IDENTIFYING EARLY INDICATORS OF SUBJECTIVE MEMORY CONCERNS IN SENIORS

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Abstract

Background: Subjective Memory Concerns (SMC) in seniors can be one of the earliest indicators of future dementia. There is a lack of research into the nature of these concerns and functional impairments. **Methods**: This retrospective secondary analysis gathered data from 67 healthy seniors aged 65+ using neuropsychological tests, memory concern questionnaires and daily functioning scales. Informants corroborated memory concerns and daily functioning. Participants comprised two groups: SMC if worried about their memory and Not Concerned about Memory if not. **Results**: People with SMC report more difficulty with word finding, remembering appointments, learning to use new equipment, and remembering details of social and personal events. Informants perceive word finding difficulties and minor problems with vocational abilities and bowel/bladder control in SMC participants. **Conclusions**: The SMC group primarily reports social difficulties. Further research is required to create a comprehensive list of cognitive concerns, which will ultimately improve care of the SMC population.

Keywords:
Aging | Seniors | Activities of Daily Living | Cognition | Alzheimer's disease | Dementia

Contexte: Les préoccupations subjectives de mémoire (PSM) chez les aînés peuvent être indicatives d'une démence future, bien qu'il existe un manque d'information sur les préoccupations et l'effet fonctionnel. **Méthodes:** Une analyse rétrospective secondaire de questionnaires de mémoire, de tests neuropsychologiques, et d'échelles fonctionnelles a été entreprise auprès de 67 personnes, en bonne santé, âgées de 65 ans et plus. Les aidants naturels ont pu appuyer les préoccupations cognitives et le niveau de fonctionnement chez deux groupes de participants: ceux avec préoccupations ou non. **Résultats:** Les participants PSM relèvent des difficultés de manque du mot, de rappel (rendez-vous, événements sociaux), et d'utilisation de nouveaux équipements. Les aidants naturels ont aussi trouvé de légères difficultés au travail et au niveau du contrôle intestinal et urinaire. **Conclusions:** Les PSM identifient principalement des lacunes au niveau social. Les recherches devront viser l'identification d'une liste exhaustive des préoccupations afin de pouvoir octroyer de meilleurs soins.

Mots-clés:
Vieillissement | Aînés | Activités de vie quotidienne | Cognition | Maladie d'Alzheimer | Démence

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Interdisciplinary relevance

Although this thesis is rooted in a disciplinary approach, the perspective and results could inform a variety of disciplines. It has long been recognized that the cognitive processes examined in this thesis have underlying neurological correlates. Knowledge about early changes in function may help inform some of the very early physiological changes in seniors with cognitive concerns. This research also sheds some light on psychosocial functioning and discusses the valuable roles that caregivers, physicians, and policy-makers play in the lives of seniors with cognitive concerns. Further research into issues relating to early diagnosis will result in valuable information that will assist seniors with self-identification of their cognitive concerns, which in turn will promote timely access to health care services. Caregiver support programs may also benefit from additional research in this area, because as the number of people with cognitive concerns increases, there will be an equal increase in the number of caregivers who require support. Finally, the results of further research will prepare clinicians and the health care system to effectively manage seniors who present with these concerns.

Abbreviations

α	Alpha
χ^2	Chi-square
ϕc	Cramer's Phi
ω^2	Omega squared
AD	Alzheimer's disease
ADL	Activities of Daily Living
BNT	Boston Naming Test
BRI	Bruyère Research Institute
CVLT-II	California Verbal Learning Test – Second Edition
DCP	Disability Creation Process
EMCI	Early Mild Cognitive Impairment
GDS	Geriatric Depression Scale
IADL	Instrumental Activities of Daily Living
IQCODE	Short Informant Questionnaire on Cognitive Decline in the Elderly
IQCODE-SR	Short Informant Questionnaire on Cognitive Decline in the Elderly – Self-Report
LMCI	Late Mild Cognitive Impairment
MAQ	Memory Assessment Questionnaire
MCAR	Missing Completely at Random
MCI	Mild Cognitive Impairment
MOANS	Mayo's Older Americans Normative Studies
MoCA	Montréal Cognitive Assessment
MSR	Memory Self-Rating Questionnaire
MVA	Missing Values Analysis
N	Number of participants
NBFADL	Neurobehavioural Function and Activities of Daily Living Rating Scale
NCM	Not Concerned about Memory
NPI-Q	Neuropsychiatric Inventory Questionnaire
SD	Standard deviation
SMC	Subjective Memory Concerns
SPSS	Statistical Package for the Social Sciences
WCST	Wisconsin Card Sorting Task

CHAPTER 1: INTRODUCTION

Canada's Rising Tide Report released in 2010 proposed a *Call To Action* for Canada to acknowledge dementia as a national priority. Dementia affects not only the individual, but also their care partners and society as a whole (Alzheimer Society, 2010). In 2008, there were over 480,000 people, or 1.5% of the Canadian population, living with dementia and the annual total economic burden was nearly $15 billion. If the trajectory remains unchanged, by the year 2038, the number of dementia cases is expected to grow to over 1.1 million, or 2.8% of the Canadian population, and the annual total economic burden will rise to an estimated $153 billion (Alzheimer Society, 2010). Despite these statistics, dementia is largely under-diagnosed (Prince, Bryce, & Ferri, 2011) or diagnosed in the advanced stages of cognitive decline (Moorhouse, 2009) rather than in earlier stages where therapies might be more effective (Prince et al., 2011). Furthermore, it is estimated that anywhere from 25% to 90% of dementia cases might be missed (Callahan, Hendrie, & Tierney, 1995; Finkel, 2003; Ross et al., 1997; Valcour, Masaki, Curb, & Blanchette, 2000). The reasons for the delay in receiving a diagnosis are largely due to uncertainty of the severity of the first signs of impairment, as well as mistaking the signs for normal aging (Knopman, Donohue, & Gutterman, 2000).

The spectrum of cognitive decline, proposed by Burns & Zaudig (2002) consists of Normal Aging, Asymptomatic Alzheimer's disease, Subjective Cognitive Complaints, Mild Cognitive Impairment (MCI), and Dementia. The authors emphasize that this spectrum is an oversimplification of the disease process. As evidenced by many longitudinal studies (de Jager & Budge, 2005; Ganguli, Dodge, Shen, & DeKosky, 2004; Nordlund et al., 2010; Tyas et al., 2007), this continuum does not proceed linearly from normal aging to dementia, as it

is possible for individuals who are diagnosed with MCI to revert back to normal cognition. Recently, there has been an increase in interest and research initiatives that focus on identifying people in the early stages of cognitive decline (Ganguli & Petersen, 2008). This interest is due in part because of the belief that medications – which are currently prescribed once a person is clearly exhibiting signs of dementia – might be more effective if prescribed in the earlier stages of cognitive impairment (Prince et al., 2011). Another reason the medical field is paying close attention to early diagnosis is due to the anticipation of the advent of potential disease-modifying therapies for dementia (Ganguli & Petersen, 2008). Furthermore, early identification allows the person with the diagnosis and their care partner access to specialized programs and services that require a diagnosis for admittance. In addition, early identification allows for effective planning for the future including arranging financial matters and having discussions with family members about a plan of care (Prince et al., 2011).

1.1 Normal cognitive function

It is very difficult to identify and define normal cognitive function because criteria to describe what exactly constitutes normal cognition have not been formally established (Morra, Zade, McGlinchey, & Milberg, 2013). Morra and colleagues (2013) have recently questioned if normal cognition refers to one's cognitive ability in the absence of brain trauma and neurodegenerative disorders, or whether it refers to the "average" cognitive function across a specific population – for example, an age-matched population of normative values that can be used for comparison purposes. These authors suggest that published research on normal cognitive aging is littered with participants who are considered "normal" but in fact have various biological diseases (e.g. impaired metabolic regulation or vascular

function) that may worsen cognition independent of aging. Consequently, this suggests that research participants who have been included in cognitive impairment literature and categorized as having "normal" cognition may actually be cognitively compromised as a result of an underlying disease state, thus resulting in flawed norms.

Previous research has shown that seniors are more prone to forgetfulness and decreased cognitive function compared to their younger counterparts, suggesting that cognitive decline is an inherent element of aging (Jenkins, 2000; Mitchell, 2000; Souchay, 2000). Some researchers suggest that individuals who can identify cognitive deficits in themselves but are not concerned about the decline are likely exhibiting "normal age-associated decline" (Burke & Barnes, 2006; Jessen et al., 2013). Research has also shown that declines in memory, executive function and information processing are associated with "healthy aging" (Lezak, Howieson, Bigler, & Tranel, 2012; Zec, 1995); it is, however, important to note that dementia is *not* a normal part of aging (Alzheimer Society, 2010).

The Mayo Clinic has created its own definition of normal cognition for people aged 55 years and older. Since 1987, this clinic has carried out many research projects, collectively known as Mayo's Older Americans Normative Studies (MOANS), with the goal of obtaining normative data from neuropsychological assessments of seniors. The criteria for normalcy in MOANS studies is "independently functioning, community dwelling persons who have been recently examined by their personal physician and who have no active neurologic or psychiatric disorder with potential to affect cognition" (Ivnik, Malec, Smith, Tangalos, & Petersen, 1996, p. 263). There are several issues with this definition; many seniors may not meet the MOANS criteria for normalcy if they have physical limitations that affect their ability to function independently. These physical limitations may result in

institutionalization, which means that the senior does not meet the community dwelling criteria. Furthermore, it is possible that some seniors who experience depressive or other psychiatric symptoms do not disclose these symptoms to their personal physician, which may result in false documentation that the senior is cognitively normal. Additionally, not all seniors have a personal physician to determine normalcy status. Individuals who do not meet the criteria for normalcy may be further along the trajectory of cognitive decline outlined by Burns & Zaudig (2002); for example, these individuals may experience Subjective Cognitive Complaints.

1.2 Subjective stage of cognitive decline

Reisberg (1986) was the first to propose a subjective stage of cognitive impairment. This stage is believed to last approximately 15 years before a person transitions to Mild Cognitive Impairment (MCI) and it suggests a subjective phase of recognition. Several descriptors have appeared in the literature to describe this phase, including: Subjective Memory Impairment, Subjective Memory Complaints, Subjective Memory Concerns, Subjective Cognitive Impairment, Subjective Cognitive Complaints, and Subjective Cognitive Concerns. For the purpose of clarity, the term "Subjective Memory Concerns" (SMC) has been used in the current study to describe this phase.

Subjective Memory Concerns in seniors, in the absence of objective cognitive impairment on standardized tests, are one of the earliest indicators of future dementia (Geerlings, Jonker, Bouter, Ader, & Schmand, 1999; Jorm, Christensen, Korten, Jacomb, & Henderson, 2001; Petersen et al., 1997; St. John & Montgomery, 2002; Wang et al., 2004). The most common approach to identifying SMC is an affirmative answer to the question "Do you have problems with your memory?" (Abdulrab & Heun, 2008). There are, however,

disadvantages to using this simple identification method. For example, some people lack insight into their symptoms (Roberts, Clare, & Woods, 2009), meaning these individuals would not identify a problem with their cognition and therefore would not be classified as having SMC. Nevertheless, this lack of insight accurately represents an issue that exists in the general population. The word "subjective" in the term SMC requires that the person in question must believe there is a problem with his or her memory function; therefore, if an individual has memory issues but is not concerned, he or she should not be classified as SMC. If this is the case, the individual who lacks insight would bypass the subjective stage and would not be diagnosed until the MCI stage where a subjective concern on behalf of the patient is not required for diagnosis; at this stage, the concern can be reported by the patient, the informant, or by the patient's doctor (Albert et al., 2011).

The notion of this early stage of cognitive decline was initially met with scepticism; the controversy surrounding the topic of SMC is largely due to the difficulty in defining the stage, its association with other mental disorders and depression, and the lack of detection of observable deficits (Stewart, 2012). Some studies investigating its features revealed that SMC was not predictive of future cognitive decline (Jorm et al., 1997; Schofield et al., 1997) though many longitudinal studies show the relationship exists (Dufouil, Fuhrer, & Alperovitch, 2005; Geerlings et al., 1999; Glodzik-Sobanska et al., 2007; Jessen et al., 2010; Jorm et al., 2001; Martin & Zimprich, 2003). Results from a recent study (Jessen et al., 2013) suggest that an individual's subjective report of cognitive impairment represents the individual's perception of change of their cognitive performance over a period of time, and may be a better indicator of minor changes in cognition than a single measurement at one point in time. For example, minor cognitive changes would be difficult to detect using a

standardized cognitive test at a single time point on an individual who generally performs well on tests, even if this individual perceives slight changes in their cognition. However, if this high-performing individual documents their cognitive concerns over a period of time, this report may suggest longitudinal development of cognitive issues. For this reason, a subjective report of cognitive concerns may be best for identifying subtle cognitive changes over a period of time. The same study reports that SMC are predictive of future cognitive decline only if the individual with the subjective impairment is concerned about the decline. The study also suggests that those who believe they have cognitive decline but are not concerned are likely exhibiting signs of normal age-related decline rather than incipient Alzheimer's disease (AD). Although there is controversy on this topic, a population-level screening program for cognitive impairment does not exist, leaving no other alternative for identifying individuals with early cognitive impairment besides self-disclosure of deficits (Stewart, 2012).

1.3 Mild stage of cognitive decline

Mild Cognitive Impairment is the stage that follows SMC (Jorm et al., 2001) and precedes dementia (Burns & Zaudig, 2002). The term MCI was proposed in the late 80's by the New York University group (Petersen & Morris, 2005). The criteria for MCI have changed over the years, but at present, the term refers to people who exhibit some cognitive impairment that is less severe than what is seen in people with dementia (Petersen, 2004). People with MCI may also show signs of very minor difficulties with their functional abilities (Petersen, 2004). Mild Cognitive Impairment has many sub-types, one of which is specified as amnestic because its core feature is memory loss (Petersen, Doody et al., 2001). Non-amnestic MCI is the classification used for people who have cognitive deficits that are

not memory related. Single-domain MCI involves impairment in only one cognitive domain, whereas multiple-domain MCI requires impairments in more than one domain, for example, language and executive function (Petersen, 2004). The concept of MCI assumes a transient stage between normal cognition and AD, meaning that people do not simply transition from normal cognition to dementia without first demonstrating mild signs of cognitive impairment (Petersen et al., 2001). There is an early stage of MCI (EMCI) as well as a late stage (LMCI) which are distinguishable by the level of performance on neuropsychological assessments (Aisen et al., 2010). A systematic review (Roberts et al., 2009) found significant variability in insight in people with MCI, ranging from overestimates of dysfunction, to excellent awareness, to none at all. The review warns that self-assessment of memory concerns becomes less reliable over time, suggesting the need to assess concerns in a timely manner. People with MCI have been found to have a conversion rate to AD of approximately 10-15% per year compared to healthy individuals without MCI who progress at a rate of 1-2% per year (Petersen et al., 2001). There are currently no treatments shown to be clinically effective for any subtype of MCI (Petersen & Morris, 2005).

1.4 Dementia

Dementia is *not* a normal part of aging (Alzheimer Society, 2010). This syndrome is diagnosed using a set of criteria that describes it as progressive, degenerative, with gradual symptom onset, including deterioration of memory and other cognitive functions (McKhann et al., 2011) as well as significant impairment in daily functioning (Alzheimer Society, 2010). Some functional limitations include impairment in the ability to maintain work life and personal relationships, difficulty managing mood and behaviours, communication difficulties, and the inability to maintain self-care (Alzheimer Society, 2010).

Given the individual differences in presentation of dementia, it can be difficult to detect in the early stages of the disease process (Alzheimer Society, 2010; Ganguli & Petersen, 2008), which can be an issue for timely diagnosis. Standard methods for evaluating cognitive decline include the use of neuropsychological assessment tools such as the Mini Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975) or the more recent Montréal Cognitive Assessment (MoCA) (Nasreddine et al., 2005), both of which evaluate several cognitive domains in a simple 10-minute in-clinic test. The MoCA is designed to detect MCI, whereas the MMSE is designed to detect cases of dementia (Nasreddine et al., 2005). Higher scores on these tests indicate better cognition, and lower scores can indicate MCI or possible dementia. The patient also completes one or several of the available questionnaires designed to assess his or her Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL). Examples of ADL include activities related to personal care (e.g. bathing, dressing, and feeding oneself) whereas IADL are activities that are more complex such as managing finances, meal preparation, and using the telephone. Informants – who are people who have significant contact with the patient and whom the patient believes knows them well – complete questionnaires to document their perception of the patient's cognitive deficits and daily functioning. More recent approaches to predict future cognitive decline are now used in research studies, but are not yet available in the clinical setting (Mariani, Monastero, & Mecocci, 2007). These approaches combine neuropsychological tests, questionnaires and imaging with more expensive and invasive procedures. Such procedures include Positron Emission Tomography to assess brain function (Jack et al., 2009), genotyping (Ganguli & Petersen, 2008) and biomarker collection through blood and Cerebral Spinal Fluid samples for further analysis of tau and beta-amyloid

proteins that are believed to be associated with AD (Devanand et al., 2008; Mattsson et al., 2009).

Dementia of the Alzheimer's type is the most common form of dementia; in 2008, an estimated 63% of all dementia cases in Canada were of the Alzheimer's type (Alzheimer Society, 2010). The pathophysiology of AD is believed to begin years prior to diagnosis; the lengthy latent phase of preclinical AD could be an opportune time for therapeutic intervention (Begum et al., 2013; Reisberg et al., 2008; Sperling et al., 2011). Clinical trials for AD therapies have taken this belief into consideration, as they have begun transitioning from tertiary to secondary prevention methods by treating people earlier in the stages of cognitive decline (Amariglio et al., 2012). With this shift to earlier treatment, there is a great need for early detection strategies.

Early publications on AD pathology (Brayne & Calloway, 1988) as well as more recently published diagnostic guidelines (Sperling et al., 2011) indicate that senile plaques and neurofibrillary tangles are characteristic of a dementing brain; however, this pathology is also seen in normal aging brains, albeit in smaller amounts. The plaque and tangle hypothesis proposes that the number of accumulated plaques and tangles must reach a certain threshold before dementia occurs (Roth, Tomlinson, & Blessed, 1966). Alzheimer's disease pathology weakens the body and immune system, thus increasing susceptibility to diseases that the person with dementia inevitably cannot recover from (Alzheimer Society, 2010). This disease is ultimately fatal, and death usually occurs seven to ten years following diagnosis (Alzheimer Society, 2010).

There are currently five pharmaceutical interventions on the market that are approved to treat the stages of AD once a diagnosis is made (Farlow & Cummings, 2007). Four of

these drugs are acetylcholinesterase inhibitors, which are used to treat mild to moderate stages of AD. These drugs – tacrine, donepezil, rivastigmine and galantamine – prevent the breakdown of acetylcholine, thus increasing the amount available for neurotransmission (Bond et al., 2012). A fifth drug, memantine, is used to treat those with moderate to severe AD (Farlow & Cummings, 2007). Memantine works by blocking the excessive levels of glutamate that cause neuronal dysfunction (Bond et al., 2012). Although these treatments are available and commonly prescribed for AD, they do not cure or reverse the disease; they are merely symptomatic medications (Prince et al., 2011). These treatments are effective for approximately six months to three years, for about 50% of people who take them (Bond et al., 2012).

In terms of non-pharmacologic dementia treatment options in Canada, there is a wide variety of stage-specific programs and services available for people with dementia and their caregivers (Alzheimer Society, 2010). During the early stages of cognitive decline, the Alzheimer Society provides educational material on prevention and recognition strategies. Once a diagnosis is made, additional services are available including: pharmaceutical interventions, educational support, respite, adult day programs, and family counselling. It is important to note that a diagnosis must be made in order to receive these "extra" services in Canada, which is one reason why early diagnosis is desirable (Prince et al., 2011). In the late stages of the disease, long-term care and end-of-life care options are available.

A meta-analysis (Mitchell, 2008) of SMC in people with dementia revealed that only 40-50% of those diagnosed with dementia reported any SMC. An explanation for the lack of complaints is that this population tends to overestimate their abilities (Graham, Kunik, Doody, & Snow, 2005). Another explanation for low complaints in the dementia population

is that insight decreases as the severity of dementing symptoms increases (Aalten et al., 2006; Kazui et al., 2006; Lopez, Becker, Somsak, Dew, & DeKosky, 1994; Sevush, 1999; Vogel, Hasselbalch, Gade, Ziebell, & Waldemar, 2005), which suggests that insight into cognitive complaints must be best in the early stages of cognitive decline, thus demonstrating the need to identify concerns early.

1.5 Significance

Seniors comprise the fastest growing age group in the Canadian population and this growth rate is expected to accelerate over the next 20 years (Statistics Canada, 2007). This population, especially those aged 75 and over, are heavy users of health care services – particularly in terms of visits to their family physician (Rogers, Hassell, & Nicolas, 1999). Despite their above average use of health services, there is ongoing concern that seniors represent a vulnerable, disadvantaged, and underserviced population (Dixon-Woods et al., 2005). As the population of seniors increases, family physicians will be faced with patients who exhibit signs and symptoms of dementia with increasing frequency, as these physicians are usually the first medical professionals to hear about cognitive concerns from their patients (Galvin & Sadowsky, 2012). It is at the family physician's discretion whether a patient should be referred for further, detailed neuropsychological testing. A major problem with this referral system is that medical students receive inadequate training in geriatrics (Bardach & Rowles, 2012) and as a result, they may be uncomfortable or unable to effectively assess or recognize which cognitive deficits in seniors are of concern. Many family physicians believe that diagnosing dementia is within a specialist's domain (Turner et al., 2004), because these physicians feel inadequately prepared to make the diagnosis and subsequently treat it (Allen et al., 2005). This hesitancy has many consequences: early signs

of dementia might be missed or the suspicion of AD might not be disclosed, which further delays diagnosis and referral to specialists and prevents early access to treatments and support programs.

The 2011 World Alzheimer Report (Prince et al., 2011) suggests that early recognition and intervention are desirable for both the person with dementia and their caregivers. Some of the benefits stated in the report include: effective planning for the future while the person with cognitive impairment remains autonomous, increased awareness and understanding of the symptoms, increased safety for the person with dementia and others, and early access to information, medications, and services. The 2013 World Alzheimer Report (Prince, Prina, & Guerchet, 2013) explains that caregivers of people with dementia experience tremendous burden and strain while caring for their loved ones over long periods of time. The report notes that access to support systems and case management during the early stages is likely to be cost saving in the long run. Therapeutic intervention in the early stages of cognitive decline may be more effective than treating dementia (Begum et al., 2013; Prince et al., 2013); therefore, early identification of memory concerns is important to ensure that those with SMC are offered studies for therapies targeting the early stages of cognitive decline. People who are identified as having early cognitive decline may ultimately benefit from successful disease-modifying treatments when they become available.

Previously published literature of cognitive performance in the SMC population has focused on entire memory domains (Elfgren, Gustafson, Vestberg, & Passant, 2010; Glodzik-Sobanska et al., 2007) as well as pathological changes in brain structure and function (Bajo et al., 2012; Maestu et al., 2011; Saykin et al., 2006; Stewart et al., 2008) rather than specific memory and ADL concerns. A problem with studying entire memory

domains in the SMC population using standardized neuropsychological testing is that, although these tests are designed to replicate memory functions (e.g. recognizing or repeating word lists and paragraphs after a predetermined time delay), they are not necessarily representative of everyday life situations in which people must rely on their memory. Furthermore, previous studies (Beaudoin & Desrichard, 2011; Mascherek, Zimprich, Rupprecht, & Lang, 2011) have shown that SMC are, at best, modestly correlated with an individual's performance in a laboratory setting. This finding is an indication that perhaps the tools that are currently available to measure cognitive decline may identify individuals with clinical levels of cognitive impairment, but they may not be sensitive enough to detect the subtleties in decline from previous levels of functioning in seniors who perform very well on cognitive tasks. Instead, self-report measures may be the best resource to gain insight into the cognitive issues of these high-functioning seniors (Ossher, Flegal, & Lustig, 2013) and they may also be the best available method to monitor cognitive changes at very early stages of cognitive decline (Geerlings et al., 1999; Jonker, Geerlings, & Schmand, 2000).

One study (Schmand, Jonker, Hooijer, & Lindeboom, 1996) used a brief 10-item assessment tool to identify common memory concerns in adults aged 65 to 84; their sample reported forgetting where things have been left, making notes, word finding difficulties, and overall forgetfulness. A 2006 study (Newson & Kemps) that used a 20-item assessment tool found that working memory – which, in their study, measured items related to short-term retention of information – was a key cognitive concern in their sample of seniors. A more recent study of French-speaking seniors (Langlois & Belleville, 2013) identified that the

impact of distractions, whether external (e.g. noise) or internal (e.g. stress, fatigue), was most detrimental to learning and memory.

Current literature differentiates indicators of MCI from those of dementia (Petersen et al., 1999; Petersen et al., 2001), and SMC from MCI (Mitchell, 2008; Reisberg et al., 2008; Reisberg & Gauthier, 2008; Yoon et al., 2012), but there is a lack of research into the nature of subjective complaints of cognitive impairment (Stewart, 2012) and how people who are concerned about their memory differ from people who are not concerned. There is a great need for further research in this area, as it is required to validate criteria to identify SMC status (Abdulrab & Heun, 2008). At this time, to the author's knowledge, a comprehensive set of cognitive concerns and functional impairments specific to individuals with SMC does not exist. The lack of research in this area is problematic because of the astounding number of people of all ages who are concerned about their memory. Cognitive concerns are common at any age; one study showed that 22% (± 1.9%) of subjects aged 18 to 92 reported poor memory and that the percentage increased by age group (Bassett & Folstein, 1993). Furthermore, concerns about decline in memory function are fairly common in seniors (Bolla, Lindgren, Bonaccorsy, & Bleecker, 1991; Jorm et al., 1994). Since memory is not a perfect function, it is reasonable to assume that it is normal for seniors to have occasional memory lapses, but how many or of what nature must they be before an individual realizes something is wrong? Previous research has shown that people are more likely to seek medical attention if they perceive they have problems with their memory, are more highly educated, or have a positive family history of dementia (Ramakers et al., 2009). Alternatively, people are less likely to seek medical attention if they believe these memory lapses are due to normal aging (Hurt, Burns, Brown, & Barrowclough, 2011). Unfortunately,

many people do hold this belief, which causes delays in seeking medical attention (Knopman et al., 2000); these individuals may only be seen by a health care professional once they are clearly exhibiting signs of dementia. Since a formal diagnosis is required for access to medical support and services (Prince et al., 2011), it is imperative that individuals are diagnosed in a timely manner and receive support when required. Given the need to identify individuals in the earliest stages of the disease, there is significant value in creating a profile of cognitive concerns and functional deficits that are characteristic of early cognitive decline.

1.6 Theoretical framework

The initial drive behind this research was to produce findings to validate the concerns of the SMC population so that health professionals would take their concerns seriously. With this purpose in mind, it became evident that the Candidacy Model by Dixon-Woods et al. (2005) was a suitable theoretical framework to follow. This model highlights the intricate nature of the processes involved in accessing health care services by the health care user (e.g. seniors with SMC) and it indirectly speaks to the barriers that the SMC population might encounter should they choose to seek help for their cognitive concerns. The concept of candidacy is divided into seven dimensions: identification, navigation, permeability of services, appearances at health services, adjudications, offers and resistance, and operating conditions. These dimensions are explained in further detail below.

To begin, candidacy is described as "the ways in which people's eligibility for medical attention and intervention is jointly negotiated between individuals and health services" (Dixon-Woods et al., 2005, p. 6). Candidacy is a dynamic, non-linear process that is constantly redefined through the interactions between users of the health care system and health providers. The first step for an individual to gain access to health services is to

personally *identify* a need for the service, and for the individual to feel that he or she is deserving of the care (Dixon-Woods et al., 2005). A common deterrent that prevents seniors from identifying this need is that many feel they are expected to be healthy, independent and active, and are supposed to avoid making demands on health services if their concerns could be considered minor (Dixon-Woods et al., 2005; 2006). More specifically, research has shown that the occurrence of seeking medical help for cognitive concerns is very low (Begum, Morgan, Chiu, Tylee, & Stewart, 2012). Avoidance could occur when, for example, a senior with SMC delays seeking help from a health provider if he or she feels that the concerns are mild and does not wish to burden their healthcare provider with this purportedly minor concern. In cases where the individual successfully identifies his or her need for help and believes he or she is deserving of the care, navigation can take place.

The concept of *navigation* refers to one's awareness of available services and his or her ability to access the health care system; successful navigation is essential for effective use of health services (Dixon-Woods et al., 2005). Difficulties in navigation result from a lack of awareness of available services, which is especially common in vulnerable populations such as seniors with mental health issues (Dixon-Woods et al., 2005). Access requires significant work on behalf of the user (e.g. actively searching for available and relevant services) and the "amount, difficulty and complexity of that work may operate as barriers to receipt of care" (Dixon-Woods et al., 2006, p. 11). An individual's decision to access health care is heavily influenced by past experiences with the health care system (Garrett et al., 2012); negative experiences tend to delay or prevent individuals from seeking help. For example, if a senior presents to their family physician with memory concerns and

their concerns are dismissed due to a lack of objective evidence of decline, this individual may be unwilling to reiterate this concern at a later date, even if the symptoms worsen.

The *permeability* dimension varies by health service because it depends on the ease of access of the service (Dixon-Woods et al., 2005). A person's willingness to use a health service is dependent on the permeability of a service. Services with high permeability require the least amount of work on the part of the user, and are often services that the user is most comfortable using (e.g. visiting the family physician). Services that require a referral, are complex in nature, cause anxiety and confusion, or are difficult to comply with, are considered to have low permeability (Dixon-Woods et al., 2005). Since the majority of people with SMC first present to their family physician (Galvin & Sadowsky, 2012), the permeability aspect of SMC candidacy works in favour of the individual with SMC.

The next dimension of the Candidacy Model is the *appearance* the user has when presenting their medical concern(s) to health providers. In order to 'appear' well, the user "requires a set of competencies, including the ability to formulate and articulate the issue for which help is being sought" (Dixon-Woods et al., 2006, p. 13). Based on these appearances, health providers make *adjudications*, which are 'judgment calls' that effectively categorize the user into their next phase of treatment or care. For example, a physician's adjudication, in combination with the appearance of the user, may result in a referral to a specialist (Dixon-Woods et al., 2005; 2006). Unfortunately, mental health issues are stigmatized and are subject to discrimination, which have been found to prevent seniors from recognizing and subsequently presenting their symptoms to health care professionals (Conrad & Pacquiao, 2005; Polyakova & Pacquiao, 2006).

Another dimension of candidacy is termed *offers and resistance*, which refers to either the acceptance or refusal to commit to a plan of care (e.g. uptake of referral or prescription). If, for example, a health care user is opposed to the prescribed plan of care, it is unlikely that the user will adhere to the plan; thus, the user is effectively dismissing the recommendation of the healthcare provider. Refusal to adhere requires further negotiations of candidacy between the user and the provider.

The last dimension of the model is *operating conditions and the local production of candidacy,* which pertains to the environmental context in which negotiations between the user and the provider take place. Major components of this dimension are the user's proximity to services and the provincial policies that affect the delivery of health care and services; these components vary by geographical location in Canada. Due to transportation and proximity constraints, individuals with SMC who live in remote and rural areas may not present their concerns to a health provider until a much later stage in the spectrum of cognitive decline.

Appropriate goals that could be considered when devising a plan to facilitate early recognition and treatment of cognitive concerns are to strive to achieve the ideal outcomes of each stage in the Candidacy Model. For example, by continuing to investigate the common concerns of the SMC population, tools will ultimately be developed that will help individuals *identify* their deficits and start the *navigation* process early, which will increase their chances of receiving timely care. Increased awareness of the symptoms of SMC and of pertinent services will not only improve the *appearance* of the person seeking care, but also their *navigation* of available health services. Furthermore, it is important to increase family doctors' awareness of the most common cognitive concerns of people with SMC because

they are usually the health service providers that people are most willing to use. By increasing doctors' awareness, their *adjudications* will be better informed, and the *permeability of services* will improve. Moreover, if people are aware of the common cognitive concerns and respective treatment options, they will be less likely to *resist* treatment plans. Finally, with further research into identifying the benefits of early recognition of cognitive concerns, it is possible that a national dementia strategy will be developed which will focus on early identification of cognitive deficits, thus improving the *operating conditions* required for successful candidacy.

CHAPTER 2: RESEARCH QUESTIONS

One of the aims of this research project is to address the knowledge gap regarding the common characteristics of seniors with memory concerns. This goal will be accomplished by building on previous studies and by adding a greater number of assessment tools to analyze ADL and IADL function, including additional questions specific to cognitive concerns. A second goal is to provide a starting point for future research on the identified areas of interest in terms of cognitive and functional concerns in the SMC population. It is anticipated that once this preliminary research receives adequate replication and more sophisticated analyses, the dissemination of the findings to the general public will empower citizens by providing them with information that may assist them in detecting early signs and symptoms of cognitive decline and functional impairments either in themselves or others. If citizens are comfortable using this information, they may be willing to seek guidance from their physician before cognitive deterioration becomes unmanageable. The following research questions were created to address the goals of this research:

1. What are the early indicators of Subjective Memory Concerns (SMC) in seniors in terms of their functional abilities (ADL and IADL), their neuropsychological profile and their common cognitive concerns that would help identify them as candidates for care?
2. How do these indicators differ from those of seniors who are Not Concerned about Memory (NCM)?

2.1 Hypothesis

It is hypothesized that there will be differences in functioning and cognitive concerns in people with SMC compared to those who are NCM beyond the perceived memory issues.

2.2 Objective

To identify deficits that might be characteristic of individuals with SMC who responded to research advertisements, are aged 65 and older, are in good general health, are not depressed and have no history of neurological or psychiatric disorders by using cognitive concern questionnaires, neuropsychological measures and assessments of ADL and IADL.

CHAPTER 3: MATERIALS AND METHODS

3.1 Setting

This research project is a retrospective secondary analysis of data gathered cross-sectionally from seniors who, since 2010, have participated in research studies conducted by Dr. Vanessa Taler from the School of Psychology at the University of Ottawa. Study sessions took place at the Bruyère Research Institute (BRI) located in Ottawa, Ontario. This project was granted ethical approval by both the University of Ottawa and BRI (Appendix A).

3.2 Participant recruitment

Recruitment for all of Dr. Taler's studies required participants to be 65 years of age or older, in good general health, not depressed, have no history of neurological or psychiatric disorders, and have less than four risk factors for stroke. Several techniques were employed to recruit participants. One technique involved publishing advertisements in Ottawa's Forever Young magazine (Appendix B); this approach acquired 15 participants. A second technique involved direct communication with the target population. Using this approach, a research assistant recruited a further six participants from an independent living retirement home during an informal presentation about research opportunities at BRI. The remaining 57 participants, for a total of 78, were recruited from the National Association of Federal Retirees' Ottawa Chapter through a bilingual email sent to all members of the chapter (Appendix C).

All respondents were required to answer a history questionnaire over the telephone to ensure eligibility. Eligible respondents attended BRI to complete the first of two

neuropsychological assessments. These sessions comprised a battery of tests and questionnaires designed to assess cognitive and daily function. Each session lasted between one and two and a half hours. Participants were reimbursed for their time at a rate of $10 per hour. Parking and transportation costs were also reimbursed. Following the first session, participants took home memory, ADL and IADL assessment questionnaires and completed them as directed. Depending on the assessment, some were to be completed by the participant, by the participant's informant, or together. These assessments were returned at the next appointment. At the end of recruitment, there were 78 participants in the dataset. The research sample is a convenience sample.

3.3 Instruments

The assessment tools used in this research project closely mirror the assessment tools used by Saykin et al. (2006) who studied brain atrophy of seniors with cognitive complaints and individuals with amnestic MCI. In addition to these tools, a history questionnaire administered over the phone captured information regarding participant characteristics (e.g. age, sex), as well as language, medical history, medication use (current and within the past year), smoking history, concentration, memory and word finding difficulties, and overall self-rated health.

3.3.1 Assessment tools completed by the participant

3.3.1.1 Montréal Cognitive Assessment (MoCA)

The MoCA (Nasreddine et al., 2005) is a brief test that is designed to screen for MCI. It assesses general cognitive function in multiple domains including visuospatial and executive function, naming, immediate recall, attention, language, abstraction, delayed recall and orientation. The purpose of the MoCA in this research is to ensure participants are

cognitively intact. A total composite score is calculated by adding together correct scores for each item; scores can range between 0-30. Participants should score in the normal range (≥ 26 out of 30), indicating no objective cognitive impairment – a requirement to be classified as either SMC or normal cognition. Low scores on the MoCA should be taken seriously; however, the MoCA is only a 10-minute screen, and thus additional information (such as education level, other neuropsychological tests, hand tremors which may affect drawing skills, or a distracted/upset participant) should be taken into account when faced with MoCA scores slightly below the cut-off of 26. The MoCA is validated in seniors with 90% sensitivity in identifying individuals diagnosed with MCI, and 87% specificity in identifying normal cognition. Internal consistency as measured by Cronbach's alpha (α) is 0.83, and concurrent validity is 0.79 (Nasreddine et al., 2005).

3.3.1.2 Digit Span

Attention and verbal working memory was measured using a Digit Span task (Wechsler, 1997), which evaluates the temporary storage and manipulation of information. This task is a subset of the Wechsler Memory Scale – Third Edition. There are two components of the task, forward and backward digit span. In the Forward Digit Span task, participants are verbally presented with a series of digits (e.g. 5, 8, 2) and asked to repeat them back immediately in the same order in which they were presented. If the participant successfully completes this, he or she is given incrementally longer lists of digits to recall (e.g. 6, 4, 3, 9). The test ends when the participant is no longer able to recall the digits in two trials of the same length; the maximum score is 14. In the Backward Digit Span task, the participant is asked to repeat back the reverse order of the numbers spoken to them. The length of the longest list correctly repeated back indicates the backward digit span; the

maximum score is 16. The Digit Span Total is calculated from the sum of the forward and backward tasks, for a maximum total of 30. Normative data for the Digit Span Total were established for seniors aged 65-89 (Wechsler, 1997). Internal consistency as measured by Cronbach's α is 0.80-0.89 (Wechsler, 1997).

3.3.1.3 Wisconsin Card Sorting Task (WCST)

The WCST (Kongs, Thompson, Iverson, & Heaton, 2000) is a measure of abstraction and set shifting and provides measures of thinking and reasoning. This test uses 64 response cards with each card containing one to four identical symbols of a single colour. The cards vary by symbol (star, cross, triangle, circle), number of symbols (one to four), and by colour (red, blue, yellow, green). Four stimulus cards are positioned on the table in front of the participant in the order from left to right: one red triangle, two green stars, three yellow crosses and then four blue circles. The participant is given the pack of 64 response cards one at a time and asked to sort each card according to the stimulus cards laid in front of him or her. The cards can be sorted into any of three categories according to the number, form, or colour of the symbols. The participant is not given any instruction on how to sort the cards; they are simply told that they will be informed whether they have sorted the card correctly or incorrectly. After ten cards are correctly sorted (e.g. according to colour), the category is changed (e.g. number) and this cycle is repeated until all cards are sorted. Results of the WCST are based on the number of successful categories achieved – a perfect score is six. Normative data for the WCST resulted from a group of 384 adults aged 20 and older, with a maximum education of 20 years (Heaton, Chelune, Talley, Kay, & Curtiss, 1993). Within this sample, there were a total of 99 subjects aged 65 and older. The average number of

categories completed for the adult sample was 5.07 with a standard deviation (SD) of 1.63. Cronbach's α is 0.39-0.72 (Heaton et al., 1993).

3.3.1.4 Stroop 1, 2, and 3

The Stroop test (Stroop, 1992) measures attention, processing speed, and executive function. The purpose of the test is to assess the participant's ability to purposively inhibit a habitual response and instead respond in a less familiar way (Strauss, Sherman, & Spreen, 2006). In the first condition, which is the word-naming condition, the participant is presented with a list of 120 words, all of which are one of four colours: green, red, blue, yellow. These colours are written in black ink in six columns. The participant is instructed to read the words down the column, starting with the top word in the left-most column. In the second condition, which is called the colour-naming condition, the participant is asked to name the colour of a list of X's that are printed in green, red, blue or yellow ink. In the third condition, which is called the colour-word condition, the participant is presented with a list of colour words (green, red, blue, yellow) printed in colours that do not match the word's meaning. Participants are asked to say the colour of the word, not the word itself. This condition requires inhibition of the prominent response (reading the actual word). Each section yields a score based on the number of correct items completed. Participants are given 45 seconds to complete each task. There is no maximum score; if a participant reads all 120 words before the 45 seconds have expired, they are asked to restart at the top of the list and continue until the time runs out. Errors are not counted towards the total score. Normative data for the Stroop test were collected from 221 individuals aged 65 to 97 who participated in a MOANS study (Ivnik et al., 1996). Cronbach's α for Stroop 1, 2, and 3 is 0.90, 0.83 and 0.91, respectively (Strauss et al., 2006).

3.3.1.5 California Verbal Learning Test-Second Edition (CVLT-II)

The CVLT-II (Delis, Kramer, Kaplan, & Ober, 1987) quantifies learning strategies, recall and recognition abilities, rate of learning, retention of information, analysis of intrusion type errors, and repetition errors. Participants are asked to recall two word lists over immediate and delayed trials. List A, which consists of four semantic categories with four words per category, is verbally presented to the participant five times. Words belonging to the same word category are never presented consecutively. List B is an interference list of 16 words and is presented once. Following the presentation of List B, there is a short-delay free-recall and short-delay cued-recall of the words form List A. After a 20-minute delay, in which nonverbal neuropsychological testing takes place, there is a long-delay free-recall, long-delay cued-recall and a yes/no recognition trial of the words from List A. Ten minutes after the yes/no recognition trial, a forced-choice recognition trial of the words from List A is administered. There is no maximum score for the CVLT-II. This test is scored using T-scores based on gender and age. Cronbach's α for this test is 0.94 (Delis et al., 1987).

3.3.1.6 Logical Memory immediate and delayed recall

The Logical Memory task is a subtest of the Wechsler Memory Scale (Wechsler, 1945). In this task, participants are read a short narrative consisting of two paragraphs. Immediately following the oral presentation, participants are asked to recall as many details as possible. This process is repeated for a second story. The maximum score per immediate recall is 25, for a total of 50. Participants are then asked to recall the details of the first and second paragraph after a period of approximately 20 to 30 minutes. The maximum score per delayed recall is 25, for a total of 50. Normative data are not available for the version of the

test used in this study. The Cronbach's α for this test is 0.70-0.79 (The Psychological Corporation, 1997, 2002).

3.3.1.7 Boston Naming Test (BNT)

The BNT (Kaplan, Goodglass, & Weintraub, 1983) assesses word retrieval. The participant is shown a predetermined sequence of 60 black line drawings and has to name what the drawing depicts. The drawings are arranged by level of difficulty, from easy and high frequency words like "bed" and "tree", to difficult and low frequency words like "protractor" and "abacus". One point is awarded for each correctly identified word. A total score is calculated by adding together correct responses for each drawing and correct responses after a stimulus cue (semantic or phonemic); scores can range between 0-60. Normative data were collected from 521 individuals aged 65 to 97 who participated in a MOANS study (Ivnik et al., 1996). The Cronbach's α for this test is 0.91 (Pedraza, Sachs, Ferman, Rush, & Lucas, 2011).

3.3.1.8 Letter Fluency (F, A & S)

The Letter Fluency task (Benton, 1968) is a test of phonemic fluency. Performance on Letter Fluency is dependent on the function of the frontal lobes (Abrahams et al., 2003) and requires the input of verbal as well as executive functions to retrieve information from memory (Perret, 1974). Participants have one minute to list as many words as they can that begin with a given letter. In this study, participants were first asked for words that start with F, then A, and then S. Slang terms and foreign words that are not part of the standard English vocabulary are acceptable (e.g. faux pas). The words cannot be proper names, non-existent words, or repetitions, and each new word must have a different root word (e.g. love, lover and loved are all derived from the root "love" and therefore would only count as one word).

A total score is calculated by adding together each admissible word from the three categories. Tombaugh, Kozak & Rees (1999) collected normative data from 1300 residents of Ottawa, Ontario; 778 participants were seniors who were over the age of 60. This normative data indicate that the average FAS score total varies by age group; the average FAS score for 60-69 year olds was 38.5 ± 13.7; for 70-79 year olds the average FAS score was 34.8 ± 12.8; for 80-89 year olds the average FAS score was 28.9 ± 11.7; and for 90-95 year olds the average FAS score was 28.2 ± 11.0.

3.3.1.9 Animal Fluency

This task is a test of semantic verbal fluency where participants are given one minute to name as many animal names as possible. Performance on the Animal Fluency task is dependent on the function of the temporal lobes (Pihlajamäki et al., 2000). Names of extinct, imaginary, or magical animals are admissible so long as they are not names given to animals (e.g. Fido). A total composite score is calculated by adding together each correct word. Normative data by Tombaugh et al. (1999) were derived from a sample of 735 Canadians aged 16-95, 544 of which were 60 years and older. This data show that the mean animal fluency score varies by age group; the average score for 60-69 year olds was 17.6 ± 4.7; for 70-79 year olds the average score was 16.1 ± 4.0; for 80-89 year olds the average score was 14.3 ± 3.9; and for 90-95 year olds the average score was 13.0 ± 3.8. In AD, letter fluency generally remains relatively intact whereas category fluency is often affected (Monsch et al., 1992).

3.3.1.10 The Short Form Geriatric Depression Scale (GDS)

The Short Form GDS (Yesavage et al., 1983) is a tool to screen for depression in seniors. Depression is very common in seniors; one study reported that between 15 and 27%

of seniors in the United States had some form of subsyndromal depression (Lebowitz et al., 1997); therefore, it is imperative that depression be assessed and treated in the geriatric population. There are a total of 15 yes/no questions on the short form GDS; ten questions indicate the presence of depression when answered positively, while the rest indicate depression when answered negatively. The test is scored out of 15, with higher scores indicating more severe depression. Eligible participants should have a GDS score below five, which does not indicate depression. If a participant's total score is five or greater, it is important to consider other information and extraneous circumstances in the interpretation of the final score (Woodard & Axelrod, 1999). For example, two participants in this sample had a score of 6; however, they assured the examiners that they did not consider themselves to be depressed and insisted that circumstantial situations at the time of testing accounted for their high score. It is important to note that the GDS is a screening tool for depression, not a diagnostic tool; due to the brevity of this test, there is the possibility for misclassification (Yesavage et al., 1983).

The GDS is a reliable and valid screening tool for major depressive disorder across different age, gender, ethnicity and chronic illness statuses (Nyunt, Fones, Niti, & Ng, 2009). This tool is validated in seniors and has 90% sensitivity and 80% specificity, Cronbach's α is 0.80, and its concurrent validity is 0.80 (Nyunt et al., 2009). A normal score is <5, a score between 5-8 indicates mild depression, a score between 9-11 is indicative of moderate depression, and a score of 12-15 indicates severe depression.

3.3.1.11 Memory Self-Rating Questionnaire (MSR)

The MSR (Squire, Wetzel, & Slater, 1979) consists of 18 questions designed to measure perceived changes in several memory functions. The nine-point scale ranges from

-4 (worse than ever before) through 0 (same as before) to +4 (better than ever before). Each question is prefaced by the words "Compared to before…". A total score is the sum of the answers, for a maximum score of ± 72. The original publication explains that a normal average score from their sample ranged from -0.05 to +0.06, which was not significantly different from zero (Squire et al., 1979). The Cronbach's α for this test is 0.93 (van Bergen, Brands, Jelicic, & Merckelback, 2010).

3.3.1.12 Short Informant Questionnaire on Cognitive Decline in the Elderly – Self-Report (IQCODE-SR)

The questions on the Short IQCODE-SR (Jorm, 2004) measures change in cognitive function from the participant's perspective. This questionnaire has 16 items rated on a five-point scale, from "1) Much improved" to "5) Much worse". Each item is prefaced with "Compared with 10 years ago, how were you at…". The total score is a sum of the item values divided by the total number of items answered, ultimately providing a final score between 1 and 5. Up to two missing values are allowed for the shortened version. A higher score is indicative of greater impairment. A score below 3.00 indicates cognitive improvement; 3.00 indicates no change; 3.01 – 3.50 indicates slight decline; 3.51- 4.00 indicates moderate decline; and 4.01 – 5.00 indicate severe decline. Normative data and cut-off scores are not available for this tool. The Cronbach's α for this test is 0.94 (Jansen et al., 2008).

3.3.2 Assessment tools completed by the informant

Awareness of deficits is reduced in individuals with cognitive impairment (Vogel et al., 2004). For this reason, information should not only be collected from the person with cognitive concerns, but from their informant as well (Vogel et al., 2004). Although the

relationship between self and informant reports is less certain for cognitive concerns than it is for cognitive impairment (Jorm et al., 1994), informant reports may still be more reliable, and are therefore useful to collect.

3.3.2.1 Short Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)

The Short IQCODE (Jorm, 1994) is the same questionnaire as the IQCODE-SR but this version is from the perspective of the informant. Normative cut-off scores for the informant version of the IQCODE were calculated from an Australian sample of 684 informants aged 18 and older, who completed the IQCODE on behalf of a person aged 70 and older, with whom they had had regular contact over the previous 10 years (Jorm, 1994). Results from this study concluded that a cut-off score of ≥3.38 has a sensitivity of 79% and specificity of 82% in correctly identifying individuals with cognitive decline. The Cronbach's α for this test is 0.93-0.97 (Jorm, 2004).

3.3.2.2 Neuropsychiatric Inventory Questionnaire (NPI-Q)

The NPI-Q (Kaufer et al., 2000) addresses 12 mental and behavioural disturbances commonly seen in people with psychiatric disorders. These disturbances include: delusions, hallucinations, agitation or aggression, depression or dysphoria, anxiety, elation or euphoria, apathy or indifference, disinhibition, irritability/liability, aberrant motor activity, sleep and night time behaviour disorders, and appetite and eating disorders. The informant rates each section in accordance with his or her perception of changes from the usual or normal behaviour of the participant in the previous month. If any of the disturbances apply to the participant, the informant indicates "Yes" (which is given a value of one) and subsequently rates the severity of the disturbance on a subscale. Values on the subscale include: 1 (mild – noticeable, but not significant change), 2 (moderate – significant, but not a dramatic change),

and 3 (severe – very marked or prominent; a dramatic change). The disturbances that do not apply to the participant's change from normal behaviour in the previous month are answered "No" (which is given a value of zero) with no further classification.

The NPI-Q produces 12 subscale scores, and each scale is scored for frequency (yes or no) and severity (mild, moderate, severe). A total score for each subscale is calculated by multiplying the frequency by the severity. The global score is calculated by summing the total scores of each subscale ranging from zero to a maximum score of 36. There is no cut-off score to determine normalcy on the NPI-Q (Cummings et al., 1994). The presence of delusions or hallucinations is considered to be abnormal; therefore, a score of 1 or more in these sections is an abnormal score (Cummings et al., 1994). Symptoms of irritability, anxiety and depression occur in non-diseased populations; therefore, low scores in these domains may be considered normal (Cummings et al., 1994). For these reasons, it is inappropriate to suggest a cut-off score for normalcy. The Cronbach's α for this test is 0.88 (Cummings et al., 1994).

3.3.3 Assessment tools completed by both the participant and informant

3.3.3.1 Neurobehavioral Function and Activities of Daily Living Rating Scale (NBFADL)

The NBFADL is a self-rating scale that assesses daily functioning and activities (Saykin, 1992). A study by Saykin et al. (2006) used the NBFADL-60 item scale as a rating of the participant's perceived functioning, as well as an informant version of the NBFADL as a rating of the informant's perceived functioning of the participant. Separately, the participant and the informant score each question on a Likert scale that ranges from 1 (Above average ability) to 7 (Severe disability) with the option of choosing N/A if the item is not applicable. For scoring purposes, following the completion of the scale, the items are

rescored by the test administrator such that items are scored as a 1 if endorsed in the abnormal direction (e.g. ≥3) and a 0 otherwise. The sum of the items is divided by the total number of items answered, then multiplied by 100 to yield an index with a range from 0 to 100 percent of items endorsed. In the current study, the total scores were calculated using a percentage, but analysis of the individuals items were not scored this way. For the purpose of analyzing the subtle differences in individual item scores between the SMC and NCM groups, the original data with values that range from 1 to 7 were analyzed rather than the 0 or 1 rating. Normative data are not available for this assessment tool.

3.3.3.2 Memory Assessment Questionnaire (MAQ)

The MAQ (Santulli et al., 2005) is an assessment tool that is completed by the participant and the informant together. The version used in this thesis is slightly modified from the original. The scoring format for the original publication used the combination of the MAQ scores as well as other scales that together created a Cognitive Complaint Index (Saykin et al., 2006). For research projects in Dr. Taler's laboratory, only the MAQ portion of the index was used. This modification prevents a total score calculation, effectively turning the MAQ into an information-gathering tool to capture details regarding functional decline in each study participant. The following sections are included in the MAQ: memory concerns; general functioning (e.g. writing checks, meal preparation); driving concerns; personal care; mood, behaviour and personality difficulties, and medical history. Normative data are not available for this tool.

3.4 Data analysis

A systematic review of electronic databases by Abdulrab & Heun in 2008 identified definitions of SMC used in the literature. The authors reported findings from 37 papers that

included definitions used to identify their participants as either having SMC or not. Seventeen of these studies used one yes or no question to classify their participants as having SMC; nine papers used questions or scales with scored responses whose scores were above a pre-determined threshold; five sources required one question with a scaled or graded response (e.g. no; sometimes, but is no problem; yes, is a problem; yes, is a serious problem); five studies used a minimum number of positive answers to yes or no questions, and one paper required only one affirmative response to a set of questions that were either rated, or were yes or no responses (Abdulrab & Heun, 2008). Although not required, it is preferable for cognitive concerns to be corroborated by someone who knows the individual well (e.g. an informant) (Petersen et al., 1999; Petersen, Stevens et al., 2001).

In the current study, a participant was classified as having SMC if they answered "Yes" to the question "Do you have problems with your memory?" on the MAQ, and NCM if they answered "No". This method of classification is the one most commonly used to differentiate individuals with SMC from those who have normal cognition; however, further research is required to validate a comprehensive set of criteria to identify SMC status (Abdulrab & Heun, 2008). In this thesis, the term NCM will refer to the participants in this study who do not have objective evidence of cognitive impairment on neuropsychological tests, and when asked, do not believe they have a problem with their memory. The use of the term NCM is appropriate because it effectively contrasts those who do have concerns about their memory abilities from those who do not, and it does not make a statement about normalcy. Although the NCM participants indicate that they do not have a problem with their memory, this does not mean they do not have *any* memory concerns, it simply means that the cognitive deficits that they are aware of are not of concern to them. Since

participants were not randomly allocated, the NCM group is not a true control group, but rather a comparison group that perceives themselves as healthy.

Data from the assessment tools were examined in three different ways. The initial approach was to analyze the tools as they were originally designed for analysis, which was to analyze the total scores of each tool to identify significant differences in total scores between the SMC and NCM groups. The second approach was to group each individual assessment tool question – which will hereafter be referred to as 'item' – into logical units to reduce the large number of items, thus reducing the number of statistical tests that needed to be performed. By reducing the number of tests performed, the chance for a Type I error is decreased. A Type I error is a false-positive result that is more likely to occur when several statistical analyses are performed on a single dataset. The more tests that are performed on a dataset, the higher the likelihood of obtaining a significant result simply due to chance alone.

Logical units were established by grouping similar items into units derived from the Disability Creation Process (DCP) (Fougeyrollas et al., 1998), which is a conceptual model that was designed through a worldwide consultation process with the goal of capturing the constructs of functioning. The DCP explains the causes and consequences of disease, trauma, or other damage to the individual's integrity or development (Fougeyrollas et al., 1998). This model provides definitions and taxonomies of day-to-day functioning, and acts as a tool to classify an individual's ability to accomplish a physical or mental task (Levasseur, Desrosiers, & St Cyr, 2007). The DCP was used for the purpose of grouping similar items into logical units according to the taxonomy of the major DCP categories "Capabilities" and "Life Habits". For example, the major category "Capabilities" has categories titled Intelligence, Language, Behaviour, Sense and Perception, Motor Activity,

Breathing, Digestion, Excretion, Reproduction, and Protection and Resistance. Under the category "Intelligence", there are many subcategories including Consciousness, Mnesia, and Thought. These subcategories consist of further subcategories; for example, the subcategory Consciousness consists of Vigilance, Sleep and Attention. The "Life Habits" major category includes the categories Nutrition, Fitness, Personal Care, Communication, Housing, Mobility, Interpersonal Relationships, Community Life, Education, Employment, Recreation, and Other Habits. Each of these categories also consists of several subcategories; for example, the Nutrition subcategory consists of Diet, Food Preparation and Meals. The items from the questionnaires in this research project were categorized according to the most applicable subcategory of the DCP's Capabilities and Life Habits categories.

The sum of the number of items from each assessment tool that were included in the logical units was 209. The author then classified each of the 209 items according to a DCP category (e.g. Explicit Memory, Executive Function, Understanding, Personal Care). The process of grouping the items into DCP categories was as follows: Each assessment tool item was typed out into an excel spreadsheet for organization purposes. The author then consulted the DCP handbook, reading all of the descriptions of each category, subcategory, and so on. One by one, each assessment item was classified based on the most specific DCP classification possible. Once all of the items were classified, the author reviewed the classifications and grouped items that were classified under the same DCP category – this created preliminary logical units. Any unit that consisted of only one item was then classified to a lesser degree, if possible. For example, the assessment item "Dressing/Undressing" on the NBFADL tool was first classified under the major DCP category "Life Habits" then the subcategory "Personal Care" then the sub-subcategory

"Dressing". Since none of the other 208 items were classified under "Dressing", this classification was not considered a unit, as it only comprised one item. The "Dressing/Undressing" item was then reclassified under the previous subcategory "Personal Care" because other items were also classified within that unit (e.g. Managing own medications). Two informant-rated units – short-term memory and implicit memory – consist of only one item. The corresponding participant-rated units for short-term memory and implicit memory consisted of two and three items respectively; however, these participant-rated items did not have corresponding informant-rated items. In order to maintain consistency of the items within each unit, the author felt it was necessary for the short-term and implicit memory informant units to remain, even with only one item each. Once the classification process was finalized, 48 logical units were created. Twenty-four of those units were created for the items answered by the participant (e.g. Participant Explicit Memory), and 24 units corresponded to informant-answered items (e.g. Informant Explicit Memory). Not all participant units have a corresponding informant unit. These groupings were revised, rearranged and finalized in consultation with the thesis supervisors.

In order to create accurate logical units, the scores from the various assessment tools that made up a unit were combined. Since the scales were different for each tool, and the meaning of the values differed between assessments (e.g. values ranged from -4 to +4 on the MSR where a score of -4 indicated 'worse than ever before' and a score of +4 indicated 'better than ever before', whereas values on the ADL scales ranged from 1 to 7, where a score of 1 indicated above average ability and 7 indicated severe disability), it was important to ensure that the sum of the scores produced a meaningful value. To do this, the values of the assessments scales where a low score indicated superior function were reverse-coded.

This change meant that a higher total score was indicative of a higher functioning participant, whereas lower functioning participants had a lower total score.

The third approach involved statistical analysis at the individual item level. Items included participant characteristics, depressive symptoms, measures of ADL and IADL, neuropsychological measures, and cognitive concerns. This third approach was required because it was quickly realized that the initial perspective of analyzing logical units did not reveal the fine detail that was required to uncover the subtle deficits of the SMC population. In order to capture the mild nature of the cognitive concerns, statistical analyses had to be completed at the item level. Given the number of individual items, numerous analyses were performed. A Type I error calculation indicated that approximately 10 results may have been significant due to chance alone. We were, however, able to identify 30 statistically significant differences, which indicates that there is presumably something substantial occurring in the data that would allow us to find that many significant differences. Due to the exploratory nature of this research and the interest in identifying potential indicators of SMC, it was important to reduce the possibility of a Type II error. For this reason, a Bonferroni correction was not applied to the .05 α level that was used as a criterion for determining significance. In contrast to the rationale for using a Bonferroni adjustment within logical units, the adjustment is not desirable in this case. If the critical α level is adjusted with a Bonferroni correction, the chance of a Type II error greatly increases because the adjusted critical level will be very small, which makes it difficult to demonstrate an existing difference.

The Statistical Package for the Social Sciences (SPSS) software program version 20 (IBM Corp., 2011) was used for analysis. Data screening was completed prior to any data

analysis. This process involved carefully checking the accuracy of the inputted data. Given the large amount of data, the *frequencies* function in SPSS was used to examine univariate descriptive statistics. This function is ideal for locating inaccurate data input in a large sample. Some of the mistakes that were found were values that were outside of the acceptable range specific to the scale (e.g. locating a '6' in the database for the IQCODE when only the values between 1 and 5 are acceptable). Any discrepancy that was found was double-checked with the original test and re-entered correctly.

Following the guidelines for missing data by Tabachnick & Fidell (2007), a Missing Values Analysis (MVA) in SPSS was run to determine where missing values were located and to determine the extent of missing data. The MVA imputes values through a process that estimates the missing values based on patterns in the dataset. Variables with less than 10% of missing data were corrected using the imputation process. Excluded from the MVA imputation process were variables that had more than 10% missing data and variables that captured medical history (e.g. high blood pressure, smoking history, etc.). The author felt it was inappropriate to estimate values for medical history, which is why these variables were removed from the MVA imputation process. To confirm that data were missing at random, a Little's Missing Completely at Random (MCAR) test was performed. Little's MCAR test resulted in a non-significant result, (χ^2 (3954) = 1562.62, p>.05) indicating that data were missing at random.

3.4.1 Statistical tests

Cronbach's α of each assessment tool was calculated for the purpose of comparing the internal consistency of the obtained value of the sample to established criteria and to ensure internal consistency in the responses of the sample. Cronbach's α for items within

each unit were calculated to ensure internal consistency within the units. A Cronbach's α value greater than 0.7 is considered reliable (Nunnally, 1967). Cronbach's α for the neuropsychological assessments (e.g. MoCA, Digit Span, WCST, Stroop 1, 2, and 3, CVLT-II, Logical Memory, BNT, Letter Fluency, Animal Fluency) were not calculated because the original publications that provide the established Cronbach's α indicate that the calculation was based on "the standardized questions" which were not specified. Additionally, the modified NBFADL and MAQ Cronbach's α were not calculated because the modifications would produce a result that is dissimilar to the established Cronbach's α which included the full set of questions.

A Bonferroni adjustment was performed within each logical unit to reduce the chance of a Type I error. This adjustment divides the critical α value of .05 by the number of items within each logical unit. The adjusted value becomes the new critical value, which was used to determine statistical significance.

Cramer's Phi (ϕ_c) was calculated for the significant chi-square results, and omega squared (ω^2) was calculated for the significant t-test results. These calculations are measures of effect size; they are an estimate of the degree of importance of the significant findings. They provide an estimate of how much variability in the dependent variable (e.g. assessment tool item) can be accounted for based on the independent variable (e.g. SMC or NCM) (Tabachnick & Fidell, 2007).

Independent samples t-tests are used to compare means on an interval scale (e.g. Likert scale) and two nominal categories (e.g. SMC and NCM). In this thesis, these tests were completed to identify significant differences between the SMC and NCM groups in terms of total scores on each assessment tool, as well as any significant differences in logical

units. These tests serve the purpose of identifying potential areas of interest for further analysis.

Chi-square analyses identify significant differences in categorical distributions, for example: differences between the SMC and NCM groups for items with dichotomous answers (e.g. yes or no). Since each item that was evaluated in this research violated the requirements of Pearson's chi-square, the Fisher's Exact Test value determined significance. This test yields probability values even when the assumptions underlying a categorical two-by-two design chi-square analysis have not been fulfilled. Fisher's Exact Test could not be calculated for items when both the SMC and NCM groups answered the item identically; the tests that could not be calculated are denoted with a "--" in the tables.

CHAPTER 4: RESULTS

4.1 Participant characteristics

The inclusion criteria for this study required that participants be 65 years of age or older, not have a neurological or psychiatric history, have less than four risk factors for stroke, not be depressed (determined by a score less than five on the GDS), not be cognitively impaired (determined by a score of 26 or more on the MoCA), they must have answered the question "Do you have problems with your memory" on the MAQ, they must have answered at least 50% of the assessment items, and they required an informant to corroborate memory concerns and daily functioning. An informant is defined as a person who knows the participant well (e.g., spouse, child, close friend); the participant determined who was a suitable informant.

The original database included 78 seniors. One participant was removed from the database because the MoCA score was too low (a score of 21/30) indicating cognitive problems that are too severe for the purposes of this research. Another participant was removed because it was determined that she was a repeat participant whose information was collected at an earlier time and captured under a different participant number within the database. Eight participants were removed from the database because they did not answer the question "Do you have problems with your memory?" The answer to this question was used to classify the participants into either the SMC or NCM group; therefore, it was essential for this question to be answered in order to be a part of the analysis. One participant was removed due to greater than 50% missing data. The final database consisted of 67 seniors; 22 were identified as SMC and 45 as NCM. With these exclusions to the original dataset, the

percentage of missing values that were imputed using the MVA program in SPSS represents 4.29% of the data.

Our sample size of 67 participants is small. An *a priori* power analysis was calculated to determine the minimum sample size required to detect medium effect sizes. In this calculation, the value for power was set to 0.80, and the result indicated that a minimum of 144 participants was required to detect medium effect sizes.

Participant characteristics are presented in Table 1. Nearly a third of the sample had SMC. There were no significant differences between the SMC and NCM groups for age ($t(65)= -0.35$, $p=.73$), education level ($t(65)= 0.23$, $p=.82$) and self-rated health (χ^2 ($N= 67$), $p= .38$). Chi-squares were conducted to determine the significance of the relationship between the informant and the participant, as well as the significance of the marital status of the participants. Due to the small sample size, the SPSS software calculated a Fisher's Exact Test. The relationship between the participant and their informant did not differ between groups (χ^2 ($N= 67$), $p=.62$), nor did the classification of marital status (χ^2 ($N= 67$), $p= .08$).

Significant differences in medical history were evaluated using a Fisher's Exact Test from chi-square analyses. A yes or no answer was provided for each medical condition. Due to missing data, the number of participants varies by test. There were no significant differences found for handedness or for any medical conditions that were measured; the values are recorded in Table 2.

4.2 Analysis of total scores

The results of the obtained Cronbach's α of the neuropsychological assessment tools that allowed for a Cronbach's α calculation indicate that the responses on the assessments

completed by participants were internally consistent, but the responses on the informant assessments were not; see Table 3 for results.

Only two significant differences in total scores were found; the total scores on the IQCODE informant and the MSR tools significantly differed by group. Mean scores and SD for each group, independent samples t-test results on the total scores of each assessment item, as well as omega-squared values for significant results can be found in Table 4.

4.3 Analysis of logical units

The next approach was to group each item from each assessment tool into logical units using the Disability Creation Process classification (Fougeyrollas et al., 1998). Cronbach's α was calculated to ensure internal consistency within the units, which would ultimately validate or invalidate the logic of the invented units. Several units were unreliable, meaning that groupings were not stable enough to be analyzed as entities. Regardless of the unsatisfactory results, independent samples t-tests were completed and significance was determined at the Bonferroni-adjusted value to identify potential areas of interest for further analysis. Of the 48 units, six were found to be statistically significant, and of those six, only two (explicit memory and long-term memory) were also deemed reliable with a Cronbach's α value greater than 0.7. Of the six significant units, five corresponded with participant units: Episodic Memory ($t(65)= 2.74$, $p= .01$), Explicit Memory ($t(65)= 3.65$, $p= .001$), Long Term Memory ($t(65)= 3.49$; $p= .001$), Short Term Memory ($t(65)= 3.04$, $p= .003$), and Thought ($t(64)= 3.07$, $p= .003$). One informant unit, Memory ($t(16.87)= 2.82$, $p= .01$), was also significant. See Table 5 for the t-tests, Cronbach's α, means and SD for the logical units and Table 6 for individual items of each significant unit.

4.4 Analysis of individual items

A total of 30 of the individual items were significant, including five chi-square results and 25 t-tests. Two of the significant chi-square items were from the MAQ; these results can be found in Table 7. Fisher's Exact Test revealed significant differences between groups for those who had difficulty remembering appointments, family occasions, and holidays (χ^2 (N= 67), p= .03); significant crosstab results are in Table 8. Fisher's Exact Test also revealed significant differences between groups for those who had difficulty thinking of words, and difficulties with the ability to communicate clearly (χ^2 (N= 67), p= .00); significant crosstab results are in Table 9. There were no significant results for the individual items on the NPI-Q tool.

The remaining three significant chi-squares were from the GDS; chi-square results are in Table 10. Sixty-three of 67 participants completed the GDS; however, the remaining four indicated on the item addressing depression on the MAQ that they were not depressed. Fisher's Exact Test revealed the following significant differences between groups: the number of participants who were basically satisfied with their life (χ^2 (N= 63), p= .02), significant crosstab results are in Table 11; the number of participants who felt happy most of the time (χ^2 (N= 63), p= .03), significant crosstab results are in Table 12; and the item "Do you think it is wonderful to be alive now" also significantly differed by group (χ^2 (N= 63), p= .03), significant crosstab results are in Table 13. All other differences on items on the GDS were not significant, including items such as feeling helpless, perceived energy levels and preferring to stay at home.

Of the 25 t-tests that were significant, 12 were from the MSR. It is important to note that although the MSR item *my general alertness to things happening around me* showed a

significant difference between groups, the average scores for both the SMC and NCM groups were not indicative of decline. This finding was replicated on one of the NBFADL participant items for *general alertness*. T-test results for the MSR are in Table 14, and significant t-test means, SD and omega squared are in Table 15.

Analysis of the individual items on the MoCA resulted in one significant result. The score for the "Serial 7s" component of the MoCA, which requires participants to count backwards from 100 by sevens, was significantly different between groups ($t(26)= 3.04$, $p= .01$). T-test results for the individual MoCA items are in Table 16, and the significant t-test mean, SD and omega squared are in Table 17.

There were no significant findings on the individual items on the IQCODE informant tool. Four items from the IQCODE-SR were significant. It is important to note that although the IQCODE-SR item *making decisions on everyday matters* showed a significant difference between groups, the average scores for both the SMC and NCM groups were not indicative of decline. T-test results of the IQCODE-SR are in Table 18, and significant t-test means, SD and omega squared are in Table 19.

Four items from the NBFADL informant scale were significant: ability to be flexible rather than rigid or have an overly set manner ($t(65)= -2.46$, $p= .02$), finding words and remembering names ($t(27.57)= -3.09$, $p= .01$), bowel/bladder control ($t(26.43)= -2.06$, $p= .049$), and vocational functioning (ability to do regular job) ($t(46)= -2.04$, $p= .047$).

The average scores for *flexible personality* (1.86 ± 0.56) and *bowel/bladder control* (1.95 ± 0.65) from the perspective of the SMC participants fell between the "above average ability" and "normal ability" rating, whereas the informant's perspective of the SMC group's flexible personality (2.14 ± 0.64) and bowel/bladder control (2.23 ± 0.87) corresponded with

relatively normal ability but in the direction of mild disability. In contrast, the average scores from the perspective of the NCM participants for flexible personality (1.76 ± 0.65) and bowel/bladder control (1.96 ± 0.42) as well as the informant's perspective of the NCM group flexible personality (1.78 ± 0.52) and bowel/bladder control (1.82 ± 0.44) corresponded with above average ability.

The average score for *vocational functioning* from the perspective of the SMC participants (2.00 ± 0.37) corresponds with the "normal ability" rating whereas the informant's perspective of the SMC group (2.23 ± 1.24) reflects relatively "normal ability" but is in the direction of "mild disability". In contrast, the average scores from the perspective of the NCM participants (1.86 ± 0.36) as well as the informant's perspective of the NCM group (1.74 ± 0.44) indicate that the perception of job performance of the individuals who are NCM is of "above average ability".

The most interesting significant findings on the NBFADL scale are the average scores of the *word finding/name recall* item. The average score from the perspective of the SMC participants (2.86 ± 0.77) corresponds most closely with the "mild disability" rating whereas the informant's perspective of the SMC group (2.50 ± 0.80) falls in the middle of the "normal ability" and "mild disability" ratings. The distribution of scores indicates that some individuals with SMC expressed "mild to moderate disability". The self-report average of the NCM group (2.51 ± 0.82) is similar to the self-report from the SMC group, whereas the informants of the NCM group (1.93 ± 0.45) perceived that the NCM group's word finding/name recall ability was of "above average ability".

Four items on the NBFADL participant scale were significant: general alertness ($t(59.37)= -2.31$, $p= .02$), ability to think clearly ($t(42.56)= -2.58$, $p= .01$), remembering new

information told to you (t(35.06)= -2.15, p= .04), and acting appropriately around friends or family (t(64.07)= -2.77, p= .01).

It is important to note that although the NBFADL participant items *general alertness* and *ability to think clearly* showed a significant difference between groups, the average scores for both the SMC and NCM groups did not indicate decline. The average scores from the perspective of the SMC participants for general alertness (2.00 ± 0.31) and ability to think clearly (2.05 ± 0.38) corresponds with a "normal ability" rating whereas the informant's perspective of the SMC group's general alertness (1.73 ± 0.70) and ability to think clearly (1.68 ± 0.48), the NCM participants' perspective of their general alertness (1.78 ± 0.47) and ability to think clearly (1.78 ± 0.42), as well as the NCM informant's perspective of general alertness (1.73 ± 0.45) and ability to think clearly (1.67 ± 0.52) corresponds with "above average ability".

The average score for *remembering new information told to you* from all perspectives – SMC participants (2.55 ± 0.74), SMC informants (2.09 ± 0.53), NCM participants (2.16 ± 0.60) and NCM informants (2.02 ± 0.40) – corresponds with "normal ability", though it is worthy to note that the SMC participants rated themselves as having the most difficulty.

The average score for *acting appropriately around friends or family* from all perspectives – SMC participants (1.95 ± 0.21), SMC informants (1.82 ± 0.50), NCM participants (1.71 ± 0.51) and NCM informants (1.80 ± 0.50) – corresponds with "above average ability". T-test results for the NBFADL informant and participant tools are in Table 20. Significant t-test means, SD and omega squared for the informant version are in Table 21 and in Table 22 for the participant version.

CHAPTER 5: DISCUSSION

A novel feature of this research is the focus on specific cognitive concerns and challenges with daily functioning, which allows for analysis of the fine details of impairments experienced by the SMC population. The results offer a starting point to further explore the identified areas of interest. The purpose of this research is to provide greater insight into the difficulties experienced by the SMC population, with the hope of validating their concerns by demonstrating that their day-to-day functioning is significantly different from those who do not identify as having a memory problem. This goal was accomplished by identifying specific concerns that are unique to the SMC population.

Demographic information including age, sex and education did not differ between NCM and SMC groups – a finding that is consistent with previous studies (Langlois & Belleville, 2013; Ossher et al., 2013; Reisberg, Shulman, Torossian, Leng, & Zhu, 2010; Slavin et al., 2010; Weaver Cargin, Collie, Masters, & Maruff, 2008). Previous community-based studies have estimated the prevalence of memory concerns between 25-50% (Jonker et al., 2000), which is consistent with our finding that 33% of the sample had SMC. The entire sample consisted of mostly women (59.7%), which is not surprising since women usually take part in this type of research more often (Jorm et al., 2001; Langlois & Belleville, 2013; Rolstad et al., 2011). The average age of this sample was 72 years, and the mean education was fairly high at 15.5 years, which is usually equivalent to a university degree. The group of seniors in this study are more highly educated than the average senior. Statistics Canada data of people 65 years of age and older show that 52% of women and 47% of men have less than a high school education, whereas 6% of women and 13% of men have a university degree (Turcotte & Schellenberg, 2007). Overall, the two groups are comparable and any

differences cannot be attributable to demographics or to level of cognitive impairment as measured by the tools administered in this study.

The major differences between the SMC and NCM groups that were identified in this study were that seniors with SMC perceived more difficulty with memory, language, and learning how to use new technology. More specifically, the SMC group perceived particular difficulty with remembering appointments and the details of social and personal events in the short and long term, word finding and communication difficulties, and difficulty learning to use a new gadget in their home. Seniors with SMC also had more depressive symptoms but these were primarily limited to reporting less life satisfaction and happiness. Other than the difficulty with gadgets, the SMC group primarily identifies difficulties with social abilities.

Informants of the SMC participants also noted word finding difficulties as well as minor differences in flexibility of personality, vocational functioning and bowel/bladder control. However, it is important to note that when comparing the average total scores of the participant and corresponding informant tools that assess daily functioning (NBFADL) and changes in cognitive ability (IQCODE), regardless of group membership, the participants were more critical of their own abilities than the informants were. These results indicate that the informants were not necessarily in tune with all of the difficulties that the participants were experiencing.

Previous research (Gilley et al., 1995) has demonstrated the utility of informant reports in cognitive impairment research, suggesting that in later stages of cognitive decline (e.g. AD) information from informants regarding symptoms is often more reliable and accurate than information gathered from the person with dementia. These authors found that people with AD tend to underreport symptoms. Perhaps in the earlier stages of cognitive

impairment the opposite occurs – people overstate their concerns whereas informants do not yet notice all of the deficits that the participants may themselves notice. One study (McDade-Montez, Watson, O'Hara, & Denburg, 2008) explains that the ability of an informant to recognize symptoms is highly influenced by the individual with the concern, the informant themselves, the assessment tools used to measure the symptoms, and the ease of recognition of the symptoms in question. Perhaps the symptoms experienced in the very early stages of cognitive impairment are too subtle to be noticed by anyone other than the person who experiences them. On the other hand, Jorm et al. (2004) explain that cognitive concerns are associated with personality characteristics, most notably neuroticism; therefore the effect of personality likely plays a role in who reports these concerns.

Further indication that the significant findings from the informant reports should be interpreted with caution are the notable differences between the obtained and established Cronbach's α on the assessment tools. The poor reliability of the informant reports and the acceptable reliability of the participant reports indicate that the informants did not reliably answer questions about the participants. This disagreement in reports is consistent with the results from a study by Jorm et al. (1994). It is possible that the discrepancies would be less glaring if the sample in the current study, which consists of high-functioning community-based participants, was instead from a clinical setting. If the sample were clinic-based, where the participants were actively seeking counsel for their concerns, their deficits might be more obvious to the informant at that point in the help-seeking process. In addition to the poor reliability in the informant-rated tools, the lack of reliability within the majority of the logical units invalidated the perspective of analyzing the grouped data. For this reason, this

research did not focus on the significance of the logical units, and instead opted to analyze items individually to uncover the specific areas of concern for the SMC population.

5.1 Memory

The difference in total scores on the MSR tool indicates that the SMC group perceives their memory abilities as significantly worse than the NCM group. The average scores of both groups show that the SMC group perceives their memory has declined, whereas the NCM group reported memory improvement. The result of the SMC group reporting memory decline was not surprising, because the sample was categorized based on the presence or absence of perceived memory problems, but it was not anticipated that the NCM group would report improved memory.

With the data that are available for analysis, it is not possible to ascertain why the NCM group perceives an improvement in their memory, but several explanations might be suggested. One possibility is that the NCM group members have recently taken up hobbies (e.g. playing cards, doing crosswords) that exercise their memory or showcase their current cognitive status, leading them to perceive that their memory has recently improved. Second, it is possible that all of the participants answered the assessment tools by comparing their current memory abilities to the abilities of people they know (e.g. their social groups) instead of following the instructions, which asked the participants to compare their current memory functioning to their prior memory function. If this is the case, then perhaps the participants have unconsciously used this type of comparison, which could influence their self-reports, especially in such a highly educated sample. Thus, the SMC group may have rated their memory as worse than before because they believe that the majority of their peers within their social group have a better memory than they do, whereas the NCM individuals have

rated their memory as improving because they believe that they perform at the top of their social group in terms of their memory functioning.

Evidence of age-related short-term memory deficits in people with SMC has been reported in the literature (Newson, Kemps, & Luszcz, 2003; Newson & Kemps, 2006; Reisberg et al., 2010; Salthouse, 1991; Smith, 1996). A study by Ahmed et al. (2008) that investigated the nature of cognitive concerns in SMC, amnestic MCI and semantic dementia populations found that difficulty remembering appointments was especially prevalent in seniors with memory concerns. Using a Principal Component Analysis, Langlois & Belleville (2013) found that their sample of healthy seniors with SMC had mild to moderate complaints about their ability to remember the details of social and personal events from the recent or remote past.

The study by Ossher et al. (2013) found that out of 105 healthy seniors without objective memory problems, 40% had difficulty remembering something they were recently told and 55% struggled with remembering sentences they had read. In line with these findings, the SMC participants in the current study identified particular difficulty with recall of recent happenings (e.g. things they have recently been told, read or seen on television). They also admitted to difficulty remembering the details of events that occurred over a year ago and dating back to childhood, details about friends and family, names of acquaintances and difficulty knowing if they would remember things they intended to remember.

The results of the total score for the MoCA for both SMC and NCM groups align with the normative data (Nasreddine et al., 2005). Upon further examination into the individual items of the MoCA, the participants in the SMC group had significantly lower scores on the Serial 7s task. This task is categorized on the MoCA as a test of attention,

concentration and working memory. Results from the original MoCA publication indicate that this category differentiated the AD group from the MCI and normal controls and was "largely preserved in the MCI sample" (Nasreddine et al., 2005, p. 697). It is well documented in the literature that some of the earliest impairments in AD occur in attentional and executive functions (Parasuraman & Haxby, 1993; Perry & Hodges, 1999); attentional control processes of working memory was also found to be compromised in the MCI population (Belleville, Chertkow, & Gauthier, 2007). Previous studies have shown that the effects of aging are particularly detrimental in the attentional domain (Glisky, 2007; Salthouse & Siedlecki, 2005). Given these findings, perhaps difficulties in attention, though subtle, arise as early as the SMC stage.

Not only did the participants with SMC believe they have difficulties with their memory, but they also believed that these memory deficits were evident to those around them, including their relatives and acquaintances. Previous research (Mol, Ruiter, Verhey, Dijkstra, & Jolles, 2008) has shown that feelings of low self-efficacy with regards to perceived memory abilities, as well as the anticipation that others have negative judgements regarding his or her memory, are significant predictors of perceived forgetfulness.

Memory difficulties that affect the ability to remember details of personal and social events can be detrimental to the quality of interpersonal relationships. Forgetting the specifics of personal events can be frustrating and may result in a loss of a sense of self. The finding that the SMC group reported difficulty remembering names and faces of acquaintances is consistent with previous research; 40% of the sample of the aforementioned Ossher et al. (2013) study also had difficulty remembering names of people they just met, and Weaver Cargin et al. (2008) found that the biggest complaint in their sample of healthy

seniors was forgetting people's names. Forgetting a name can be embarrassing, especially in the presence of the person whose name is forgotten. In a situation where someone cannot remember the name of the person they are interacting with, strong feelings of discomfort may arise, which is a feeling that might be easy to recall when asked to identify one's cognitive concerns. This feeling of discomfort that is unlikely to be forgotten is a possible explanation why difficulty remembering the name of an acquaintance is commonly reported. It is interesting that significant differences between groups were found on items that involved interacting with people but not on items that addressed remembering objects (e.g. *remembering where things are usually kept*, or *remembering where to find things which have been put in a different place from usual*). A possible explanation is that an inanimate object does not give feedback when it is eventually located, but forgetting a person's name, or forgetting a word mid-sentence receives an immediate verbal or non-verbal reaction from those involved in the conversation. These reactions may elicit feelings of embarrassment in the person who made the error, which may lead that person to believe that he or she has a memory problem.

Failure to remember details of past social situations could eventually persuade people with SMC to withdraw from future social gatherings. Withdrawal from social events has a negative effect on cognition; seniors who are more socially active experience less cognitive decline in old age (James, Wilson, Barnes, & Bennett, 2011) because the stimulating effect of social engagement may protect against cognitive decline (Wang, Karp, Winblad, & Fratiglioni, 2002). For these reasons, people with cognitive impairment are encouraged by their physicians to at least maintain, if not increase, their participation in social events as a means of delaying progression.

It is concerning that the most frequent complaint of people with SMC is their ability to recall the details of memories of past social and personal events, because it is evident that these concerns can lead to negative outcomes. In order to prevent the possibility of social withdrawal and subsequent cognitive decline of the SMC population, it is essential to identify ways for this population to maintain valued social activities with their valued social groups. Possible interventions may include the development of strategies, technology and training for others to support the person's engagement over the long term. Additionally, it is imperative to end the stigma surrounding cognitive impairment. Stigma prevents people from sharing their concerns, which prevents or delays seeking professional help from the health care system (Link & Phelan, 2006). By reducing the stigma of mental health, people with cognitive concerns will be more willing to share their concerns, which will ultimately result in early identification of cognitive decline.

5.2 Language

Difficulties with language can have a negative impact on interpersonal relationships. The informants of the SMC group, as well as the SMC participants themselves perceived difficulty with communication and word finding. Results from studies by Martins et al. (2012) and Schmand et al. (1996) also found communication difficulties in seniors, particularly with word finding. Some studies (Ossher et al., 2013; Sunderland, Watts, Baddeley, & Harris, 1986) have demonstrated that other language errors, such as "tip-of-the-tongue" mistakes, were the errors most frequently reported by healthy seniors; the SMC group in our study also reported this difficulty. It is possible that people commonly report word finding difficulties because deficits in these areas are easy to recognize. People may become very worried if they start forgetting words, because the ability to use words

effectively is a skill that is used daily. Language difficulties can create problems when interacting with others. Forgetting words affects communication, which may persuade people with word finding difficulties to reduce or avoid social interactions. Reduction in social events is problematic because, as previously mentioned, it has a negative effect on cognition.

5.3 Technology

To the author's knowledge, no literature exists that specifically suggests that people with SMC experience more difficulty with learning to use a new gadget or machine, though this result seems intuitive. One study (Rosenberg, Kottorp, Winblad, & Nygård, 2009) that examined self-reports of difficulty with technology found that people with MCI perceived more difficulty than people without cognitive impairment, but less than people with mild dementia. A subsequent study (Malinowsky, Almkvist, Kottorp, & Nygård, 2010) that assessed observable performance skills and self-report of technology competency found similar results; however, the authors found that seniors without cognitive impairment also experienced difficulty managing technology. Both studies suggested that technology management might be an IADL that is sensitive enough to detect subtle changes as a result of cognitive decline. It is conceivable then that perhaps these difficulties arise as early as the SMC stage. Another study (Malinowsky, Almkvist, Nygård, & Kottorp, 2012) found that difficulty remembering necessary information was a factor that was significantly negatively associated with effective technology management. Interestingly, our study also found that the SMC group had significantly more difficulty than the NCM group with recall and remembering new information, which is a possible explanation why the SMC group perceives difficulty using a new gadget or machine.

5.4 Depressive symptoms

Although there were no significant differences between groups on the GDS tool as a whole, three individual items occurred more frequently in the SMC population than was expected due to chance alone. This significance occurred as a result of members of the SMC group choosing the answer "no" to three GDS items that indicate depression when answered negatively; these items were: *Are you basically satisfied with your life? Do you feel happy most of the time?* and *Do you think it is wonderful to be alive now?*. This finding indicates that significantly more participants in the SMC group reported unhappiness and life dissatisfaction than the NCM participants. Previously published literature tends to look at the total score of this assessment tool to identify the presence of depression in their sample (Balash et al., 2013; Slavin et al., 2010; Weyerer et al., 2013), which leaves a gap in the literature to support the significant findings of the individual GDS items.

For years, studies have consistently shown that depression is associated with memory concerns and future cognitive decline (Bolla et al., 1991; Jorm et al., 1994; Jorm et al., 2001; Kral & Emery, 1989; Reding, Haycox, & Blass, 1985; Reisberg et al., 2008). However, depression is only one of many factors associated with SMC; a study originating in Australia (Jorm et al., 2004) that assessed over 2,500 seniors aged 60-64 found that psychiatric symptoms, physical ability and neurotic personality traits accounted for the largest significant differences between people with SMC and those who were NCM. A review of the literature (Reid & Maclullich, 2006) explained that the association between depression and cognitive impairment in seniors does not account for all of the variance, thus suggesting that depression likely plays a mediating role instead. Potential mediating influences include the possibility that depressive symptoms are a result of being aware of cognitive decline

(Pearman & Storandt, 2004) or that seniors are more likely to report SMC if they are also depressed (Bolla et al., 1991).

Life dissatisfaction and unhappiness in the SMC group may result from other cognitive concerns that were mentioned previously, for example, those that affect interpersonal relationships and social life. It is conceivable that individuals with SMC withdraw from social situations as a result of repeated instances of embarrassment, for example, when they forget names or details of previously attended social events. It is also possible that they withdraw because they sense their relationships are suffering and attribute this to their perceived memory deficits. Withdrawal from participation in activities that were once enjoyable may result in loneliness. Previous research has linked loneliness to negative mood, anxiety, anger, and depressive symptoms (Cacioppo et al., 2006).

It was surprising that some of the items on the GDS did not show significant differences between the SMC and NCM groups. Although the SMC group acknowledged difficulties with word finding and communication – which we discussed could lead to the curtailing of attending social events – the responses to the items that addressed participation in social activities and preference to stay at home did not significantly differ between groups. Perhaps the communication difficulties experienced by the SMC participants are not yet severe enough to prevent attending social events. It is also possible that the preference to stay at home is rooted in personality rather than associated with cognitive concerns, which could explain why the preference to stay at home did not differ between groups.

Another surprising non-significant finding on the GDS was the participants' perception of their memory in comparison to others. It is curious why this item did not differ between groups, considering the SMC participants have identified themselves as having

memory problems. People tend to label themselves as having memory decline when they feel they do not meet what they consider to be the accepted standard for remembering (Cromwell, 1994). These standards are usually based on the cognitive abilities of people in their social group (Cromwell, 1994). Given this finding, if the participants of this study perceived their cognitive abilities as similar to people they know, then they would answer "no" to this question on the GDS.

5.5 Personality

The informants of the SMC group noted very slight variation from normal ability for flexible personality. Several studies have shown that as people age, they are more likely to use memory-aiding strategies (Bolla et al., 1991; Loewen, Shaw, & Craik, 1990) in an attempt to compensate for their perception of increased memory impairment (de Frias, Dixon, & Bäckman, 2003; Dixon, de Frias, & Bäckman, 2001). Memory aiding strategies involve routines; for example, maintaining a regular schedule of events, keeping the car keys in the same location in the house, or leaving notes around the home to serve as reminders to carry out a specific task. Seniors with SMC may feel they need to maintain these routines in order to prevent memory lapses. Adherence to these routines may be attributable to the SMC population being more set in their ways, which others could interpret as examples of inflexibility.

5.6 Vocational functioning

A widely used assessment tool known as the Global Deterioration Scale (Kral & Emery, 1989), which assesses the various stages of cognitive impairment, does not mention noticeable impairments at work until the third stage, which is consistent with a diagnosis of MCI. In stage 2, which is comparable to the SMC stage, the only mention of work-related

issues is that there are none that are objectively measureable. In this study, the informants of the SMC group noted minor difficulties in the SMC participants' ability to do their jobs. The majority of the sample in this study consists of retirees, meaning that perhaps the informants answered this item with regard to the participants' previous employment. Though the employment status of each participant at the time of testing is unknown, it is possible that several participants were employed; Canadian statistics from 2006 show that 14.8% of men and 5.8% of women over the age of 65 were employed (Uppal, 2010).

It is interesting to note that difficulty with vocational functioning was not replicated on the participant-rated version of the assessment tool, which suggests that the informants notice difficulties in the work abilities of people with SMC before the individual with SMC themselves. Previous studies have found self-identified difficulties in vocational function that suggest that this could be one of the first areas of daily functioning that is noticeably affected by perceived cognitive decline. For example, a study by Glodzik-Sobanska et al. (2007) found that one of the most frequent complaints by individuals with SMC was perceived impairment in work. A study by Öhman, Nygård & Borell (2001) found that the majority of their 51 to 61 year old participants who experienced memory difficulties first perceived these deficits at work. These participants noted that their difficulties were most often related to memory failures, particularly when the task required learning new material or remembering work routines or appointments. Previous research suggests that viewing one's career as a calling provides a sense of meaning and purpose in life (Steger, Pickering, Shin, & Dik, 2010; Wrzesniewski, 2003). If this is true, then admitting to difficulties at work could be damaging to one's sense of self, which may explain why the SMC participants did not admit to problems with vocational functioning.

5.7 Bowel/bladder control

The informants of the SMC group identified slight but significantly more difficulty with bowel/bladder control than the informants of the NCM group. The participants were also asked if they experienced these difficulties, however, no significant differences were found between groups. There is evidence in the literature that ties incontinence and cognitive impairment in seniors; however, increasing age on its own is strongly associated with all urinary tract symptoms (Irwin et al., 2006; Malmsten, Molander, Peeker, Irwin, & Milsom, 2010). Coppola et al. (2002) reported a link between urinary incontinence and cognitive decline as measured by MMSE scores. Another study (Iwahara, Ito, Hatta, & Hamajima, 2011) found a significant link between urinary incontinence and letter fluency, attention, and information processing speed. Strikingly, these studies did not mention whether their participants were taking anticholinergic medications to treat their incontinence symptoms, as these drugs have a tendency to induce cognitive impairment in seniors (Kay et al., 2005; Mulsant et al., 2003; Terry & Buccafusco, 2003).

A possible explanation for the significant finding regarding bowel/bladder control in the informant group is that people may be hesitant to self-report these issues, but more willing to report them in others. Incontinence is a highly stigmatized condition because cultural norms consider it to be an unacceptable behaviour (Garcia, Crocker, & Wyman, 2005). People who lose their ability to control their bowel or bladder feel shame and embarrassment (Elstad, Taubenberger, Botelho, & Tennstedt, 2010; Garcia et al., 2005). Consequently, people with incontinence delay help-seeking, which contributes to underreporting of these conditions (Link & Phelan, 2006; Madoff, Parker, Varma, & Lowry, 2004).

5.8 Encouraging candidacy

The results of this study have identified early cognitive and functional concerns of seniors aged 65 and older. Previous research (Geerlings et al., 1999; Jorm et al., 2001; Petersen et al., 1997; St. John & Montgomery, 2002; Wang et al., 2004) suggests that some of these individuals will progress to more severe forms of cognitive impairment. Fortunately, the literature outlines many benefits of early recognition and early diagnosis of cognitive impairment, including lifestyle changes that could slow progression and access to support programs that otherwise would not be accessible without a diagnosis (Prince et al., 2011). Unfortunately, health professionals report having limited geriatric training (Bardach & Rowles, 2012), which can result in missed diagnoses and delayed access to services. To compound the issue of missed diagnoses, seniors avoid seeking medical help because they believe they are expected to be healthy and should only request health services for major concerns (Dixon-Woods et al., 2005; 2006). If seniors remain unaware of the common cognitive concerns of their demographic and are not informed of the benefits of early diagnosis, they will continue to worry about their memory in solitude rather than utilize the resources that are available. Lack of awareness will negatively impact all elements of the Candidacy Model (Dixon-Woods et al., 2005). By facilitating the dialogue about common cognitive concerns in the senior population, effective candidacy can take place.

In order for the candidacy process to begin, people must *identify* their need for medical services and feel they are deserving of the care. In order to identify a need, it is imperative that pertinent information be available, accessible, and easily understood. When people are equipped with knowledge, they are more likely to approach the health care system

with confidence. Additionally, relevant knowledge about the medical condition will improve the help-seeker's *appearance* when describing their concerns to a health care professional.

We have identified the common concerns of the SMC population and their informants. Although it is still uncertain which of these concerns are risk factors for future cognitive decline, it is advisable to be aware of these potential areas for concern and be mindful of any worsening. It is our hope that if physicians are aware of the common cognitive and functional concerns of seniors, they will not dismiss the concerns of their patients but instead monitor them and make referrals as necessary. Physicians play an important role in allowing people to feel they are deserving of care, and they are the ones who make the *adjudications* that determine the plan of care for each patient. With further replication of this research, a consolidated list of cognitive concerns and functional deficits can be created and the findings can be disseminated to seniors and family physicians. Increased awareness of these concerns in seniors has the potential to improve seniors' *navigation* of the medical system, encourage this population to seek timely medical attention, and improve the care they receive once they seek help.

CHAPTER 6: LIMITATIONS

This study has limitations that may constrain generalizability and thus should be taken into consideration when interpreting the results. Previous literature indicates that people who participate in research or seek medical attention are usually educated, healthy, are health literate, and are of high socioeconomic status (Begum et al., 2013). Given that the participants in this study live independently in the community and have attained a high level of education, the sample is considered to be high functioning and may not be representative of the senior population. Extending this study to a wider range of seniors – for example, seniors who are less educated, require assistance with day-to-day living, or those who attend a memory clinic – would improve the generalizability of the results. Another consideration is the age requirement for participation in this study; previous studies (Mol et al., 2008) have set their age cut-off below 65 and have successfully recruited individuals with cognitive concerns. In the current study, people under the age of 65 who were concerned about their memory were not included. Furthermore, the study sample is relatively small; the study would benefit from a larger sample size.

Finally, it is important to recognize the difficulties in the creation of logical units. Three independent researchers ultimately agreed on the items of each unit; however, several items could have been subdivided into further classifications. For example, the item *ability to search through my mind and recall names and memories* in the long-term memory unit could have been classified into two items – *recall names* and *recall memories*. Classification problems like these are commonly encountered when working with an existing dataset. This issue is one reason why the logical unit results should be interpreted carefully and they should only be used as a guide to further investigate areas of interest.

CHAPTER 7: CONCLUSIONS

Through this exploratory research, potential areas of interest were identified for future research into these specific areas of concern. This study identifies the cognitive and functional concerns of the SMC population and differentiates them from seniors who acknowledge cognitive difficulties but are not concerned. It is our hope that longitudinal studies will be created which will identify the concerns that are risk factors for future cognitive decline. Once these risk factors are established, a consolidated list of them should be disseminated to family physicians. This list would be a useful and inexpensive tool for family physicians to refer to while gathering history from their patients. With access to this tool, family physicians will be aware of which cognitive concerns and functional deficits pose a risk for seniors who report early cognitive decline, and will hopefully be able to detect these risk factors in their patients. Ideally, this list will convince physicians who do not already monitor their patients' cognitive and functional concerns to do so rather than dismiss them. To monitor cognitive status, we recommend that the MoCA be administered by family physicians to patients who complain of worsening memory; this test is validated, easily accessible, and an easily administered tool that can identify people with MCI. The MoCA should be repeated at yearly intervals, and physicians should make referrals as necessary if test scores worsen. In addition, physicians should encourage patients who complain of worsening memory to make healthy lifestyle changes to reduce their risk of vascular dementias. Physicians should also take note of the functional declines that their patients report, and document any worsening over time. A timely transition from recognition of deficits to intervention – whether the intervention is increased awareness, education, or

treatment – has the potential to significantly improve the health and wellbeing of not only the person with cognitive decline, but their caregiver as well.

The results presented in this research and in previously published literature clearly demonstrate that cognitive concerns are prevalent in the senior population. The majority of the differences between the two groups are very subtle, indicating that the concerns that are recognized at the SMC stage in the spectrum of cognitive decline are small, but significant. A major issue is that these seniors are hesitant to seek medical attention when they notice these changes. The question that remains is what to do or say to these people who are concerned about their memory when there are currently no treatments for dementia that will stop or reverse the disease process. As outlined in this thesis, many longitudinal studies (Dufouil et al., 2005; Geerlings et al., 1999; Glodzik-Sobanska et al., 2007; Jessen et al., 2010; Jorm et al., 2001; Martin & Zimprich, 2003) show a relationship between SMC and future dementia; therefore, the SMC population should not be overlooked or disregarded by the medical system. Rather, it may be wise to continue to identify these individuals and further investigate their condition in order to gather more information about this particular group.

There is always great public interest in determining a common denominator or a biological cause for any given medical condition, but regardless of whether one is ever discovered, cognitive concerns remain a great source of stress for those who experience them (Stewart, 2012). For this reason, individuals who are concerned about their memory should receive appropriate assistance and regular follow-up to determine if their condition is worsening. By continuing to investigate the experiences and the needs of this population,

awareness of the symptoms of SMC will increase and will hopefully result in better help-seeking practices in the SMC population (Stewart, 2012).

Ideally, a national dementia strategy will be created for Canada that will include funding for government-led support programs that help people cope with their cognitive concerns and offer suggestions to reduce further decline. As clinical trials proceed in the direction of early diagnosis, it is possible that one day it may be considered best practice to treat people at the SMC stage of cognitive decline. Should this be the case, it would be wise to continue to identify these individuals so that treatment or other forms of intervention can take place at the earliest sign of impairment.

CHAPTER 8: LIST OF REFERENCES

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Table 1 Participant characteristics

	NCM	SMC	Levene's Test for Equality of Variances	Significance (2-tailed)
N (%)	45 (67.2%)	22 (32.8%)	N/A	N/A
Sex (%)	16 M (35.6%) 29 F (64.4%)	11 M (50%) 11 F (50%)	N/A	0.30
Mean Age (max. 90)	71.8 ± 6.67	72.4 ± 6.55	0.78	0.73
Mean Education (max. 22)	15.7 ± 2.41	15.5 ± 3.36	0.08	0.82
Mean Health Rating (max. 5)	4.4 ± 0.65	4.3 ± 0.63	N/A	0.38
Informant N (%)				
Spouse	23 (51.1%)	10 (45.5%)	N/A	0.62
Child	8 (17.8%)	4 (18.2%)		
Friend	10 (22.2%)	5 (22.7%)		
Sister	2 (4.4%)	1 (5%)		
Cousin	1 (2.2%)	0 (0%)		
PSW	1 (2.2%)	0 (0%)		
Partner	0 (0%)	2 (9%)		
Marital Status N (%)				
Single	3 (6.7%)	4 (18.2%)	N/A	0.08
Married	30 (66.7%)	8 (36.4%)		
Divorced	4 (8.9%)	3 (13.6%)		
Widowed	4 (8.9%)	6 (27.3%)		
Separated	2 (4.4%)	0 (0%)		
Cohabit	2 (4.4%)	1 (5%)		

Table 2 Medical history chi-square results

Item	Fisher's Exact Test	Item	Fisher's Exact Test
Handedness	.46	Thyroid disease	1.00
Glasses or contacts	1.00	Frequent headaches	1.00
Near or far sighted	1.00	Dizziness	1.00
Colour Blind	--	Serious head injury	.66
Cataracts	.90	Trouble walking	.39
Trouble hearing	.10	Unsteadiness	.64
Hearing aid	.06	Serious illness	1.00
Episode of unconsciousness	1.00	Neurological disorder	1.00
Hospitalized > 6 months	.25	Exposure to toxic chemicals	.10
Stroke	--	Depression	.68
Transient Ischemic Attack	.31	Anxiety	.26
Bypass surgery	1.00	Other psychological difficulties	.33
Heart disease	1.00	Current smoker	1.00
High BP	.12	Previous smoker	.29
High cholesterol	.78	Alcohol consumer	.25
Diabetes	.39	Problem with alcohol	1.00
Seizures	--	Concentration difficulties	1.00
Epilepsy	--		

Table 3 Obtained and established Cronbach's α

Assessment	Completed by	Obtained Cronbach's α	Established Cronbach's α
Geriatric Depression Scale	Participant	0.74	0.73-0.87
Memory Self-Rating Questionnaire	Participant	0.96	0.93
Short Informant Questionnaire on Cognitive Decline in the Elderly	Informant	0.45	0.93-0.97
Short Informant Questionnaire on Cognitive Decline in the Elderly – Self-Report	Participant	0.85	0.94
Neuropsychiatric Inventory Questionnaire	Informant	0.50	0.88

Table 4 Mean scores and standard deviations by group, and total score t-test results and omega squared values for significant results

	NCM Mean (SD)	SMC Mean (SD)	Levene's Test for Equality of Variances	Significance (2-tailed)	t	df	ω^2
MoCA (max. 30)	27.82 ± 1.7	27.14 ± 1.6	0.53	0.12	1.58	65	
Total Digit Span (max. 30)	17.98 ± 3.5	17.91 ±3.5	0.80	0.94	0.76	65	
WCST (max. 6)	3.44 ± 1.3	3.41 ± 1.3	0.66	0.92	0.10	65	
Stroop 1 (no max.)	94.93 ± 16.0	95.00 ± 14.3	0.45	0.99	-0.02	65	
Stroop 2 (no max.)	59.24 ± 14.4	62.77 ± 12.0	0.72	0.32	-0.99	65	
Stroop 3 (no max.)	34.33 ± 10.0	33.64 ± 8.0	0.59	0.78	0.29	65	
CVLT-II (T-score)	57.55 ± 9.5	53.95 ± 11.0	0.32	0.17	1.38	65	
Logical Memory – Immediate (max. 50)	28.09 ± 7.3	24.59 ± 5.5	0.43	0.05	1.98	65	
Logical Memory – Delayed (max. 50)	25.75 ± 7.0	22.27 ± 6.4	0.96	0.05	1.97	65	
BNT (max. 60)	52.87 ± 4.9	53.95 ± 4.0	0.43	0.37	-0.90	65	
Total Letter fluency FAS (no max.)	42.3 ± 11.4	43.1 ± 13.0	0.76	0.79	-0.27	65	
Animal fluency (no max.)	20.46 ± 5.4	19.55 ± 4.8	0.82	0.50	0.82	65	
GDS (max. 15)	1.09 ± 1.5 N = 44	1.84 ± 1.9 N = 19	0.08	0.10	-1.69	61	
MSR (max. ± 72) (-4 to +4)	1.82 ± 16.0	-10.0 ± 13.0	0.44	0.004*	3.01	65	0.11
NBFADL informant (max. 100%)	4.67 ± 6.9	8.36 ± 9.6	0.05	0.12	-1.62	31.38	
NBFADL participant (max. 100%)	9.94 ± 11.0	13.32 ± 9.9	0.39	0.23	-1.22	65	
IQCODE informant (max. 5)	2.88 ± 0.6	2.23 ± 1.4	0.00	0.048*	2.08	25.29	0.05
IQCODE self report (max. 5)	3.06 ± 0.2	2.91 ± 0.95	0.00	0.28	0.77	21.65	
MAQ	N/A	N/A	N/A	N/A	N/A	N/A	
NPI-Q (max. 36)	0.311 ± 0.8	0.500 ± 0.9	0.14	0.38	-0.89	65	

*Significant ($p < .05$)
MoCA = Montréal Cognitive Assessment
WCST = Wisconsin Card Sorting Test
CVLT-II = California Verbal Learning Test – Second Edition
BNT = Boston Naming Test
GDS = Geriatric Depression Scale
MSR = Memory Self Rating Questionnaire
NBFADL = Neurobehavioral Function and Activities of Daily Living
IQCODE = Short Informant Questionnaire on Cognitive Decline in the Elderly
MAQ = Memory Assessment Questionnaire
NPI-Q = Neuropsychiatric Inventory Questionnaire

Table 5 Logical unit mean scores and standard deviations by group, Bonferroni adjusted α and Cronbach's α

	Unit	NCM Mean (SD)	SMC Mean (SD)	# Variables	Bonferroni Adjusted α	Significance (2-tailed)	Cronbach's α
Participant answered items	Memory	137.95 (21.2)	125.64 (17.5)	8	0.00625	.02	0.57
	Episodic memory	11.47 (2.0)	10.09 (1.8)	3	0.0167	.01*	0.64
	Explicit memory	41.20 (5.3)	36.14 (5.4)	17	0.0029	.001*^	0.77
	Implicit memory	7.80 (0.8)	7.55 (0.7)	3	0.0167	.20	0.00
	Long-term memory	3.69 (4.3)	-0.14 (4.1)	5	0.01	.001*^	0.84
	Short-term memory	3.11 (1.2)	2.13 (1.1)	2	0.025	.003*	0.29
	Executive function	191.95 (33.0)	194.82 (29.0)	4	0.0125	.73	0.65
	Language	115.62 (17.0)	116.64 (17.6)	5	0	.82	0.79
	Financial responsibility	23.62 (1.2)	23.32 (1.2)	7	0.0071	.33	0.50
	Thought	50.78 (2.5)	48.67 (2.9)	14	0.0036	.0031*	0.58
	Behaviour	31.88 (2.6)	31.46 (1.3)	6	0.0083	.52	0.66
	Motor activity	17.67 (2.3)	17.82 (2.1)	3	0.0167	.80	0.81
	Volition	33.60 (2.1)	32.91 (1.2)	6	0.0083	.09	0.55
	Consciousness & vigilance	12.84 (1.4)	12.14 (1.2)	3	0.0167	.05	0.28
	Attention	13.47 (1.6)	12.91 (1.5)	4	0.0125	.17	0.34
	Understanding	22.27 (2.9)	21.27 (2.6)	6	0.0083	.18	0.66
	Expression	18.27 (1.5)	18.09 (1.5)	3	0.0167	.65	0.63
	Body functions	23.03 (2.3)	23.08 (2.6)	4	0. 0125	.95	0.57
	Transportation	12.40 (0.9)	12.07 (0.7)	2	0.025	.16	0.36
	Life habits	24.46 (1.7)	24.25 (1.5)	4	0.0125	.68	0.68
	Home maintenance	17.97 (1.2)	18.00 (1.3)	3	0.0167	.94	0.46
	Personal care	18.49 (1.1)	18.5 (1.1)	3	0.0167	.97	0.91
	Personal safety	18.51 (1.3)	18.42 (1.07)	3	0.0167	.79	0.83
	Use of furnishings	11.98 (0.7)	11.59 (0.8)	3	0.0167	.05	-0.42
Informant answered items	Memory	9.00 (0.5)	8.13 (1.2)	2	0.025	.01*	0.41
	Episodic memory	12.13 (0.8)	12.00 (0.8)	2	0.025	.53	0.68
	Explicit memory	39.26 (1.7)	38.94 (1.3)	9	0.0056	.50	0.55
	Implicit memory	6.00 (0.4)	5.91 (0.4)	1	0.05	.42	--
	Long-term memory	3.07 (0.3)	2.88 (0.3)	1	0.05	.054	--
	Short-term memory	3.00 (0.22)	2.81 (0.4)	1	0.05	.09	--
	Financial responsibility	21.80 (1.1)	21.86 (1.3)	5	0.01	.89	0.62
	Thought	53.84 (3.0)	52.25 (1.9)	9	0.0056	.39	0.67
	Behaviour	32.30 (1.8)	31.58 (1.1)	6	0.0083	.21	0.52
	Emotion	4.80 (0.5)	4.64 (0.7)	5	0.01	.29	0.40
	Impulse control	2.91 (0.3)	2.91 (0.3)	3	0.0167	.98	-.04
	Motor activity	18.11 (2.2)	17.48 (3.1)	3	0.0167	.35	0.79
	Volition	34.09 (2.1)	33.5 (1.0)	6	0.0083	.16	0.51
	Consciousness & vigilance	13.49 (0.8)	13.50 (0.8)	3	0.0167	.96	0.28
	Attention	12.38 (0.8)	12.18 (1.1)	2	0.025	.39	0.75
	Understanding	22.30 (1.4)	21.63 (1.2)	4	0.0125	.08	0.70
	Expression	19.18 (1.2)	19.14 (1.5)	3	0.0167	.90	0.55
	Body functions	25.21 (1.8)	23.33 (3.5)	5	0.01	.16	0.77
	Transportation	12.34 (1.3)	12.08 (0.5)	2	0.025	.48	0.64
	Life habits	24.89 (1.5)	24.46 (2.2)	4	0.0125	.45	0.69
	Home maintenance	18.13 (2.0)	17.78 (2.3)	3	0.0167	.56	0.69
	Personal care	18.67 (1.3)	18.68 (1.1)	3	0.0167	.96	0.62
	Personal safety	18.76 (1.2)	18.41 (1.0)	3	0.0167	.22	0.70
	Use of furnishings	12.26 (0.8)	12.07 (1.0)	3	0.0167	.47	0.43

*Significant result based on Bonferroni-adjusted α value
^Reliable unit (Cronbach's α > 0.7)

Table 6 Items of significant logical units

Unit Participant (P) Informant (I)	Items
Memory (I)	1. Ability to search through my mind and recall names/memories 2. My ability to recall things that happened a long time ago 3. My ability now to remember things that have happened more than a year ago 4. My ability to recall things that happened during my childhood 5. Remembering things about family and friends
Episodic memory (P)	1. Remembering new information told to you 2. Remembering new information read 3. The tendency for a past memory to be on the tip of my tongue but not available to me
Explicit memory (P)	1. My ability to recall things when I really try 2. My ability to hold in my memory things that I have learned 3. If I were asked about it a month from now my ability to remember facts would be 4. My ability to remember what I was doing after I have taken my mind off it for a few minutes 5. My ability to remember what I read and watch on television 6. Recalling conversations a few days later 7. Remembering my address and phone number 8. Remembering what day and month it is 9. Remembering where things are usually kept 10. Remembering where to find things which have been put in a different place from usual 11. Remembering what you intended to do 12. Remembering events from long ago 13. Remembering information learned long ago 14. Remembering appointments or meetings 15. Difficulty remembering appointments/family occasions/holidays 16. Difficulty remembering to take medications as prescribed 17. Difficulty thinking of words, or being able to communicate clearly
Long-term memory (P)	1. Remembering things about family and friends 2. Ability to search through my mind and recall names/memories 3. My ability to recall things that happened a long time ago 4. My ability now to remember things that have happened more than a year ago 5. My ability to recall things that happened during my childhood
Short-term memory (P)	1. Remembering things that have happened recently 2. My ability to reach back in my memory and recall what happened a few minutes ago
Thought (P)	1. Difficulty shopping alone 2. Difficulty with game of skill 3. Difficulty heating water 4. Difficulty preparing a balanced meal 5. Difficulty with current events 6. Speed of thinking and reacting 7. Speed of completed work or finishing usual activities 8. Ability to think clearly 9. Ability to reason through a complicated problem 10. Ability to organize daily tasks 11. Accepting criticism 12. Calculation skills 13. Using intelligence to understand what is going on and to reason things through 14. Ability to know when the things I am paying attention to are going to stick in my memory

Table 7 Memory Assessment Questionnaire chi-square results

Item	Fisher's Exact Test
Difficulty with checks, paying bills, balancing check book	--
Difficulty with assembling tax records, business affairs, or papers	0.33
Difficulty shopping alone for clothes, household necessities, or groceries	0.33
Difficulty playing a game of skill, working on a hobby	0.33
Difficulty heating water, making a cup of coffee, turning off stove	--
Difficulty preparing a balanced meal	1.00
Difficulty keeping track of current events	--
Difficulty paying attention, understanding, discussing TV/book/magazine	--
Difficulty remembering appointments, family occasions, holidays	0.03*
Difficulty remembering to take meds as prescribed	0.33
Getting lost while walking in the neighbourhood or in the house	--
Difficulty thinking of words, or being able to communicate clearly	0.00*
Difficulty recognizing people places or things which should be familiar	--
Driving concerns	0.46
Difficulty with personal care	0.14

*Significant ($p < .05$)

Table 8 Memory Assessment Questionnaire: Difficulty remembering appointments, family occasions and holidays crosstab

Difficulty remembering appointments, family occasions, holidays				Total	ϕc
		No	Yes		
NCM	Count	45	0	45	
	Expected Count	43	2	45	
	Adjusted Residual	2.5	-2.5		
SMC	Count	19	3	22	0.31
	Expected Count	21	1	22	
	Adjusted Residual	-2.5	2.5		
Total	Count	64	3	67	
	Expected Count	64	3	67	

Table 9 Memory Assessment Questionnaire: Difficulty thinking of words or being able to communicate clearly crosstab

Difficulty thinking of words, or being able to communicate clearly				Total	ϕc
		No	Yes		
NCM	Count	44	1	45	
	Expected Count	36.9	8.1	45	
	Adjusted Residual	4.8	-4.8		
SMC	Count	11	11	22	0.59
	Expected Count	18.1	3.9	22	
	Adjusted Residual	-4.8	4.8		
Total	Count	55	12	67	
	Expected Count	55	12	67	

Table 10 Geriatric Depression Scale chi-square results

Item	Fisher's Exact Test
Are you basically satisfied with your life?	0.02*
Have you dropped many of your activities and interests?	1.00
Do you feel that your life is empty?	0.58
Do you often get bored?	0.18
Are you in good spirits most of the time?	1.00
Are you afraid something bad is going to happen to you?	1.00
Do you feel happy most of the time?	0.03*
Do you often feel helpless?	1.00
Do you prefer to stay at home rather than going out and doing new things?	1.00
Do you feel you have more problems with memory than most people?	1.00
Do you think it is wonderful to be alive now?	0.03*
Do you feel pretty worthless the way you are now?	0.52
Do you feel full of energy?	0.78
Do you feel that your situation is hopeless?	--
Do you think that most people are better off than you are?	--

*Significant ($p < .05$)

Table 11 Geriatric Depression Scale: Are you basically satisfied with your life crosstab

Are you basically satisfied with your life?				Total	ϕc
		No	Yes		
NCM	Count	0	44	44	
	Expected Count	2.1	41.9	44	
	Adjusted Residual	-2.7	2.7		
SMC	Count	3	16	19	0.34
	Expected Count	0.9	18.1	19	
	Adjusted Residual	2.7	-2.7		
Total	Count	3	60	63	
	Expected Count	3	60	63	

Table 12 Geriatric Depression Scale: Do you feel happy most of the time crosstab

Do you feel happy most of the time?				Total	ϕc
		No	Yes		
NCM	Count	1	43	44	
	Expected Count	3.5	40.5	44	
	Adjusted Residual	-2.5	2.5		
SMC	Count	4	15	19	0.32
	Expected Count	1.5	17.5	19	
	Adjusted Residual	2.5	-2.5		
Total	Count	5	58	63	
	Expected Count	5	58	63	

Table 13 Geriatric Depression Scale: Do you think it is wonderful to be alive now crosstab

Do you think it is wonderful to be alive now?				Total	ϕc
		No	Yes		
NCM	Count	1	43	44	
	Expected Count	3.5	40.5	44	
	Adjusted Residual	-2.5	2.5		
SMC	Count	4	15	19	0.32
	Expected Count	1.5	17.5	19	
	Adjusted Residual	2.5	-2.5		
Total	Count	5	58	63	
	Expected Count	5	58	63	

Table 14 Memory Self-Rating Questionnaire t-test results

Item	Levene's Test for Equality of Variances	Significance (2-tailed)	t	df
My ability to search through my mind and recall names/memories I know are there is	0.46	0.00*	3.29	65
I think my relatives and acquaintances now judge my memory to be	0.88	0.03*	2.20	65
My ability to recall things when I really try is	0.58	0.00*	3.13	65
My ability to hold in my memory things that I have learned is	0.57	0.08	1.77	65
If I were asked about it a month from now, my ability to remember facts about this form would be	0.80	0.08	1.77	65
The tendency for a past memory to be "on the tip of my tongue" but not available to me is	0.34	0.03*	2.28	65
My ability to recall things that happened a long time ago is	0.80	0.01*	2.77	65
My ability to remember the names and faces of people I meet is	0.56	0.03*	2.25	65
My ability to remember what I was doing, after I have taken my mind off it for a few minutes is	0.53	0.08	1.80	65
My ability now to remember things that have happened more than a year ago is	0.06	0.00*	2.98	65
My ability to remember what I read and watch on television is	0.88	0.01*	2.94	65
My ability to recall things that happened during my childhood is	0.99	0.04*	2.14	65
My ability to know when the things I am paying attention to are going to stick in my memory is	0.70	0.00*	2.96	65
My ability to make sense out of what people explain to me is	0.41	0.13	1.55	65
My ability to reach back in memory and recall what happened a few minutes ago is	0.64	0.03*	2.50	65
My ability to pay attention to what goes on around me is	0.02	0.15	1.23	65
My general alertness to things happening around me is	0.02	0.03*	2.18	58.92
My ability to follow what people are saying is	0.63	0.89	0.14	65

*Significant ($p < .05$)

Table 15 Memory Self-Rating Questionnaire significant t-test means, standard deviations and omega squared

Item	Group	N	Mean	SD	ω^2
My ability to search through my mind and recall names/memories I know are there is	NCM	45	-0.222	1.330	0.13
	SMC	22	-1.273	0.985	
I think my relatives and acquaintances now judge my memory to be	NCM	45	0.067	1.156	0.05
	SMC	22	-0.546	0.858	
My ability to recall things when I really try is	NCM	45	0.089	1.203	0.12
	SMC	22	-0.909	1.269	
The tendency for a past memory to be "on the tip of my tongue" but not available to me is	NCM	45	-0.289	1.254	0.06
	SMC	22	-1.000	1.069	
My ability to recall things that happened a long time ago is	NCM	45	0.444	1.407	0.09
	SMC	22	-0.591	1.501	
My ability to remember the names and faces of people I meet is	NCM	45	-0.222	1.475	0.06
	SMC	22	-1.046	1.253	
My ability now to remember things that have happened more than a year ago is	NCM	45	0.044	0.903	0.11
	SMC	22	-0.727	1.162	
My ability to remember what I read and watch on television is	NCM	45	0.244	1.004	0.10
	SMC	22	-0.500	0.913	
My ability to recall things that happened during my childhood is	NCM	45	0.400	1.156	0.05
	SMC	22	-0.273	1.316	
My ability to know when the things I am paying attention to are going to stick in my memory is	NCM	45	0.156	1.086	0.10
	SMC	22	-0.636	0.902	
My ability to reach back in memory and recall what happened a few minutes ago is	NCM	45	0.244	1.004	0.07
	SMC	22	-0.409	1.008	
My general alertness to things happening around me is	NCM	45	0.511	1.141	0.05
	SMC	22	0.000	0.756	

Table 16 Montréal Cognitive Assessment t-test results

Item	Levene's Test for Equality of Variances	Significance (2-tailed)
Trails B	0.62	0.80
Cube copy	0.92	0.96
Clock drawing	0.05	0.34
Animals	0.00	0.08
Digits forward and backward	0.07	0.38
Tapping	SD both 0	--
Serial 7's	0.00	0.01*
Repeat	0.47	0.66
Fluency "F"	0.95	0.97
Abstraction	0.50	0.74
Delayed recall	0.77	0.13
Orientation	SD both 0	--

*Significant ($p < .05$)

Table 17 Montréal Cognitive Assessment significant t-test mean, standard deviation and omega squared

Item	Group	N	Mean	SD	ω^2
Serial 7s (max. 3)	NCM	45	2.91	0.358	0.11
	SMC	22	2.41	0.734	

Table 18 Short Informant Questionnaire on Cognitive Decline in the Elderly – Self-Report t-test results

Item	Levene's Test for Equality of Variances	Significance (2-tailed)	t	df
Remembering things about family and friends	0.021	0.02*	-2.50	41.44
Remembering things that have happened recently	0.02	0.04*	-2.17	38.39
Recalling conversations a few days later	0.03	0.57	-0.57	31.22
Remembering your address and telephone number	0.43	0.42	-0.82	65
Remembering what day and month it is	0.07	0.21	-1.26	65
Remembering where things are usually kept	0.75	0.86	0.18	65
Remembering where to find things which have been put in a different place from usual	0.19	0.11	-1.61	65
Knowing how to work familiar machines around the house	0.43	0.42	-0.82	65
Learning to use a new gadget or machine around the house	0.05	0.02*	-2.42	38.68
Learning new things in general	0.08	0.38	-0.89	65
Following a story in a book or on TV	0.63	0.98	-0.02	65
Making decisions on everyday matters	0.03	0.04*	-2.08	36.37
Handling money for shopping	0.22	0.34	0.97	65
Handling financial matters	0.62	0.80	0.26	65
Handling other every day arithmetic problems	0.05	0.32	-1.01	65
Using your intelligence to understand what's going on and to reason things through	0.92	0.12	-1.59	65

*Significant ($p < .05$)

Table 19 Short Informant Questionnaire on Cognitive Decline in the Elderly – Self-Report significant t-test means, standard deviations and omega squared

Item	Group	N	Mean	SD	ω^2
Remembering things about family and friends	NCM	45	2.978	0.452	0.07
	SMC	22	3.273	0.456	
Remembering things that have happened recently	NCM	45	3.133	0.457	0.05
	SMC	22	3.409	0.503	
Learning to use a new gadget or machine around the house	NCM	45	3.133	0.548	0.07
	SMC	22	3.500	0.598	
Making decisions on everyday matters	NCM	45	2.978	0.336	0.05
	SMC	22	3.182	0.395	

Table 20 Neurobehavioral Function and Activities of Daily Living Rating Scale informant and participant t-test results

	Informant		Participant	
Item	**Levene's Test for Equality of Variances**	**Significance (2-tailed)**	**Levene's Test for Equality of Variances**	**Significance (2-tailed)**
Walking	0.51	0.51	0.88	1.00
Climbing Stairs	0.48	0.63	0.68	0.58
Use of hands and arms	0.87	0.10	0.26	0.99
Level of energy/fatigue	0.28	0.39	0.38	0.60
General Alertness	0.09	0.97	0.00	0.02*
Attention and concentration	0.83	0.88	0.43	0.53
Ability to avoid losing train of thought; distractibility	0.59	0.18	0.69	0.49
Speed of thinking and reacting	0.01	0.06	0.92	0.13
Speed of completing work or finishing usual activities	0.18	0.91	0.63	0.55
Ability to think clearly	0.44	0.91	0.03	0.01*
Ability to make decisions	0.01	0.20	0.14	0.31
Ability to reason through a complicated problem	0.71	0.91	0.29	0.07
Ability to focus on goals; carry out a plan	0.30	0.71	0.08	0.08
Ability to be flexible, rather than rigid or have an overly set manner	0.92	0.02*	0.28	0.50
Ability to shift easily from one activity to another	0.05	0.19	0.80	0.37
Ease in initiating or starting activities by oneself	0.39	0.97	0.70	0.55
Self-Awareness of problems	0.58	0.97	0.44	0.85
Understanding conversations	0.90	0.92	0.73	0.53
Expressing yourself (speech)	0.15	0.81	0.18	0.46
Finding words, remembering names	0.000	0.01*	0.30	0.10
Reading (recognizing words)	0.91	0.09	0.10	0.11
Reading (understanding)	0.41	0.16	0.38	0.21
Remembering new information told to you	0.11	0.55	0.04	0.04*
Remembering new information you have read	0.17	0.62	0.44	0.09
Remembering where you put things	0.47	0.42	0.42	0.20
Remembering what you intended to do	0.20	0.53	0.46	0.73
Remembering events from long ago	0.16	0.14	0.36	0.14
Remembering information learned long ago	0.54	0.49	0.48	0.29
Remembering appointments or meetings	0.68	0.63	0.05	0.29
Acting appropriately around friends or family	0.82	0.89	0.00	0.01*
Ability to organize daily tasks	0.43	0.89	0.16	0.10

*Significant ($p < .05$)

Table 20 Neurobehavioral Function and Activities of Daily Living Rating Scale informant and participant t-test results (continued)

	Informant		Participant	
Item	**Levene's Test for Equality of Variances**	**Significance (2-tailed)**	**Levene's Test for Equality of Variances**	**Significance (2-tailed)**
Controlling your emotions (temper, laughter, crying)	0.41	0.21	0.45	0.18
Accepting criticism	0.33	0.07	0.24	0.34
Starting up conversations when in a group	0.46	0.12	0.03	0.82
Placing telephone calls	0.92	0.82	0.74	0.87
Awareness of danger	0.90	0.51	0.75	0.79
Judgment in potentially dangerous situations	0.06	0.49	0.88	0.71
Ability to use dangerous appliances and equipment	0.34	0.18	0.65	0.19
Spelling skills	0.046	0.24	0.40	0.91
Calculation skills	0.41	0.67	0.38	0.13
Participation in outside activities (religious, museums, movies)	0.76	0.89	0.39	0.90
Participation in home activities (TV, reading, music)	0.14	0.48	0.67	0.97
Preparing meals	0.35	0.84	0.82	0.61
Doing dishes and laundry	0.04	0.41	0.06	0.31
Cleaning your house	0.63	0.24	0.68	0.58
Managing your own money (bills, budgets, balancing checkbook)	0.09	0.53	0.98	0.26
Making purchases (using credit cards, counting change)	0.54	0.77	0.54	0.39
Eating, swallowing	0.01	0.14	0.43	0.51
Personal hygiene; able to bathe oneself	0.58	0.61	0.17	0.48
Dressing/undressing	0.39	0.66	0.04	0.30
Bowel/bladder control	0.01	0.049*	0.24	0.99
Managing own medications	0.01	0.20	0.65	0.39
Current living situation	0.25	0.56	0.01	0.31
Loss of interest or motivation regarding sex	0.00	0.14	0.09	0.30
Physical problem with sex	0.06	0.21	0.63	0.54
Relationships with coworkers	0.20	0.54	0.045	0.44
Participating in groups or use of community resources (clubs, support groups)	0.35	0.57	0.047	0.69
Driving a car	0.17	0.81	0.20	0.96
Travel independently; use public transportation	0.75	0.30	0.19	0.08
Vocational functioning (ability to do regular job)	0.08	0.047*	0.17	0.19
Household repairs	0.87	0.99	0.70	0.81

*Significant ($p < .05$)

Table 21 Neurobehavioral Function and Activities of Daily Living Rating Scale informant significant t-test means, standard deviations and omega squared

Item	Group	N	Mean	SD	ω^2
Ability to be flexible, rather than rigid or have an overly set manner	NCM	45	1.778	0.517	0.07
	SMC	22	2.136	0.640	
Finding words, remembering names	NCM	45	1.933	0.447	0.11
	SMC	22	2.500	0.802	
Bowel/bladder control	NCM	45	1.822	0.442	0.05
	SMC	22	2.227	0.869	
Vocational functioning (ability to do regular job)	NCM	35	1.740	0.443	0.06
	SMC	13	2.230	1.235	

Table 22 Neurobehavioral Function and Activities of Daily Living Rating Scale participant significant t-test means, standard deviations and omega squared

Item	Group	N	Mean	SD	ω^2
General alertness	NCM	45	1.778	0.471	0.06
	SMC	22	2.000	0.309	
Ability to think clearly	NCM	45	1.778	0.420	0.08
	SMC	21	2.048	0.384	
Remembering new information told to you	NCM	45	2.156	0.601	0.05
	SMC	22	2.546	0.739	
Acting appropriately around friends or family	NCM	45	1.711	0.506	0.09
	SMC	22	1.955	0.213	

APPENDIX A. ETHICS APPROVALS

Ethics approval from the University of Ottawa

Université d'Ottawa University of Ottawa
Service de subventions de recherche et déontologie Research Grants and Ethics Services

August 24, 2010

Vanessa Taler
School of Psychology
University of Ottawa
[redacted]

Patrick Davidson
School of Psychology
University of Ottawa
[redacted]

Re: [redacted]

Dear Professors Taler and Davidson,

Thank you for the protocol documents and the Certificate of Approval from the Bruyère Continuing Care REB ([redacted]) for your project named above.

This is to confirm that, in accordance with the agreement between the University of Ottawa and Bruyère Continuing Care, the University of Ottawa has authorized the Bruyère Continuing Care (BCC REB) to act as Board of Record for the review and oversight of research involving human subjects conducted at or through the hospital.

Copies of annual reports and renewals of BCC REB approvals, as well as certificates and reports for any other study sites must be provided to our office.

We remind you of your obligation to:

- Follow all procedures of the BCC REB including reporting and renewal procedures;
- Submit to the authority of the BCC REB and that you are subject to BCC REB requirements, including, without limitation, the requirement to modify or stop the research on demand of the BCC REB.

If you have any questions, please contact our ethics office a[redacted]

Sincerely yours,

[redacted]

Catherine Paquet
Director, Office of Research Ethics and Integrity

[redacted]

Ethics approval from the Bruyère Research Institute

www.bruyere.org

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June 17, 2010

Dr. Vanessa Taler
Assistant professor
School of Psychology
University of Ottawa

[redacted]

Final Approval

Dear Dr. Taler,

Thank you for your response to our conditional approval letter dated May 14, 2010. The revised documents were received today. The revisions have satisfied all of the ethical requirements. However, prior to data collection you are required to submit Pledges of Confidentiality by each member of the research team.

We are pleased to give ethical approval for one year (June17, 2010 to June 17, 2011) to proceed with the above titled study.

As you know, any changes to the study or complaints from the participants must be reported to the REB.

You are required to give us written notification of termination of the study, or the need for renewal of approval, before the expiry of this approval period.

We wish you the best of luck with this study.

Sincerely,

[redacted]

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June 17, 2011

Dr. Vanessa Taler
Assistant professor
School of Psychology
University of Ottawa

[redacted]

Renewal Approval

Dear Dr. Taler,

Thank-you for submitting an Annual Project Update requesting renewal of ethical approval for the study named above.

The Bruyère Continuing Care Research Ethics Board (REB) is pleased to extend ethical approval for one year, from June 17, 2011 to June 17, 2012.

Congratulations on the successes to date with this project.

Sincerely,

[redacted]

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May 1, 2012

Dr. Vanessa Taler
Assistant Professor
School of Psychology
University of Ottawa

[redacted]

Renewal Approval

Dear Dr. Taler,

Thank-you for submitting the Annual Project Update form requesting an extension of the approval for the study named above.

The Bruyère Continuing Care Research Ethics Board (REB) is pleased to extend ethical approval for one year, from April 7, 2012, to April 7, 2013 to continue with this study.

We wish you best of luck as you proceed with this study.

[redacted]

DK/db

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April 16, 2013

Dr. Vanessa Taler
Scientist, Bruyère Research Institute
Assistant Professor, School of Psychology, University of Ottawa

[redacted]

Renewal/Extension Approval

Dear Dr. Taler,

Thank-you for submitting the Annual Project Update form for the above named study on April 11, 2013 via email.

The Bruyère Continuing Care Research Ethics Board (REB) is pleased to extend ethical approval for the above-named project from April 7, 2013 to April 7, 2014.

We wish you best of luck as you proceed with this study.

[redacted]

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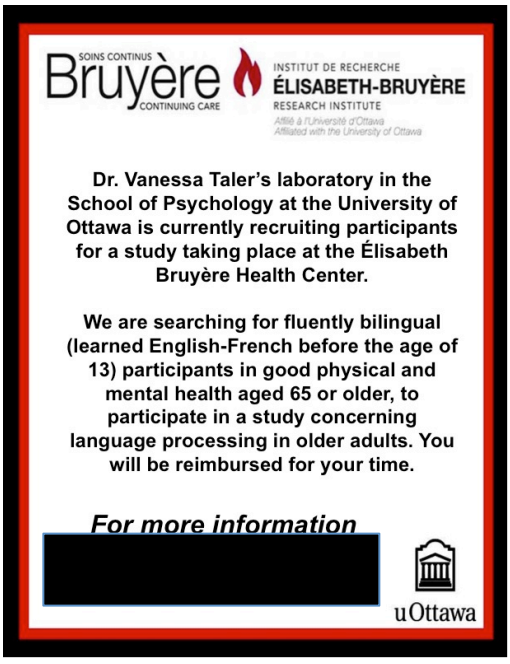
APPENDIX B. ADVERTISEMENTS

Forever Young Anglophone advertisement



Forever Young bilingual advertisement – English version

Forever Young bilingual advertisement – French version

APPENDIX C. EMAILS FOR RECRUITMENT

Dr. Vanessa Taler's laboratory in the School of Psychology at the University of Ottawa is currently recruiting participants for a study taking place at the Élisabeth Bruyère Research Institute. We are searching for participants aged 65+ who speak English and no other languages, to participate in a study concerning language processing in older adults. Participants should be in good physical and mental health. We will contact the first 40 people who respond.
The study comprises two sessions of 1 to 2 hours each (total time commitment of around 3 hours). You will be remunerated for your time, and reimbursed for parking and/or bus tickets.

[redacted]

Email sent to members of the National Association of Federal Retiree's Ottawa Chapter to recruit Anglophones

Dr. Vanessa Taler's laboratory in the School of Psychology at the University of Ottawa is currently recruiting participants for a study taking place at the Élisabeth Bruyère Research Institute. We are searching for fluent bilinguals aged 65+ who learned English and French before the age of 13, to participate in a study concerning language processing in older adults. Participants should be in good physical and mental health.
The study comprises two sessions of 2 to 2.5 hours each (total time commitment of 4 to 5 hours). You will be remunerated for your time, and reimbursed for parking and/or bus tickets.

[redacted]

Le laboratoire de Dr Vanessa Taler à l'École de psychologie de l'Université d'Ottawa recrute présentement des participants pour une étude qui aura lieu à l'Institut de recherche Élisabeth-Bruyère. Nous recherchons des personnes parfaitement bilingues agées de 65+ qui ont appris l'anglais et le français avant l'âge de 13 ans, pour participer à une étude sur le traitement du langage chez les personnes âgées. Les participants doivent être en bonne santé physique et mentale.
L'évaluation comprend deux sessions de 2 à 2,5 heures chacune (pour un total de 4 à 5 heures). Chaque participant recevra une compensation monétaire pour son temps, les frais de stationnement et/ou des billets d'autobus.

[redacted]

Email sent to members of the National Association of Federal Retiree's Ottawa Chapter to recruit bilinguals