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# Low Social Support as a Risk Factor for a Major Depressive Episode in Canadian Community Dwelling Seniors

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Low Social Support as a Risk Factor for a Major Depressive Episode in Canadian Community  
Dwelling Seniors

by

Trevor Matthew Gregory Cook

A THESIS

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## Abstract/Executive Summary

**Background:** The proportion of Canadians aged 65 years of age and older is rapidly growing. While major depression has consistently been identified in the literature as a major health concern, little research exists on geriatric depression in Canada. Current research on risk factors for depression in seniors has been generated almost exclusively through cross-sectional studies. A small number of longitudinal studies have been conducted, though their applicability is limited by short study periods, strictly defined study populations, and focus on only one or two potential risk factors. No longitudinal studies on seniors' depression have been conducted in Canada at the population level despite the availability of data to do so (the National Population Health Survey, or NPHS). Using the NPHS, this thesis explored the relationship between social support and major depression in Canadian community-dwelling seniors.

**Methods:** I assessed types and levels of social support using the Medical Outcomes Study Social Support Survey. Major depressive episode (MDE) in the past 12-months was assessed using the Composite International Diagnostic Interview – Short Form for Major Depression (CIDI-SFMD) and Anatomic Therapeutic Classification (ATC) Drug codes for anti-depressant usage. Demographic characteristics and health characteristics of respondents and non-respondents were examined and compared. The 12-month prevalence and 2- and 8-year incidence proportions of MDE were estimated. Multivariate logistic regression modeling was used to examine the association between social support and the 8-year risk of MDE.

**Results:** In participants aged 65 years of age and older, the 12-month prevalence of MDE was 6.50% (95% CI 5.28%-7.63%). The 2-year and 8-year incidence of MDE was estimated to be 4.54% (95% CI 3.38%-5.60%), and 13.09% (95% CI 11.27%-14.90%), respectively. Incidence was higher among women, those with a chronic condition, those with a restriction to activity, a pain problem or a mobility problem. In multivariate modeling low positive social interaction (OR 1.59, 95% CI 1.12-2.25, p=0.009) and low emotional social support (OR 1.53, 95% CI 1.09-2.14, p=0.013) were significantly associated with the risk of MDE. The association between tangible social support and MDE was modified by income (OR 0.2.70, p=0.019), with those of low income and low tangible support at higher risk of MDE (OR 2.66, 95% CI 1.02-6.89, p=0.044). The relationship between both tangible support (OR 0.43, p=0.025) and affection support (OR 0.35, p=0.008) with MDE was modified by the presence of a pain problem. In both cases, social support was not related to MDE if a pain problem was present. Among those without a pain problem, low tangible social support (OR 2.63, 95% CI 1.03-6.75, p=0.044) and low affection social support (OR 2.09, 95% CI 1.33-3.28, p=0.001) was associated with higher risk of MDE.

**Conclusion:** Social support is an important risk factor for MDE in seniors, even after adjustment for a number of health and demographic variables. The relationship between some types of social support (tangible and affection social support) and MDE may be modified by the presence of a pain problem. It is

therefore important that chronic pain issues be adequately controlled in seniors, as these may counter the positive effects of high levels of social support. Living arrangement was not found associated with depression in our study, suggesting that seniors aging in the community versus a long-term care facility are not at increased risk of depression, provided they have high levels of social support. Efforts such as community programs may therefore be important in helping ensure high levels of positive social interaction and social support in community-dwelling seniors.

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## 1. Background

In 2005, over 13% of Canadians (4.2 million people) were aged 65 and over, a number predicted to rise to 23% (9 million people) by 2036, and 27% by 2056 (Statistics Canada, 2005). These trends have implications for both the labour market and health care delivery strategies – particularly in relation to long term care, resource allocation, and health expenditure.

Major depression and depressive symptoms represent a great public health concern. The World Health Organization (WHO) ranked unipolar depression as the third greatest cause of disease burden in 2001(Lopez et al., 2006), on the basis of disability adjusted life years (DALY). In Canada, current estimates place the annual prevalence of a Major Depressive Episode (MDE) at 4.8%, with a lifetime prevalence of 12.2% (Patten et al., 2006). Among those aged 65 years and older, the annual prevalence of MDE has been estimated to be 1.8% (Patten et al., 2006).

Seniors with depression have been found to be at a greater risk for mortality due to physical illness, suicide, and cognitive decline, with those aged 85 and over having a suicide rate 6 times higher than the national average in the United States (Chappell, 2009).

Despite this aging population, there is a lack of population-based, longitudinal research on major depression in seniors (Jorm, 2000), especially on the risk factors of major depression in this population. There are a few longitudinal studies focusing on seniors, namely, the Longitudinal Aging Study Amsterdam (LASA), the UK Medical Research Council Cognitive Function and Aging Study and The Canadian Study on Health and Ageing. The latter two were designed with the primary objective of examining dementia, rather than major depression.

The remainders of longitudinal studies on depression are plagued by methodological flaws including rigidly defined study populations, short follow up periods, and measurement issues, preventing the ability to provide definitive evidence about the risk factors for a MDE in the senior population.

## 2. Literature Review

### 2.1 Literature Review Strategies

Literature was first reviewed by searching PubMed using keywords. Each search was conducted using three keywords: “depression”, followed by “seniors” or “geriatric” or “elderly”. The third term depended on the focus of the search. For a generation of cross-sectional studies, the keyword “risk factors” was used. For longitudinal studies, the term “longitudinal” served as the third keyword. Results were screened first by title, then by abstract, and lastly by manuscript. Additional papers were found through the bibliographies of relevant papers.

In cases where a specific population-level survey was identified through the above strategy, the survey itself was searched in Google for a study website. Examples of surveys searched in such a manner are the National Population Health Survey, Canadian Community Health Survey, Longitudinal Aging Study Amsterdam (LASA), Australian Women’s Health Study, and the Canadian Study on Health and Aging. For longitudinal datasets, such as LASA, a list of all manuscript titles published from the dataset was generated using the study website if possible or, if a study website could not be identified, using PubMed and Google Scholar. This list was then screened first by title, then by abstract, and lastly by manuscript. Results were limited to publications in the last 20 years for the purpose of the database search in order to focus on recent publications.

### 2.2 Epidemiological Information

#### 2.2.1 Major Depressive Episode (MDE) in Seniors

Major depressive disorder is a mood disorder characterized by three criteria, according to the DSM-IV. Criterion A, is the presence of a major depressive episode (MDE); B, that the MDE may not be better characterized by Schizoaffective Disorder, nor superimposed on Schizophrenia, Schizopreniform Disorder, Delusional Disorder, or Psychotic Disorder Not Otherwise Specified; and C, that there has never been a Manic, Mixed, or Hypomanic Episode (American Psychiatric Association, 2005).

The focus of this study was a MDE. Because of the nature of the NPHS and way that MDE was assessed in the NPHS, I was not able to exclude individuals on the basis

of manic, mixed or hypomanic episodes (criterion C), nor on the presence of psychotic disorders as specified in criterion B.

A MDE is characterized by the presence of at least five of nine depressive symptoms in the same two week period; one of the symptoms has to be either (1) depressed mood (sadness or emptiness) and/or (2) reduced interest in previously enjoyed activities (American Psychiatric Association, 2005). Other symptoms include (3) unintended significant changes in weight or appetite, (4) insomnia or hypersomnia, (5) feelings of restlessness or being slowed down, (6) fatigue, (7) feelings of worthlessness or guilt, (8) trouble concentrating or making decisions, and (9) recurrent thoughts of death including suicidal ideation. Additionally, the symptoms must "...cause clinically significant distress or impairment in social, occupational, or other important areas of functioning" (American Psychiatric Association, 2005: p.356). An MDE is further characterized as being not due to substance use or medication (Criterion D) or due to bereavement (Criterion E). However, the assessment of these latter criteria is not included in the Composite International Diagnostic Interview Short Form for Major Depression (CIDI-SFMD), utilized by the National Population Health Survey. A complete list of the DSM-IV criteria for MDE is found in Appendix A. The CIDI-SFMD may be found in Appendix B.

Current literature indicates the prevalence of major depression declines with age. Based on data from the Canadian Community Health Survey Mental Health and Well Being Survey (CCHS-1.2) utilizing the Composite International Diagnostic Interview (Akhtar-Danesh & Landeen, 2007; Patten et al., 2006), the 12-month prevalence of major depression was estimated to be 5.0% in those aged 15-25, 4.5% in those aged 26-45, and 3.7% in those aged 46-64 (Patten et al., 2006), dropping to 1.8% in those aged 65-74 and 1.6% in those aged 75 and older (Akhtar-Danesh & Landeen, 2007). Many authors have disputed these findings however, arguing that depression may be misdiagnosed as dementia in seniors (Chappell, 2009); may be under diagnosed (Gallo, Rabins and Hopkins, 1999); and that it is difficult to estimate depression prevalence (Patten et al., 2005), particularly in hard to reach, socially isolated individuals. This is further complicated as current estimates place only 1/3 community living seniors with potential depression seeking health services use or treatment of major depression (Cole et al.,

2008). Using data from the Canadian Study on Health and Ageing (CSHA) utilizing a 12-item clinical depression rating scale based on the DSM-III criteria, there is some evidence indicating depression prevalence may begin to rise again in those aged 75+ years, compared to those aged 65-74. Though this study had a large sample size to start (n= 2342 clinical sample; n=1421 community sample), power concerns arose after stratification by age and gender. For instance, among men the annual prevalence of major and minor depression was found to be 1.0% in those aged 65-74 (95% CI: 0.2-1.9), 5.9% in those aged 75-84 (95% CI: 2.3-9.5), and 7.9% in those aged 85 and older (95% CI: 3.7-12.3); while for women all confidence intervals for major, minor, and major & minor depression across age groups heavily overlapped (Ostbye et al., 2005), indicating that the estimates may not be different at the population level. However, it is not clear what the 12-item rating scale was and how depression was defined based on the scale.

Using the CCHS-1.2 data, the 12-month prevalence of major depression has been found to be higher in women than men across age groups (Akhtar-Danesh and Landeen, 2007; Patten et al. 2006), while data from the CSHA has supported this trend in the very old, in age groups up to age 85+ (Ostbye et al., 2005). Depression has also been found to be higher among immigrants, those of lower income, and separated or divorced individuals versus those married using the CCHS-1.2 (Akhtar-Danesh and Landeen, 2007; Patten et al., 2006).

This is of concern given that epidemiologic research from the United States has consistently found those aged 65 years of age and older to have the highest rates of suicide of any age group (Turvey et al, 2002; McIntosh et al., 1994), with depression emerging as the greatest risk factor for late life suicide (Conwell et al., 1996; Carney et al., 1994), while physical illness and pain have also emerged as strong risk factors for attempts and completion of suicide (Carnet et al., 1994)

## 2.2.2 Canada's Aging Populations

In 2005, it was estimated that over 18% of Canadians were aged 60 and over (6 million), and roughly 3% were aged 80 and over (United Nations, 2006). Statistics Canada estimates, based on recent census trends, that the proportion of seniors (aged 65 and older) will rise to 23% by 2036, representing approximately 9 million Canadians, compared to the 4.2 million reported in 2005(Statistics Canada, 2005). This figure is

expected to further rise to 27% by 2056, while those aged 80 and over is expected to represent 10% of the total Canadian population by the same year (Statistics Canada, 2005). This rise in the population of Canadian seniors has been attributed to increased life expectancy, decreased fertility rates, and the aging of Canada's "baby boomers" (Statistics Canada, 2005).

These trends have serious implications for both the labour market, as well as health care delivery strategies – particularly in relation to long term care, resource allocation, and health expenditure. Additional concerns related to the aging population include stress on already strained health care services and significant labour shortages due to an increased number of retirees (Wang, 2009). The crux of this problem stems from a smaller proportion of the population able to provide care and resources, coupled with a rising proportion of the population requiring long term health services.

Despite such a substantial predicted rise in the number of Canadian seniors, little research has been conducted on seniors' depression and its relationship to social support, living arrangements and other potential risk factors (Patten et al., 2006). This is of concern given the research suggesting that (a) suicide is higher among seniors than any other age groups, and (b) recent findings that depressive symptom scores correlate with risk of suicide in seniors (Turvey et al., 2002).

## 2.3 Social Support and Depression in Seniors

Social support refers to the interpersonal relationships we develop (Sherbourne & Stewart, 1991) that allow us to cope with stress and illness, as a result of the emotional and physical resources we receive (Sherbourne, 1988). The concept of social support has undergone much refinement since its inception, both in terms of the types of social support, and the models and mechanisms by which it is hypothesized to act.

### 2.3.1 Types of Social Support

The concept of social support has gone through much evolution since its inception by pivotal works by Caplan (1974, 1976), Cassel (1976) and Cobb (1976), with much of its refinement owed to Cohen and Wills (1985), Barrera (1986) and Sherbourne and Stewart (1991). Cohen and Wills (1985), in a review of the emerging social support literature, pointed to two key types of social support – structural and functional social

support – and the role social support plays in relation to health: the buffer model of social support, and the main effect model of social support.

Structural social support refers to the size of an individual's social network, while functional support referred to the quality of social relationships (Cohen and Wills 1985). Unsatisfied with such a simple definition, Barrera (1986) further refined these categories into three dimensions: social embeddedness – the level of social integration one held within their community was a refinement of the “structural” term; perceived social support referred to how adequate and available an individual believed their network to be; enacted social support referred to the actual support an individual received from their network (Barrera, 1986). These terms helped Barrera develop a number of types of social support models, but the categories ultimately fell short in capturing the multi-dimensional aspect of social support.

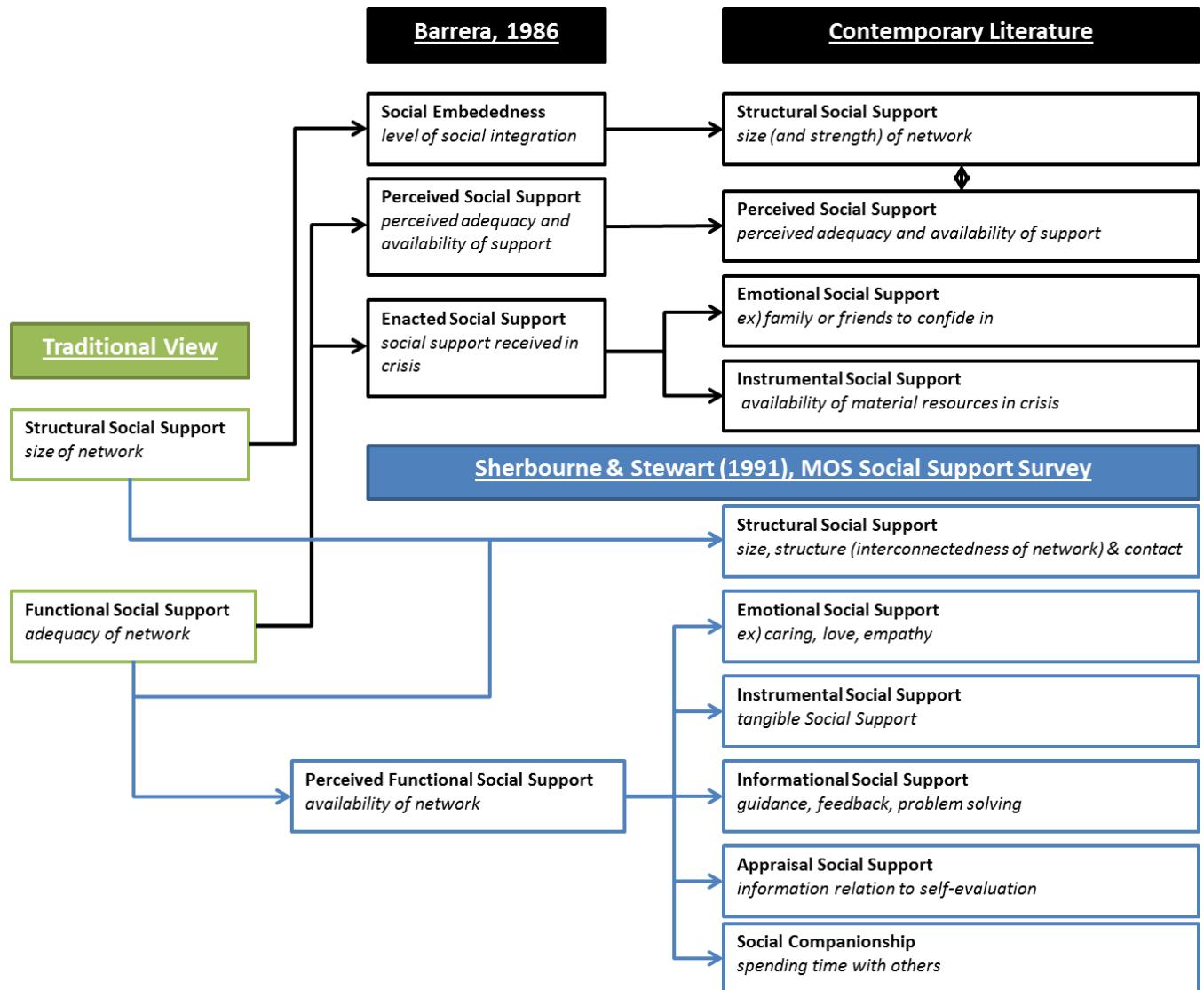
In their development of a social support scale for the Medical Outcomes Study (MOS), Sherbourne and Stewart bypassed Barrera's model, and returned to the initial structural/functional terminology to begin their refinement of social support theory. Unlike Barrera's theories, Sherbourne and Stewart pointed out that in questioning individuals about their network, it is merely the individual's perception. Social support was therefore refined from the structural/functional model to a “structural” and “perceived functional” terminology. “Perceived functional social support” was further split into a number of different categories, based on the type of support received and the individual need fulfilled – emotional, instrumental, informational, appraisal, and social companionship.

As a result, social support was based on the size and contact with an individual's network (structural), but also with the different psychosocial needs the network fulfilled (perceived functional social support), which was a significant improvement over Barrera's theories based on size, perceived availability and adequacy, and receipt.

It should be noted however that much of the contemporary literature that includes social support in the study of health outcomes examines a hybrid model – one drawn out of Barrera's theories, with a small refinement to Barrera's “enacted social support term” – splitting it into emotional and instrumental social support. That is, while Sherbourne and Stewart split social support into structural and psychosocial elements, many studies

continue to examine social support in terms of its size (structural), perceived availability and adequacy (perceived), and its enacted instrumental (physical assistance available, such as money) and emotional (such as having family to confide in) elements.

**Figure 2.A: Evolution of Types of Social Support**



While Barrera's terminology has been replaced in favour of more refined and accurate terms, his theories deserve particular attention for the role they played in the development and refinement of social support models.

### 2.3.2 Models and Theories of Social Support in Health Research

Cohen and Wills (1985) pointed to two key types of social support models in their review: The buffer model and the main-effect model. Barrera (1986) refined these models into more specific components.

The buffer model of social support held that social support influenced health and well-being by protecting individuals from the negative effects of stressful events, while the main effect model held that social support positively contributed to individual health, regardless of the presence of stressful events (Cohen and Wills, 1985). Being somewhat vague in its interpretation, Barrera (1986) is credited with refining the buffer and main effect model (Murrell, Norris and Chipley, 1992), drawing on a large number of social support studies to illustrate six models of social support.

Barrera hypothesized his models on the basis of a three-component pathway. Barrera's pathway began with an initial event, which in turn resulted in stress, in turn resulting in distress (used by Barrera synonymously with health outcomes). It should be noted that in informing his “event-stress-distress” pathway, Barrera drew extensively upon the mental health literature of the time. Specifically, Barrera focused on the current depression and psychological distress literature of the time to illustrate the impact (in many cases through longitudinal studies) of social support on depressive symptoms and psychological distress.

In his “additive model”, Barrera hypothesized that social support and stress events were independently associated with distress. That is, that social support would serve to reduce distress, while concurrently and independently stress events would serve to increase it. This is analogous to the “main effect model” proposed by Cohen and Wills.

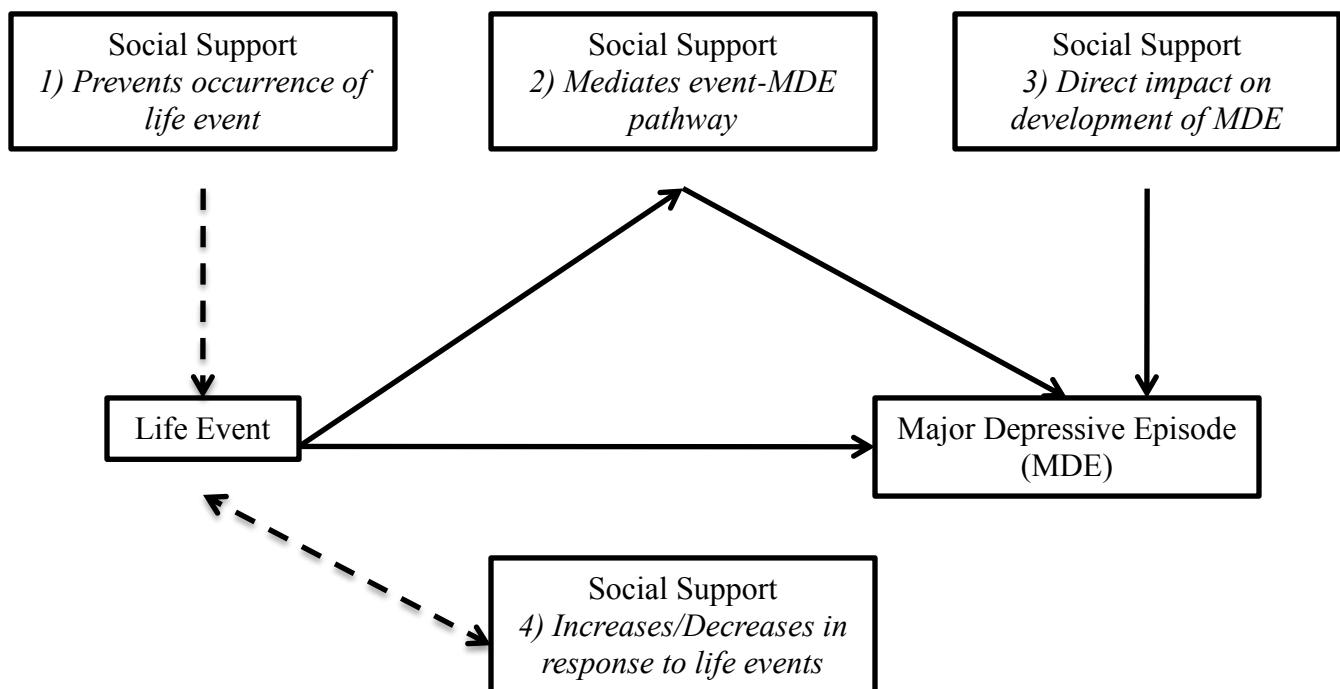
The Buffer model Barrera split into differing components. The key is that through these buffer components, Barrera allowed social support to reduce the amount of negative events, the level of social support to change in response to life events experienced by an individual, and to reduce the amount of stress actually experienced as a result of these events when they did occur.

Between these models, we see the opportunity for social support to act on all three components of Barrera's pathway: that social support reduces the occurrence of stressful

events, reduces the resulting stress from negative events, and directly reduces the amount of distress experienced by an individual.

In addition to the main-effect and buffer models, Barrera, pointed out that social support is not static, but may itself be directly impacted by, and change in response to life events. It may either increase, either due to the mobilization of the social support network (Enacted Social Support Model), or due to an individual seeking out help (Support Seeking / Triage Model); or, social support may decrease in response to stress events (Support Deterioration model, Reciprocity of Stress and Perceived Support Model). The hypothesized relationships among life events, social support and major depression are summarized in Figure 2.B. Instead of examining all possible relationships, which is beyond the scope of a Masters thesis, this research focused on the direct impact of social support on the risk of a major depressive episode.

**Figure 2.B: Multiple Pathway Social Support Model**



### 2.3.3. Sherbourne and Stewart and the MOS Social Support Survey

The Medical Outcomes Study Social Support Survey was developed by Sherbourne and Stewart (Sherbourne & Stewart, 1991) and featured 20 different questions assessing different types and availability of social support. As previously stated, Sherbourne and Stewart hypothesized six types of social support in their model: structural, tangible (instrumental), emotional, informational, affection, and positive social interaction. Following their study and use of a correlation matrices however, two of these scales – emotional and informational – were collapsed together. Each of the 20 questions within the MOS Social support survey therefore contributes to one of these five types of social support and their scale, allowing for five social support sub-scales. This questionnaire was used in its entirety in the Canadian NPHS, from which the data was drawn for this thesis. The five types of social support assessed through the MOSSS are:

**Structural social support** is made up of a single question, assessing the number of close friends and family the participant perceives themselves to have.

**Tangible social support** refers to whether individuals feel they have someone to help them with daily tasks were they unable, such as preparing meals, daily chores, etc.

**Affection social support** reflects feelings of love, affection, and feeling wanted.

**Positive social interaction** assesses whether or not an individual feels they have “someone to have a good time with”, relax with and “help get their mind off things”.

**Emotional and informational support** includes someone to get information, advice and suggestion from, confide in, listen to you, and “share your private worries and fears”.

### 2.3.4 Social Support and Depression

The link between social support and depression is not a new phenomenon. When Barrera (1986) began developing his social support models, he drew on over 37 sources that specifically examined the relationship between social support and psychiatric disorders – over 27 specifically examining the relationship to depression. Unfortunately these studies had poorly defined measures and metrics of social support: the literature of the time has been criticized by its contemporaries first for having social support scales confounded by the concepts of stress and distress (Cohen & Hoberman, 1983; Dohrenwend et al., 1984), and second for the concepts and definitions themselves.

Further, nearly all the depression and psychiatric studies referenced by Barrera in support of his models utilized symptom-based measures of depression – a problem that remains in much of the contemporary literature – such as the Longitudinal Aging Study Amsterdam – which will be explored in subsequent sections.

### 2.3.5 Social Support and Depression in Seniors

Current research indicates that due to a loss of established social support networks as a result of life changes such as retirement or widowhood, coupled with mobility constraints, seniors are likely to be socially isolated and lack friends or family to confide in (Conwell, 2001). These factors have been found to increase the risk of depression and suicide in seniors (Conwell, Rotenberg, & Caine, 1990; Conwell et al., 1991; Turvey, et al., 2002). While there are some studies on the relationship between social support and depression in seniors, most of these studies are cross-sectional.

Cross sectional studies have consistently found social support to be associated with depression in seniors (McDougall et al.c 2007; Osborn et al., 2003; Prince et al., 1997). This parallels findings of the social support-depression relationship in other special populations, including those with chronic medical conditions such as cancer survivors (Boyes et al., 2009), HIV-positive women (Vyavaharkar, et al., 2007), and even among women dealing with postpartum depression (Surkan et al., 2006). This suggests that the relationship between social support and depression may persist across age and othe population boundaries.

The bulk of longitudinal information on the relationship between social support and depression however has been drawn primarily from studies utilizing Longitudinal Aging Study Amsterdam Data. In the Longitudinal Aging Study Amsterdam (LASA), Bisschopp and colleagues (2004) found evidence for the “main effect model”, with psychosocial resources such as having a partner, less loneliness, more self-esteem, self-efficacy and mastery resulting in fewer depressive symptoms over time based on a repeated measures analysis using generalized estimating equations (GEE). Interestingly, these authors also found increased emotional and instrumental social support to be associated with increased depressive symptoms, regardless of chronic diseases. Social network size was found non-significant (Bisschopp et al., 2004). Bisschopp and colleagues investigated the unexpected finding of increased depressive symptoms with

increased emotional and instrumental support, and found the results to be confounded by a third variable, loneliness, for which collinearity was present. Further, Bisschopp and colleagues postulate that the direct effect of emotional and instrumental social support on depressive symptoms may be due to a negative perception of increased social support (for example, in the presence of illness). This is an intriguing finding, as it suggests and supports earlier research (Barrera, 1986) that the social support – depression relationship may be bi-directional.

Unfortunately many of these findings are marred however by poor measures of social support, and use of a symptom-based measure of depression – the Center for Epidemiological Studies Depression Scale (CES-D).

A number of European studies have found strong associations between depression and social support deficits and loneliness (McDougall et al., 2007; Prince et al., 1997). Some studies have used the presence of family and friends as proxy measures of emotional and instrumental social support (Bisschopp et al., 2004), with the absence of living close to friends and family emerging as a risk factor for development of a MDE (Osborn, et al., 2003; Wilson, Mottram, & Sixsmith, 2007) and late-life suicide (Turvey, et al., 2002).

Another study from the LASA found that social support in seniors varied by income and education – individuals at the higher income and education levels reported higher levels of social support (Koster, et al. 2006). This same study also found the presence of a being without a partner, small social network size, and low self-mastery to be associated with a higher risk of depression. Therefore, it is possible that education and income are potential confounders in the relationship between social support and the risk of depression.

## 2.4 Risk Factors for Major Depression in Seniors

To date, a number of potential risk factors for depression in seniors have been investigated through cross-sectional studies. These include age, gender, smoking, income, education, employment, physical activity, functional disability/handicap, physical or mental comorbidity and social support – often assessed through (problematic) proxy measures such as marital status, living arrangement, living near family and friends, and feelings of loneliness. This review focuses on the relationships between these factors and major depression. However,

if these factors are also associated with social support, they can be potential confounding factors in the relationship between social support and the risk of major depression.

#### 2.4.1: Gender

Women have consistently been found to be at higher prevalence and incidence of depression compared to men. This trend has persisted through different socioeconomic strata, health status variables, and geographic regions, regardless of the instruments used. This association has been found across different age groups, though it is uncertain if it remains in old age. Akhtar-Danesh & Landeen, in a 2007 analysis of Canadian Community Health Survey 1.2 data utilizing the CIDI as a measure of major depression, found higher lifetime and 12-month prevalence of major depression among women compared to men across all strata: age group, education, marital status, immigration status and income (Akhtar-Danesh & Landeen, 2007). A study from the UK utilizing the Geriatric Depression Scale found women to be at increased odds of depression over men in those aged 75 years of age and older (OR 1.32, 95% CI: 1.14-1.54). However the association became non-significant in fully adjusted analysis (OR: 1.14, 95% CI: 0.98-1.32) (Osborn, et al., 2003).

Data from the Canadian Study on Health and Aging found depression prevalence (major and minor depression) to be higher among women than men – 9.3% for women (95% CI: 3.7-15.0) and 2.9 for men (95% CI: 1.5-4.2). The same study found the odds of depression to be much greater in women than men in those aged 65 years of age and older (OR: 3.5, 95% CI: 1.4-8.8)(Ostbye et al., 2005).

While elderly women were found to have higher depression scores both before and after widowhood than men, men experienced a much greater increase in depressive symptoms due to widowhood than women (van Grootenhuis et al., 1999), as a result it is important to consider the role gender plays in modifying or confounding the social support – depression relationship.

Lastly, many studies have been unable to find an association between gender and depression in the elderly (*see* van't Veer-Tazelaar et al., 2008 & Wilson, Mottram, & Sixsmith, 2007), though it is uncertain whether this is due to sample size and power problems, particularly after adjusting for multiple risk factors, or due to the gender difference being the result of confounding by other risk factors. In the case of Wilson

and colleagues (2007), the Geriatric Depression Scale (GDS), was utilized on a small sample size ( $n=376$ ); while in the case of van't Veer-Tazelaar and colleagues (2008) the CES-D was utilized in a Dutch sample of 2850 participants.

#### 2.4.2: Age

Utilizing the Canadian Community Health Survey data, the bulk of Canadian literature indicates the prevalence of a MDE declines with age (Akhtar-Danesh & Landeen, 2007; Chappell, 2009; Patten et al., 2006). A portion of the literature however indicates that depression prevalence may in fact increase with age in the very old. This has been found in both Canadian samples utilizing the CSHA (Ostbye et al., 2005), and in samples from the United Kingdom's Medical Research Council's "trial of assessment and management of older people in the community" study, utilizing the Geriatric Depression Scale (Osborn et al., 2003). In the CSHA, men aged 85 years of age and older (12-month prevalence: 7.9, 95% CI: 3.7-12.3), and those aged 75-84 years of age and older (12-month prevalence: 5.9; 95% CI: 2.3-9.5) were found to have higher prevalence of major and minor depression than those aged 65-74 (12-month prevalence: 1.0; 95% CI: 0.2-1.9) (Ostbye et al., 2005). No significant differences in prevalence by age groups were found in women (Ostbye et al., 2005). The United Kingdom study found a prevalence of major depression of 6.5% in those aged 75-79 (95% CI: 5.6-7.6), rising to 7.7% (95% CI: 5.6-8.9) in those aged 80-84, 10.3% (95% CI: 8.4-12.4) in those aged 85-90, and 11.7 (95% CI: 8.6-15.8) in those aged 95+ (Osborn et al., 2003).

Similar results were reported by the LASA data, with age positively associated with the risk of depression (Vink et al., 2009), with the odds of depression increasing by 1.04 (95% CI: 1.01-1.07) per year of age after age 55.

It is difficult to compare this result with the Canadian literature however, since Canadian studies typically limit the reporting of age prevalence estimates to those 65+ or 75+ years of age (see Akhtar-Danesh and Landeen, 2007; Patten et al., 2006) or lack the power to reach conclusive estimates (see Ostbye et al. 2005). Further, the estimates from the CCHS were based on the CIDI to determine the presence of a MDE, while the UK study relies on a symptom based depression scale tailored to the geriatric population.

#### 2.4.3: Education

A recent Canadian study by Wang and colleagues (2010) using NPHS data found low education to place individuals at a higher risk for the 6-year longitudinal risk of major depression in the general population (Wang, Schmitz and Dewa, 2010). This association has also been found in seniors using LASA data, finding lower levels of education to be associated with increasing risk of depression (Koster et al., 2006; Vink et al., 2009;). Of particular relevance to this study is the finding by Koster and colleagues (2006) that levels of social support actually differed by education level, suggesting that socio demographic variables, specifically education and income, may influence the social support – depression relationship. However, Data drawn from a community sample of the Canadian Study on Health and Aging found no association between education and depression (Ostbye et al., 2005).

#### 2.4.4: Employment

It has been hypothesized that the workplace provides an individual with a wide, easily accessible social support network. As a result, the loss of this network upon termination of employment (either due to retirement or unemployment) may serve to place individuals at risk for a MDE. Conversely, the workplace may actually serve as a source of stress for an individual, resulting in increased risk of developing major depression (Blackmore et al., 2007; Wang, 2004; Wang, 2005).

Using the Canadian Community Health Survey (CCHS) 1.2, Blackmore and colleagues (2007), found that stress due to employment increased the risk of major depression, and was associated with lack of social support in the workplace (Blackmore et al., 2007). This helps demonstrate the inter-relationship of depression, social support and stress proposed by Barrera: namely that stress may increase the risk of depression, stress may lead to a reduction in social support, and (potentially) that social support may impact the occurrence of a depressive episode – either directly or through mediating the stress-depression pathway.

#### 2.4.5: Income

The association between depression and income has been well established in Canadian samples using cross-sectional data, with studies of CCHS data consistently

showing increased depression prevalence in lower income groups in the general population (Akhtar-Danesh & Landeen, 2007; Patten et al., 2006).

More recent Canadian longitudinal studies utilizing NPHS data have found the odds of a MDE to increase in the presence of financial strain in the general population (Wang, Schmitz, & Dews, 2010). The same authors further found personal and household income not to be significant in developing an MDE (Wang et al., 2010; Wang, Schmitz, & Dews, 2010) among the general population. This raises questions as to whether it is actual income or financial strain that is responsible for contributing to the development of an MDE.

In senior populations, using LASA data and the Geriatric Mental State Exam, Koster and colleagues (2006) found increased hazard ratios of depression in those aged 65 years of age and older in lower income categories during 9 years of follow-up compared to those in higher income categories, even after extensive adjustment for other potential risk factors and confounders. A longitudinal study of the very old (aged 80-90) in the UK found income level to have no impact on development of an MDE one year later, but did find income dissatisfaction to increase the odds of a MDE in logistic regression analysis (Wilson, Mottram, & Sixsmith, 2007). As previously discussed, income may also be associated with level of social support (Koster et al., 2006).

#### **2.4.6: Chronic Medical Conditions, Pain and Functional Decline**

A study by Rockwood and Andrews (2007), found that seniors who are physically frail are more likely to suffer psychiatric illness, which is of concern given that over 83% of seniors reported being diagnosed with at least one chronic condition, with up to 25% of those aged 65 and 37.5% of those aged 85 and over experiencing chronic pain (Chappell, 2009).

Among the general population, Wang and colleagues found the incidence of MDE to be higher among those with chronic conditions versus those without in a longitudinal analysis of NPHS data in the general population (Wang et al., 2010). This parallels findings of Vink, Geerlings and colleagues that functional decline, functional limitation, activity limitations due to health and the presence of chronic disease increase the risk of depression among seniors using LASA data (Geerlings et al., 2000; Vink et al., 2000).

Similar findings have been found in cross-sectional studies in the UK (McDougall et al., 2007), and in Canada using the CSHA (Ostbye et al., 2005).

Not only are co-morbid medical conditions and functional decline associated with depression, current literature indicates that social support may also be associated with medical conditions, specifically that low social integration and feelings of loneliness may be greater among those with a physical disability (Golden, et al., 2009). Therefore, co-morbid medical conditions may be either a confounder or an effect modifier in the relationship between social support and major depression.

#### **2.4.7: Marital Status, Living Arrangement**

Marital status has been a well-established factor associated with depression in Canadian samples. Canadian studies utilizing CCHS 1.2 (Mental Health and Wellbeing) data found depression prevalence to be higher among separated & divorced individuals versus those who were single, married, or widowed (Akhtar-Danesh & Landeen, 2007; Patten et al., 2006). This association has been confirmed in a more recent Canadian study utilizing longitudinal data from the NPHS (Wang et al., 2010). Koster et al (2006) found those with a partner to be at lower risk of incident depression utilizing LASA data.

Using LASA data, Guiaux et al (2007) found that social support changes in relation to widowhood. In particular, Guiaux and colleagues found social support to increase after widowhood, before beginning to decrease around 2.5 years after widowhood. This is of interest given other research, where van Grootenhuis et al (1999) found widowhood to have a direct impact on depression among men and women, with depressive symptoms higher among widowed versus non-widowed individuals, but found that this relationship to be stronger among men than women. Additionally, the authors found that there was no sex difference in the first four years after widowhood (van Grootenhuis et al., 1999), and that the impact of social support on depression among widowed individuals differed between men and women. Specifically, low emotional and low instrumental social support was significantly associated with depression in men, while low social network size was significant for women in relation to depression scores. Additionally, widowhood differentially impacted social support among men and women (van Grootenhuis et al., 1999).

Such literature suggests that while marital status is an important risk factor for depression, marital status, particularly widowhood, may have a time-dependent relationship to both social support and depression. As a result, marital status may be a potential confounding factor in the relationship between social support and major depression.

## 2.5 Knowledge Gaps

### 2.5.1. Lack of longitudinal, population-based studies

To date, there are few population-based longitudinal studies investigating risk factors for depression in seniors. These include The Longitudinal Aging Study Amsterdam (LASA) – a population based study following 3109 seniors, aged 55-85 at baseline, every 3 years since 1992; The United Kingdom based Medical Research Council Cognitive Function and Ageing Study (MRC CFAS) – a community based cohort of 13 004 individuals aged 65 and over at baseline begun in 1989 with annual follow-up; and The Canadian Study on Health and Ageing (CSHA) – a population based study of 10 253 individuals aged 64 years and older, followed up every 5 years. Other studies, such as the Canadian National Population Health Survey and the Australian Longitudinal Study on Women’s Health (ALSWH) have yet to be applied to an examination of risk factors for major depression in the senior population.

### 2.5.2 Difficulty assessing depression in seniors

The LASA has resulted in the greatest number of publications on risk factors for depression in seniors of any single survey. The LASA assessed depression using the Center for Epidemiological Studies Depression Scale (CES-D) – a symptom based measure of depression designed for the general population. Cut-off points based on a specific number of depressive symptoms has been used to define “depressive syndrome” rather than major depression in certain studies (omitting other DSM-IV diagnostic criteria of depression). Additionally, these cutoffs have not been uniform across LASA publications, while others have maintained the continuous nature of the CES-D, often with statistical modification (Bisschopp et al, 2004).

Assessment of depression in seniors may be further complicated by misdiagnosing depression as dementia (Chappell, 2009), and underdiagnoses due to either social

isolation (Patten et al., 2005) or lack of presentation to health services (Cole et al., 2008). Gallo, Rabins & Hopkins (1999) further argue that the presentation of depression may be altered in seniors, with a stronger focus on somatic complaints, hopelessness, anhedonia and slowed movement. Therefore while traditional metrics such as the CES-D, PHQ-9, Beck Depression Inventory or other metrics may be useful in tracking symptoms and treatment progress (Gallo, Robins & Hopkins, 1999), they may none-the-less fall short in meeting diagnostic criteria for depression in this age group.

### 2.5.3 Inadequate measure of social support

While literature does exist with comprehensive, robust measures of social support, their interpretation to the current study is difficult due to different definitions and philosophies of social support. For instance Murrell, Norris & Chipley (1990) used a multi-item questionnaire to assess the level of social integration of individuals, which the authors described as an aspect of structural and functional social support. This differs from the majority of studies that assess structural support as number of contacts only (for instance in LASA, or the NPHS and other studies using the MOSSS).

The LASA study assessed social support in terms of partner status (married, single, etc.), network size, instrumental & emotional support, and perceived social support. Particular problems arise with the measures of instrumental and emotional social support – instrumental support was defined as “how often *x* helps with chores around the house”, while emotional support was defined as “how often you talk about personal experiences and feelings with *x*.<sup>1</sup>” In both cases, many dimensions of each type of support were omitted. Further, these questions were only asked of the most frequently contacted network members – not necessarily the most influential or supportive (*see* Bisschopp et al., 2004).

Other studies assessed emotional/informational support through single questions, such as “do you have a confidant”, and tangible support through single questions such as “do you have someone to lend or give you money” (*see* Gielen et al., 2001), or through single questions to assess frequency, satisfaction, and perceptions of social support (*see* Prince et al., 1997).

As a result, much of the literature may fail to adequately assess and characterize the level or type of social support received by an individual, while a lack of

standardization in social support definitions, and the changing of these definitions over time, makes the generalizability or applicability of authors' findings difficult.

#### **2.5.4 Studies not designed to examine depression**

The MRC CFAS and the CSHA studies were both originally designed to examine dementia in seniors, and their measures of depression and dementia drawn using the Geriatric Mental State Examination (GMS) and Automated Geriatric Examination for Computer-Assisted Taxonomy (AGECAT) algorithm, designed to diagnose a number of conditions including dementia, mania, depression, schizophrenia, anxiety, and others (Newman, Sheldon and Bland 1998). Depression research has largely been added as an afterthought, with the MRC CFAS study not assessing depression until later study periods, while the CSHA examined depression in demented patients, or in rigidly defined study populations free of dementia (such as dementia patient caregivers). In both cases the generalizability of the results to the general senior population are limited.

#### **2.5.5 Seniors as an afterthought**

The depression literature emerging from the ALSWH has focused primarily on post-partum depression, with no studies examining depression risk factors in seniors. While the Canadian NPHS has been used for research in seniors, and research in population level risk factors for depression, it has yet to be used for investigating the relationship between potential risk factors and depression in seniors.

### 3. Objectives

The objectives of this study are as follows: among Canadian seniors 65 years of age and older, to -

- (1) Describe demographic & socioeconomic characteristics of Canadian seniors.
- (2) Estimate the 12-month prevalence of a major depressive episode.
- (3) Estimate the 2-year and 8-year cumulative incidence proportion of a major depressive episode in seniors overall and by social support.
- (4) Investigate the 8-year longitudinal associations between social support and the risk of a major depressive episode in seniors.
  - a. Assess the role of potential effect modifiers of the social support – depression relationship
  - b. Assess the role of potential confounders of the social support – depression relationship

## 4. Methods

To achieve the objectives specified above, the data from the Canadian National Population Health Survey (NPHS) were used.

### 4.1 The National Population Health Survey (NPHS)

The NPHS was initiated by Statistics Canada, launched in 1994/1995, with the mandate of collecting health and related socio-demographic information on the Canadian Population.

The target population is all household residents of all Canadian provinces (Territories were excluded), excluding those who were (a) full-time members of Canadian Forces Bases, (b) institutionalized, (c) from remote communities in Quebec and Ontario, or (d) living on Indian Reserves and Crown Land.

A multi-stage stratified sampling strategy was used. First, each province was split into three types of areas: major urban centers, urban towns, and rural areas. From these areas, different geographic and/or socio-economic strata were drawn. From each stratum, six clusters were selected. These clusters were usually census enumeration areas to ease data collection and make the survey more cost effective. A dwelling list of each cluster was prepared, and households randomly selected from the list (Statistics Canada, 2008b; Statistics Canada, 2010).

The initial sample (cycle 1) of the NPHS consisted of 17 276 individuals. This comprises the longitudinal sample. The NPHS is collected using Computer Assisted Interview (CAI). All interviews were conducted by trained Statistics Canada employees, through Statistics Canada calling centers. Nearly all interviews were conducted by telephone, though respondents were interviewed in person if (a) they had no telephone, (b) if a personal visit was made by an interviewer during respondent tracing, or (c) if requested by the respondent. Proxy reporting was allowed in cases of illness or incapacity, though this is estimated to have been less than 6% of respondents (Statistics Canada, 2008b).

Participants in the longitudinal cohort were re-interviewed every two years. Thus far, 8 cycles of interview have been conducted (1994 – 2008). Non response was minimized through a number of strategies including frequent calling / visits at various times and pre-arranging interviews; multiple requests from various levels of seniority to minimize drop-out and refusal, and use of interviewers specially trained to trace respondents who could not be contacted. Additionally, respondents were able to return to the survey even after missing cycles.

Individuals who moved out of Canada were not interviewed; however their contact information is kept on file and updated to allow for subsequent interviews on a return to Canadian residency.

**Figure 4.A: Initial longitudinal respondents, versus those in each province who completed all cycles. Source: (Statistics Canada, 2008b)**

Province	Longitudinal Sample Cycle 1 (1994/1995)	Number of Respondents Full Response in Cycles 1 to 7
Newfoundland	1,082	746
Prince Edward Island	1,037	719
Nova Scotia	1,085	704
New Brunswick	1,125	728
Quebec	3,000	1,890
Ontario	4,307	2,546
Manitoba	1,205	805
Saskatchewan	1,168	824
Alberta	1,544	979
British Columbia	1,723	1,051
<b>Total</b>	<b>17,276</b>	<b>10,992</b>

Individuals who died have cause of death checked with the Canadian Vital Statistics Database. Death is not considered a form of non-response or attrition in the NPHS. Both death and institutionalization are coded in the NPHS, but are not included in calculations of attrition or non-response. The response rate of subsequent NPSH was as follows: Cycle 2, 92.8%; Cycle 3, 88.3%; Cycle 4, 84.9%; Cycle 5, 80.8%; Cycle 6, 77.6%; Cycle 7, 77.0%. Partial response was considered non-response for the purpose of response rate calculations (Statistics Canada, 2008b).

#### **4.2 Outcome Variable – Major Depressive Episode**

The primary outcome of interest in this study is the occurrence of a MDE in the last 12 months. In the NPHS, the presence or absence of an MDE in the past 12-months was assessed using the CIDI-SFMD. The CIDI is a fully structured & validated diagnostic interview, developed by the World Health Organization (Wittche, 1994; World Health Organization, 1994) possessing high inter-rater reliability. This tool was developed and refined by Kessler and Mroczek (1998), resulting in a shortened version – the CIDI-SFMD – used in the NPHS and other surveys. The CIDI-SFMD is estimated to have a sensitivity of 89.6%, a specificity of

93.9%, a positive predictive value of 75.7% and a negative predictive value of 86.9% when compared to the CIDI and DSM-III-R (Kessler et al., 1998). When a cut-point of five symptoms is used to dichotomize respondents, with one of them as either depressed mood or loss of interests in the CIDI-SFMD, there is a 90% predictive positive value of the participant having experienced a MDE in the last 12 months, according to Kessler and colleagues (1998).

While the CIDI is considered valid, a recent review by Kurdyak & Gnam has questioned the validity of the depression module specifically (Kurdyak & Gnam, 2005). In evaluating the CIDI-Short Form, Patten (1997) found the CIDI Short Form to have high sensitivity (98.4%), but relatively low specificity (72.7%) among a clinical sample. As a result, the NPHS might result in an overestimation of 12-month major depression prevalence when comparing results from the NPHS to the Mental Health Supplement of the Ontario Health Survey, which utilized the full version of the CIDI (Patten, 1997), and more recently when compared to the CCHS 1.2 (Patten et al., 2005) which utilizes the full version of the CIDI. Patten further found this overestimation (false positives) to occur among subjects with active medical conditions, substance use disorders, and dysthymia (Patten, 1997). The tendency of the CIDI-SFMD to overestimate prevalence has been consistently found in more recent studies (Patten et al., 2000; Patten et al., 2005), likely due to the CIDI-SFMD lacking an exclusion criteria (such as bereavement). This literature however has been developed based on population level evaluations of the CIDI-SFMD performance. It is unclear therefore whether the CIDI-SFMD would lead to an over-estimation in seniors, particularly in light of concern that depression may be underdiagnosed among the elderly (Chappell, 2009).

Due to concerns about recall bias, misdiagnosis (Chappell, 2009; Gallo, Rabins and Hopkins, 1999) and concerns about the validity of the CIDI-SFMD in the elderly (Turvey, et al., 1999), the use of anti-depressants by the participants was employed as an indicator for depression in the current study. Anti-depressant use determined through the use of Anatomical Therapeutic Chemical Classification (ATC) Codes. ATC Codes are based on the World Health Organization classification, and are coded through the Health Canada Drug Product Database (Statistics Canada, 2008b). As part of the NPHS questionnaire, the ATC codes of all medications (prescription and over-the-counter) currently being taken by participants are recorded by the interviewer (Statistics Canada, 2009) for each cycle. In cycle 5 of the NPHS, all

drugs in all NPHS cycles were reverse-coded to ensure that all drugs conformed to the current Health Canada Drug Product Database ATC Classification system (Statistics Canada, 2008b).

In this research, participants were considered to have a MDE if they coded positive on the basis of CIDI-SFMD criteria, or reported the usage of one or more anti-depressants as determined through ATC classification. This was repeated for each cycle. Using anti-depressants as an indicator for having depression is consistent with the pharmacoepidemiology literature, where that the use of antidepressants can serve to capture individuals with more severe depressive symptoms (Nabi, et al., 2010).

#### **4.3 Primary Exposure of Interest – Social Support and the MOSSS**

The primary exposure variable of interest in this study is social support. Social support in the NPHS was initially derived through a series of questions and combined to form three measures: a perceived social support index, social involvement dimension, and average frequency of contact index , which were administered in cycle 1 and cycle 2 (Statistics Canada, 2008a). This series of questions and variables was replaced by the Medical Outcomes Study (MOS) Social Support Survey (MOSSS) beginning in cycle 3. For this reason, cycle 3 served as the baseline cycle for this study.

The Medical Outcomes Study (Social Support Survey) was developed by Sherbourne and Stewart (Sherbourne & Stewart, 1991) and employed in its entirety in the NPHS (Statistics Canada, 2009), beginning in cycle 3 (1998/1999) and has been included in each cycle since (Statistics Canada, 2008a). All 20 questions comprising the MOSSS are in Appendix C. In addition to allowing each question to be viewed independently the NPHS also has derived social support variables, corresponding to the six types of social support proposed by Sherbourne and Stewart (Sherbourne & Stewart, 1991). Following correlation analysis, emotional and informational social support were combined, resulting in five categories (Sherbourne & Stewart, 1991): Structural Social Support, Tangible (Instrumental) Social Support, Emotional & Informational Social Support, Affection, and Positive Social Interaction. Each of these five categories were analyzed using the NPHS for their association with a major depressive episode, given the literature indicating that different types of social support may have different associations with health and depression (Bisschopp et al., 2004; Guiaux, van Tilburg, & van Groenou, 2007).

Each of the five categories of social support has an index value in the NPHS. This value is calculated by first recoding the individual MOS items from 1-5 as they appear in the original MOSSS scale, to 0-4, with 0 = “none of the time”, and 4 = “all the time for each question”. For tangible social support and positive social interaction, four items contributed to the subscale, resulting in a possible score of 0-16. For the affection subscale, this index variable was made of three items, resulting in a possible score of 0-12. For the emotional & information social support, this index was made of 8 items, resulting in a score of 0-32. Structural social support remains a continuous variable, coded from 0-99, representing the number of close friends and relatives.

The current trend in the literature is to retain the continuous Likert-scale nature of the four social support categories (tangible, positive social interaction, affection, emotional & informational social support) (*see Houston, Cooper, & Ford, 2002; Jenks Kettmann & Altmaier, 2008; Vyawaharkar et al., 2007*). However there appears to be a lack of consensus on how to deal with the network size component. In many studies this dimension of the MOSSS is omitted completely in favour of other instruments (*see Boyes et al., 2009; Houston, Cooper, & Ford, 2002; Jenks Kettmann & Altmaier, 2008; Vyawaharkar, et al., 2007*), while in other instances is dichotomized at very low cutoff points – for instance 0-1 versus 2+ (*Surkan et al., 2006*), or remains continuous (*Rodin et al., 2007*). In the LASA, a similar “network size” variable was used, where respondents indicated the number of close friends/family with whom they had frequent contact. Some authors utilizing LASA data treated network size as continuous (*Guiaux, van Tilburg, & van Groenou, 2007*), while others grouped network seize based on tertile (*Koster et al., 2006*). In some instances, the scores of all five MOSSS categories are combined to form a single social support score, where higher scores indicate higher levels of social support (*Rodin, et al., 2007; Sherbourne & Stewart, 1991*).

In our study, the Likert-scale was retained in preliminary analysis, however was later dichotomized into “high” and “low” social support categories based on quartiles. This was done due to power considerations, following analysis of the data distribution. Each of the five types of social support was found to have a logarithmic distribution, with a greater frequency of respondents reporting low as opposed to high levels of social support. As a result, the scales were dichotomized with the lowest quartile of social support representing “low social support”, and the remaining quartiles representing “high” social support. Attempts to stratify social

support into more categories, for instance “low, medium, high”, quintiles, etc., were dropped in favor of the current method due to power considerations following stratification.

#### 4.4 Other Included Variables

Other variables selected in the analysis included demographic and socioeconomic characteristic as well as health status variables. Variable names and coding are available in Appendix D. Each of these variables was assessed at baseline (cycle 3). These included age, sex, education, income, living arrangement, marital status, presence of a pain problem, presence of a chronic condition, mobility problem, and a restriction to activities of daily living. Each of these variables was collapsed into a dichotomous variable.

Initial analysis additionally included employment status, smoking, alcohol consumption, physical activity, childhood traumatic event, presence of Alzheimer’s and/or Dementia, and a dexterity problem (assessed through the Health Utility Index). These variables were dropped, however, due to power and sample size considerations in keeping with Statistics Canada data-vetting policy.

Age was treated as a continuous variable, beginning at age 65 when used as a covariate in multivariate regression models. Age was collapsed into 5-year age groups for purposes of demographic information, prevalence and incidence estimates.

Education was initially comprised of four responses, based on highest level of education achieved: did not graduate secondary school, graduated secondary school, some post-secondary education, and completed post-secondary school. This variable was later dichotomized into those who did, and those who did not graduate high school.

Income was measured in terms of total household income. This variable is initially coded as continuous in the NPHS however two derived measures of this variable were available for analysis. The first collapsed household income into 5 categories, the second into 2 categories. In each case, household income is derived based on total household income, and the number of people living in the household. As a result, the actually dollar value for the different categories is not universal. Preliminary analysis revealed the two-income category variable to better capture the relationship between income and depression, and therefore this category was used. For 2 income categories, the depending on household size, the cuts are made at: low income, < \$15 000 (1 or 2 person household), <\$ 20 000 (3 or 4 person household), and < \$30 000 (5 or

more person household); high income,  $\geq \$15\,000$  (1 or 2 person household),  $\geq \$20\,000$  (3 or 4 person household), and  $\geq \$30\,000$  (5 or more person household).

Marital status was originally coded into 6 categories: married, living in common law, widowed, separated, divorced, single & never married. Due to sample size considerations however, these categories were collapsed into Married/Common Law/Single, and Widowed/Separated/Divorced. Attempts were made to separate widowed from separated/divorced, however this was not possible due to sample size considerations. Preliminary analysis suggested that those widowed had a similar relationship to depression as those separated/divorced when compared to those married/common law/single.

Living arrangement is made up of 9 categories as coded in the NPHS: (1) unattached, living alone (2) unattached, living with others, (3) living with spouse/partner, (4) parent, living with spouse or partner & children, (5) parent, living with children, (6) child, living with single parent, (7) child, living with single parent, siblings, (8) child living with two parents, (9) child living with two parents, siblings. The categories were subsequently re-coded as follows: (1) living alone, (2) living with partner, and (3) living with others.

Chronic condition was initially assessed through the presence or absence of 22 different chronic conditions. This was recoded to a continuous variable, ranging from 0-22, representing the number of chronic health conditions experienced by the respondent. Six of these conditions were omitted from the scale, such as “allergies”, and “sinusitis”. From the resulting 0-16 subscale, participants were coded into two groups: no chronic conditions, and one or more chronic conditions.

The Restriction to Activity Index, which includes 6 items to assess whether or not participants require assistance in a number of activities of daily living and instrumental activities of daily living (for example, “do you need help preparing meals?”), was subsequently dichotomized into any restriction versus no restrictions. Preliminary attempts were made to examine a restriction to each of the six activities of daily living in the index, however in keeping with Statistics Canada sample size considerations this was not possible. Attempts to utilize the continuous nature of the index of the number of restrictions on a scale from 0-6 was abandoned for similar reasons.

The Health Utility Index is a derived, weighted measure that assigns a health value based on responses to a number of questions. These questions allow respondents to indicate the degree

to which they have trouble with vision, hearing, speech, dexterity, mobility, emotion, cognition, and the extent to which their activities are limited by pain. Of these measures, initially only mobility, dexterity, and activity limitation due to pain functions were used. Other measures such as vision or hearing were omitted due to concerns over sample size. Measures such as emotional trouble and a cognition problem were dropped due to potential collinearity with the outcome of interest. Dexterity was not included in the analysis due to sample size and power problems that emerged during longitudinal analysis. In the final analysis, only a pain problem and mobility problem were included.

#### 4.5 Analysis

For the objectives of this study, participants aged 65 years and older in cycle 3 (1998) of the NPHS were included. Cycle 3 was the first cycle to include the MOS Social Support Survey, and therefore this cycle was set as the “baseline” cycle for this study. Individuals were excluded if they were missing data in 1998 that prevented the establishment of types and levels of social support, or that lacked information allowing for assessment of depression via the CIDI-SFMD or ATC Codes. This sample was further restricted for the longitudinal analysis, as detailed below. All analysis and results are bootstrapped and survey-weighted.

As the NPHS sample was drawn using multi-stage stratified design, survey weights used were developed based on census data and weighted by sex and age group for each province. As the first cycle of data was collected in 1994/1995, census data from 1994/1995 was used to develop survey weights. The weights were subsequently adjusted after each subsequent cycle to reflect response and non-response of study participants. This was done as the probability of response versus non-response differs from the probability of being chosen for the study. Survey weights used in this study therefore not only take into account the representation of the sample compared to the population by age, demographics, and geography, they also adjust for response patterns that are not homogeneous across these categories. A full description of survey weight calculations is available in the Statistics Canada NPHS documentation (Statistics Canada, 2008b).

#### 4.5.1 Objective 1 – Describe the characteristics of included participants and of non-respondents

##### 4.5.1.1 Study Sample

The study sample consisted of all individuals, aged 65 years of age and older, at cycle 3. As the primary objective of this study is to investigate the relationship between social support and the longitudinal risk of a MDE in seniors, the demographic, socioeconomic, and health status characteristics are presented for the sample in the longitudinal analysis. To ensure as much as possible that cases were incident, individuals were excluded if they coded positive for depression in 1998 or in the previous two cycles. Data was examined for variables associated with participant response in subsequent cycles, referred to as follow up. As cycle 3 served as baseline, follow-up was assessed using data from the following NPHS cycle (cycle 4). As cycles occurred every 2 years, this corresponds to our 2-year incidence estimates. Participants were considered “non-response” in the longitudinal analysis if they did not have a CIDI-SFMD or ATC code in Cycle 4.

##### 4.5.1.2 Analysis

The following demographic, socioeconomic and clinical characteristics of the included participants were described: age, sex, education, income, marital status, and living arrangement; Mobility or pain problem, a restriction to activity, and presence of a chronic condition; and type and level of social support.

Response and non-response were compared using bootstrapped and survey-weighted Chi-squared statistics, and are presented for each demographic, socioeconomic, and health status variable, in addition to social support categories. Death and institutionalization were not considered non-response, and therefore were not included in calculations relation to a loss to follow-up.

#### 4.5.2 Objective 2 – Estimate the 12-month prevalence of MDE at baseline

Investigate the cross-sectional association between social support and MDE

##### 4.5.2.1 Study Sample

The cross-sectional analysis was conducted using the data of cycles 3. The sample was restricted to those aged 65 years of age and older in cycle 3. Individuals were excluded if they did not have sufficient data to establish depression status (missing data for both CIDI-SFMD and ATC code) or social support data in cycle 3.

#### **4.5.2.2 Analysis**

The prevalence of a MDE was estimated. The denominator consisted of all individuals aged 65 years of age and older in cycle 3 with a code (0 or 1) for MDE (CIDI-SFMD or ATC codes) and a code for social support. The numerator consisted of all individuals in cycle 3 with a positive code for MDE.

Estimates of prevalence were then stratified by demographics (sex, education, income, marital status and living arrangement), health status (a mobility problem, pain problem, restriction to activity or chronic condition), and by type and level of social support. These variables were assessed at cycle 3.

### **4.5.3 Objective 3 – To estimate the 2-year and 8-year cumulative incidence proportion of MDE**

#### **4.5.3.1 Study Sample**

For 2-year incidence proportions, participants were aged 65 years of age and older, and free of a MDE on all cycles prior to, and including cycle 3. MDE in cycle 4 was used to determine the 2-year incidence of MDE. For 8-year cumulative incident proportion estimate, participants were aged 65 years of age and older at cycle 3 and free of a MDE on cycles 1, 2, and 3. Individuals were coded as depressed if they coded positive on the CIDI-SFMD or took an anti-depressant as assessed by ATC codes during cycle 4 or any subsequent cycle. Complete follow-up data was not required.

#### **4.5.3.2 Analysis**

For 2-year incident proportion, the denominator consisted of all individuals, aged 65 years of age and older at cycle 3 (baseline), free of a MDE in cycles 1, 2 and 3. This comprised the at risk population. The numerator consisted of all individuals from this at risk population who had developed an MDE in cycle 4.

For 8-year incident proportion, the denominator consisted of all individuals 65 years of age and older at cycle 3, free of MDE on cycles 1, 2 and 3. The numerator consisted of all individuals from this at risk population who had developed an MDE in cycles 4-8.

Incident proportion estimates were then stratified by demographics (sex, age group, education, income, marital status, living arrangement), health status (a mobility problem, pain problem, restriction to activity or chronic condition), and type and level of social support.

#### 4.5.4 Objective 4 – Investigate the longitudinal association between social support and MDE

##### 4.5.4.1 Study Sample

All participants were aged 65 years of age and older, and free of a MDE on all cycles prior to, and including cycle 3. Participants were excluded if the MOSSS module was not completed in cycle 3. Participants were coded as “non-response” if no data was available to establish depression status after cycle 3. Individuals are not required to have a CIDI-SFMD or ATC code for all cycles following cycle 3.

##### 4.5.4.2 Analysis

For longitudinal modeling, 8-year incidence was used as the outcome. That is, individuals were considered depressed if they coded positive on the CIDI-SFMD or reported taking an anti-depressant during any cycle after baseline. The crude association between each type of social support and a depression was estimated using univariate logistic regression. Models were then adjusted for age and assessed first for effect modification by each demographic and health status variable, then for confounding through a comparison of the crude odds ratio to the covariate adjusted model.

The potential effect modification of the social-support and depression relationship by each demographic and health status variable was examined. This was done through the creation of an “interaction” term by generating a product term of social support x the variable that was then input into the model. There was considered evidence of effect modification if the p-value associated with the interaction term was less than 0.05, as is common in the psychiatric epidemiology literature, or if the confidence interval associated with the estimate of the odds ratio did not enclose the null value. It should be noted that in instances where the p-value was very close to significance (for arguments sake 0.051), or had a confidence interval only slightly enclosing the null value the student erred on the side of caution and included the interaction term in initial multivariate models. Where effect modification was found, results are described by the levels of the effect modifier. If no effect modification was found, confounding was assessed through a comparison of the crude and variable-adjusted odds ratios. Any demographic or health status variable that was found to be an effect modifier, confounder, or strong independent-risk factor for a MDE, or strongly associated with social support levels based on univariate analysis was included in initial multivariate models.

In multivariate models, terms were removed through step-wise backwards elimination. If an effect modification term was present in the model, this was the first term assessed. If it was not-significant on the basis of p-value, it was removed from the model. After assessing each effect modification term present in the model, the student began to remove terms one at a time on the basis of significance, with the least significant terms being removed first. Terms were removed from the model if  $p < 0.05$ . After the removal of each term, the odds ratio associated with the social support – depression relationship was compared to the earlier model. If the odds ratio differed significantly then there was considered to be evidence of confounding, and the term was replaced. It was intended that models would be compared using likelihood-ratio tests and Wald tests to compare the similarity between multivariate models. Unfortunately this was not possible due to constraints imposed through the survey and bootstrap weights used in the analysis. Therefore the comparison of models and conclusions regarding confounding was done subjectively, and evidence of confounding considered if the odds-ratio associated with the social support – depression relationship differed significantly.

## 4.6 Supplementary Analysis

Following completion of the specified objectives above, a supplementary analysis was undertaken. This included (1) a comparison of the incidence and prevalence of MDE when coded using solely the CIDI-SFMD versus that of solely ATC codes, versus the combined outcomes which served to inform Objective 2; (2) an analysis of the types of antidepressants reported by participants; and (3) the impact on the estimates of the risk of an MDE if anti-depressants commonly prescribed for other conditions, such as sleep or chronic pain, were excluded from the analysis. Further details of these methods are as follows:

### 4.6.1 Supplementary Analysis 1 – Comparison of outcome coding through incidence and prevalence estimates

#### 4.6.1.1 Sample 1 - CIDI-SFMD

The analytical technique and sample is identical to that specified for objectives 2 and 3, with the exception that MDE was classified as coding positive on the CIDI-SFMD only. Those with a positive CIDI-SFMD code in 1998 contributed to the prevalence estimates. Those who coded positive on the CIDI-SFMD in 2000, who did not have a prior CIDI-SFMD code in 1998 for MDE contributed to the 2-

year incidence estimates of MDE. Those with a CIDI-SFMD code for MDE in cycles 4 (2000) – 7 (2006) who did not have a CIDI-SFMD code for MDE in 1998 contribute to the 8-year incidence estimates of MDE.

#### **4.6.1.2 Sample 2 - ATC-Codes**

The analytical technique and sample is identical to that specified for objectives 2 and 3, with the exception that MDE was classified as antidepressant use, as specified through ATC-Codes. Those with a positive ATC-code in 1998 contributed to the prevalence estimate. Those with a positive ATC-code in 2000, who did not have a prior ATC-code in 1998 contributed to the 2-year incidence estimates of MDE. Those with an ATC-Code for antidepressant use in cycles 4 (2000) – 7 (2006) who did not have an ATC-Code in 1998 contribute to the 8-year incidence estimates of MDE.

#### **4.6.1.3 Sample 3 - CIDI-SFMD and ATC Codes**

The analytical technique and sample is identical to that specified for objectives 2 and 3. This sample was used for all non-supplementary analysis.

#### **4.6.1.2 Analytical Technique**

Computation of prevalence and incidence estimates is identical to that specified in Objectives 2 and 3, respectively, with the exception of differences in the determination of the sample for analysis, as specified above. The point estimates of MDE prevalence, 2-year incidence, and 8-year incidence are presented for each of the three groups: CIDI-SFMD, ATC-Codes, and CIDI-SFMD and ATC-Code combined. Confidence Intervals are presented for each point estimate. Differences in estimates were examined based on differences in point estimates and width and overlap of confidence intervals.

### **4.6.2 Supplementary Analysis 2 – Antidepressant usage by participants**

#### **4.6.2.1. Sample**

All participants who received an ATC Code for antidepressant usage at 2-year follow-up were included in this analysis.

#### *4.6.2.2 Analytic Technique*

Study participants reported up to 11 different types of medication being concurrently used. This represented 11 different medication lists of ATC codes. Each list was individually searched for ATC drug codes. Each antidepressant formulation was individually searched within each list. These codes were then condensed into antidepressant drug categories (SNRI, SSRI, MAOI, etc.) based on ATC drug classifications. Categories of antidepressants were not mutually exclusive – that is individuals were able to code positive for more than one type of antidepressant usage.

### **4.7 Data Access**

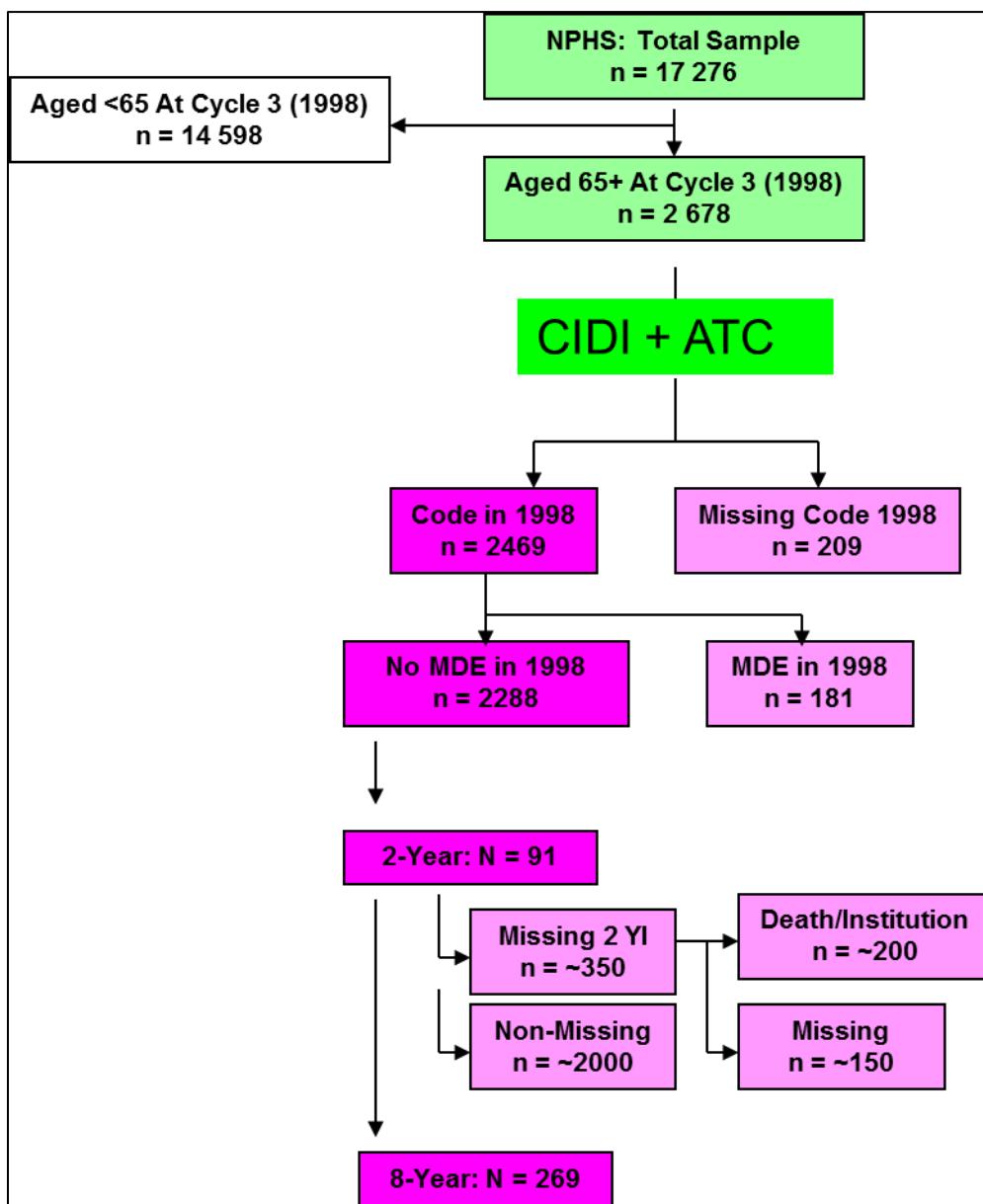
The NPHS data is strictly controlled by the Social Sciences and Humanities Research Council (SSHRC) and Statistics Canada. The student obtained written permission, and signed the necessary documentation with the SSHRC and Statistics Canada to gain access to the NPHS data through the Prairie Regional Data Center (RDC) prior to beginning analysis. The Prairie RDC is a closed network, video monitored, secure facility for data storage and analysis and is located at McKimmie Library on the University of Calgary Campus. All information released from the facility was done so at the discretion of the Senior Analyst, a Statistics Canada official in accordance with Statistics Canada and Research Data Center policy. Additionally, all members of the research team must sign a binding contract of confidentiality and non-disclosure. Due to privacy and confidentiality concerns, no data that can risk identifying a participant may be published or released from the facility. Therefore, results to be released are vetted by analysts at the RDC to ensure confidentiality.

In fulfilling the requirements of a Master's of Science degree in Community Health Sciences (Epidemiology) in the Faculty of Medicine at the University of Calgary, this study obtained approval from the Conjoint Health Research Ethics Board (CHREB) prior to study commencement.

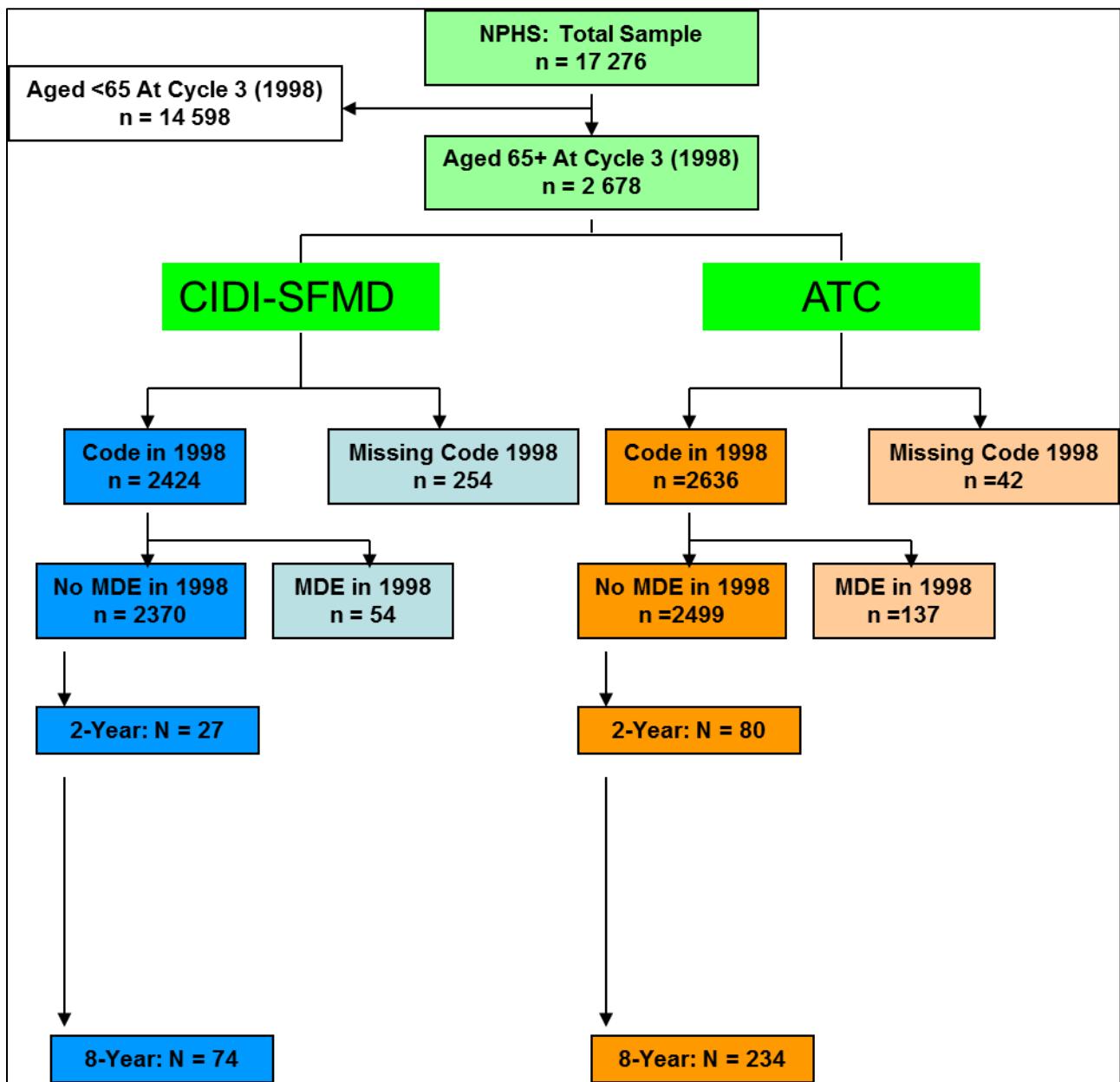
## 5. Results

There were 2469 participants, who were aged 65 years and older and had complete information about social support and MDE at baseline. They were eligible to be included in the analysis. Among the eligible participants, 2288 had complete follow-up data and were included in the longitudinal analyses.

**Figure 5.1 – Sample Size diagram for final outcome coding: MDE by CIDI-SFMD and ATC Codes**



**Figure 5.2 – Sample size diagram for alternative outcome coding; changes in MDE using CIDI-SFMD or ATC codes alone**



## 5.1. Objective 1 - Describe demographic & socioeconomic characteristics

### 5.1.1 Sample Characteristics

The demographic characteristics of respondents (n=2469) are presented in Table 1.1. The mean age of participants at baseline was 73.7 years of age (95% CI 73.41-74.1, SE 0.17). At baseline, 58.29 (95% CI 56.46%-60.11%) of participants were female, 48.88% (95% CI 46.07%-61.69%) had less than a high school education, and 78.61% (95% CI 76.22%-81.01%) were

classified as middle or high income. The majority of participants were married, common law or single (59.33%, 95% CI 56.56%-62.09%), while 40.67% (95% CI 37.91%-43.44%) were widowed, separated or divorced. Over half of participants reported living with their partner (53.50%, 95% CI 50.66%-56.34%). Remaining participants were living alone (36.42%, 95% CI 33.78%-39.06%) or with others (10.09%, 95% CI 8.13%-12.04%).

**Table 1.1 – Baseline demographic characteristics and response rate at first follow-up**

		Baseline (1998) N=2288			Follow up (2-year) N=2000* N=150*			
DEMOGRAPHICS		%	95 % CI LL UL		% Resp	% Non-Resp	Chi2	p
Variable								
Sex	Male	41.71	39.89	53.54	40.46	42.01	0.14	0.797
	Female	58.29	56.46	60.11	59.54	57.99		
Age Group	65-69	31.33	29.10	33.56				
	70-74	27.32	24.81	29.82				
	75-79	22.31	20.12	24.51				
	80-84	12.13	10.48	13.78				
	85+	6.91	5.62	8.20				
Education	Less than HS	48.88	46.07	61.69	47.81	59.08	7.12	0.088
	High School +	51.12	48.31	53.93	52.19	40.92		
Income	Low	21.39	18.99	23.78	21.60	24.48	1.08	0.453
	Middle/High	78.61	76.22	81.01	79.40	75.52		
Marital Status	Mar/CL/Single	59.33	56.56	62.09	60.02	54.83	1.44	0.439
	Widowed/Sep/Div	40.67	37.91	43.44	39.98	45.17		
Living Arrangement	Alone	36.42	33.78	39.06	36.01	39.04	31.70	0.007
	w/ Partner	53.50	50.66	56.34	55.04	38.88		
	w/ Others	10.09	8.13	12.04	8.95	22.08		

\*Sample size (N) approximations are presented keeping with Statistics Canada data vesting policy.

Analysis used exact sample sizes.

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

Results unavailable due to Statistics Canada cell-count requirements

The health characteristics of participants are presented in Table 1.2. A mobility problem was reported by 11.24% (95% CI 9.72%-12.77%) of participants and a pain problem by 23.76% (95% CI 21.49%-26.03%). A third of participants (35.47%, 95% CI 33.14%-37.80%) reported a restriction to activity, while the majority of participants (80.39%, 95% CI 78.10%-82.68%) reported the presence of one or more chronic conditions.

As social support was dichotomized based on quartile, with the lowest quartile representing “low social support”, approximately 25% of participants were classified as low support and 75% as high support. The exact estimates differed slightly: 28.67% low tangible social support, 29.70% low affection social support, 26.20% low positive social interaction, and 27.08% emotional social support. The exception is structural social support, where due to the highly skewed distribution 36.77% (95% CI 34.09%-39.45%) were classified as low social support.

**Table 1.2 – Baseline health status characteristics and response rate at first follow-up**

		Baseline (1998)			Follow up (2-year)			
		N=2288		N=2000*	N=150*			
<b>HEALTH STATUS</b>	<b>Variable</b>	%	95 % CI LL	UL				
		%	95 % CI LL	UL	% Resp	% Non-Resp	Chi2	p
HUI - Mob	No Problem	88.76	87.23	90.28	90.06	89.73	0.02	0.914
	Problem	11.24	9.72	12.77	9.94	10.27		
HUI - Pain	No Problem	76.24	73.97	78.51	77.40	75.11	0.41	0.641
	Problem	23.76	21.49	26.03	22.60	24.89		
Restriction to Activity	No	64.53	62.20	66.86	67.40	59.09	3.23	0.26
	Yes	35.47	33.14	37.80	33.60	40.91		
Chronic Condition	No	19.61	17.32	21.90	20.91	9.63	11.14	0.002
	Yes	80.39	78.10	82.68	79.09	90.37		

\*Sample size (N) approximations are presented keeping with Statistics Canada data vesting policy.

Analysis used exact sample sizes.

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

### 5.1.2 Participant response and non-response

Participants who dropped out of the cohort and who did not have data about MDE (through CIDI-SFMD or ATC coding) for the entire follow-up period (cycles 4-7) were considered “non-response”. They were excluded from the longitudinal analysis. Participants were not considered non-response if MDE data was available for at least one cycle after baseline. Proportions of response and non-response of participants were compared across each demographic, health status variable and levels of social support, using chi-square tests.

Participants who were classified as “non-response” were more likely to be “living with others” at baseline than other respondents ( $\text{Chi}^2 31.70, p < 0.007$ ). They were not different in other demographic characteristics. Those with a chronic condition at baseline were less likely to be classified as “non-response” at 2-year follow-up than those without a chronic condition ( $\text{Chi}^2 11.14, p < 0.002$ ) (Table 1.2). Levels and types of social support (Table 1.3) were not found to be associated with participant response on the basis of chi-squared statistics.

**Table 1.3 – Baseline social support characteristics and response rate at first follow-up**

		Baseline (1998) N=2469			Follow up (2-year)			
		%	95 % CI LL	UL	% Resp	% Non-Resp	Chi2	p
<b>SOCIAL SUPPORT</b>	<b>Variable</b>							
Tangible	High	71.33	68.86	73.81	71.00	77.64	2.76	0.185
	Low	28.67	26.19	31.14	29.00	22.36		
Affection	High	70.29	67.63	72.95	71.00	77.64	2.76	0.185
	Low	29.70	27.05	32.37	29.00	22.36		
Positive Social Interaction	High	73.80	71.43	76.16	73.61	77.65	1.08	0.423
	Low	26.20	23.84	28.57	26.39	22.35		
Emotional	High	72.92	70.58	75.27	72.79	77.74	1.61	0.326
	Low	27.08	24.73	29.42	27.24	22.26		
Structural	High	63.23	60.55	65.91	63.35	65.40	0.24	0.721
	Low	36.77	34.09	39.45	36.65	34.60		

\*Sample size (N) approximations are presented keeping with Statistics Canada data vesting policy.

Analysis used exact sample sizes.

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

## 5.2. Objective 2 – 12-Month Prevalence

Prevalence of a MDE was estimated to be 6.50% (95% CI: 5.38% - 7.63%). No statistically significant differences in prevalence estimates were found by sex, education, marital status, income, or living arrangement on the basis of confidence intervals. The 12-month prevalence was higher among those aged 65-69 (8.17%, 95% CI 5.84%-10.49%) than it was among those aged 70-74 (3.85%, 95% CI 2.30-5.39%). There were no differences in prevalence estimates between those aged 75-79, 80-84, or 85+ years compared to other age groups. (Table 2.1.1)

**Table 2.1.1 – 12-Month prevalence of MDE, by demographics (N=2469)**

<b>Variable</b>		<b>%</b>	<b>95 % CI</b>	
			<b>LL</b>	<b>UL</b>
Prevalence		6.50	5.38	7.63
Sex	Male	5.90	4.06	7.74
	Female	6.93	5.42	8.44
Age Group	65-69	8.17	5.84	10.49
	70-74	3.85	2.30	5.39
	75-79	6.40	3.71	9.08
	80-84	6.02	2.45	9.60
	85+	10.07	5.22	14.92
Education	<HS	5.51	3.99	7.02
	HS+	5.80	4.19	7.41
Income	Low	9.47	6.33	12.60
	Middle/High	5.56	4.33	6.78
Marital Status	Mar/CL/Single	5.56	4.15	6.98
	Wid/Sep/Div	7.95	5.85	10.05
Living Status	Live Alone	8.56	6.33	10.79
	Live w/Partner	5.41	3.85	6.97
	Live w/Others	4.61	2.08	7.14

\*CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

Differences in the prevalence of MDE were found among all health status indicators: mobility problem, pain problem, restriction to activity and chronic condition. Those with a

mobility problem had a prevalence of depression three times that of those who did not report a mobility problem at 15.90% (95% CI: 11.03% - 20.78%) and 5.16% (95% CI: 4.09% - 6.23%) respectively. The prevalence of MDE among those reporting a pain problem was found to be 11.24% (95% CI: 8.23%-14.24%) versus those without a pain problem being lower at 4.92% (95% CI: 3.79%-6.06%). Those who reported a restriction to activity were found to have a prevalence of a MDE of 10.95% (95% CI: 8.65%-13.24%) versus those without a restriction at 3.85% (95% CI: 2.57%-5.13%). Those who reported the presence of at least one chronic condition were found to have a higher prevalence than those without a chronic condition, with estimates at 7.43% (95% CI: 6.08%-8.79%) and 2.48% (95% CI: 0.68%-4.29%) respectively. Correlations between these health status variables were examined in multivariate modeling – no correlations were found.

**Table 2.1.2 – 12-Month prevalence of MDE, by health status (N=2469)**

<b>Variable</b>		<b>%</b>			<b>95 % CI</b>	
			<b>LL</b>	<b>UL</b>		
HUI-Mobility	No Problem	5.16	4.09	6.23		
	Problem	15.90	11.03	20.78		
HUI-Pain	No Problem	4.92	3.79	6.06		
	Problem	11.24	8.23	14.24		
Restriction to activity	No	3.85	2.57	5.13		
	Yes	10.95	8.65	13.24		
Chronic Condition	No	2.48	0.68	4.29		
	Yes	7.43	6.08	8.79		

\*CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

Tangible social support and positive social interaction were found to be statistically significant in their association with 12-month prevalence of MDE on the basis of confidence intervals. Those with a high level of tangible social support were found to have a depression prevalence of 3.70% (95% CI: 2.62%-4.80%), compared to those with a low level of tangible social support who had a much higher 12-month depression prevalence (8.65%, 95% CI: 6.12%-11.19%). Those with a high level of positive social interaction had a lower 12-month depression prevalence of 4.23% (95% CI: 3.10%-5.35%), compared to those with a low level of positive

social interaction at 8.39% (95% CI: 5.80%-10.97%). Emotional social support had confidence intervals that were only slightly overlapping, suggesting there may be some evidence for an association between low emotional social support and increased 12-month prevalence of MDE (4.25%, 95% CI: 3.13%-5.37% vs. 7.69%, 95% CI: 5.24%-10.13%). Point estimates of 12-month MDE prevalence were higher among all low social support groups, even were statistical significance was not demonstrated on the basis of confidence intervals.

**Table 2.1.3 – 12-Month prevalence of MDE, by Social Support (N=2469)**

<b>Variable</b>		<b>%</b>	<b>95 % CI</b>	
			<b>LL</b>	<b>UL</b>
Tangible Social Support	High	3.70	2.61	4.80
	Low	8.65	6.12	11.19
Affection Social Support	High	4.97	3.66	6.27
	Low	6.28	4.03	8.52
Positive Social Interaction	High	4.23	3.10	5.35
	Low	8.39	5.80	10.97
Emotional Social Support	High	4.25	3.13	5.36
	Low	7.69	5.24	10.13
Structural Social Support	High	4.95	3.66	6.24
	Low	5.77	3.98	7.57

### 5.3. Objective 3 – 2-Year and 8-Year Incidence Proportions

Among included participants, the 2-year Incidence proportion of a MDE was estimated to be 4.54% (95% CI: 3.38%-5.60%); the 8-year incidence proportion of MDE was estimated to be 13.09% (95% CI: 11.27%-14.90%). The 2-year incidence did not differ by demographic variables. When examining 8-year incidence, differences in the incidence of MDE were only found by sex, with 8-year depression incidence higher among women (16.53%, 95% CI: 13.98%-19.07%) than men (7.92% 95% CI: 5.27%-10.55%).

**Table 3.1 – Incidence by demographic characteristic, 2- and 8-year incidence of MDE**

<b>Variable</b>		<b>2-Year</b>			<b>8-Year</b>		
		<b>%</b>	<b>95 % CI</b>		<b>%</b>	<b>95 % CI</b>	
			<b>LL</b>	<b>UL</b>		<b>LL</b>	<b>UL</b>
MDE		4.54	3.38	5.60	13.09	11.27	14.90
Sex	Male	2.75	1.01	4.40	7.92	5.27	10.55
	Female	5.75	4.18	7.30	16.53	13.98	19.07
Age Group	65-69	5.88	3.40	8.37	13.41	9.99	16.83
	70-74	2.83	1.18	4.48	10.69	7.68	12.70
	75-79	5.21	2.31	8.11	14.58	10.11	19.05
	80-84	3.20	0.90	5.50	13.48	8.59	18.38
	85+	5.12	0.90	9.37	16.26	9.22	23.31
Education	Less than HS	4.27	2.89	5.65	12.82	10.35	15.30
	High School +	4.79	2.94	6.64	13.33	10.59	16.07
Income	Low	4.79	2.72	6.86	15.58	11.09	20.07
	Middle/High	4.50	3.07	5.90	12.62	10.39	14.85
Marital Status	Mar/CL/Single	4.67	3.01	6.34	11.73	9.41	14.05
	Widowed/Sep/Div	4.20	2.68	5.72	15.33	12.30	18.36
Living Arrangement	Alone				14.23	11.34	17.13
	w/ Partner	Result unavailable*			12.43	9.87	15.00
	w/ Others				12.49	5.84	19.14

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

\*Results unavailable due to Statistics Canada cell-count requirements

It was found that those with a restriction to an activity of daily living had a 2-year incidence of MDE of 9.30% (95% CI 4.00% - 10.37%) compared to those without a restriction of 2.15% (95% CI 1.17%-3.10%). Among those with a chronic condition, 2-year incidence was estimated to be 5.42% (95% CI 4.01%-6.80%) compared to 1.20% (95% CI 0.02%-2.30%) among those without a chronic condition. For the 8-year incidence of MDE, 21.70% of those with a mobility problem developed MDE (95% CI 15.06%-28.34%) compared to those without a mobility problem (12.22%, 95% CI 10.27%-14.18%). Those with a pain problem were more likely to have had MDE at 8-years (19.92%, 95% CI 15.32%-24.53%) compared to those without a pain problem (11.05%, 95% CI 9.02%-13.08%). Those with a chronic condition had an estimated 8-year incidence of MDE of 14.96% (95% CI 12.85%-17.06%) compared to those without a chronic condition (5.85%, 95% CI 3.12%-8.58%).

**Table 3.2 – Incidence by health status, 2- and 8-year incidence of MDE**

<b>Variable</b>		<b>2-Year</b>			<b>8-Year</b>		
		<b>%</b>	<b>95 % CI</b>		<b>%</b>	<b>95 % CI</b>	
			<b>LL</b>	<b>UL</b>		<b>LL</b>	<b>UL</b>
HUI - Mob	No Problem	4.19	2.92	5.40	12.22	10.27	14.18
	Problem	7.67	3.55	11.77	21.70	15.06	28.34
HUI - Pain	No Problem	3.77	2.60	4.90	11.05	9.02	13.08
	Problem	7.19	4.00	10.37	19.92	15.32	24.53
Restriction to Activity	No	2.15	1.17	3.10	Result unavailable*		
	Yes	9.30	6.59	12.00			
Chronic Condition	No	1.20	0.02	2.30	5.85	3.12	8.58
	Yes	5.42	4.01	6.80	14.96	12.85	17.06

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

\*Results unavailable due to Statistics Canada cell-count requirements

The 2-year incidence of MDE did not differ by types or level of social support. When examining 8-year incidence of MDE however, differences were found among those with a high (11.75%, 95% CI: 9.60%-13.89%) versus low (17.96%, 95% CI: 13.97%-21.95%) positive

social interaction. Although differences by other types of social support were approaching statistical significance (affection social support and emotional social support), the confidence intervals overlapped, indicating that the stratum specific proportions may not be significantly different at the population level. .

**Table 3.3 – Incidence by social support, 2- and 8-year incidence of MDE**

<b>Variable</b>		<b>2-Year</b>			<b>8-Year</b>		
		<b>%</b>	<b>95 % CI</b>		<b>%</b>	<b>95 % CI</b>	
			<b>LL</b>	<b>UL</b>		<b>LL</b>	<b>UL</b>
Tangible	High	4.00	2.58	5.40	12.24	10.04	14.44
	Low	6.18	3.85	8.51	16.17	12.26	20.06
Affection	High	4.14	2.73	5.50	11.69	9.58	13.80
	Low	5.39	3.12	7.65	17.10	13.17	21.04
Positive Social Interaction	High	3.80	2.52	5.00	11.75	9.60	13.89
	Low	6.99	4.28	9.70	17.96	13.97	21.95
Emotional	High	4.10	2.79	5.40	11.95	9.90	14.00
	Low	6.16	3.56	8.76	17.37	13.44	21.30
Structural	High	4.43	2.94	5.90	12.56	10.27	14.84
	Low	4.90	3.05	6.70	14.46	11.36	17.55

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

## 5.4. Objective 4 – Longitudinal investigation of the relationships between social support and the risk of major depression

I estimated the crude association of the social support relationship between each type of social support and the 8-year risk of depression, followed by a sex and age adjusted model. No evidence of modification by sex or age was found (Table 4.0). I found affection (OR 1.56, 95% CI 1.08-2.21, p=0.013), positive social interaction (OR 1.64, 95% CI 1.16-2.33, p=0.005) and emotional social support (OR 1.55, 95% CI 1.11-2.16, p=0.001) to be associated with the development of a MDE in the crude and age & sex adjusted models, with those of low social support being more likely to develop a MDE over our study period. No evidence of confounding was found by sex or age through a comparison of the adjusted to crude estimates for each type of social support.

**Table 4.0 – Crude association of the longitudinal risk of depression, by type of social support**

Type of Social Support	Crude Association (Unadjusted)				Age and Sex Adjusted			
	OR	P	95% CI		OR	P	95% CI	
			LL	UL			LL	UL
Tangible Social Support	1.38	0.082	0.96	1.99	1.28	0.173	0.90	1.82
Affection Social Support	1.56	0.013	1.10	2.21	1.53	0.018	1.08	2.16
Positive Social Interaction	1.64	0.005	1.16	2.33	1.59	0.009	1.12	2.25
Emotional Social Support	1.55	0.010	1.11	2.16	1.53	0.013	1.09	2.14
Structural Social Support	1.18	0.330	0.85	1.63	1.18	0.318	0.85	1.64

OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

Potential effect modifications by other variables in the relationship between social support and MDE were assessed. Marital status, living arrangement, a mobility problem and the presence of one or more chronic conditions were not found to be effect modifiers. They were not significantly associated with MDE in the models, and therefore were removed in the final model (Table 4.1.1). While no confounding was found by sex or age, both were included in the final model. Income (p = 0.019) and pain (p = 0.025) were found to be effect modifiers in the relationship between tangible social support and MDE. It was found that those with low tangible social support, without a pain problem, had a risk of MDE of 2.66 (95% CI 1.03-6.75, p=0.044) compared to those of high social support. Among those with a pain problem, the level of tangible social support became unrelated to the risk of a MDE (OR 1.66, 95% CI 0.63-4.32,

$p=0.303$ ). A similar finding was found by income level, with those of low social support among the low income group having a risk of 2.66 (95% CI 1.02-6.89,  $p=0.044$ ) compared to those of high social support. Tangible social support was not associated with development of a MDE in those of a middle or high income (OR 1.23, 95% CI 0.72-2.12,  $p=0.451$ ). Stratum specific estimates of the odds ratio are presented in Table 4.1.2. It should be noted that while a restriction to activity was not found to be a confounder in the relationship between tangible social support and depression, it was included in the final model as it assessed “restrictions to activity of daily living”, while tangible support largely assessed support available to help with such restrictions.

**Table 4.1.1 – Longitudinal multivariate regression of the risk of depression, by tangible social support**

Term	Starting Model*				Final Model			
	OR	P	95% CI		OR	P	95% CI	
			LL	UL			LL	UL
Tangible Social Support	1.14	0.633	0.66	1.98	1.13	0.658	0.66	1.95
Age	0.99	0.685	0.96	1.02	1.00	0.805	0.97	1.03
Sex	1.86	0.006	1.19	2.90	1.90	0.005	1.20	2.98
Income	0.57	0.064	0.31	1.03	0.58	0.050	0.33	1.00
Marital Status	1.11	0.672	0.69	1.80	-	-	-	-
Living Arrangement	1.07	0.740	0.73	1.55	-	-	-	-
Mobility Problem	1.29	0.389	0.72	2.33	-	-	-	-
Pain Problem	1.54	0.117	0.90	2.65	1.74	0.031	1.05	2.88
Restriction to Activity	2.72	0.000	1.78	4.15	3.00	0.000	2.00	4.51
Chronic Condition	1.75	0.069	0.96	3.22	-	-	-	-
Modification: TNG * Income	2.68	0.023	1.14	6.26	2.70	0.019	1.18	6.19
Modification: TNG * Pain	0.43	0.028	0.20	0.91	0.43	0.025	0.20	0.90

TNG = Tangible social support, OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

In addition to the variables identified as potential confounders in the tangible social support model (income, marital status, living arrangement, a mobility and pain problem, restriction to activity and presence of a chronic condition), education was additionally identified as a potential confounder in the setting of affection social support and included in the initial model. There was evidence that a reported pain problem acted as an effect modifier in the

relationship between affection social support and MDE (OR = 0.35, p=0.008). Among those without a pain problem, the risk of a MDE among those of low affection social support compared to those with high affection social support was estimated to be OR 2.09 (95% CI 1.33-3.28, p=0.001). Among those with a pain problem, no difference was found between those of low and high affection social support regarding the risk of depression (OR 1.00, 95% CI 0.55-1.82, p=0.989) (Table 4.2.2).

**Table 4.1.2 – Longitudinal multivariate regression of the risk of depression, by tangible social support, stratum specific estimates**

Stratum specific ORs of tangible social support		OR	P	95% CI	
				LL	UL
Tangible Social Support	No Pain	2.63	0.044	1.03	6.75
	Pain Problem	1.66	0.303	0.63	4.32
	Low Income	2.66	0.044	1.02	6.89
	Middle/High Income	1.23	0.451	0.72	2.12

**Table 4.2.1 – Longitudinal multivariate regression of the risk of depression, by affection social support**

Term	Starting Model				Final Model			
	OR	P	95% CI		OR	P	95% CI	
			LL	UL			LL	UL
Affection Social Support	2.12	0.001	1.34	3.35	2.07	0.001	1.33	3.24
Age	0.99	0.581	0.96	1.02	0.98	0.271	0.96	1.01
Sex	1.86	0.010	1.16	2.96	2.01	0.004	1.26	3.22
Education	1.02	0.928	0.69	1.51	-	-	-	-
Income	1.12	0.653	0.69	1.81	-	-	-	-
Marital Status	1.10	0.673	0.70	1.73	-	-	-	-
Living Arrangement	1.16	0.399	0.82	1.65	-	-	-	-
Mobility Problem	1.35	0.317	0.75	2.42	-	-	-	-
Pain Problem	1.59	0.099	0.92	2.75	2.06	0.005	1.25	3.38
Restriction to Activity	2.59	0.000	1.72	3.91	2.70	0.000	1.82	4.01
Chronic Condition	1.73	0.081	0.94	3.18	-	-	-	-
Modification: AFF * Pain	0.36	0.018	0.15	0.84	0.35	0.008	0.16	0.76

AFF = Affection social support, OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

**Table 4.2.2 – Longitudinal multivariate regression of the risk of depression, by affection social support, stratum specific estimates**

Stratum specific ORs of affection social support		OR	P	95% CI	
				LL	UL
Affection Social Support	No Pain	2.09	0.001	1.33	3.28
	Pain Problem	1.00	0.989	0.55	1.82

OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

No evidence was found of effect modification by any of the demographic or health status terms in the positive social interaction – MDE relationship. Following the initial model, income, marital status, living arrangement, pain and mobility problems, chronic condition and restriction to activity were all removed from the model (Table 4.3). Positive social interaction was significant in the initial model (OR 1.59, 95% CI 1.09-2.34, p=0.017), and remained significant in the final model, with those with a low level of positive social interaction more likely to develop and MDE than those of a high positive social interaction (OR 1.59, 95% CI 1.12-2.25, p=0.009). The final positive social interaction model did not differ significantly from the crude (OR 1.64, 95% CI 1.16-2.33, p=0.005). I did not find any effect modifiers or confounders of the positive social interaction – depression relationship.

**Table 4.3 – Longitudinal multivariate regression of the risk of depression, by positive social interaction**

Term	Starting Model				Final Model			
	OR	P	95% CI		OR	P	95% CI	
			LL	UL			LL	UL
Positive Social Interaction	1.59	0.017	1.09	2.34	1.59	0.009	1.12	2.25
Age	0.99	0.508	0.96	1.02	1.01	0.669	0.98	1.03
Sex	1.87	0.007	1.19	2.94	2.30	<0.001	1.49	3.55
Income	1.09	0.731	0.67	1.75	-	-	-	-
Marital Status	1.07	0.795	0.66	1.73	-	-	-	-
Living Arrangement	1.11	0.563	0.77	1.60	-	-	-	-
Mobility Problem	1.45	0.213	0.81	2.59	-	-	-	-
Pain Problem	1.00	0.987	0.65	1.56	-	-	-	-
Restriction to Activity	2.58	0.000	1.68	3.96	-	-	-	-
Chronic Condition	1.72	0.079	0.94	3.16	-	-	-	-

OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

In the initial model, emotional social support was significantly associated with MDE (OR=1.47, p = 0.05) (Table 4.4). No effect modifications of emotional social support by demographic or health status variables were found. Beginning with the least significant term, variables were removed from the model via backwards-elimination. After the removal of each term models were compared to assess for the presence of confounding. In the final model, emotional support remained to be significantly associated with MDE (p=0.013). The final risk of a MDE was estimated to be 1.53 times higher among those with low emotional social support than those with high level of emotional support (OR=1.53, 95% CI: 1.09-2.14, p=0.013). The odds ratio associated with emotional social support did not differ significantly from the crude estimate of 1.55 (95% CI: 1.11-2.16, p=0.010), suggesting that chronic condition, restriction to activity, sex and age did not confound the relationship between emotional social support and depression.

**Table 4.4 – Longitudinal multivariate regression of the risk of depression, by emotional social support**

Term	Starting Model				Final Model			
	OR	P	95% CI		OR	P	95% CI	
			LL	UL			LL	UL
Emotional Social Support	1.47	0.050	1.00	2.15	1.53	0.013	1.09	2.14
Age	0.99	0.572	0.96	1.02	1.01	0.510	0.98	1.04
Sex	1.82	0.009	1.16	2.86	2.30	<0.001	1.49	3.55
Income	1.09	0.717	0.68	1.77	-	-	-	-
Marital Status	1.12	0.651	0.69	1.80	-	-	-	-
Living Arrangement	1.11	0.594	0.76	1.60	-	-	-	-
Mobility Problem	1.43	0.230	0.80	2.57	-	-	-	-
Pain Problem	0.99	0.953	0.64	1.53	-	-	-	-
Restriction to Activity	2.56	0.000	1.66	3.93	-	-	-	-
Chronic Condition	1.72	0.079	0.94	3.16	-	-	-	-

OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

In the initial model of structural social support and the odds of a MDE, the adjusted associated was estimated to be OR 1.16 (95% CI 0.81-1.67, p=0.411) (Table 4.5). No evidence was found to suggest effect modification by any demographic or health status variables. Terms were removed through backwards elimination and models compared to assess for potential confounding. The final model was adjusted age and sex. Structural social support remained

non-significant at  $p=0.318$ . The odds of depression among those of low and high structural support did not differ between the adjusted ( $OR\ 1.18$ , 95% CI 0.85-1.65,  $p=0.318$ ) and crude model ( $OR\ 1.18$ , 95% CI 0.85-1.63,  $p=0.330$ ), suggesting this relationship was not confounded by age, sex, restriction to activity or chronic condition.

**Table 4.5 – Longitudinal multivariate regression of the risk of depression, by structural social support**

Term	Starting Model				Final Model			
	OR	P	95% CI		OR	P	95% CI	
			LL	UL			LL	UL
Structural Social Support	1.16	0.411	0.81	1.67	1.18	0.318	0.85	1.65
Age	0.99	0.543	0.96	1.02	1.01	0.606	0.98	1.03
Sex	1.82	0.008	1.17	2.83	2.29	<0.001	1.49	3.52
Income	1.09	0.715	0.68	1.74	-	-	-	-
Marital Status	1.10	0.693	0.69	1.76	-	-	-	-
Living Arrangement	1.06	0.767	0.73	1.52	-	-	-	-
Mobility Problem	1.29	0.385	0.73	2.30	-	-	-	-
Pain Problem	1.12	0.597	0.73	1.72	-	-	-	-
Restriction to Activity	2.63	0.000	1.73	3.98	-	-	-	-
Chronic Condition	1.80	0.054	0.99	3.29	-	-	-	-

OR = Odds ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

## 5.5 Supplementary Analysis

Following planned analysis, investigations were performed to assess the role of including ATC codes in the identification of a MDE in order to help contrast findings with other Canadian studies that relied solely on the CIDI-SFMD. Additionally, analysis was performed to examine what role anti-depressants that are commonly used for chronic pain may have had on the estimation of the social support – depression relationship

First, CIDI-SFMD and ATC code-based estimates were compared. This resulted in a 12-month prevalence estimate of 2.23% (95% CI, 1.51% - 2.95%), a 2-year incidence estimate of 1.46% (95% CI: 0.68% - 2.25%), and an 8-year incidence estimate of 4.45% (95% CI, 3.00%-5.89%) using the CIDI-SFMD alone. Estimates of depression incidence and prevalence were nearly doubled when assessing depression by ATC codes alone when compared with those using only the CIDI – for instance a prevalence of 4.89% (95% CI 3.85% - 5.92%) using ATC codes versus 2.23% (95% CI 1.51% - 2.95%) using the CIDI-SFMD. When these two outcomes were combined, the resulting incidence and prevalence estimates were roughly additive of the two prior models. For example, 8-year incidence was estimated to be 4.45% with the CIDI, and 8.75% with ATC codes. Summing these two estimates together is equal to 13.20% - a number very close to the combined estimate of 13.09%. This is due to there being a very small proportion of the depressed sample that were both using an antidepressant and coding positive with the CIDI-SFMD.

**Table 5.1 – A Comparison of point estimates by outcome coding**

	CIDI			ATC			CIDI + ATC		
	%	95% CI		%	95% CI		%	95% CI	
		LL	UL		LL	UL		LL	UL
Prevalence	2.23	1.51	2.95	4.52	3.57	5.47	6.50	5.38	7.63
2-Year Incidence	1.46	0.68	2.25	3.45	2.55	4.34	4.54	3.38	5.60
8-Year Incidence	4.45	3.00	5.89	9.68	9.19	11.17	13.09	11.27	14.90

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

Second, due to concerns of potential antidepressant use for the treatment of chronic pain, the proportion of anti-depressant use by sub-class and specific anti-depressant was estimated. In order to ensure these results were as applicable to our estimates as possible, anti-depressant use at 2-year follow-up was estimated. This ensured that it was incident anti-depressant use. 8-year usage of antidepressants was not estimated due to concerns over participants changing anti-

depressant medication. The longitudinal sample was used for this analysis. It should be noted that Trazodone was the only anti-depressant of the SARI class used by our study sample. “Other Anti-depressant” includes the Monoamine Oxidase Inhibitor (MAOI), Serotonin-Norepinephrine Reuptake Inhibitor (SNRI), and Selective Dopamine Reuptake Inhibitor (SDRI) drug classes. Only anti-depressants with sufficient sample size to be listed by name are presented.

**Table 5.2 – Antidepressant usage of participants, by drug class at 2-year follow-up**

<b>Drug Class (N=2288)</b>	<b>Drug</b>	<b>95 % CI</b>		
		<b>%</b>	<b>LL</b>	<b>UL</b>
Not on an antidepressant		96.95	96.14	97.76
Tricyclic Antidepressant (TCA)	<b>Any TCA</b>	<b>1.13</b>	<b>0.59</b>	<b>1.66</b>
	Amitriptyline	0.61	0.18	1.04
	Doxepin	0.21	0.01	0.41
	Other TCA	0.30	0.05	0.55
Selective Serotonin Reuptake Inhibitor (SSRI)	<b>Any SSRI</b>	<b>1.46</b>	<b>0.83</b>	<b>2.09</b>
	Fluoxetine	0.09	-0.01	0.19
	Paroxetine	0.78	0.29	1.27
	Sertraline	0.38	0.09	0.68
	Other SSRI	0.20	0.01	0.39
Serotonin Antagonist and Reuptake Inhibitors (SARI) (Trazodone)		<b>0.30</b>	<b>0.03</b>	<b>0.57</b>
Other Antidepressant (MAOI, SNRI, SDRI)		<b>0.16</b>	<b>0.00</b>	<b>0.32</b>

CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

## 6. Discussion

### 6.1 Review of Key Findings

The purpose of this study was to examine the relationship between social support and the risk of a MDE among Canadian Community Dwelling seniors. Of the five types of social support examined, I found that the prevalence of MDE was higher among those with low tangible support compared to those with high support (3.70% vs. 8.65%), and among those with low levels of positive social interaction compared to high levels (8.39% vs. 4.23%). The 8-year incidence of a MDE was higher among those of low positive social interaction compared with high positive social interaction (4.23% vs. 8.39%).

In multivariate modeling, I found that those with low levels of positive social interaction and those with low emotional social support were more likely to develop a MDE over the 8-year study period than those with high levels of positive social interaction or high emotional social support. There was evidence that a reported pain problem and income level acted as an effect modifier in the relationship between tangible social support and MDE. Low tangible social support was a risk factor for a MDE, but only among those with either low income, or without a pain problem. Similar findings were found with affection social support, with low levels of affection social support being associated with higher risk of a MDE among those without a pain problem. I did not find evidence of effect modification or confounding for the other social support – depression relationships. No differences in incidence or prevalence of MDE were found by level of structural social support. Further, structural social support was not found significant in multivariate modeling.

I estimated a 12-month MDE prevalence of 6.50%, a 2-year incidence of 4.54%, and an 8-year incidence of 13.09%. The prevalence was higher among those aged 65-69 compared to those aged 70-74 on the basis of confidence intervals, though no other age groups were significantly different. Among those with a mobility problem, pain problem, or restriction to activity, and among those of low tangible or emotional social support. The 2-year incidence of MDE was highest among those with a restriction to activity or chronic condition; the 8-year incidence was highest among women, those with a pain problem or chronic condition, and among those with low levels of positive social interaction or emotional social support.

## 6.2 Social Support and MDE

The finding that the relationship between tangible social support and depression is modified by income is a reasonable finding. In Sherbourne and Stewart's social support categories, tangible social support assessed whether or not individuals felt they had someone to help them if they were confined to bed, take them to the doctor if needed, prepare meals, or help with daily chores. These tasks are synonymous with activities of daily living. Among those with a low income, having this support made a great difference in the risk of depression. Among those with middle or high income however, having such support available through your network was not significant in the risk of MDE. This is a reasonable finding, as those of middle or high income are likely able to pay for services to cover these activities if support is unavailable through their network – through hiring taxis, maids, paying for homecare, etc. – options that may not be available to those of low income. In this manner, income level may serve as a means of overcoming tangible social support deficits, thereby allowing middle or high income individuals to resemble those of high social support, regardless of what their actual level of tangible social support might be. Those of low income however have no means by which to over-come deficits in activities of daily living, save through the utilization of their tangible support network. It should be noted that in the assessment of effect modification and confounding, a restriction to activity was not significant. None-the-less, it was included in the final tangible support model as it assessed whether individuals had a restriction to activities of daily living, while tangible support assessed support to assist with these restrictions. It is difficult to contrast these results with current literature, due to the lack of comprehensive social support metrics employed in the majority of studies. Using LASA data, Koster and colleagues (2006) found evidence to suggest the level of social support changed by income group, with those of low income reporting less social support, and that those of low income were more likely to develop depression over a 9-year study period. Other studies have not found income to be a risk factor for a MDE (Wilson, Mottram, & Sixsmith, 2007), while others have suggested that it is not income per-say, but income strain that services to increase the risk of a MDE (Wang, Schmitz, & Dewa, 2010). Following this last hypothesis, it is reasonable to assume that high levels of tangible social support help to alleviate financial strain in the setting of low income, and therefore reduce the risk of depression.

A pain problem was found to be an effect modifier in the relationships between MDE and tangible social support (OR 0.42, 95% CI 0.02-0.89, p=0.023), as well affection social support (OR 0.35, 95% CI 0.16-0.76, p=0.008). In both cases it was found that among those with a pain problem, these types of social support ceased to be significant. Among those without a pain problem, low tangible support or affection social support were associated with an increased risk of MDE in multivariate modeling. That is, those of low tangible support were more likely to develop a MDE over 8-years than those of high tangible social support, provided they did not have a pain problem. If a pain problem was present, then level of tangible support was not related to the risk of a MDE. It should be noted that those with a pain problem were more likely to develop a MDE as demonstrated in prevalence and incidence estimates. A similar relationship was found regarding pain and affection social support. Among those with a pain problem, affection social support was not related to the risk of a MDE. Among those without a pain problem, those with low affection social support were more likely to develop a MDE than those of high affection social support.

A possible explanation for this is that in the setting of a pain problem, differences in levels of social support are not noticed by participants, or that a chronic pain problem is so disturbing that high social support is unable to mitigate the high risk of MDE in these individuals attributed to pain. For both affection and tangible social support, the existence of pain may prevent social support from having a positive mental impact in participants. To more directly address this point, Eisenberger (2012) discussed the experience of “social pain”, which she defined as “...the unpleasant experience that is associated with actual or potential damage to one’s sense of social connection or social value...” (Eisenberger, 2012). She found that social exclusion and social pain follow similar neuro-biologic and neuro-chemical pathways as physical pain, and reasons that this may be why physical pain may decrease in the presence of social support, or conversely why physical pain leads to feelings of social disconnect. As such, among those with a pain problem, they present the same risk of depression as those with low social support, regardless of their actual reported social support. The findings that both tangible and affection social support cease to be significant in the presence of a pain problem may help support Eisenberger’s argument that physical pain may lead to perceptions of social disconnection, and therefore serve to eliminate the effects of high social support, particularly given our findings of the strong relationship between pain and depression in prevalence and

incidence estimates. That is, in the presence of physical pain participants may perceive their levels of social support as being low, nullifying any positive impact these networks hold.

These findings support the “main effect” model of social support, in that social support has a direct impact on the risk of a MDE. I found both positive social interaction and emotional social support to have a direct impact on the risk of a MDE. The finding that pain modifies this relationship in the context of tangible and affection social support, and income in the case of tangible support, suggests that at least part of this “main effect” model may in fact be modified by other variables. Alternatively, in the case of pain it may be that this main effect can simply be “overridden” and cancelled out in the context of very strong risk factors for depression; or in the case of pain specifically counteract the positive effects of social support through a similar neurochemical pathway, as discussed by Eisenberger (2012). Previous studies utilizing the MOSSS have found positive social interaction to be a strong predictor of depressive and anxiety symptoms, with an inverse relationship – higher depression and anxiety symptoms correspond to lower levels of positive social interaction (Boyes et al., 2009). Of note is that many health status variables that were strongly associated with incidence and prevalence estimates of MDE, such as a mobility problem restriction to activity, or chronic condition, did not confound this relationship. Therefore despite the accumulation of comorbid medical conditions expected in seniors (Wu et al., 2011), this does not confound or otherwise dilute the positive effect of social support, with the exception of a pain problem as previously discussed.

Our findings that structural social support was not associated with the risk of a MDE are consistent with the existing social support literature (Bisschop et al., 2004; Vink et al., 2009), though some studies have found evidence to suggest that structural support may be a risk factor for depression among those with very small network sizes (Koster et al., 2006; Surkan et al., 2006). This finding may be due to those with very small network sizes lacking necessary levels of emotional and other types of social support, in which case structural support may be merely serving as a proxy measure of other support availability.

### 6.3 Follow Up

One concern in our study was the finding that at 2-years of follow-up, participants were less likely to respond if they lived with others, or if they had a chronic condition. In an analysis of Canadian Study on Health and Aging Data, Wu et al (2011) concluded that there was a linear

increase in depressive symptoms with age, however found this increase not to be the result of age itself but more the accumulation of medical comorbidity. This corroborates findings in Canada (Andrew & Rockwood, 2007; Chappell 2008; Ostbye et al 2005; Wang et al., 2010), the UK (McDougall et al., 2007), and Amsterdam (Geerlings et al., 2000; Vink et al., 2009) which have all found the presence of chronic medical conditions to be a risk factor for depression in the elderly and contribute to higher depression incidence and prevalence among those with chronic conditions compared to those without. This study confirmed these findings utilizing the NPHS, finding a higher 12-month depression prevalence (7.43% vs. 2.48%), 2-year incidence (5.42% vs. 1.20%), and 8-year depression incidence (14.96% vs. 5.85%) among those with a chronic condition to those without. Similar findings were found among those with a restriction to activity, pain problem, or mobility problem in our study. Additionally while I found some evidence to suggest that depression prevalence may be higher among those 65-69 years of age compared to those aged 70-74, I otherwise found no evidence to suggest differences in depression incidence by age group, nor did age confound or otherwise appear as a risk factor in logistic regression modeling.

The finding that those with a chronic condition were less likely to respond at 2-year follow up therefore is likely to lead to an underestimation of the true 2- and 8-year incidence proportion. Given that those with a chronic condition had a higher prevalence (7.43% vs. 2.48%), a higher 2-year incidence (5.42% vs. 1.20%), and a markedly higher 8-year incidence (14.96% vs. 5.85%), it follows that those most likely to develop a future MDE were also the least likely to respond in subsequent surveys. However, in univariate analysis I did not find a chronic condition to be associated with types or levels of social support, and it is therefore difficult to determine what impact the loss of follow-up of participants with a chronic condition will have on multivariate regression estimates based on social support. If the presence of a chronic condition is truly unassociated with type and level of social support, and solely related to the occurrence of an MDE, than multivariate regression estimates should remain largely unaffected, despite the previously stated tendency to underestimate prevalence and incidence.

Participants living with others were found less-likely to respond at 2-year follow-up. Studies in the United States with Russian-speaking immigrants have found that those living alone had higher levels of depressive symptoms (Tran et al., 2000), as well as in the general

population (Dean et al., 1992; Wilmoth & Chen 2003). Wilmoth & Chen further found that the change in depressive symptoms at 2-year follow-up among their sample of elderly participants was related to living arrangement, but that this relationship was mediated by immigration status: non-immigrants living with family or others were at higher risk for depression than those living alone, while among immigrants those living alone were at higher risk in multivariate regression models. These results suggest that living arrangement may merely serve as a proxy measure for immigration status. A Finnish study found living arrangement to be associated with development of depression (Kivela et al., 1996), but found this relationship to differ between men and women. This study did not look at immigration status as a covariate, nor did it examine for effect modification of living arrangement by gender. The primary purpose of this study was to examine the relationship of social support and depression. It is the suspicion of the author that while living arrangement was associated with depression in univariate model, this association merely served as a proxy measure of social support, hence its non-significance in multivariate models. In light of findings by researchers in Finland and the United States however, a more in-depth exploration into the relationship between living arrangement and depression should be undertaken, particularly in light of findings by Wilmoth & Chen (2003) and Kivela and colleagues (1996) that suggest that the cross-sectional relationship and longitudinal relationship between living arrangement and depression differ considerably.

#### **6.4 Prevalence and Incidence Estimates**

I estimated an annual prevalence of major depression in 1998 of 6.50% (95% CI 5.28%-7.63%) in those aged 65 years of age and older. This is higher than previously reported estimates in Canadian seniors using data from the Canadian Community Health Survey 1.2, with estimates at 1.9% (1.5-2.4) in 2002 (Patten et al., 2006), or the Canadian Study of Health and Aging (CSHA) with estimates of 2.6% in the general population and 7.0% in the institutionalized sample (1990) (Wu et al., 2011). This finding is expected as the Canadian Community Health Survey 1.2 utilized the CIDI-SFMD alone, while the current study utilized both the CIDI-SFMD and ATC Codes to indicate a depressive episode. Utilizing CIDI-SFMD codes alone, my estimates closely parallel the findings of Patten et al. (2006) at 2.23% (95% CI 1.51-2.95)

Utilizing data from the CSHA, Ostbye et al. (2005) estimated the prevalence of depression to increase with age, in contradiction with the bulk of Canadian literature which

suggests a decline in depression prevalence with age (Akhtar-Danesh & Landeen, 2007; Chappell, 2009; Patten et al., 2006). While CCHS estimates place the prevalence of depression in the elderly just below 2%, Ostbye estimated a prevalence of 1.0% in those aged 65-74, rising to 5.9% in those aged 75-84, and 7.9% in those age 85 and older. Estimates in the United Kingdom using the Geriatric Depression Scale support these findings, with estimated depression to be 6.5% in those aged 75-79 , rising to 7.7% in those aged 80-84, 10.3% in those aged 85-90, and 11.7% in those aged over 95 (Osborn et al., 2003). Due to our inclusion of ATC codes in addition to the CIDI-SFMD, it was expected our estiamtes of incidence and prevalence would be higher than those previously reported utilizing the CIDI-SFMD alone – such as in the CCHS. It is interseting that through the use of both CIDI-SFMD and ATC Codes my estimates of prevalence more cloesly reseble those found in those studies utilizing the Geriatric Depression Scale.

This increasing prevalence of depression with age has also been found in the American literature, with estimates of depression prevalence at 1-4% (Blazer, 2003), with estimates that both the prevalence (Palsson et al., 2001) and incidence (Teresi et al., 2001) double after age 70. This same author estimates the prevalence of minor depression to be 4-13% (Blazer, 2003).The findings by Wu et al. (2011) using CSHA data that depressive symptoms increase linearly with age as the result of accumulated comorbidity helps make sense of the findings of Ostbye et al. (2005) and others. This raises questions as to why CCHS estimates are finding a decreasing prevalence in depression among seniors, while other scales (Geriatric Depression Scale, AGECAT Algorithim) are finding an increase.

While this may be attributed to population differences in the case of the Geriatric Depression Scale drawn from the UK (*see* Osborn et al., 2003), the CSHA was drawn from a Canadian sample with a focus on dementia and closely parallels Osborn and colleagues findings. It is therefore possible that the CIDI-SFMD reaches different estimates on depression prevalence and incidence on the basis of the symptomolgy assessed within the surveys themselves, though this is difficult to assess without further validity testing of the CIDI-SFMD or comparison of the two surveys in the same study group. A second explanation may lie in the CCHS's cross-sectional versus longitudinal study design, possibly through the exclusion of institutionalized, or

previously depressed individuals as stated on self report versus the ability to follow institutionalized individuals and more effectively control for recall bias in longitudinal studies.

It is difficult to contrast our findings of MDE incidence with previous literature, as there is a lack of published data on depression incidence in Canadian seniors, or among seniors in general (Weyerer et al., 2013). What studies on depression incidence do exist are generated from German estimates in the very old. Specifically, 1-year incidence of depression was estimated to be 12.3% among the very old, 85 years and older, in a German sample utilizing the Geriatric Mental State Exam and AGECAT Algorithm (Meller et al., 1996). Weyerer et al. (2013) found evidence to suggest incidence of MDE increases with age during 3-year follow-up, though this study was limited to those aged 75 and older, utilizing the Geriatric Depression Scale (Weyer et al., 2013). The findings of Weyerer et al. (2013) contrasts Canadian estimates that suggest a decline in depression incidence with age among the general population aged <65 years of age (Wang et al., 2010). I estimated a 2-year depression incidence of 4.54% and an 8-year incidence of 13.09% among those aged 65 years of age and older. The findings that depression incidence is higher among women compared to men, and among those with a chronic condition, restriction to activity and a pain or mobility problem is consistent with previous studies, both in the general population (Wang et al., 2010), and among the elderly (Palsson et al., 2001; Weyerer et al., 2013). A proper contrast with German estimates is difficult however due to the German studies' restriction to the very old, use of different metrics to assess depression, and short follow up periods.

## 6.5 The Role of the CIDI-SFMD and ATC Codes in MDE

In our analysis, depression prevalence was estimated to be 2.23% (1.51%-2.95%) using only the CIDI-SFMD, and 4.89% (3.85%-5.92%) using only ATC codes. Hence, even when assessing depression in the same manner as in CCHS literature, the estimates of depression prevalence are slightly higher. It is worthwhile to note that the estimates of depression prevalence using both CIDI-SFMD and ATC code criteria (6.50%, 95% CI 5.38%-7.63%) most closely resemble those found utilizing the Geriatric Depression Scale (Osborn et al., 2003) in the UK, and utilizing a 12-item depression symptom measure in the CSHA.

It should be noted that the MDE 12-month prevalence estimates utilizing ATC codes only were 4.89%, using only the CIDI were 2.23%, and utilizing both were 6.50% - a nearly additive

relationship. This owes to the fact that very few individuals coded positive for depression with the CIDI-SFMD who were also taking anti-depressants. This was expected, as those with a diagnosis of depression who are adequately controlled through anti-depressant treatment would no longer exhibit sufficient depressive symptoms to code positive on the CIDI-SFMD. Additionally, some participants who experienced a MDE in the past year might take anti-depressants, but not code positive on the CIDI-SFMD due to the CIDI-SFMD potentially lacking sensitivity in seniors (the CIDI-SFMD has only been validated in community drawn, adult sample, no data on the sensitivity or specificity of the CIDI-SFMD in seniors is available). The use of ATC codes in our study, in addition to the CIDI-SFMD, allow for the capture of two different groups of depression: Those who are depressed and not-yet treated with anti-depressants, and those who are treated with anti-depressants and as a result no longer exhibit depressive symptoms. This may help explain why the CCHS and other health studies utilizing only questionnaires to assess depression may underdiagnose depression: participants who are not currently experiencing an MDE, or who cannot recall sufficient symptoms prior to treatment may not be picked up through such tools.

It is possible that members of our sample were taking anti-depressants for reasons other than depression. Of the antidepressants commonly prescribed for pain, very few members of our sample reported taking them: Only 0.61% reported taking Amitriptyline, less than 0.30% another Tricyclic such as Nortriptyline, and less than 0.16% reported taking “other” antidepressant medications such as Venlafaxine or Duloxetine. While the inclusion of these medications and their use for non-depression reasons may have led to a small over-estimation of the incidence and prevalence of depression, they also led to a reduction in the overall significance of the social support – depression association as found in multivariate modelling, which was none-the-less still found significant. While this may slightly over estimate MDE incidence and prevalence among seniors, it led to an underestimation of the true effect in the multivariate logistic regression models.

## 6.6 Limitations & Strengths

It is possible that some participants would have experienced an MDE prior to cycle 1. In this case these individuals should have been excluded from the analysis as they would not

represent new or incident cases, but would have in-fact been recurrent cases. This would have led to an over-estimation of the incidence of major depressive episodes in seniors.

As the NPHS is assessed every two years, incident depression can only be assessed in two year intervals. Further, each cycle only assesses the past 12-months, not the past 24. As a result, there is a 12-month period immediately following each cycle for which information is not collected. It is therefore possible that some participants experienced a MDE in the 12-month gap immediately following a cycle, but prior to the 12-month period assessed at the next cycle. This would lead to an under-estimation of both the incidence and prevalence of a MDE.

It remains possible that participants taking antidepressants were doing so for reasons other than treatment of depression, such as dysthymia, sleep, or chronic pain. This would have resulted in individuals being coded as depressed on the basis of a positive ATC code in the calculation incidence and prevalence estimates, resulting in an over estimation of these proportions. Conversely, the coding of non-depressed individuals as depressed would have likely decreased the association between types of social support and depression, resulting in a decrease in the estimates of the multivariate regression modeling.

The implications of these over- and underestimations would be that first, the association between social support and depression is likely greater than estimated in our multivariate models. While incidence and prevalence proportions may be over-estimated on the basis of ATC codes, it is difficult to comment on the full impact in light of difficulties in estimating depression in seniors that have been previously discussed in this paper – namely validity of the CIDI-SFMD in seniors, differential presentations of depression in old age, and lack of information from socially isolated individuals.

The decision was made early in the analysis to perform traditional longitudinal logistic regression modeling. None-the-less, it remains likely that the variables included in the analysis – namely marital status, restrictions to activity, levels of social support, etc – will change over time. As a result, there may be subtle nuances to the social support – depression relationship that were not evident in our study due to the omission of time-varying covariates.

Lastly, the NPHS relied on self-report. Recall and reporting biases are possible. In an attempt to overcome these limitations, data should be collected on previous occurrence of an MDE, and this information be corroborated with health services data if possible. While it may not be feasible in long-term, population-based studies, efforts should be made - where possible -

to limit periods of unknown, such as the first 12-months post-cycle in the NPHS where ambiguity remains around the possibility of an undocumented MDE.

Despite these limitations, this has a number of strengths. It incorporated a population-based longitudinal study design that ensured a comprehensive, power-driven sample from various geographic and demographic regions across Canada. The 8-years of data used for our study represent a novel examination of depression in Canada, as no Canadian studies have examined depression in the elderly from a general population sample over such a long study period.

The use of ATC codes in addition to a depression screening tool allowed authors to minimize the opportunity for recall bias. Additionally, as previously stated this allowed for the capture of what is a likely more serious spectrum of depressive disorders.

The usage of both incidence and prevalence estimates, in addition to multivariate longitudinal modeling allowed for a thorough examination of the relationship between types and levels of social support and the development of a major depressive disorder. The usage of a comprehensive social support metric allowed an examination of social support not typically seen in the social support – depression literature.

In light of these limitations and strengths, a key element of future research into this area should be a longitudinal approach to depression and social support allowing for time-varying covariates, particularly in regards to marital status as changes marital status is associated with significant social support and depression changes (Guiaux et al., 2007; van Grootenhuis et al., 1999), as well as restrictions to activity, pain problems, and chronic conditions, as each of these were found to be independent risk factors for a major depressive episode, and are likely to change over time.

## 7. Significance

This project represents an important contribution on risk factors for major depression in Canadian seniors, in its ability to establish a temporal relationship between risk factors formerly hypothesized primarily through cross-sectional studies. This study has great strength due to its longitudinal nature and ability to adjust for multiple risk factors, its large study sample, impressive study length, and population-level approach. Utilizing an unprecedented 8 years of population-based longitudinal data, this study presents a truly novel examination of risk factors for major depression in Canadian seniors from a longitudinal perspective.

The strong relationship between different types of social support and depression, and the finding that it is not the number of contacts (structural support) but rather the strength of the relationship points to the importance of preventing social isolation in Canadian seniors in order to reduce the risk of major depression, particularly through high levels of positive social interaction and emotional social support. The finding that part of this relationship is mediated by the presence of a pain problem in the context of tangible and affection social support highlights the importance of controlling pain in the context of accumulating medical conditions.

While our study demonstrated the importance of social support in Canadian seniors in reducing the risk of MDE, future studies should examine what demographic and health status variables contribute to different types and levels of social support over time. By understanding what factors contribute to increases or decreases in social support, researchers and community groups may better be able to assist Canadian seniors in increasing their own levels of social support, and similarly identify those most likely to benefit from such intervention. Through increasing levels of social support, we may help our seniors better avoid development of depressive episodes.

Lastly, our study was performed using traditional multivariate logistic regression techniques. This did not allow for many of our covariates, such as marital status, living arrangement, etc. to change over time. Future studies should examine whether the relationship between social support and MDE is at all altered through adjustment for these time-altered variables. Currently, no longitudinal mixed-model studies have explored geriatric depression and social support.

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## Appendix A: Criteria for Major Depressive Episode

Source: American Psychiatric Association, 2005: p 356.

- A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

**Note:** Do not include symptoms that are clearly due to a general medical condition, or mood-incongruent delusions or hallucinations

- (1) Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful).

**Note:** In children and adolescents, can be irritable mood

- (2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others)

- (3) Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decreased or increase in appetite nearly every day. **Note:** In children, consider failure to make expected weight gains

- (4) Insomnia or hypersomnia nearly every day

- (5) Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)

- (6) Fatigue or loss of energy nearly every day

- (7) Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)

- (8) Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)

- (9) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide

- B. The symptoms do not meet the criteria for a Mixed Episode.

- C. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

- D. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).
- E. The symptoms are not better accounted for by Bereavement, i.e., after the loss of a loved one, the symptoms persist for longer than 2 months or are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation.

## Appendix B: Composite International Diagnostic Interview Short Form for Major Depression (CIDI-SFMD)

MH\_QINT Now some questions about mental and emotional well-being.

1. **MH\_Q01** During the past month, that is, from [date one month ago] to yesterday, about how often did you feel

- a. **MH\_Q01A** ... so sad that nothing could cheer you up?

- 1 All of the time
  - 2 Most of the time
  - 3 Some of the time
  - 4 A little of the time
  - 5 None of the time
- DK, R (Go to MH\_Q01K)

- b. **MH\_Q01B** ... nervous?

- 1 All of the time
  - 2 Most of the time
  - 3 Some of the time
  - 4 A little of the time
  - 5 None of the time
- DK, R (Go to MH\_Q01K)

- c. **MH\_Q0C** ... restless or fidgety?

- 1 All of the time
- 2 Most of the time
- 3 Some of the time

- 4      A little of the time  
5      None of the time  
DK, R                    (Go to MH\_Q01K)

d. **MH\_Q01D** ... hopeless?

- 1      All of the time  
2      Most of the time  
3      Some of the time  
4      A little of the time  
5      None of the time  
DK, R                    (Go to MH\_Q01K)

e. **MH\_Q01E** ... worthless?

- 1      All of the time  
2      Most of the time  
3      Some of the time  
4      A little of the time  
5      None of the time  
DK, R                    (Go to MH\_Q01K)

f. **MH\_Q01F** ... that everything was an effort?

- 1      All of the time  
2      Most of the time  
3      Some of the time  
4      A little of the time  
5      None of the time  
DK, R                    (Go to MH\_Q01K)

If MH\_Q01A to MH\_Q01F are all “None of the time”, go to MH\_Q01K.

- g. **MH\_Q01G** We have just been talking about feelings and experiences that occurred to different degrees during the past month. Taking them altogether, did these feelings occur more often in the past month than is usual for you, less often than usual or about the same as usual?

- 1      More often
- 2      Less often                (Go to MH\_Q01I)
- 3      About the same         (Go to MH\_Q01J)
- 4      Never have had any    (Go to MH\_Q01K)
- DK, R                          (Go to MH\_Q01K)

- h. **MH\_Q01H** Is that a lot more, somewhat more or only a little more often than usual?

- 1      A lot
- 2      Somewhat
- 3      A little
- DK, R                          (Go to MH\_Q01K)

Go to MH\_Q01J.

- i. **MH\_Q01I** Is that a lot less, somewhat less or only a little less often than usual?

- 1      A lot
- 2      Somewhat
- 3      A little
- DK, R                          (Go to MH\_Q01K)

- j. **MH\_Q01J** How much do these experiences usually interfere with your life or activities?

- 1 A lot
- 2 Some
- 3 A little
- 4 Not at all

k. **MH\_Q01K** In the past 12 months, that is, from [date one year ago] to yesterday, have you seen or talked on the telephone with a health professional about your emotional or mental health?

- 1 Yes
- 2 No (Go to MH\_Q02)
- DK, R (Go to MH\_Q02)

l. **MH\_Q01L** How many times (in the past 12 months)?

|\_|\_|\_| Times (MIN: 1) (MAX: 366; warning after 25)

m. **MH\_Q01M** Whom did you see or talk to?

Mark all that apply.

- |                 |   |                                       |
|-----------------|---|---------------------------------------|
| <b>MH_Q01MA</b> | 1 | Family doctor or general practitioner |
| <b>MH_Q01MB</b> | 2 | Psychiatrist                          |
| <b>MH_Q01MC</b> | 3 | Psychologist                          |
| <b>MH_Q01MD</b> | 4 | Nurse                                 |
| <b>MH_Q01ME</b> | 5 | Social worker or counsellor           |
| <b>MH_Q01MF</b> | 6 | Other – Specify                       |

**2. MH\_Q02** During the past 12 months, was there ever a time when you felt sad, blue, or depressed for 2 weeks or more in a row?

- 1 Yes
- 2 No (Go to MH\_Q16)
- DK, R (Go to next section)

**3. MH\_Q03** For the next few questions, please think of the 2-week period during the past months when these feelings were the worst. During that time, how long did these feelings usually last?

- 1 All day long
- 2 Most of the day
- 3 About half of the day (Go to MH\_Q16)
- 4 Less than half of a day (Go to MH\_Q16)
- DK, R (Go to next section)

**4. MH\_Q04** How often did you feel this way during those 2 weeks?

- 1 Every day
- 2 Almost every day
- 3 Less often (Go to MH\_Q16)
- DK, R (Go to next section)

**5. MH\_Q05** During those 2 weeks did you lose interest in most things?

- 1 Yes (KEY PHRASE = Losing interest)
- 2 No
- DK, R (Go to next section)

**6. MH\_Q06** Did you feel tired out or low on energy all of the time?

1 Yes (KEY PHRASE = Losing interest)

2 No

DK, R (Go to next section)

**7. MH\_Q07** Did you gain weight, lose weight or stay about the same?

1 Gained weight (KEY PHRASE = Gaining weight)

2 Lost weight (KEY PHRASE = Losing weight)

3 Stayed about the same (Go to MH\_Q09)

4 Was on a diet (Go to MH\_Q09)

DK, R (Go to next section)

**8. MHQ08**

a. **MH\_Q08A** About how much did you [gain/lose]?

Enter amount only.

|\_| Weight (MIN: 1) (MAX: 99; warning after 20 pounds / 9 kilograms)

DK, R (Go to MH\_Q09)

b. **MH\_Q08B** Was that in pounds or in kilograms?

**MHCC\_8LB** 1 Pounds

**MHCC\_8KG** 2 Kilograms

(DK, R are not allowed)

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**9. MH\_Q09** Did you have more trouble falling asleep than you usually do?

- 1 Yes (KEY PHRASE = Trouble falling asleep)
  - 2 No (Go to MH\_Q11)
- DK, R (Go to next section)

**10. MH\_Q10** How often did that happen?

- 1 Every night
  - 2 Nearly every night
  - 3 Less often
- DK, R (Go to next section)

**11. MH\_Q11** Did you have a lot more trouble concentrating than usual?

- 1 Yes (KEY PHRASE = Trouble concentrating)
  - 2 No
- DK, R (Go to next section)

**12. MH\_Q12** At these times, people sometimes feel down on themselves, no good or worthless.  
Did you feel this way?

- 1 Yes (KEY PHRASE = Feeling down on yourself)
  - 2 No
- DK, R (Go to next section)

**13. MH\_Q13** Did you think a lot about death - either your own, someone else's or death in general?

- 1 Yes (KEY PHRASE =Thoughts about death)

2 No

DK, R (Go to next section)

If “Yes” in MH\_Q05, MH\_Q06, MH\_Q09, MH\_Q11, MH\_Q12 or MH\_Q13, or MH\_Q07 is “gain” or “lose”, go to MH\_Q14C.

Otherwise, go to next section.

Reviewing what you just told me, you had 2 weeks in a row during the past 12 months when you were sad, blue or depressed and also had some other things like (KEY PHRASES).

**14. MH\_Q14** About how many weeks altogether did you feel this way during the past 12 months?

|\_| Weeks (MIN: 2 MAX: 53)

(If > 51 weeks, go to next section.)

DK, R (Go to next section)

**15. MH\_Q15** Think about the last time you felt this way for 2 weeks or more in a row. In what month was that?

- 1 January
- 2 February
- 3 March
- 4 April
- 5 May
- 6 June
- 7 July
- 8 August
- 9 September

- 10      October
- 11      November
- 12      December

Go to next section.

**16. MH\_Q16** During the past 12 months, was there ever a time lasting 2 weeks or more when you lost interest in most things like hobbies, work or activities that usually give you pleasure?

- 1      Yes
- 2      No      (Go to next section)
- DK, R      (Go to next section)

**17. MH\_Q17** For the next few questions, please think of the 2-week period during the past 12 months when you had the most complete loss of interest in things. During that 2-week period, how long did the loss of interest usually last?

- 1      All day long
- 2      Most of the day
- 3      About half of the day      (Go to next section)
- 4      Less than half of a day      (Go to next section)
- DK, R      (Go to next section)

**18. MH\_Q18** How often did you feel this way during those 2 weeks?

- 1      Every day
- 2      Almost every day
- 3      Less often      (Go to next section)
- DK, R      (Go to next section)

**19. MH\_Q19** During those 2 weeks did you feel tired out or low on energy all the time?\

1 Yes (KEY PHRASE = Feeling tired)

2 No

DK, R (Go to next section)

**20. MH\_Q20** Did you gain weight, lose weight, or stay about the same?

1 Gained weight (KEY PHRASE = Gaining weight)

2 Lost weight (KEY PHRASE = Losing weight)

3 Stayed about the same (Go to MH\_Q22)

4 Was on a diet (Go to MH\_Q22)

DK, R (Go to next section)

**21. MH\_Q21**

a. **MH\_Q21A** About how much did you [gain/lose]?

|\_| Weight (MIN: 1) (MAX: 99; warning after 20 pounds / 9 kilograms)

DK, R (Go to MH\_Q22)

b. **MH\_Q21B** Was that in pounds or in kilograms?

MHCC\_21L 1 Pounds

MHCC\_21K 2 Kilograms

(DK, R are not allowed)

**22. MH\_Q22** Did you have more trouble falling asleep than you usually do?

1 Yes (KEY PHRASE = Trouble falling asleep)

2 No (Go to MH\_Q24)

DK, R (Go to next section)

**23. MH\_Q23** How often did that happen?

- 1 Every night
- 2 Nearly every night
- 3 Less often

DK, R (Go to next section)

**24. MH\_Q24** Did you have a lot more trouble concentrating than usual?

- 1 Yes (KEY PHRASE = Trouble concentrating)
- 2 No

DK, R (Go to next section)

**25. MH\_Q25** At these times, people sometimes feel down on themselves, no good, or worthless. Did you feel this way?

- 1 Yes (KEY PHRASE = Feeling down on yourself)
- 2 No

DK, R (Go to next section)

**26. MH\_Q26** Did you think a lot about death - either your own, someone else's, or death in general?

- 1 Yes (KEY PHRASE = Thoughts about death)
- 2 No

DK, R (Go to next section)

If any "Yes" in MH\_Q19, MH\_Q22, MH\_Q24, MH\_Q25 or MH\_Q26, or MH\_Q20 is "gain" or "lose", go to MH\_Q27C.

Otherwise, go to next section.

Reviewing what you just told me, you had 2 weeks in a row during the past 12 months when you lost interest in most things and also had some other things like (KEY PHRASES).

**27. MH\_Q27** About how many weeks did you feel this way during the past 12 months?

||| Weeks (MIN: 2 MAX: 53)

(If > 51 weeks, go to next section.)

DK, R (Go to next section)

**28. MH\_Q28** Think about the last time you had 2 weeks in a row when you felt this way. In what month was that?

- 1 January
- 2 February
- 3 March
- 4 April
- 5 May
- 6 June
- 7 July
- 8 August
- 9 September
- 10 October
- 11 November
- 12 December

## Appendix C: Medical Outcomes Study (MOS) Social Support Survey

MOS Social Support Survey (Sherbourne & Stewart, 1991)

Next are some questions about the support that is available to you.

1. About how many close friends and close relatives do you have (people you feel at ease with and can talk to about what is on your mind)?

Write in number of close friends and close relatives: \_\_\_\_\_

**People sometimes look to others for companionship, assistance, or other types of support.**

**How often is each of the following kinds of support available to you if you need it?**

Circle one number on each line. 1 = none of the time, 5 = all of the time.

2. Someone to help you if you were confined to bed

1      2      3      4      5

3. Someone you can count on to listen to you when you need to talk

1      2      3      4      5

4. Someone to give you good advice about a crisis

1      2      3      4      5

5. Someone to take you to the doctor if you need it

1      2      3      4      5

6. Someone who shows you love and affection

1      2      3      4      5

7. Someone to have a good time with

1      2      3      4      5

8. Someone to give you information to help you understand a situation.

1      2      3      4      5

9. Someone to confide in or talk to about yourself or your problems

1      2      3      4      5

10. Someone who hugs you

1      2      3      4      5

11. Someone to get together with for relaxation

1      2      3      4      5

12. Someone to prepare your meals if you were unable to do it yourself

1      2      3      4      5

13. Someone whose advice you really want

1      2      3      4      5

14. Someone to do things with to help you get your mind off things

1      2      3      4      5

15. Someone to help with daily chores if you were sick

1      2      3      4      5

16. Someone to share your most private worries and fears with

1      2      3      4      5

17. Someone to turn to for suggestions about how to deal with a personal problem

1      2      3      4      5

18. Someone to do something enjoyable with

1      2      3      4      5

19. Someone who understands your problems

1      2      3      4      5

20. Someone to love and make you feel wanted      1      2      3      4      5

These 20 items were broken down into 5 subscales by Sherbourne and Stewart as follows:

**Tangible**

- 2 Someone to help you if you were confined to bed
- 5 Someone to take you to the doctor if you need it.....
- 12 Someone to prepare your meals if you were unable to do it yourself
- 15 Someone to help with daily chores if you were sick

**Affection**

- 6 Someone who shows you love and affection
- 10 Someone who hugs you
- 20 Someone to love and make you feel wanted

**Positive Social Interaction**

- 7 Someone to have a good time with
- 11 Someone to get together with for relaxation
- 14 Someone to do things with to help you get your mind off things
- 18 Someone to do something enjoyable with

**Emotional/Informational**

- 3 Someone you can count on to listen to you when you need to talk
- 4 Someone to give you good advice about a crisis
- 8 Someone to give you information to help you understand a situation
- 9 Someone to confide in or talk to about yourself or your problems
- 13 Someone whose advice you really want
- 16 Someone to share your most private worries and fears with
- 17 Someone to turn to for suggestions about how to deal with a personal problem
- 19 Someone who understands your problems

**Structural**

- 1 About how many close friends and close relatives do you have (people you feel at ease with and can talk to about what is on your mind)?

## Appendix D: Variables for Analysis

**NOTE:** The NPHS makes use of a character in each variable to indicate cycle year. These indicators are as follows, and occur as the fourth character of each variable:

Cycle 3: 8      Cycle 4: 0      Cycle 5: 2      Cycle 6: A      Cycle 7: B      Cycle 8: C

For example, the CIDI Depression Short Form Score variable is MHC0DSF in cycle 4, and MHCCDSF in Cycle 8 (emphasis added)

Item	Description	Original NPHS Variable	Coding (After re-code)
<b>Outcome</b>			
Depression	Depression (All)		0 = No MDE 1 = MDE
	CIDI SFMD Short Form Score	MHC8DSF	0 = CIDI-SFMD Score <5 1 = CIDI-SFMD Score >=5
	ATC Code		0 = No Antidepressants 1 = Any antidepressant
<b>Exposure</b>			
Social Support	Structural Social Support – # Close friends, family	SSC8_101	0 = High Social Support 1 = Low Social Support
	Tangible Social Support – MOS Subscale (D)	SSC8DTNG	0 = High Social Support 1 = Low Social Support
	Affection – MOS Subscale (D)	SSC8DAFF	0 = High Social Support 1 = Low Social Support
	Positive Social Interaction – MOS Subscale (D)	SSC8DSOC	0 = High Social Support 1 = Low Social Support
	Emotional or Informational Social Support – MOS Subscale (D)	SSC8DEMO	0 = High Social Support 1 = Low Social Support
<b>Covariates</b>			
Gender	Sex	DHC_Sex	0=Male 1=Female
Age	Age	DHC8_AGE	Age in Years (continuous)
		Age Groups	0 = 65-69 1 = 70-74 2 = 75-79 3 = 80-84 4 = 85+
Education	Highest education level achieved	EDC8D3	0= Less than high school graduation 1=High school graduation or more
Income	Household Income, 2 – Groups	INC8DIA2	0 = Middle or High Income 1 = Low Income

Item	Description	Original NPHS Variable	Coding (After re-code)
Marital Status	Marital Status.	DHC8_MAR Cycle 3	0 = Married/Common Law/ Single (never married) 1 = Widowed/Separated/ Divorced
Living Arrangement	Living Arrangement	DHC8DLVG	0 = Living alone 1 = Living with spouse/partner 2 = Living with others
Chronic Conditions	Presence of a Chronic Condition	CCC8DNUM	0 = No Chronic Condition 1 = One or more chronic conditions  (Dementia or Alzheimer's disease, sinusitis, food & other allergies, cataracts omitted)
Restriction to Activity	Restrictions to activities (Any restriction below)	RAC8F6	0 = No 1 = Yes
	Needs help for ... ...preparing meals ...shopping for necessities ...housework ...heavy household chores ...personal care ...moving about inside house	RAC8_6A RAC8_6B RAC8_6C RAC8_6D RAC8_6E RAC8_6F	
Functional Disability (Health Utility Index)	HUI – Mobility Problem	HSC8DMOB	0 = No mobility problem 1 = Mobility Problem
	HUI – Dexterity Problem	HSC8DDEX	0 = No dexterity problem 1 = Dexterity Problem
	HUI - Activities Prevented By Pain	HSC8DPAD	0 = No pain or discomfort 1 = Pain prevents activity