone/living with someone).

Data analysis dealt with weighted data to represent Canadian population. Univariate and multivariate logistic regressions, including descriptive statistics and the calculation of odds ratios, were applied. Possible interactions between the study variables were tested.

For all the study variables, individual records with missing value equal to three and more were deleted. The statistical software SAS package 9.1 was used for the analysis.

Ethical Issues

As the micro data used in the study was secondary data collected by Statistics Canada for research and public use, there were no ethical considerations directly related to data collection in this study. No individual or personal identifiable information was released from Statistics Canada and therefore presents minimal harm to those involved. The study was also approved by Memorial University Human Investigation Committee.

5.4 RESULTS

PALS 2001 categorized disabilities into seven main types: agility, mobility, seeing, hearing, speech, pain and others. As individuals could experience more than one type of disability, the distribution of the disability types is as shown in Figure 5-1. The weighted result indicates that the percentage of mobility disabilities ranked as the most frequent (77.94%) among overall disabilities in elderly Canadians in 2001, followed with agility disabilities (72.08%) and pain disabilities (61.12%). Comparing to the three most frequently reported disabilities, the other four categories of disabilities (seeing, speech, hearing and other disabilities) occupied a smaller percentage among the elderly in Canada. Older adults with mobility disabilities were the sub-sample of interest to the current study.

Figure 5-2 describes the patterns of out-of-home social participation in the study population. Summing all eight patterns of out-of-home social participation together, 21.30% reported being non-active in participations within the past 12 months. For the eight activity subgroups, over 90% participants reported non-restrictions in attending sporting or cultural events, visiting museums, libraries or national or provincial parks, taking personal interest courses, and traveling for business or personal reasons. Shopping and doing physical activities were the two most restricted behaviours, with corresponding percentages of 58.36% and 51.62% respectively.

Table 5-1 provides the descriptive statistics and corresponding weighted odds ratios with 95% confidence interval of the variables included in both univariate and multivariate regressions. Among the study population of 6,038, 58.97% of individuals had less-severe mobility disabilities and 68.31% reported suffering from pain. Women comprised a higher percentage (62.60%) comparing to men (37.40%). A large majority of the study population (84.42%) had a low annual income of less than 30,000 from all sources. Older adults aged 65 to 75 and 75 to 85 comprised a similar proportion (42.95% and 42.54%); the remaining 14.52% were individuals aged 85 and older. A small proportion of the elderly with mobility disabilities (7.73%) claimed that they needed specialized features to enter or leave their residence or the design and layout of their home made them feel difficult to participate in activities that they wanted or needed to do.

To describe the patterns of out-of-home social participation among elderly Canadians with mobility disabilities the data were analyzed using univariate and multivariate

logistic regressions with out-of-home social participation as the outcome variable and personal factors (pain and disability severity), sociodemographics (gender age, and income), and environmental barriers as the predictor variables. Results from Table 5-1 indicated that in both unadjusted and adjusted logistic models, increased severity level of mobility disabilities, environmental barriers in housing and being female were positively associated with restrictions in out-of-home social participation, with corresponding significant ORs from multivariate regressions of 3.12 (95%CI: 2.73, 3.56), 1.36 (95%CI: 1.10, 1.69) and 1.26 (95%CI: 1.09, 1.44) separately. Increased ages were also found to be positively related with participation restrictions. However, at the significance level of 0.05, income and pain level did not appear to affect out-of-home social participation restrictions among the study population.

Living status, which was dichotomized into living alone and living with partners, was also taken into account. Effect modification between the severity level of mobility disabilities and living status were expected considering those with more severe disability level were more likely to be dependent on somebody else in assisting their daily life, and the interaction term of these variables was significant. In this case, subgroups were classified by the stratification of living status, and the effect of study variables between the two subgroups was compared - 67.25% of the study population lived with partners, while the rest lived alone. Functioning impairments and environmental barriers performed stronger restriction effects in those living with partners with corresponding ORs of 3.75 (95%CI: 3.19-4.42) and 1.54 (95%CI: 1.19-2.00), compared with those living alone with ORs of 1.99 (95%CI: 1.56-2.54) and 0.91 (95%CI: 0.58-1.44). However,

among those living alone, higher income significantly reduced approximately 50% of the restrictions in out-of-home social participation; while those having pain were more likely to get involved in social participations. Environmental barriers tended to have no effect on the outcome in the same subgroup.

5.5 DISCUSSION

For people with disabilities, social behaviours, especially social participation, are essential to their quality of life and well-being (Guralnik, Fried, & Salive, 1996; Holley, 2007; Hsu, 2007; Levasseur, et al., 2008). Based on the key components in ICF model, restrictions in participation are correlated with functioning impairments. For the consideration of severity level of disabilities, previous studies have also suggested that limited activity levels and disability factors were strongly and independently associated with participation levels (Gignac, et al., 2000; Levasseur, et al., 2008; Wilkie, et al., 2007). As anticipated, this study suggests a similar three-fold association with measures of out-of-home social participation restrictions specifically among an elderly Canadian sample with mobility disabilities. Pain could be considered as another pattern of functioning impairment. Although previous studies have found pain to be associated with the decline of physical functioning and limited mobility among different populations (Mottram, et al., 2008; Slatkowsky-Christensen, Mowinckel, & Kvien, 2009), no significant association was detected with respect to out-of-home social participation in the subgroup of elderly Canadians with mobility limitations who lived with some one else. But for those living alone, having pain was found to be negatively associated with out-of-home social participation restrictions. Previous studies have found that pain

intensity and pain self-efficacy beliefs were significantly related to physical disability and depression (Asghari, Julaeiha, & Godarsi, 2008). Thus a possible explanation is participating in out-of-home activities, including leisure and social behaviours, may benefit in reducing depression thus lowering pain intensity and pain perception. For those living by themselves, participating in activities outside of the home could ease their feeling of pain, while those having some one else at home were less likely to go outside for emotional and social contacts or support.

The association between environmental barriers and social participation has been inconsistent among various types of disabilities, barriers and study samples (Clarke, et al., 2009; Dijkers, Yavuzer, Ergin, Weitzenkamp, & Whiteneck, 2002; Rolfe, Yoshida, Renwick, & Bailey, 2009). This study suggests that lack of environmental facilitators or barriers in design and the layout of home are significantly and positively associated with out-of-home social participation restrictions among elderly individuals with mobility disabilities living with partners after adjusting to contextual factors and functioning impairment. However, this association was not significant among those living alone. This finding possibly suggests that the relationships between environmental factors and participation restrictions vary depending on other contextual factors. Living status, which was considered in this study as an implication of help with daily life activities participants require, was a significant factor in examining the relation between environmental barriers and restrictions in activity participation. Because the study was limited to secondary data, the study was unable to directly measure the actual daily help

individuals received and required directly; rather living status was used to estimate the help with activities of daily living.

Personal factors were also taken into account as adjusted factors in our study to avoid confounding variables. Approximately 85% of the study population reported lower income, but generally there was not a significant relationship between income and participation restrictions. Consistent with literature (Statistic Canada, 2004), increased age and being female were positively associated with a lower level of participation. The effect of personal factors also greatly influenced social participation after stratification with living status - among those living alone, the effect of age was diluted but gender and income differences were much pronounced. Considering increased disability severity had a stronger impact on those living alone than those living with partners, the trend relation between living status and social participation is plausible because those living alone and with no financial difficulties may have a stronger desire to get involved in social activities to reduce loneliness and possibly may have more spare time to get involved in social participation.

The identification of modifiable factors that support participation in activities can lead to the development of population-based intervention strategies to support community mobility and provide further implications to research on in-home mobility. Comparing all the factors included in the study, the severity level of disabilities was a great determinant for out-of-home social participation with the highest point estimate of an odds ratio of 3.38, and 95% confidence interval of 2.97 to 3.85. Environmental barriers in the home

and contextual factors had smaller effects on the outcome. Although improvement in functioning impairments through medical treatments could significantly decrease restrictions, considering mobility disability is a long-term chronic disease, impairment level is not an effectively modifiable factor. Comparatively, environmental barrier in home-design is a feasible and modifiable determinant; however only a small percentage (7.73%) of the study population reported experiencing environmental barriers. Because some participants claimed that certain specialized facilitators other than the eight main categories listed in the questionnaire of PALS 2001 were also necessary, further qualitative research is called for to address the needs of the study population.

The WHO ICF conceptual framework currently serves as the model for understanding disability from a population perspective (Vanleit, 2008). The strength of our study is that it provides population-based evidence of this framework in a Canadian context, specifically in the population aged 65 and over. This study derived a large study sample of 6,038 from PALS 2001, which collected data from the Canada population from 10 provinces, and represented 18.6% of Canada's adult population. However, for operational reasons, persons living in Yukon, Northwest Territories or Nunavut, on an Indian Reserve or in an institutional collective dwelling were excluded from the sampling frame. Another limitation is that PALS failed to provide certain geographic information, such as the classification of urban and rural areas or provincial information. This limitation might directly affect the participants' perceptions of barriers in home design and the difficulties in entering or leaving their residence. To measure out-of-home social participation only information on frequency was included. However, the intensity of participation (which

could be represented by the duration of participation) or whether or not participants had interest in increasing their participation in these activities was not included in the questionnaire, which could also bias the association of interest. As a series of variables included in PALS were based on participant's self-report, non-differential misclassification of the self-reported variables could make the estimated odds ratios toward the null. The cross-sectional nature of the study design is also limited in assessing the temporality of the associations measured.

This study should have taken into account possible confounding factors, but the corresponding information was not available. For example, education is one of the important determinants in social behaviours, including participation (Lee, et al., 2008; Lindstrom, et al., 2004). However, PALS 2001 did not provide any education information for individuals aged 65 and over. Cognitive functioning have also been found to affect participation restrictions (Wilkie, et al., 2007) but could not be examined in the study due to the availability of the data. Therefore, future studies should attempt to include these and other possible confounding factors to examine restrictions in social participation.

In summary, environmental barriers in home design and living status are significant factors affecting out-of-home social participation among elderly Canadians with mobility disabilities. Thus, reducing environmental barriers and increasing health care assistance are expected to enhance social participation and mobility in this population.

5.6 FIGURES AND TABLES

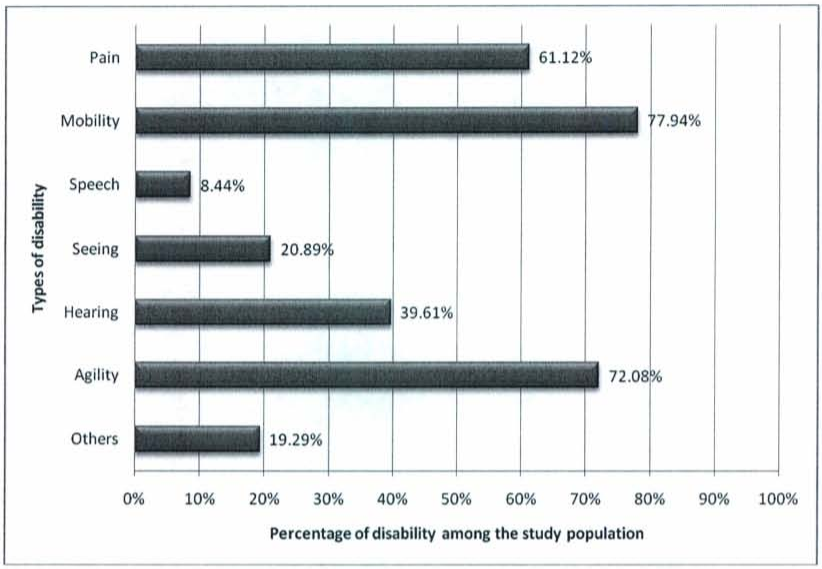

Figure 5 - 1 Distribution of disability type among elderly Canadians with disabilities (N = 6,038)

*An individual could self-report more than one type of disabilities

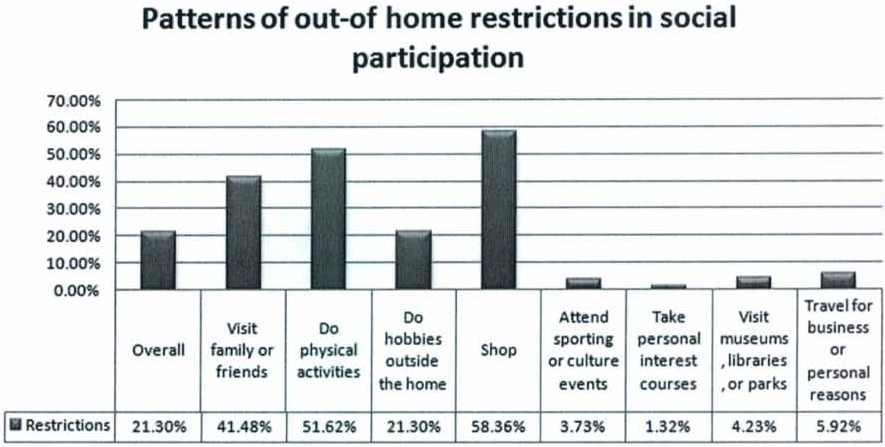

Figure 5 - 2 Patterns of out-of-home social participation restrictions among elderly Canadians with disabilities (N=6,038)

Table 5 - 1 Summary statistics on observed variables and weighted odds ratios for out-of-home social participation within the last 12 months among elderly Canadians with mobility disabilities ($N = 6,038$)

Variable and level	Percentage (%)	Odds ratios with 95% confidence intervals	
		Univariate	Multivariate
Severity scale of disabilities			
Less-severe	58.97%	1.00	1.00
More-severe	41.03%	3.38 (2.97, 3.85)	3.12 (2.73, 3.56)
Gender			
Male	37.40%	1.00	1.00
Female	62.60%	1.45 (1.27,1.66)	1.26 (1.09, 1.44)
Age			
65-75	42.95%	1.00	1.00
75-85	42.54%	1.19 (1.05, 1.35)	1.46 (1.26, 1.69)
85+	14.52%	2.06 (1.76, 2.41)	2.12 (1.77, 2.55)
Annual Income			
<=30,000	84.42%	1.00	1.00
>30,000	15.58%	0.74 (0.62, 0.89)	0.81 (0.67, 0.98)
Pain			
No	31.69%	1.00	1.00
Yes	68.31%	1.07 (0.94, 1.23)	0.91 (0.79, 1.05)
Environmental barriers			
No	92.27%	1.00	1.00
Yes	7.73%	1.82 (1.48, 2.23)	1.36 (1.10, 1.69)

Table 5 - 2 Comparison of study variables for out-of-home social participation within the last 12 months among elderly Canadians with mobility disabilities after stratification with living status (N=6,038)

Variable and level	Multivariate odds ratios and 95% confidence intervals	
	Living alone (n = 1,977)	**Living with partners (n = 4,061)**
Severity scale of disabilities		
Less-severe	1.00	1.00
More-severe	1.99 (1.56, 2.54)	3.75 (3.19, 4.42)
Gender		
Male	1.00	1.00
Female	2.33 (1.63, 3.33)	1.28 (1.08, 1.50)
Age		
65-75	1.00	1.00
75-85	1.44 (1.07, 1.94)	1.52 (1.28, 1.80)
85+	2.02 (1.44, 2.83)	2.37 (1.87, 2.99)
Annual Income		
<=30,000	1.00	1.00
>30,000	0.49 (0.33, 0.72)	0.95 (0.75, 1.19)
Pain		
No	1.00	1.00
Yes	0.55 (0.43, 0.71)	1.14 (0.95, 1.36)
Environmental barriers		
No	1.00	1.00
Yes	0.91 (0.58, 1.44)	1.54 (1.19, 2.00)

5.7 REFERENCES

Asghari, A., Julaeiha, S., & Godarsi, M. (2008). Disability and depression in patients with chronic pain: pain or pain-related beliefs? *Arch Iran Med, 11*(3), 263-269.

Clarke, P., Ailshire, J. A., Bader, M., Morenoff, J. D., & House, J. S. (2008). Mobility disability and the urban built environment. *Am J Epidemiol, 168*(5), 506-513.

Clarke, P., Ailshire, J. A., & Lantz, P. (2009). Urban built environments and trajectories of mobility disability: findings from a national sample of community-dwelling American adults (1986-2001). *Soc Sci Med, 69*(6), 964-970.

Dijkers, M. P., Yavuzer, G., Ergin, S., Weitzenkamp, D., & Whiteneck, G. G. (2002). A tale of two countries: environmental impacts on social participation after spinal cord injury. *Spinal Cord, 40*(7), 351-362.

Gignac, M. A., Cott, C., & Badley, E. M. (2000). Adaptation to chronic illness and disability and its relationship to perceptions of independence and dependence. *J Gerontol B Psychol Sci Soc Sci, 55*(6), P362-372.

Guralnik, J. M., Fried, L. P., & Salive, M. E. (1996). Disability as a public health outcome in the aging population. *Annu Rev Public Health, 17*, 25-46.

Holley, U. A. (2007). Social isolation: a practical guide for nurses assisting clients with chronic illness. *Rehabil Nurs, 32*(2), 51-56.

Hsu, H. C. (2007). Does social participation by the elderly reduce mortality and cognitive impairment? *Aging Ment Health, 11*(6), 699-707.

Lee, H. Y., Jang, S. N., Lee, S., Cho, S. I., & Park, E. O. (2008). The relationship between social participation and self-rated health by sex and age: a cross-sectional survey. *Int J Nurs Stud, 45*(7), 1042-1054.

Levasseur, M., Desrosiers, J., & St-Cyr Tribble, D. (2008). Do quality of life, participation and environment of older adults differ according to level of activity? *Health Qual Life Outcomes, 6*, 30.

Lindstrom, M., Moghaddassi, M., & Merlo, J. (2004). Individual self-reported health, social participation and neighbourhood: a multilevel analysis in Malmo, Sweden. *Prev Med, 39*(1), 135-141.

Mottram, S., Peat, G., Thomas, E., Wilkie, R., & Croft, P. (2008). Patterns of pain and mobility limitation in older people: cross-sectional findings from a population survey of 18,497 adults aged 50 years and over. *Qual Life Res, 17*(4), 529-539.

Rolfe, D. E., Yoshida, K., Renwick, R., & Bailey, C. (2009). Negotiating participation: how women living with disabilities address barriers to exercise. *Health Care Women Int, 30*(8), 743-766.

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *Gerontologist, 37*(4), 433-440.

Slatkowsky-Christensen, B., Mowinckel, P., & Kvien, T. (2009). Health status and perception of pain: a comparative study between female patients with hand osteoarthritis and rheumatoid arthritis. *Scand J Rheumatol*, 1-7.

Statistic Canada (2004). *2003 General Social Survey on Social Engagement, Cycle 17: An overview of Findings.* Ottawa: Statistics Canada.

Statistics Canada (2005). *Population Projections for Canada, Provinces and Territories.*

Vanleit, B. (2008). Using the ICF to address needs of people with disabilities in international development: Cambodian case study. *Disabil Rehabil, 30*(12-13), 991-998.

Wang, P. P., & Badley, E. M. (2002). Contribution of chronic conditions to aggregate changes in old-age functioning. *Am J Public Health, 92*(1), 7-8.

WHO (2002). *Active ageing: A policy framework.* Geneva.

Wilkie, R., Peat, G., Thomas, E., & Croft, P. (2007). Factors associated with participation restriction in community-dwelling adults aged 50 years and over. *Qual Life Res, 16*(7), 1147-1156.

CHAPTER 6 DISABILITY LEVEL, ENVIRONMENTAL FACILITATORS, AND ACTIVITY DEPENDENCE AMONG ELDERLY CANADIANS WITH MOBILITY DISABILITIES

6.1 ABSTRACT

Introduction

One of the negative consequences of disabilities is the increased likelihood of experiencing difficulty in independently executing everyday activities. Environmental facilitators, especially specialized features in the residence are believed to improve the independence in daily activity participation. However, scientific research remains scant in assessing whether a mediating effect from facilitators exists between disability and activity limitations.

Objectives

Based on the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) conceptual framework, objectives were: 1) to describe the use of environmental facilitators among elderly Canadians with mobility disabilities; and 2) to investigate the mediating effect of environmental facilitators between mobility disability and activity dependence.

Methods

1,267 individuals with self-reported mobility disabilities and in need of environmental facilitators, aged 65 years or older were selected from the 2001 cross-sectional Canadian Participation and Activity Limitation Survey. Participants were classified into two levels of disability severity. Activity dependence was derived based on 18 activities. Environmental

facilitators included eight categories of specialized features: elevator, ramps, automatic doors, level handles, warning devices, grab bars, lowered counters in the kitchen, and others. Other variables included age, gender, income, living status, and pain level. Structural equation modeling was used to test the model.

Results

Factor loadings from the measurement model indicated that all specialized features well represented latent environmental facilitators. The direct effect from disability level to activity dependence was 0.04 but non-significant. The indirect effects, consisting of the paths from disability level to lacking environmental facilitators and lacking environmental facilitators to activity dependence, had corresponding significant path coefficients of 0.21 and 0.43. The increase of pain level also associated with activities dependence with coefficient of 0.25. The overall model's goodness of fit was excellent.

Conclusions

The study showed the effect between disability and activity independence was completely mediated by environmental facilitators. Thus, the provision of corresponding environmental facilitators could enhance independence, and further improve the well-being of the study population.

Keywords

Mobility Disability, Aging, Activity independence, environmental facilitator, pain, severity level, PALS

6.2 INTRODUCTION

Aging is becoming a world health issue with the baby boom generation turning 65 years of age. The decline of physical function and physical performance with increased age contributes to mobility limitations and deficits among older adults (Peel, et al., 2005; Vestergaard, et al., 2009; Visser, et al., 2005). Among Canadian seniors aged 65 and over with disabilities 76.4% reported a mobility limitation, compared to less than 2% between the ages of 15 and 24 (Statistics Canada., 2007a). Disability, as one of the chronic diseases that require long-term health care, is also a particularly useful concept in assessing the health of the elderly population (Melzer & Parahyba, 2004). Mobility limitation is also a major adverse health outcome associated with aging and impediments to older adults' well-being and valued life activities (Katz & Yelin, 2001).

One of the negative consequences of having a chronic physical health problem is the increased likelihood of experiencing difficulty in executing everyday activities, known as physical activity limitation (WHO, 2001a). Movement impairment affects the independence of a significant number of people worldwide (Sivan & Bhakta, 2008). A series of research suggests that activity limitation is associated with a loss of independence and thus increased dependence (Badley, 1995; Badley, Rothman, & Wang, 1998; Badley, Tennant, & Wood, 1990; Gignac & Cott, 1998; Manton, Stallard, & Corder, 1998). Being independent in the activities of daily living has been found to be associated with an increased life-expectancy, enhanced quality of life, and reduced prevalence of depression and health care utilization (Guralnik, et al., 1996; Manuel, Goel, Williams, & Corey, 2000). Resources and facilitators (i.e., personal coping, social, financial, health and community services, and environmental) can reduce the severity of physical activity limitations among

older adults with disabilities.

Environmental facilitators, such as assistive technology, benefit mobility impaired people in terms of the elimination of falls and therapeutic interventions, and minimization of negative health outcomes of disability (Clarke, et al., 2009; Gray, Hollingsworth, Stark, & Morgan, 2008; Sivan & Bhakta, 2008). A decline in mobility occurs when mobility limited older adults encounter environmental challenges such as an inconvenient home environment or lack of availability of services in their community (Yeom, et al., 2008). Thus, environmental factors, in conjunction with disability, are a major predictors of physical dependence (Badley, et al., 1998). The purpose of this study is to assess whether environmental facilitators could mediate the relationship between level of mobility disabilities and their perception of dependence in everyday activities; thus addressing a gap in the research as this area of investigation scant. A theoretical model was hypothesized that a) Lacking environmental factors would be positively related to activity dependence and severity level of mobility limitations; 2) A greater level of severity of mobility limitations would be significantly related to activity dependence but this relationship would be mediated by lacking environmental facilitators, which means greater level of disability would be positively related to lack of environmental facilitator and lack of environmental facilitator would be positively related to activity dependence; 3) Sociodemographic factors including gender, age, living status, income and pain would also associated with lacking environmental factors, the severity level of mobility limitations, and activity dependence.

6.3 METHODS

Study population and study design

The study applied secondary data from the cross-sectional study, Participation and Activity Limitation Survey (PALS) that was conducted by Statistics Canada in 2001. A sub sample of 1,267 individuals was included in the study from the total sample of 20,710 records. Selection criteria of individuals included being: 1) 65 years of age or older; 2) self-reporting having mobility disabilities; and 3) reporting a need for environmental facilitators (i.e. specialized features). The sampling method of PALS was probability proportional-to-size.

Measurements

Activity dependence was used as the outcome variable. This variable was derived by PALS 2001 from participants' responses to questions regarding whether respondents received help (yes/no) with 18 everyday activities because of their mobility limitations. Responses were dichotomized into dependence (requiring need for assistance in daily activities) and independence. Dependence indicated that the person needed help with everyday activities because of their health condition. Such activities included meal preparation, everyday housework, household chores, getting to appointments and running errands, looking after personal finances, child care, personal or specialized nursing care, and moving around within the home.

The severity level of mobility disabilities data was derived from PALS 2001 based on individual's responses to the mobility screening questions. It represented a score of the

respondent's degree of severity of mobility disability. This scale was developed according to the intensity and frequency of the activity limitations reported by respondents. For mobility disability, the levels of severity were: less severe and more severe.

Within the original PALS dataset, respondents were asked to indicate whether they currently needed, but did not have, eight specialized accessibility features. These variables were dichotomous (yes/no) to the accessibility of each feature. Those with no response or refused to response were treated as missing value. Environmental facilitator was developed as a latent variable (a variable that cannot be observed or measured directly) and was represented by these 8 manifest variables or indicators. These indicators were: 1) ramps or street level entrances; 2) automatic or easy to open doors; 3) widened doorways or hallways; 4) elevator or lift device; 5) visual alarms or audio warning; 6) grab bars or a bath lift; 7) lowered counters in the kitchen; 8) other special features. Thus, the greater the environmental facilitator score, the greater the individual was lacking in specialized features in their residence in order to live independently.

Other variables examined in the study included gender, age group, living status, pain level and income. Age was categorized using a 10-year interval (65-75/75-85/85+). Living status consisted of those living alone and living with partner(s). The related question in PALS was "Numbers of persons in household"; those who answered "one person" were considered as living alone while all other responses were classified as living with partner(s). Pain level was based on a 3-point ordinal level self-reported response (no pain, less-severe of pain, and more-severe). With respect to these variables, annual income was categorized

as "low" and "high" with the cutting point of $30,000, which included the total money income received during the calendar year of 2000 from the all the resources including wages, all kinds of benefits, income from government sources, interests and investment income and other money income. All the records with three or more missing values were deleted.

Statistical Analyses

Descriptive statistics were calculated to describe the baseline characteristics of the subjects. Cronbach's Alpha correlation analyses were used to examine the internal consistency of the items. Next, Confirmatory Factor Analysis (CFA) was performed to test the factor loadings of each indicator on the latent variable of environmental facilitators to ensure that the indicator variables loaded significantly on this underlying latent variable. Maximum likelihood (ML) procedures were used to estimate parameters in CFA analyses. ML is the preferred estimation method when data are not substantially multivariate nonnormal because it tends to produce estimates that are unbiased, consistent, and efficient. The CFA model was evaluated based on the following three indices of fit: (1) The Comparative Fit Index (CFI) — CFI is an incremental fit index that assess fit in comparison to a baseline model. The CFI is considered a type-III fit index because it incorporates information from the noncentrality parameter. The CFI does not seem to be as sensitive to distribution and sample size. Values for the CFI greater than 0.9 (Bentler, 1990) are typically considered an acceptable fit however (Hu & Bentler, 1999) have recommended that values of .95 and above are more indicative of a good fit; (2) The Tucker Lewis Index (TLI) also called Non-Normed Fit Index (NNFI) – TLI is relatively independent of sample size (Marsh,

Balla, & McDonald, 1988). Values for the TFI greater than 0.9 (Hair, Tatham, Anderson, & Black, 1998) are typically considered an acceptable fit however Hu and Bentler (Hu & Bentler, 1999) have recommended that values of .95 and above are more indicative of a good fit; and (3) Root Mean Square Error of Approximation (RMSEA)--The RMSEA is an indicator of the fit of population data to the model. It is an attempt to remove sampling error from model fit. Values < 0.08 are acceptable, but Hu and Bentler (Hu & Bentler, 1999) suggest RMSEA < 0.06 to represent the boundary of acceptable fit. Finally, Structural Equation Modeling (SEM) was used to measure the mediating effect of environmental facilitators and the overall model fit. Maximum likelihood (ML) procedures were used to estimate parameters in SEM. The size and statistical significance of the effects within the model were examined. Statistical significance of individual path coefficients in the initial model was assessed at significance level of 0.05. Model fit was evaluated based on the previously discussed fit indices (i.e., CFI, TLI, RMSEA) as well as the Weighted Root Mean Square Residual (WRMR) which is a relatively new fit index that is believed to be better suited to categorical data. WRMR values less than 1.0 depict a good fitting mode (Hancock GR, 2006).

Ethical Issues

As the micro data used in the study was secondary data collected by Statistics Canada for research and public use, there were no ethical considerations directly related to data collection in this study. No individual or personal identifiable information was released from Statistics Canada thus presenting minimal harm to those involved. The study was also approved by Memorial University Human Investigation Committee.

6.4 RESULTS

Descriptive Statistics

Table 6-1 indicated 37.02% of the research individuals reported needing help in daily activities, which was activity dependence. Seventy percent of the study population was female, almost a double of the male proportion. The majority of respondents were within the 75 to 85 age group (43.89%), followed by the 65-75 (37.88%) and 85+ age groups (18.23%). Overall, the sample was of lower economic status as only 15.23% reported an annual income of over $30,000 from all sources. More than 60% reported experiencing more-severe mobility disabilities, and 75.06% suffered from pain. Approximately 60% of this population lived with someone else. Among the eight items that represent environmental facilitators, grab bars or a bath lift were the most frequently reported needed specialized accessibility features (14.76%), followed by ramps or street level entrances (8.05%) and other special features (7.58%). Only 25 respondents (1.97%) reported the need of lowered counters in the kitchen.

Confirmatory Factor Analysis

Table 6-2 presents results from Cronbach's Alpha test, which suggested that each individual environmental facilitator had a moderate or high correlation coefficient (>0.5) for their corresponding total summated score. The overall standardized Cronbach's Coefficient Alpha for the summated items was 0.6640. Results of factor loadings of each item from CFA were also shown in Table 6-2. Unadjusted factor loadings for the latent variable indicated that all items had loadings over 0.4 with the exception of "visual alarms or audio warning" and "other specialized features", had loadings of 0.5 and greater which

were considered practically significant (Hair, et al., 1998). To evaluate the goodness of fit of the CFA model, corresponding parameters were: CFI = 0.987; TLI = 0.986; RMSEA = 0.026; and WRMR = 0.848. Based on model fit it appears the eight indicators adequately signify the latent variable of "environmental facilitators." Thus, the measurement model for this model was deemed appropriate for SEM analysis. All the eight environmental indicators were items that satisfy the theoretical predictions about environmental facilitators and were internally associated with each other.

Structural Equation Modeling

After testing structural theoretical models of interest, SEM was used to measure the mediating effect of environmental facilitators on disability severity and activity dependence and the overall hypothesized model (see Figure 6-1). As hypothesized no significant effect was found between the severity level of disability and activity dependence (β = 0.04; p = 0.482 (2-tailed)). Also as hypothesized, an indirect effect included the pathway from disability level to lack of environmental facilitators ($\beta = 0.43, p < .001$) lack of environmental facilitators to activity dependence ($\beta = 0.21, p < .001$). In terms of personal factors, being female was not related to activity dependence, severity levels, nor pain. Increase age was also not related to severity level and activity dependence. Living status had no impact on activity dependence or pain, but did have a significant positive effect to severity level (β = -0.19, $p < .05$) which was in the opposite direction as was hypothesized. As hypothesized, increased pain was related with higher level of disability severity ($\beta = 0.51, p < .001$) and activity dependence ($\beta = 0.25, p < .001$). Finally, there was no significant relation between income and activity dependence or

severity level. Parameters to assess goodness of fit of the model were: CFI = 0.96; TLI = 0.955; RMSEA = 0.028; and WRMR = 1.004. Thus, the goodness of fit of the model was acceptable.

6.5 DISCUSSION

For people with disabilities, feeling independent is essential to their quality of life and well-being (P. P. Wang, Badley, & Gignac, 2006; Westhoff, Listing, & Zink, 2000). Based on the key components of the ICF model, dependence, firmly associated with activity limitations, is correlated with functioning impairments and contextual factors, including personal factors and environmental factors. In this study, it was hypothesized that lacking environmental facilitators, which were represented by eight items, would partially mediate the effect of higher disability level on people's dependence in everyday activities. That is, increased disability level has a direct association with activity dependence, while an indirect effect from functioning impairment to activity dependence via environmental facilitators also exists. This assumption was examined in a sample of older adults with mobility disabilities who reported a need for the aid of environmental facilitators.

Descriptive statistics showed only a small proportion of the study population lacked access to desired environmental facilitators. Cronbach's Alpha analysis and CFA were applied to test the internal validity of the eight environmental facilitators' indicators forming environmental facilitators as a latent variable. For the Cronbach's Alpha coefficients, each item presented at least a moderate correlation coefficient (>0.5). Factor loadings in CFA also confirm that all items met at least the minimum criteria, although correlation between

the latent variable and "other specialized features" was comparatively lower with a factor loading less than 0.5. It was concluded that all eight items to represent the latent variable, which is environmental facilitator. SEM was applied to the model to evaluate the mediating effect of environmental facilitators on disability severity and activity dependence while taking other study variables into consideration. The data did fit the model and as hypothesized there was a direct positive effect of disability severity on lack of environmental facilitators and a direct positive effect of environmental facilitators on activity dependence. Severity of disability was no related to activity dependence but had an indirect effect on activity dependence through environmental facilitators. Previous studies have suggested that activity limitation and dependence were significantly associated with functioning impairment and environmental factors (Bautz-Holter, Sveen, Cieza, Geyh, & Roe, 2008; Westhoff, et al., 2000). However, in this study, we did not find a significant direct impact of disability level on activity dependence at significance level of 0.05. Thus, environmental barriers completely mediated the effect of disability severity on activity dependence. Therefore, regardless of people's impairment level, if environmental facilitators assist them successfully, we could expect that they would be less likely to perceive further dependence in their everyday activities.

As reported in the literature, pain is associated with the decline of physical functioning and limited mobility among different population (Mottram, et al., 2008; Slatkowsky-Christensen, et al., 2009). Similarly, this study found pain to be strongly and significantly associated with perceived severity of mobility impairments, as well as activity dependence. Personal factors (gender, age, and income) had minimal or no impact

on the predictor or outcome variables in this study. However, living alone contributed to disability level.

Strengths and limitations

This study had several strengths including the fact that a comparatively large sample size (n = 1,267) was analyzed and the goodness of fit of the model analyzed was excellent. Additionally, this study provides further insight into examining interventions or strategies to increase environmental facilitators in order to improve the well-being of older adults with mobility disabilities. The results must be interpreted considering several limitations of the study. For the Cronbach's Alpha test, the overall standardized coefficient for all the eight summated items was 0.6640. This is considered as moderate but not a large coefficient value considering the number of items; thus there are residual impacts from more types of facilitators and other potential factors. Some factors beyond study variables should also be taken into account, but the non-availability of the secondary data limited the study. For example, education is one of the important determinants in mobility limited individuals (Lee, et al., 2008; Lindstrom, et al., 2004), but PALS 2001 did not provide any education information for individuals aged 65 and over. Cognitive functioning has also found to affect behavior restrictions (Wilkie, et al., 2007), but was not assessed in this study due to the unavailability of the data.

In summary, the study showed the effects between disability and activity independence was completely mediated by environmental facilitators. Thus, the provision of corresponding environmental facilitators could enhance independence, and further

improve the well-being of the study population.

6.6 FIGURE AND TABLES

Table 6 - 1 Descriptive Statistics of the Variables Observed in Study Population

Variables and Levels		*n*	Percentage (%)
Sociodemographics			
Gender	Male	347	29.91
	Female	888	70.09
Age group	65-75	480	37.88
	75-85	556	43.89
	85+	231	18.23
Annual income	<30,000	1074	84.77
	>30,000	193	15.23
Living Status	Living alone	505	39.98
	Living with others	785	60.02
Severity level of disabilities	Less-severe	464	36.62
	More-severe	803	63.38
Pain level	No	316	24.94
	Less-severe	291	22.97
	More-severe	660	52.09
Activity Dependence	Yes	469	37.02
	No	798	62.98
Environmental Facilitators			
Ramps or street level entrances	Lack	102	8.05
	Have	1165	91.95
Automatic or easy to open doors	Lack	55	4.34
	Have	1212	95.66
Widened doorways or hallways	Lack	32	2.53
	Have	1235	97.47
Elevator or lift device	Lack	69	5.45
	Have	1198	94.55
Visual alarms or audio warning	Lack	24	1.89
	Have	1243	98.11
Grab bars or a bath lift	Lack	187	14.76
	Have	1080	85.24
Lowered counters in the kitchen	Lack	25	1.97
	Have	1242	98.08
Other special features	Lack	96	7.58
	Have	1171	92.42

Table 6 - 2 Cronbach's coefficient Alpha, factor loadings of environmental facilitators

Items	Standardized correlation with total*	Unadjusted factor loading	Adjusted factor loading**
Ramps or street level entrances	0.604	1.000	1.000
Automatic or easy to open doors	0.587	1.080	1.388
Widened doorways or hallways	0.616	1.016	1.050
Elevator or lift device	0.614	0.956	0.844
Visual alarms or audio warning	0.668	0.695	0.463
Grab bars or a bath lift	0.634	0.774	0.503
Lowered counters in the kitchen	0.647	0.854	0.646
Other special features	0.684	0.409	0.227

Note: All factors loadings were significant at $p < .05$.

* An item-total correlation is the correlation between an individual item and the sum of the items that constitute the scale.

** Adjusted for gender, age, income, pain, severity level of disability, living status and pain level.

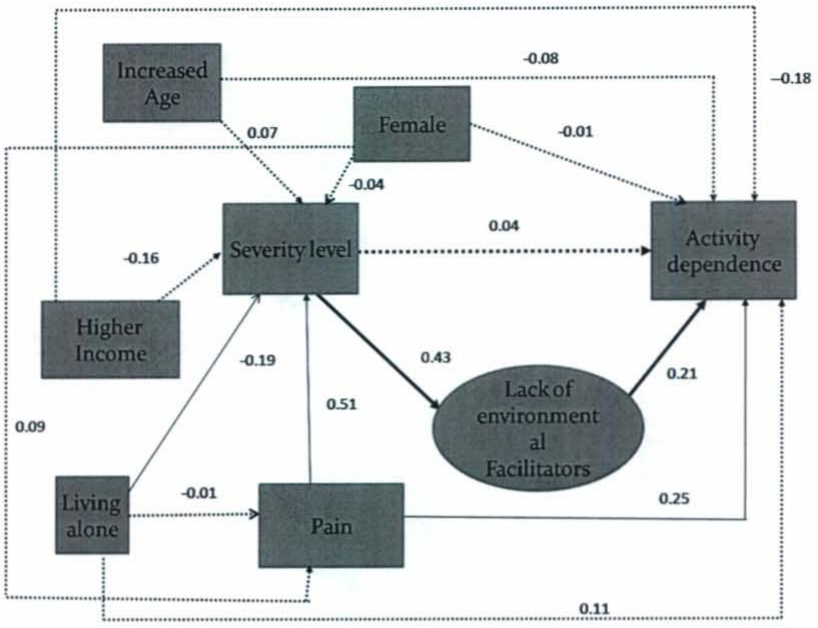

Figure 6 - 1 SEM model of environmental facilitator as a mediating factor in the relationship between severity level of disability and activity independence

* Solid lines represent significant (P<0.05) path coefficients. Dotted line represent insignificant (P>0.05) path coefficients.

6.7 REFERENCES

Adamson, J., Hunt, K., & Ebrahim, S. (2003). Association between measures of morbidity and locomotor disability: diagnosis alone is not enough. *Soc Sci Med, 57*(8), 1355-1360.

Aquino, J. A., Russell, D. W., Cutrona, C. E., & Altmaier, E. M. (1996). Employment status, social support, and life satisfaction among the elderly. *Journal of Counseling Psychology, 43*(4), 480-489.

Asbridge, M. (2004). Public place restrictions on smoking in Canada: assessing the role of the state, media, science and public health advocacy. *Soc Sci Med, 58*(1), 13-24.

Asghari, A., Julaeiha, S., & Godarsi, M. (2008). Disability and depression in patients with chronic pain: pain or pain-related beliefs? *Arch Iran Med, 11*(3), 263-269.

Avlund, K. (2004). Disability in old age. Longitudinal population-based studies of the disablement process. *Dan Med Bull, 51*(4), 315-349.

Badley, E. M. (1995). The effect of osteoarthritis on disability and health care use in Canada. *J Rheumatol Suppl, 43*, 19-22.

Badley, E. M., Rothman, L. M., & Wang, P. P. (1998). Modeling physical dependence in arthritis: the relative contribution of specific disabilities and environmental factors. *Arthritis Care Res, 11*(5), 335-345.

Badley, E. M., Tennant, A., & Wood, P. H. (1990). The assessment of physical independence handicap: experience in a community disablement survey. *Int Disabil Stud, 12*(2), 47-53.

Bateni, H., & Maki, B. E. (2005). Assistive devices for balance and mobility: benefits, demands, and adverse consequences. *Arch Phys Med Rehabil, 86*(1), 134-145.

Bautz-Holter, E., Sveen, U., Cieza, A., Geyh, S., & Roe, C. (2008). Does the International Classification of Functioning, Disability and Health (ICF) core set for low back pain cover the patients' problems? A cross-sectional content-validity study with a Norwegian population. *Eur J Phys Rehabil Med, 44*(4), 387-397.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychol Bull, 107*(2), 238-246.

Bernard, A. L., Prince, A., & Edsall, P. (2000). Quality of life issues for fibromyalgia patients. *Arthritis Care Res, 13*(1), 42-50.

Budd, R. J., Eiser, J. R., Morgan, M., & Gammage, P. (1985). The personal characteristics and life-style of the young drinker: the results of a survey of British adolescents. *Drug Alcohol Depend, 16*(2), 145-157.

Bullers, S., Cooper, M. L., & Russell, M. (2001). Social network drinking and adult alcohol involvement - A longitudinal exploration of the direction of influence. *Addictive Behaviors, 26*(2), 181-199.

Carlson, L. E., Goodey, E., Bennett, M. H., Taenzer, P., & Koopmans, J. (2002). The addition of social support to a community-based large-group behavioral smoking cessation intervention: improved cessation rates and gender differences. *Addict Behav, 27*(4), 547-559.

Clark, C. R., Kawachi, I., Ryan, L., Ertel, K., Fay, M. E., & Berkman, L. F. (2009). Perceived neighborhood safety and incident mobility disability among elders: the hazards of poverty. *BMC Public Health, 9*, 162.

Clarke, P., Ailshire, J. A., Bader, M., Morenoff, J. D., & House, J. S. (2008). Mobility disability and the urban built environment. *Am J Epidemiol, 168*(5), 506-513.

Clarke, P., Ailshire, J. A., & Lantz, P. (2009). Urban built environments and trajectories of mobility disability: findings from a national sample of community-dwelling American adults (1986-2001). *Soc Sci Med, 69*(6), 964-970.

Cornelissen, P. G., Rasker, J. J., & Valkenburg, H. A. (1988). The arthritis sufferer and the community: a comparison of arthritis sufferers in rural and urban areas. *Ann Rheum Dis, 47*(2), 150-156.

Davis, L. (2005). Disabilities in the workplace: recruitment, accommodation, and retention. *AAOHN J, 53*(7), 306-312.

Dijkers, M. P., Yavuzer, G., Ergin, S., Weitzenkamp, D., & Whiteneck, G. G. (2002). A tale of two countries: environmental impacts on social participation after spinal cord injury. *Spinal Cord, 40*(7), 351-362.

Dormann, C., & Zapf, D. (1999). Social support, social stressors at work, and depressive symptoms: Testing for main and moderating effects with structural equations in a three-wave longitudinal study. *Journal of Applied Psychology, 84*(6), 874-884.

Edwards, N., & Lockett, D. (2008). Development and validation of a modified falls-efficacy scale. *Disabil Rehabil Assist Technol, 3*(4), 193-200.

Epp, J. (1986a). Achieving Health for All - a Framework for Health Promotion. *Canadian Journal of Public Health-Revue Canadienne De Sante Publique, 77*(6), 393-407.

Epp, J. (1986b). *Achieving health for all: A framework for health promotion.* Ottawa: Health and Welfare Canada.

Gignac, M. A., & Cott, C. (1998). A conceptual model of independence and dependence for adults with chronic physical illness and disability. *Soc Sci Med, 47*(6), 739-753.

Gignac, M. A., Cott, C., & Badley, E. M. (2000). Adaptation to chronic illness and disability and its relationship to perceptions of independence and dependence. *J Gerontol B Psychol Sci Soc Sci, 55*(6), P362-372.

Graham, J. D., Corso, P. S., Morris, J. M., Segui-Gomez, M., & Weinstein, M. C. (1998). Evaluating the cost-effectiveness of clinical and public health measures. *Annu Rev Public Health, 19*, 125-152.

Gray, D. B., Hollingsworth, H. H., Stark, S., & Morgan, K. A. (2008). A subjective measure of environmental facilitators and barriers to participation for people with mobility limitations. *Disabil Rehabil, 30*(6), 434-457.

Guralnik, J. M., Fried, L. P., & Salive, M. E. (1996). Disability as a public health outcome in the aging population. *Annu Rev Public Health, 17*, 25-46.

Hair, J. F., Tatham, R. L., Anderson, R. E., & Black, W. (1998). *Multivariate data analysis with readings* (5th edition ed.): Prentice Hall.

Hancock GR, M. R. (2006). *Structural Equation Modeling: A Second Course*. Greenwich ct: Information Age Publishing Inc.

Harry, B. (1992). Making sense of disability: low-income, Puerto Rican parents' theories of the problem. *Except Child, 59*(1), 27-40.

Health Canada (1994). *Federal/Provincial/Territorial Advisory Committee on Population Health*. Ottawa: Health Canada.

Heim, D., Hunter, S. C., Ross, A. J., Bakshi, N., Davies, J. B., Flatley, K. J., et al. (2004). Alcohol consumption, perceptions of community responses and attitudes to service provision: results from a survey of Indian, Chinese and Pakistani young people in Greater Glasgow, Scotland, UK. *Alcohol Alcohol, 39*(3), 220-226.

Helms, L. B., & Helms, C. M. (1994). Medical education and disability discrimination: the law and future implications. *Acad Med, 69*(7), 535-543.

Holley, U. A. (2007). Social isolation: a practical guide for nurses assisting clients with chronic illness. *Rehabil Nurs, 32*(2), 51-56.

Hsu, H. C. (2007). Does social participation by the elderly reduce mortality and cognitive impairment? *Aging Ment Health, 11*(6), 699-707.

Hu, & Bentler (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Iliffe, S., Tai, S. S., Haines, A., Booroff, A., Goldenberg, E., Morgan, P., et al. (1993). Assessment of elderly people in general practice. 4. Depression, functional ability and contact with services. *Br J Gen Pract, 43*(374), 371-374.

Johnson, V., & Pandina, R. J. (2000). Alcohol problems among a community sample: Longitudinal influences of stress, coping, and gender. *Substance Use & Misuse, 35*(5), 669-686.

Katz, P. P., & Yelin, E. H. (2001). Activity loss and the onset of depressive symptoms: do some activities matter more than others? *Arthritis Rheum, 44*(5), 1194-1202.

Koster, A., Penninx, B. W., Newman, A. B., Visser, M., van Gool, C. H., Harris, T. B., et al. (2007). Lifestyle factors and incident mobility limitation in obese and non-obese older adults. *Obesity (Silver Spring), 15*(12), 3122-3132.

Lan, T. Y., Melzer, D., Tom, B. D., & Guralnik, J. M. (2002). Performance tests and disability: developing an objective index of mobility-related limitation in older populations. *J Gerontol A Biol Sci Med Sci, 57*(5), M294-301.

Lee, H. Y., Jang, S. N., Lee, S., Cho, S. I., & Park, E. O. (2008). The relationship between social participation and self-rated health by sex and age: a cross-sectional survey. *Int J Nurs Stud, 45*(7), 1042-1054.

Levasseur, M., Desrosiers, J., & St-Cyr Tribble, D. (2008). Do quality of life, participation and environment of older adults differ according to level of activity? *Health Qual Life Outcomes, 6*, 30.

Lindstrom, M., Hanson, B. S., & Ostergren, P. O. (2001). Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in shaping health related behaviour. *Soc Sci Med, 52*(3), 441-451.

Lindstrom, M., Moghaddassi, M., & Merlo, J. (2004). Individual self-reported health, social participation and neighbourhood: a multilevel analysis in Malmo, Sweden. *Prev Med, 39*(1), 135-141.

Manton, K. G., Stallard, E., & Corder, L. S. (1998). The dynamics of dimensions of age-related disability 1982 to 1994 in the U.S. elderly population. *J Gerontol A Biol Sci Med Sci, 53*(1), B59-70.

Manuel, D. G., Goel, V., Williams, J. I., & Corey, P. (2000). Health-adjusted life expectancy at the local level in ontario. *Chronic Dis Can, 21*(2), 73-80.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. . *Psychological Bulletin, 103*(3), 391-410.

Melzer, D., Gardener, E., & Guralnik, J. M. (2005). Mobility disability in the middle-aged: cross-sectional associations in the English Longitudinal Study of Ageing. *Age Ageing, 34*(6), 594-602.

Melzer, D., & Parahyba, M. I. (2004). Socio-demographic correlates of mobility disability in older Brazilians: results of the first national survey. *Age Ageing, 33*(3), 253-259.

Miller, M. E., Rejeski, W. J., Reboussin, B. A., Ten Have, T. R., & Ettinger, W. H. (2000). Physical activity, functional limitations, and disability in older adults. *Journal of the American Geriatrics Society, 48*(10), 1264-1272.

Mocellin, J., & Foggin, P. (2008). Health status and geographic mobility among semi-nomadic pastoralists in Mongolia. *Health Place, 14*(2), 228-242.

Mottram, S., Peat, G., Thomas, E., Wilkie, R., & Croft, P. (2008). Patterns of pain and mobility limitation in older people: cross-sectional findings from a population survey of 18,497 adults aged 50 years and over. *Qual Life Res, 17*(4), 529-539.

Nagi, S. (1965). *Some conceptual issues in disability and rehabilitation.* Washington D.C.: American Sociological Association.

Odding, E., Valkenburg, H. A., Stam, H. J., & Hofman, A. (2001). Determinants of locomotor disability in people aged 55 years and over: the Rotterdam Study. *Eur J Epidemiol, 17*(11), 1033-1041.

Peel, C., Sawyer Baker, P., Roth, D. L., Brown, C. J., Brodner, E. V., & Allman, R. M. (2005). Assessing mobility in older adults: the UAB Study of Aging Life-Space Assessment. *Phys Ther, 85*(10), 1008-1119.

Pope, A., & Tarlow, A. (Eds.). (1991). *Disability in America: Toward a National Agenda for Prevention.* Washington D.C.: National Academy Press.

Rolfe, D. E., Yoshida, K., Renwick, R., & Bailey, C. (2009). Negotiating participation: how women living with disabilities address barriers to exercise. *Health Care Women Int, 30*(8), 743-766.

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *Gerontologist, 37*(4), 433-440.

Sivan, M., & Bhakta, B. (2008). Restoring mobility: theories, technologies and effective treatments. *Clin Med, 8*(6), 596-600.

Slatkowsky-Christensen, B., Mowinckel, P., & Kvien, T. (2009). Health status and perception of pain: a comparative study between female patients with hand osteoarthritis and rheumatoid arthritis. *Scand J Rheumatol*, 1-7.

Statistic Canada (2001). Participation and Activity Limitation Survey.

Statistic Canada (2004). *2003 General Social Survey on Social Engagement, Cycle 17: An overview of Findings.* Ottawa: Statistics Canada.

Statistics Canada (2001). Participation and Activity Limitation Survey.

Statistics Canada (2005). *Population Projections for Canada, Provinces and Territories.*

Statistics Canada (2008). *The Daily, Tuesday, June 3, 2008. Participation and Activity Limitation Survey.*

Statistics Canada. (2005). *Population Projections for Canada, Provinces and Territories.*

Statistics Canada. (2006). Participation and Activity Limitation Survey.

Statistics Canada. (2007a). *The Daily, Monday, December 3, 2007. Participation and Activity Limitation Survey.*

Statistics Canada. (2007b). *Portrait of the Canadian Population in 2006, by Age and Sex: Provincial/Territorial populations by age and sex.*

StatisticsCanada (2007). *Portrait of the Canadian Population in 2006, by Age and Sex: Provincial/Territorial populations by age and sex.*

Strine, T. W., Chapman, D. P., Balluz, L., & Mokdad, A. H. (2008). Health-related quality of life and health behaviors by social and emotional support. Their relevance to psychiatry and medicine. *Soc Psychiatry Psychiatr Epidemiol, 43*(2), 151-159.

Tomey, K. M., & Sowers, M. R. (2009). Assessment of physical functioning: a conceptual model encompassing environmental factors and individual compensation strategies. *Phys Ther, 89*(7), 705-714.

Vandenakker, C. B., & Glass, D. D. (2001). Menopause and aging with disability. *Phys Med Rehabil Clin N Am, 12*(1), 133-151.

Vanleit, B. (2008). Using the ICF to address needs of people with disabilities in international development: Cambodian case study. *Disabil Rehabil, 30*(12-13), 991-998.

Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. *Soc Sci Med, 38*(1), 1-14.

Verbrugge, L. M., Rennert, C., & Madans, J. H. (1997). The great efficacy of personal and equipment assistance in reducing disability. *Am J Public Health, 87*(3), 384-392.

Vestergaard, S., Nayfield, S. G., Patel, K. V., Eldadah, B., Cesari, M., Ferrucci, L., et al. (2009). Fatigue in a representative population of older persons and its association with functional impairment, functional limitation, and disability. *J Gerontol A Biol Sci Med Sci, 64*(1), 76-82.

Visser, M., Goodpaster, B. H., Kritchevsky, S. B., Newman, A. B., Nevitt, M., Rubin, S. M., et al. (2005). Muscle mass, muscle strength, and muscle fat infiltration as predictors of incident mobility limitations in well-functioning older persons. *J Gerontol A Biol Sci Med Sci, 60*(3), 324-333.

Voigt, K., Twork, S., Mittag, D., Gobel, A., Voigt, R., Klewer, J., et al. (2009). Consumption of alcohol, cigarettes and illegal substances among physicians and medical students in Brandenburg and Saxony (Germany). *BMC Health Serv Res, 9*, 219.

Vollrath, M. (1998). Smoking, coping and health behavior among university students. *Psychology & Health, 13*(3), 431-441.

Wang, J., & Patten, S. B. (2001). A prospective study of sex-specific effects of major depression on alcohol consumption. *Can J Psychiatry, 46*(5), 422-425.

Wang, P. P., & Badley, E. M. (2002). Contribution of chronic conditions to aggregate changes in old-age functioning. *Am J Public Health, 92*(1), 7-8.

Wang, P. P., Badley, E. M., & Gignac, M. (2006). Exploring the role of contextual factors in disability models. *Disabil Rehabil, 28*(2), 135-140.

Westhoff, G., Listing, J., & Zink, A. (2000). Loss of physical independence in rheumatoid arthritis: interview data from a representative sample of patients in rheumatologic care. *Arthritis Care Res, 13*(1), 11-22.

WHO (1980). *International classification of impairments, disabilities, and handicaps : a manual of classification relating to the consequences of disease.* Geneva: World Health Organization.

WHO (2001a). *International Classification of Fucntioning, Disability, and Health (ICF).* Geneva: World Health Organization.

WHO (2001b). *International Classification of Functioning, Disability and Health (ICF).* Geneva: World Health Organization.

WHO (2002). *Active ageing: A policy framework.* Geneva.

WHO (2006). *Disability And Rehabilitation WHO Action Plan 2006-2011*. Geneva: World Health Organization.

Wilkie, R., Peat, G., Thomas, E., & Croft, P. (2007). Factors associated with participation restriction in community-dwelling adults aged 50 years and over. *Qual Life Res, 16*(7), 1147-1156.

World Health Organization (2001). *International Classification of Functioning, Disability and Health: ICF*. Geneva: WHO.

Yeom, H. A., Fleury, J., & Keller, C. (2008). Risk factors for mobility limitation in community-dwelling older adults: a social ecological perspective. *Geriatr Nurs, 29*(2), 133-140.

CHAPTER 7 DISCUSSIONS AND CONCLUSIONS

This study described the health status of elderly Canadians with mobility disabilities, including lifestyle patterns and the impact of environmental factors on activity dependence and participation restrictions based on the WHO ICF framework. This population presented different patterns of sociodemographic characteristics, personal factors, lifestyle behaviors, and participation and activity behaviors. We found that among Canadians 65 years and older, and with mobility disabilities: 62.60% were female; age intervals of 65 to 75 and 75 to 85 both comprised more than 40%, while the rest of 15% were 85 years and older; 41.03% reported having more-severe disability level; only 15.58% had annual income of higher than $30,000 from all sources in the calendar year of 2001; 68.31% had pain accompanied with mobility impairments; 78.7% were active in out-of-home social participations; 12.55% of those with less-severe mobility disabilities smoked, and the proportion was 11.57% among those with more-severe disability level; in terms of alcohol consumption, 19.37% with less-severe disability drank at least once per week, and 12.85% among more-severe impaired elderly. Such specific patterns of contextual factors, participation restrictions, activity limitations and functioning impairment interact and contribute to the health outcomes of this study population.

Mobility disability performed differently in lifestyle patterns - smoking status was relatively the same regardless of the severity of the mobility disability based on both descriptive statistics and adjusted odds ratios; however, with an increase on the mobility disability scale, persons were less likely to regularly consume alcohol. Furthermore, comparing with the general older adults in Canada, we found there were no significantly

differences in the prevalence of smoking but a great reduction in alcohol consumption. Such differences may partially due to the social context – mobility disability could cause social isolation which may limit social connections and behaviors, thus alcohol consumption, which carried more social content than smoking, was significantly influenced due to the physical functioning impairment. Other factors including social participation, income, gender, and living status also potentially influenced the two lifestyle patterns. Although research indicates that smoking and alcohol consumption patterns are often positively correlated with each other, this study suggested that these two lifestyle patterns can be inversely associated and should be evaluated separately in terms of health issues for individuals with mobility disability.

Both participation restrictions and activity limitations correlate with contextual factors including personal factors and environmental factors based on the WHO ICF framework. The study suggested that the lack of environmental facilitators, or barriers in design and the layout of home were significantly and positively associated with out-of-home social participation restrictions among elderly individuals living with partners and self-reported mobility disabilities, after adjusting to contextual factors and functioning impairment. However, such association was not significant among individuals living alone but more pronounced among individuals living with partner(s). Living status and pain also impacted on evacuating everyday activities independently and out-of-home social behaviors.

For the use of assistive aids and devices, such facilitators completely mediated the effect

of disability level on dependent activities, which means, the severity level of mobility disability had no direct effect on activity dependence but only through the pathway of environmental facilitators at significance level of 0.05. Thus, further health policies and strategies are called for to reduce such environmental barriers to prevent negative health outcomes of mobility disabilities, and finally lead to minimize mobility limitations to reach a better quality of life.

To sum up, the study relied on national surveys thus having comparatively large sample size to represent the Canadian elderly population. Although the study was limited to its nature of cross-sectional design and non-availability of necessary information due to the application of a secondary dataset, it carefully examined the WHO ICF model in a sample of Canadian adults aged 65 and over. Thus, it certainly provided implications on decision making and public health policy to benefit the population health of this specific population especially in the design and provision of environmental facilitators. In addition, considering the limitations of the study, researchers cannot engage in making observations and developing concepts, I would suggest further research which offers researchers more flexibility would be recommended, including qualitative research to explore the needs of this population, and studies containing a time component and the design of questionnaires, which make efforts in reducing potential bias and address causal relationship between determinants and health outcomes.

APPENDIX

1. QUESTIONNAIRE OF THE PARTICIPATION AND ACTIVITY LIMITATION SURVEY 2001 (RELEVANT PART ONLY, DERIVED VARIABLES NOT INCLUDED)

Participation and Activity Limitation Survey – 2001 (Adults – 15 and over)

FORM 02

Collected under the authority of the Statistics Act, Statutes of Canada, 1985, Chapter S-19.

INTRODUCTION

Statistics Canada is conducting a survey on Canadians whose day-to-day activities may be limited because of a condition or health problem. Survey results will help to identify difficulties and barriers these Canadians may face. To reduce the number of questions we need to ask, the Census information collected last May will be added to the information provided in this interview. All information will be kept confidential and used for statistical purposes only. While your participation is voluntary, your assistance is very important to ensure that the results are accurate.

CONFIDENTIAL WHEN COMPLETED

First name(s) | Initial(s) | Family name

Sex: Male ☐ Female ☐

Date of Birth: Year | Month | Day

Telephone: Area code | Telephone No.

Address:

Number and Street or lot and concession or exact location | Apt. No.

City, Town, Village or Municipality | Province or Territory | Postal Code

Number of residents in the household: Adults (15 and over) ☐☐ Children (0-14) ☐☐

INFORMATION SOURCE

Source:
- (1) Respondent ... ○
- (2) Respondent (via interpreter) ... ○
- (3) Proxy ... ○

Proxy information

Relationship to respondent:
- (1) Parent ... ○
- (2) Guardian ... ○
- (3) Child ... ○
- (4) Other household member ... ○
- (5) Other, specify ... ○

Reason for proxy:
- (1) Does not speak English or French ... ○
- (2) Unable to respond ... ○
- (3) Absent – duration of survey ... ○
- (4) Parent wishes to respond for child (15 or older) ... ○

Proxy name:

First name(s)

Family name

Statistics Canada / Statistique Canada

Canada

SECTION A — FILTER QUESTIONS

A1. **Do you (Does .....) have any DIFFICULTY hearing, seeing, communicating, walking, climbing stairs, bending, learning or doing any similar activities?**

Interviewer: Read list.

(1) Yes, sometimes .... ○ ▶ Check box General – Limitation on Profile Sheet
(2) Yes, often ..... ○
(3) No ..... ○
(x) Don't know ..... ○
(r) Refusal ..... ○

A2A. **Does a physical condition OR mental condition OR health problem REDUCE THE AMOUNT OR THE KIND OF ACTIVITY you (.....) can do at home?**

Interviewer: Read list.

(1) Yes, sometimes .... ○ ▶ Check box General – Limitation on Profile Sheet
(2) Yes, often ..... ○
(3) No ..... ○
(x) Don't know ..... ○
(r) Refusal ..... ○

A2B. **Does a physical condition OR mental condition OR health problem REDUCE THE AMOUNT OR THE KIND OF ACTIVITY you (.....) can do at work or at school?**

Interviewer: Read list.

(1) Yes, sometimes .... ○ ▶ Check box General – Limitation on Profile Sheet
(2) Yes, often ..... ○
(3) No ..... ○
(5) Not applicable ..... ○
(x) Don't know ..... ○
(r) Refusal ..... ○

A2C. **Does a physical condition OR mental condition OR health problem REDUCE THE AMOUNT OR THE KIND OF ACTIVITY you (.....) can do in other activities, for example, transportation or leisure?**

Interviewer: Read list.

(1) Yes, sometimes .... ○ ▶ Check box General – Limitation on Profile Sheet
(2) Yes, often ..... ○
(3) No ..... ○
(x) Don't know ..... ○
(r) Refusal ..... ○

F1. **This section will collect information on your (..... 's) day to day activities such as leisure and recreation, unpaid voluntary activities, local and long distance transportation and housing facilities.**

I'll start with a few questions concerning your (..... 's) health in general.

In general, would you say your (..... 's) health is:

Interviewer: Read list. Mark one only.

(1) excellent? ..... ○
(2) very good? .... ○
(3) good? ..... ○
(4) fair? ..... ○
(5) poor? ..... ○
(x) Don't know .... ○
(r) Refusal ..... ○

F2. **Do you (Does .....) smoke cigarettes?**

Interviewer: Read list. Mark one only.

(1) Not at all ..... ○
(2) Regularly, that is usually every day .... ○
(3) Occasionally, not every day? ..... ○
(x) Don't know ..... ○
(r) Refusal ..... ○

F3. **Now I would like to ask you (.....) a question about alcohol consumption. When I use the word drink, it means one beer, one small glass of wine or 1½ ounces of liquor.**

In the past twelve months, how often have you (has .....) had a drink?

Interviewer: Read list.

(1) Never ..... ○
(2) Every day ..... ○
(3) 4 to 6 times a week ..... ○
(4) 2 to 3 times a week ..... ○
(5) Once a week ..... ○
(6) Once or twice a month ..... ○
(7) Less than once a month .... ○
(x) Don't know ..... ○
(r) Refusal ..... ○

F6. **In the past 12 months, how often did you (.....) participate in any of the following activities OUTSIDE YOUR (HIS/HER) HOME?**

Interviewer: Read categories. Mark one only.

Interviewer: Read list.	(1) Every-day	(2) At least once a week	(3) At least once a month	(4) Less than once a month	(5) Never	(x) DK	(r) Ref
(a) visit family or friends	○	○	○	○	○	○	○
(b) do physical activities such as exercise, walk or play sports	○	○	○	○	○	○	○
(c) do hobbies outside the home such as playing cards, bridge or bingo	○	○	○	○	○	○	○
(d) shop	○	○	○	○	○	○	○
(e) attend sporting or cultural events, such as plays or movies		○	○	○	○	○	○
(f) take personal interest courses	○	○	○	○	○	○	○
(g) visit museums, libraries or national or provincial parks		○	○	○	○	○	○
(h) travel for business or personal reasons		○	○	○	○	○	○

Housing

F44. **I am now going to ask you (.....) some questions about your (his/her) residence and any specialized features you (he/she) may have.**

Because of your (.....'s) condition, do you (does .....) use any specialized features to enter or leave your (his/her) residence, or inside your (his/her) residence?

(1) Yes ..... ○
(3) No ..... ○
(x) Don't know .... ○ ▶ **Go to F47**
(r) Refusal ..... ○

F45. **Do you (Does .....) now use:**

Interviewer: Read list. Mark all that apply.

	(1) Yes	(3) No	(x) DK	(r) Ref
(a) ramps or street level entrances?	○	○	○	○
(b) automatic or easy to open doors (includes lever handles)?	○	○	○	○
(c) widened doorways or hallways?	○	○	○	○
(d) elevator or lift device?	○	○	○	○
(e) visual alarms or audio warning devices?	○	○	○	○
(f) grab bars or a bath lift (in the bathroom)?	○	○	○	○
(g) lowered counters in the kitchen?	○	○	○	○
(h) other, specify	○	○	○	○

F46. **Do you (Does .....) need any other specialized features, which you do (he/she does) not already have?**

(1) Yes ..... ○ → **Go to F48**
(3) No ..... ○
(x) Don't know .... ○ ▶ **Go to F50**
(r) Refusal ..... ○

F47. **Are there any specialized features that you NEED (..... NEEDS) but do not have (does not have)?**

(1) Yes ..... ○
(3) No ..... ○
(x) Don't know .... ○ ▶ **Go to F50**
(r) Refusal ..... ○

F48. **Which specialized features do you (does .....) need, but do(es) not have?**

Interviewer: Read list. Mark all that apply.

	(1) Yes	(3) No	(x) DK	(r) Ref
(a) Ramps or street level entrances	○	○	○	○
(b) Automatic or easy to open doors (includes lever handles)	○	○	○	○
(c) Widened doorways or hallways	○	○	○	○
(d) Elevator or lift device	○	○	○	○
(e) Visual alarms or audio warning devices	○	○	○	○
(f) Grab bars or a bath lift (in the bathroom)	○	○	○	○
(g) Lowered counters in the kitchen	○	○	○	○
(h) Other, specify	○	○	○	○

F50. **Has the design and layout of your (..... 's) home, including entrance and exits, made it difficult to participate in the activities you (he/she) want(s) or need(s) to do? (INCLUDE ALL activities of daily living, not just leisure or recreational activities.)**

(1) Yes ○
(3) No ○
(x) Don't know ○ → **Go to F53**
(r) Refusal ○

2. QUESTIONNAIRE OF CANADIAN COMMUNITY HEALTH SURVEY 2003 (RELEVANT PART ONLY)

SMK_Q202
SMKC_202 **At the present time, [do/does] [you/FNAME] smoke cigarettes daily, occasionally or not at all?**

1	Daily	
2	Occasionally	(Go to SMK_Q205B)
3	Not at all	(Go to SMK_C205D)
	DK, R	(Go to SMK_END)

ALC_Q1
ALCC_1 **During the past 12 months, that is, from [date one year ago] to yesterday, [have/has] [you/FNAME] had a drink of beer, wine, liquor or any other alcoholic beverage?**

1 Yes
2 No (Go to ALC_Q5B)
DK, R (Go to ALC_END)

ALC_Q2
ALCC_2 **During the past 12 months, how often did [you/he/she] drink alcoholic beverages?**

1 Less than once a month
2 Once a month
3 2 to 3 times a month
4 Once a week
5 2 to 3 times a week
6 4 to 6 times a week
7 Every day
DK, R

3. PALS 2001 SUMMARY OF DISABILITY SCALE

An index for measuring the severity of disability was constructed on the basis of responses to the screening questions for the 2001 PALS. This document presents the methodology used to construct the adult disability index.

3.1 TYPES OF DISABILITY

To construct the index, ten types of disabilities were considered: hearing, seeing, communication, mobility, agility, pain and discomfort, learning difficulties, memory problems, developmental disability and psychological conditions.

Points are assigned to each question on the basis of severity. For some types of disability, more than one question is asked. Each of these questions seeks to measure a functional limitation related to the disability. Thus, for example, to measure hearing-related disability, three questions are asked:

(1) How much difficulty do you have hearing what is said in a conversation with one other person?

(2) How much difficulty do you have hearing what is said in a conversation with at least three other persons?

(3) How much difficulty do you have hearing what is said in a telephone conversation?

A score is thus derived for each of these questions. Further on, we will see how these scores are then combined to obtain a single score per type of disability. Table 1 below shows the number of functional limitations measured by the PALS questionnaire by type of disability as well as the contexts for which these questions are asked.

Table 1 Number of functional limitations and contexts by type of disability

Type of disability	**Variable names**	**Functional limitations**	**Contexts**
(A) Hearing	HEAR	3	General
(B) Seeing	SEE	2	General
(C) Communication	COMM	2	Family, friends, services and other
(D) Mobility	MOBI	5	General
(E) Agility	AGIL	7	General
(F) Pain and discomfort	PAIN	1	Home, work, school and other
(G) Learning	LEAR	1	Home, work, school and

			other
(H) Memory	MEMO	1	Home, work, school and other
(I) Developmental	DEVE	1	Home, work, school and other
(J) Psychological	PSYC	1	Home, work, school and other

3.2 SCORES

Some questions measure the intensity of the disability, while others instead measure the frequency of its presence. Both types of questions are used in calculating scores. Points are assigned to each question on the basis of severity. Thus, when there is no disability, no points are assigned. Conversely, the maximum score is given for total disability. For example, for an intensity question, scores are assigned as follows:

Some difficulty - 1 point

A lot of difficulty - 2 points

Completely unable - 3 points

Other answer (no, refusal, don't know) - 0 points

For a frequency question, points are assigned as follows:

Yes, sometimes - 1 point

Yes, often or always - 2 points

Other answer (no, refusal, don't know) - 0 points

When both intensity and frequency are available for a given type of disability, the product of the scores for the two questions is used.

For each type of disability, a single value is required. Take, for example, the case of hearing, for which three different questions are asked: "How much difficulty do you have hearing what is said in a conversation with one other person?" (HEAR1), "How much difficulty do you have hearing what is said in a conversation with at least three other persons?"(HEAR2) and "How much difficulty do you have hearing what is said in a telephone conversation?" (HEAR3). Here the three scores must be combined in order to have only one score. The same is true for questions asked in different contexts: these sub-questions must be combined to have only one score for each type of disability. For example, for learning difficulties, the same question is asked for four contexts: home, work, school and other.

Since the number of questions varies depending on the disability, we standardized the indices by type of disability, so as not to over-represent types for which there are numerous questions. We do not want to assign more weight to one type of disability than to another. Where there is more than one question for a given type, the scores for these questions are summed and the sum is then standardized to obtain a score that lies between 0 and 1:

$$S_T = \left(\frac{1}{\sum_{i=1}^{N} M_{T_i}} \right) \sum_{i=1}^{N} S_{T_i} \qquad (1a)$$

where S_T is the score for disability type T, N is the number of different questions (functional limitations) for type T, M_{T_i} is the maximum score for the i^{th} question for disability type T and S_{T_i} is the score obtained for the i^{th} question for disability type T. In some cases, S_{T_i} may be made up of more than one question. When the same question is asked in different contexts, we take the mean of the scores for each of the contexts. For example, for learning difficulties, since the same question is asked four times, we take the mean of the four scores:

$$S_{T_i} = \frac{1}{C_{T_i}} \sum_{j=1}^{C_{T_i}} S_{T_{ij}} \qquad (2a)$$

where C_{T_i} is the number of different contexts in which the i^{th} question of disability type T is asked and $S_{T_{ij}}$ is the score for question i and context j of type T.

The following is an example for communication-related disability (T=COMM). This type of disability is made up of two different questions ($N = 2$), COMM1 (*difficulty speaking*) and COMM2 (*difficulty making yourself understood*). COMM1 is asked in a general context ($C_{T_1} = 1$), whereas COMM2 is asked in four different contexts (*family, friends,*

professional services, and other) ($C_{T_2} = 4$). The maximum value of COMM1 is 3, while the maximum value of COMM2 is 2 ($M_{T_1} = 3$, $M_{T_2} = 2$):

$$COMM = \frac{1}{(3+2)}(COMM_1 + COMM_2) \qquad (1b)$$

where $COMM_1$ is asked in a general context and where:

$$COMM_2 = \frac{1}{4}(COMM_{2\ family} + COMM_{2\ friends} + COMM_{2\ services} + COMM_{2\ other}) \quad (2b)$$

3.3 FILTER QUESTIONS

For respondents who have a non-nil index value based on the screening questions, no additional points are assigned for answers to the filter questions. But for respondents who have no points based on the screening questions *(that is, basically the "yes-no's", YES at the filter questions and NO to the screening questions*), points are assigned on the basis of the four filter questions. The overall score for the filter questions is calculated in the same way as for the types of disability, based on the expressions (1a) and (2a). In this case, we have $N = 2$, $M_{T_1} = M_{T_2} = 2$, $C_{T_1} = 1$ and $C_{T_2} = 3$.

3.4 IMPUTATION OF THE "UNDETERMINED"

For some respondents, we have enough information to know that they have a certain type of disability but the information for them is incomplete because either intensity, frequency or both are missing. They were initially assigned an "undetermined" flag and a score of 0, with the intention of imputing them after a score was calculated for all those for which the information was complete.

For imputation, we decided to confine ourselves to a relatively simple technique. It consists in looking for a group of respondents having the same responses to certain questions as the respondent to be imputed and imputing the mean of their scores. Here are a few examples:

(a) A respondent has answered "Yes, sometimes" to Question B41 (difficulty walking), but he has not answered Question B42 on the intensity of the disability. Among all the respondents for whom the information is complete for these two questions, we look for those who have the same response to Question B41. We then take the mean of the scores for this disability and impute this value to the "undetermined" respondent.

This type of action is justified by the fact that there is a correlation between the frequency question and the intensity question. A person who answers "Yes, often or always" to the frequency question is more likely to answer "Completely unable" or "A lot of difficulty" to the intensity question than persons who answered "Yes, sometimes" to the frequency question.

(b) A respondent has a "Yes undetermined" to Question B41 (code '4') but has given a valid response of "Some difficulty" to Question B42. Among all respondents for whom the information is complete for these two questions, we look for those who have the same response to Question B42. We then take the mean of the scores for this disability and impute this value to the respondent who has a "Yes undetermined" to Question B41.

The justification for this type of action is the same as in the preceding example.

3.5 SPECIAL CASES

There are some types of disability for which we ask,

A) Whether a given condition reduces the quantity or number of activities that a respondent can engage in (frequency question).

If the answer is yes, we then ask,

B) How many activities does this condition prevent (at home, at work, at school, elsewhere).

A respondent is considered limited if he/she answers "Yes" to A). However, the respondent may answer "None" to each of the four contexts in question B). This situation is not corrected by the rules during processing. Since the points on the scale are assigned

on the basis of the combined response to A) and B) (generally the product of the two), no points are assigned to persons in this situation (since B=0), even though they are considered as being limited for the type of disability concerned. Thus, overall, a respondent may be limited for two types of disability but have points for only one type or even, in some cases, for neither type.

We decided to assign a minimum number of points to these respondents for the types of disability for which this problem arises. Accordingly, we assign one point to everyone who answered "Yes" to A), and then we calculate the score for B) as presented above. For example, if the maximum score for a given type of disability is 6 (frequency (2) X intensity (3)), then with this change, the maximum score becomes 7 and respondents who have a "Yes" for A) and "None" for B) have a score of 1. To summarize,

"Yes" to A) and "None" to each question in B) - 1 point

"Yes" to A) and at least one answer to B) - 1 point + points assigned to B)

In this way, respondents who answered "None" throughout B) will necessarily have the lowest score, since they have points only because of A).

For some types of disability, a respondent is considered limited (and is assigned points accordingly) if a disability is reported even though there is no limitation. In such cases (learning difficulty and developmental disability), a point is still assigned even if the answer to the frequency question is negative. These special cases, along with the

questions for which an additional point is assigned for a "Yes," are shown in Table 2, below.

Table 2 Special cases

Type of disability	Variable	Question for which a point is assigned for a "yes"
Communication	COMM2	B30 or B32
Pain and discomfort	PAIN	B75
Learning	LEAR	B77 or B78
Memory	MEMO	B86
Developmental	DEVE	B88
Psychological	PSYC	B92

3.6 CONSTRUCTION OF INDEX

We observed an important relationship between learning difficulties and developmental disability. For a majority of persons with developmental disability, a learning difficulty was also reported. We therefore decided that when points are assigned to a respondent for a developmental disability, points cannot also be assigned for learning difficulties.

The overall score is calculated taking the average of all standardized scores. Unlike what was done in the case of children, where the presence of two age groups not having the same questions requires that two scales be calculated, the score for adults is calculated in the same way for respondents of all ages:

$$SI = \frac{1}{9}\begin{pmatrix} S_{HEAR} + S_{SEE} + S_{COMM} + S_{MOBI} + S_{AGIL} + S_{PAIN} + \\ I_{DEVE} S_{LEAR} + S_{MEMO} + S_{DEVE} + S_{PSYC} \end{pmatrix} \quad (3)$$

where $$I_{DEVE} = \begin{cases} 0 & if \ S_{DEVE} \neq 0 \\ 1 & if \ S_{DEVE} = 0 \end{cases}$$

This scale is derived for people who has an affirmative answer to the screening questions (the "yes-yes" group and the "no-yes" group) only. For the "yes-no" group, only the filter questions are used to calculate the score, and these questions are considered to represent an additional disability:

$$SI_{YN} = \frac{1}{10} S_{FILT} \quad (4)$$

The reason why we did not consider the filter questions in (3) is that it is not desirable to have redundant information. For example, a person who has a disability related to mobility has probably answered "Yes" to the filter questions, thinking of his/her mobility-related disability (the filter questions being general in nature) and also answered "Yes" to the mobility questions.

For the "yes-no" group, the reason why they did not answer "Yes" to the screening questions is probably that we are unable to measure their type of disability with our questionnaire or that they had too mild a disability to be reported in the screening

questions. For this reason, we dealt with them separately and assigned a relatively low score.

A few results concerning the overall index are shown in tables 3 and 4. First, Table 3 presents descriptive statistics according to the number of disabilities reported. Thus, for a given number of disabilities, it shows the number of respondents having that number of disabilities, the mean and the standard deviation from the overall index for these respondents, as well as the minimum and maximum values. As may be seen, the mean increases with the number of disabilities, which is entirely desirable. The same is true for the standard deviation. When the number of disabilities is large, there may be people who have several mild disabilities and other that are quite severe, and who have a high score for a number of disabilities.

Table 3 Descriptive statistics by number of disabilities (unweighted data)

Disability	**Frequency (%)**		**Mean**	**Minimum**	**Maximum**	**Standard Deviation**
No disability	6,886	(23.7)	0.00000	0.00000	0.00000	0.00000
One disability	3,900	(13.4)	0.02866	0.00265	0.11111	0.02111
Filters only	729	(2.5)	0.03276	0.00833	0.10000	0.01967
Two disabilities	4,207	(14.5)	0.05649	0.00635	0.22222	0.03541
Three	6,066	(20.8)	0.10208	0.01869	0.33333	0.05424

disabilities						
Four disabilities	3,799	(13.1)	0.15436	0.03457	0.44444	0.07026
Five disabilities	1,974	(6.8)	0.21866	0.06058	0.53968	0.09345
Six disabilities	873	(3.0)	0.28476	0.09806	0.66667	0.11029
Seven disabilities	451	(1.5)	0.36129	0.11085	0.76111	0.13428
Eight disabilities	181	(0.6)	0.43153	0.19339	0.79574	0.14654
Nine disabilities	45	(0.2)	0.52122	0.23408	0.96296	0.16628
Total	29,111					

Table 4 shows, by number of disabilities, the proportion of respondents having each of the disabilities identified. Thus, row 1 of the table shows that among persons with one disability, 27.6% have a disability related to hearing, 4.0% a disability related to seeing, 1.1% to communication, etc. As may be seen, disabilities such as PAIN, HEAR and MOBI are often unaccompanied by other disabilities (28.1%, 27.6% and 20.3% respectively). Also, MOBI, AGIL and PAIN are often present together, since the rates are similar in each row starting with row 2.

Other approaches were considered in order to limit the redundancy of the information contained in the severity scale. In addition to the strong relationship between developmental disability and learning disability, there are other significant correlations between some disability types in the scale. For example, there is a strong correlation between mobility difficulties, agility difficulties and pain and discomfort. Thus, in many cases, a person who has mobility problems also has some pain and discomfort. On the other hand, seeing or hearing difficulties are more often encountered on their own.

In order to remove redundancy of information, an unequally weighted scale was considered. Instead of having a weight of 1, disability types that are strongly correlated would have a smaller weight in the global score. Since it is difficult to justify the use of unequal weights in the scale, this option was rejected.

Table 4 Frequency of different types of disability by number of disabilities (weighted data)

Disability	**Hearing**	**Seeing**	**Communication**	**Mobility**	**Agility**	**Pain**	**Learning**	**Memory**	**Developmental**	**Psychological**
One disability	27.6%	4.0%	1.1%	20.3%	9.4%	28.1%	3.9%	0.6%	0.9%	4.1%
Two disabilities	20.5%	7.4%	4.7%	55.7%	42.5%	54.0%	5.0%	1.8%	1.5%	6.9%
Three disabilities	16.5%	7.7%	4.0%	88.1%	86.2%	83.1%	3.4%	3.2%	1.8%	5.9%
Four disabilities	45.1%	25.6%	11.4%	92.4%	91.7%	87.9%	10.3%	11.6%	4.4%	19.6%
Five	53.7	44.4	23.7%	95.4	92.2	90.7	22.4	35.0	5.8%	36.7%

disabilities	%	%		%	%	%	%	%		
Six disabilities	51.4%	47.9%	41.7%	97.0%	95.1%	90.0%	47.7%	64.3%	10.4%	54.6%
Seven disabilities	59.1%	58.7%	63.7%	98.3%	96.5%	94.4%	54.5%	81.3%	24.2%	69.2%
Eight disabilities	77.9%	86.7%	82.5%	99.8%	100.0%	99.4%	55.6%	94.3%	30.3%	73.4%
Nine disabilities	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	94.0%	100.0%	6.0%	100.0%

3.7 CREATION OF CLASSES

In order to create severity classes, the distribution of the global severity score was examined. The distribution has been separated into deciles. The first decile corresponds to the 10% of people with activity limitation with the lowest scores. The second decile corresponds to the next 10% of people with activity limitation with the lowest scores, etc. The average score was calculated for each decile and a plot of this average score as a function of the decile was produced in Figure 1.

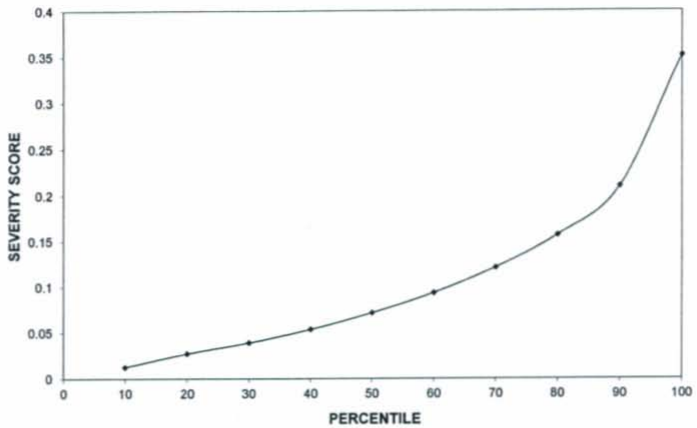

Figure 1 Distribution of the global score for the adults

As can be seen in Figure 1, no obvious cut-off points in the global severity score distribution exist. Several techniques were considered in order to create the severity classes. However, given the continuous nature of the severity curve and because it was desirable to employ a strategy that users would readily understand, we were unable to enter into exhaustive analyses, and we had to confine ourselves to a relatively intuitive approach. Thus, the severity classes were essentially determined by means of a graphic analysis of the data.

After discussion with some data users, it was decided that the disability scale should be cut into four severity classes, Class #1 being the less severe and Class #4 the most severe. The creation of the classes has been done in two steps.

In a first step, an attempt was made to identify a "natural cut-off point" in the scale. Although this is not obvious, one can note that the beginning of the distribution is fairly linear up to 70th percentile and then, the slope starts to increase more and more rapidly. This cut-off point in the trend of the distribution seems to correspond to a score around 1/9. This particular score corresponds to the score of someone with the maximum score for one type of disability and no points for the other types. Many such cases were found in the sample. Of course, there is a number of ways to obtain a score of 1/9. Because of the particular interpretation of this point, the cut-off was chosen to be exactly 1/9. This cut-off creates two groups: 1) Least severe: SI < 1/9; and 2) Most severe: 1/9 $\leqslant$SI $\leqslant$ 1.

For example, a person with a total disability related to seeing ($S_{VUE}=1$), but with no other disability, would fall into the most severe group. Table 5 shows the number of persons in this situation as well as the types of disability concerned. It also shows the number of persons who have more than one disability with a maximum score and no points for other disabilities. Thus, there are only 62 cases where there is a score of 1 for a one disability and where the nine other types are nil. Problems of hearing (11 cases), seeing (22 cases) and pain and discomfort (17 cases) are the severe disabilities most often unaccompanied by others.

Table 5 Number of cases for which the maximum score was assigned for a given number of disabilities and a nil score for all others (unweighted data)

Number of	Frequency	Hearing	Seeing	Communication	Mobility	Agility	Pain	Learning	Memor	Developmental	Psychological

disabilities									y		
1	62	11	22	1	1		17	1		2	7
2	4			1			1	1	1	3	1
3	4		1	1	2	2	2		1	2	1
4	2			2	2	2		1		1	
6	1				1	1	1	1	1		1

We then separated these two groups into two parts. These two boundaries correspond to respectively half and double the maximum score obtained for a given disability. Thus, respondents who have a score lower than half the maximum score for a disability are included in Class 1, while those who have a score that lies between half the maximum score for a disability and the maximum score for that disability are in Class 2. Those whose score lies between the maximum score for a disability and double that score are in Class 3; while those with a score greater than double the maximum score for a disability are in Class 4: 1) Class 1: $SI < 1/18$; 2) Class 2: $1/18 \leq SI < 1/9$; 3) Class 3: $1/9 \leq SI < 2/9$; and 4) Class 4: $1/9 \leq SI < 1$.

The advantage of this classification system is that it is easy for all users to understand and interpret. In light of the subjective nature of such a system, we preferred not to use specific terms to characterize the classes, so as to avoid misinterpretations. The only possible interpretation of these classes is that according to our measurement tool, persons in Class 4 have a more severe disability than persons in Class 3, who in turn have a more severe

disability than persons in Class 2, and so forth. However, for practical purposes, these classes were assigned names. We use the terms "mild," "moderate," "severe" and "very severe" to designate classes 1 to 4 in that order. It should be noted that there is no judgment associated with the use of this terminology; the classes of severity depend on the way in which the scale is constructed.