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Cognitive Impairment and the Mediterranean Diet: a Canadian Perspective

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Health and Rehabilitation Sciences

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Abstract

Global life expectancy has increased steadily over the past century and is projected to continue increasing. Life expectancy increases are co-occurring with a reduction of fertility rates in many economically developed countries, which is resulting in an aging population, meaning that the proportion of older adults within the total world population will continue to increase. This is of particular concern as there is a rise of chronic neurodegenerative diseases among older adults, such as dementia, where the number of global deaths more than doubled since the turn of the century, making dementia the fifth leading cause of death worldwide.

Dementia is a syndrome in which there are persistent and progressive declines in memory, language and communication, personality, visuospatial skills and other cognitive processes such as executive functions. Alzheimer's dementia (AD) and vascular dementia (VaD) are the two most commonly occurring dementias worldwide. The simultaneous occurrence of both types of dementia in one individual is called mixed dementia (MD). There is no cure for any form of dementia, and great emphasis has been placed on prevention instead. A common preventive approach is through dietary modification, with the Mediterranean diet (MeDi) gaining significant research interest over the past half century due to its numerous health benefits, including its protective effects against dementia.

The purpose of this component mixed-methods dissertation research was to compare the difference of the diets of Canadian older adults (CanDi) against known estimates of the MeDi and examine the extent of MeDi familiarity among Canadian older adults and their willingness to adopt such a diet into their lifestyle. An estimate of the CanDi revealed that the primary difference between it and the MeDi is in the lower daily consumption of monounsaturated fatty acids. The adoption and adherence to the MeDi requires a change in an individual's behaviour

and thinking. Many of the participants reported not knowing about how to change effectively their habits. It is recommended that consideration be given to issues about behaviour change when promoting preventive approaches to health such as the MeDi. Furthermore, extrinsic barriers to health such as lower socioeconomic status also should be considered when making policy decisions. It is important for decision makers not to confuse extrinsic factors with intrinsic factors, as poor lifestyle choices (e.g., a poor diet) are not necessarily an indication of a poor personal choice.

Keywords: dementia, diet, behaviour change, older adults

Epigraph

“Old age is not a disease – it is strength and survivorship, triumph over all kinds of vicissitudes and disappointments, trials and illnesses.”

Maggie Kuhn

Dedication

For my grandmother Gospava – who always looks for the best in people.

For my late grandparents Emilija, Mihajlo, and Špiro – from whom I was separated too early by fate.

For my mother, Mirjana – who sacrificed everything to give me a normal childhood when we were forced to flee our home.

For my wife, Caterina – who endured the long years of graduate study.

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PART 1. INTRODUCTION

Overview of Thesis

This doctoral thesis follows an integrated article style. In Part 1, the declaration of self, background and significance, statement of problem, purpose of study, and the research question are presented. In Part 2, a synthesis of the relevant literature is presented regarding the phenomenon of mixed dementia, defined as dementia with concurrent Alzheimer's and vascular dementia pathologies. The focus is on highlighting differences and similarities of the syndrome of dementia based on aetiology, risk factors, disease symptoms and progression, diagnosis, and available treatment options. In Part 3, results of the first (quantitative) phase of the dissertation research are reported and discussed, whereas the results of the second (qualitative) phase of this research study are reported and discussed in Part 4. The integrated discussion, conclusion, and implications of the dissertation research are presented in Part 5.

Declaration of Self

This dissertation research involves qualitative methods in addition to quantitative methods. The following section is included to provide important philosophical underpinnings for the qualitative phase of the project with special regard to the ontological and epistemological beliefs of this author as well as the rationale for choosing this qualitative research paradigm. The foundational and background information is provided so that readers may assess the interpretation of qualitative data within the established framework for this type of inquiry (Patton, 1999).

A research paradigm is described as a set of common beliefs shared among scientists in order to understand and to address problems in research (Kuhn, 1963). According to Guba and Lincoln (Guba & Lincoln, 1994), the core components of a research paradigm are: (a) ontology,

which is concerned with the researcher's beliefs in reality; (b) epistemology, which is concerned with how knowledge can be acquired; and (c) methodology, which is concerned with how knowledge is acquired. The primary investigator's (IC) ontological position is that there is a single, objective reality, with the epistemological position that it is not always possible for researchers to accurately measure this reality due to a lack of reliable and valid assessment tools (Guba & Lincoln, 1994). Despite a belief in objective reality, this investigator acknowledges the existence of constructed realities, which is the reason for including qualitative methodology of data collection – to examine how perceptions of reality can influence health behaviour.

The vast majority of this researcher's methodological education and training has been grounded in positivist, quantitative methodology, which is not uncommon in the health sciences. Biomedical research is traditionally reductionist, meaning that complex phenomena are viewed as a sum of their component parts (Agazzi, 2012). Despite receiving graduate instruction in qualitative research, this researcher did not initially consider pursuing a qualitative research study nor including a qualitative component within this study, primarily because of an initial reductionist focus on a specific dietary component (i.e., omega-3 polyunsaturated fatty acids) (Culum, Orange, Forbes, & Borrie, 2012). As the biomedical literature evolved concurrently with the development of the proposal of this study, it became evident that the questions of interest to this researcher did not align completely with a purely quantitative research methodology. However, it also did not align completely with a purely qualitative research methodology. It was for this reason that a decision was made to conduct two separate studies, using quantitative methods in one (reported in Part 3 of this thesis) and qualitative methods in the other (reported in Part 4). For the purpose of this thesis, these studies are referred to as *Study 1* for the quantitative component (reported in Part 3 of this thesis) and *Study 2* for the qualitative

component (reported in Part 4 of this thesis). The integration of findings is reported in Part 5 of this thesis.

Background and Significance

Global life expectancy has increased steadily from the early 1900s with the average life expectancy rising from 46.5 years to 70.8 years (United Nations [UN], 2017). According to the United Nations (UN) Population Division, the trend of rising life expectancy will continue into the near future, with a projected increase to 77 years by 2050, which is chiefly attributed to increasing ability, globally speaking, to address acute medical conditions such as infectious diseases (UN, 2017). While the global population is still expected to continue to rise for the next several decades, this is not true for all age groups. Life expectancy increases are co-occurring with a reduction of fertility rates in many economically developed countries, which is resulting in an aging population, meaning that the proportion of older adults within the total world population will continue to increase (Rowland, 2012; UN, 2017). In 2017, approximately 13% of the global population (~962 million individuals) was over the age of 60, with a projected annual increase by 3% (UN, 2017). The number of individuals older than 80 years of age is projected to triple by 2050 (UN, 2017). This is of particular concern as there is a rise of chronic neurodegenerative diseases among older adults, such as dementia, where the number of global deaths more than doubled since 2000 (when it was not among the top 10 global causes of death) to just under 2 million deaths in 2016. Dementia now is the 5th leading cause of death worldwide (WHO, 2017). Approximately 6500 Canadians died from Alzheimer's dementia (AD) in 2016, making it the 7th leading overall cause of death in Canada, and 4th among those over 85 years of age (Statistics Canada, 2018). These figures underscore a serious and growing concern far

beyond mortality rates for both healthcare systems as well as individuals living with dementia and their caregivers.

Dementia

Dementia is a syndrome in which there are persistent and progressive declines in memory, language and communication, personality, visuospatial skills and other cognitive processes such as executive functions (McKhann et al., 2011). Currently, there are an estimated 50 million individuals living with dementia globally (Alzheimer's Disease International [ADI], 2018), with a projected 75 million living with dementia by 2030 (WHO, 2017). In Canada, there are approximately 500,000 individuals presently living with dementia, with a projected 66% increase by 2031 (Alzheimer Society of Canada [ASC], 2016). The incidence of AD, the most prevalent type of dementia, was previously projected to continue rising (World Health Organization [WHO], 2012), but has since stabilized, though the prevalence of AD is more difficult to project especially with the increasing proportion of older adults within the global population (ADI, 2018). It is important to note that AD is the most prevalent type of dementia, followed by vascular dementia (VaD), Lewy-body dementia (LBD), and frontotemporal dementia (FTD) (WHO, 2012). AD and VaD account for most of the dementia cases worldwide and are the most prevalent among those over 65 years of age, whereas the less common types are mostly prevalent in those younger than 65 (Alzheimer's Association [AA], 2018). However, classifying dementia is a complex issue due to frequent co-morbidity of the two more prevalent types of dementia, AD and VaD.

“Pure” AD and “pure” VaD are less common than previously thought. It is common to find pathology relating to more than one dementia type in the brain of a person with dementia. The combination of pathologies of AD and VaD is called mixed dementia (MD) though there are

no standard diagnostic tools for this type of pathology (Culum et al., 2012). This topic is explored in detail in Part 2 of this thesis.

Regardless of dementia type, the ensuing care for those with dementia is a significant financial burden, with costs of care increasing sharply from an estimated US\$1 trillion to a projected US\$2 trillion by 2030 (ADI, 2018). Canadian costs of dementia also are staggering, with an estimated CA\$10.4 billion spent on caring for people with dementia in 2016, which is projected to double by 2031, mirroring the global projections (ASC, 2016). The costs of care include both institutional and out of pocket expenses, but it remains difficult to account for the multiple variables involved in determining the true monetary value of this cost (e.g., direct vs. indirect costs of care) (ASC, 2016). The financial burden to Canadians because of dementia, in all its forms, now and in the coming future simply cannot be ignored, and the caregivers must not be ignored with regard to this cost. Providing informal care to a person with dementia is a very time-intensive process. An estimated 19.2 million hours were spent providing informal, unpaid care in Canada in 2011. It also is suggested that costs will continue to rise even if prevalence of dementia does not decrease significantly (ASC, 2016). As there are no medical treatments to stop or reverse the neurological degeneration observed in dementia (Kumar & Singh, 2015), there is considerable interest in the exploration of preventive measures for dementia, such as diet (Petersson & Philippou, 2016).

Diet

The notion that a person's diet has an important influence on health outcomes, with a healthier diet being associated with reducing time spent living with illness at the end of life (compression of morbidity) is not a novel idea (Fries, 1980). It is unsurprising that an unhealthy diet is associated with many poor health outcomes, such as diabetes, hypertension,

hyperlipidemia, and cardiovascular disease (Middleton & Yaffe, 2009). These health conditions have been previously identified as risk factors for developing dementia (Whitmer, Sidney, Selby, Johnston, & Yaffe, 2005). Furthermore, adoption of a healthy diet is associated with positive health outcomes (such as increased life expectancy and better overall health), suggesting that it is often not too late to adopt healthy eating habits (Charlton, 2002). Therefore, the appeal of a healthy diet is twofold: (a) by promoting a longer life as well as (b) a better life by increasing life expectancy while compressing morbidity. While there are many diets that have received scientific scrutiny, few if any have been the subject of more inquiry than the Mediterranean diet (MeDi).

Investigations into the health benefits of the MeDi began in the 1960s, and the adherence to this diet has since been implicated in reducing the incidence of negative health outcomes including hypertension (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004) and coronary heart disease (Singh et al., 2002), as well as reducing overall mortality rates (Knoops et al., 2004). It is unsurprising that MeDi adherence also is implicated in reducing the risk for developing AD (Scarmeas et al., 2009). Furthermore, researchers have suggested an association between specific components of the MeDi, such as antioxidants present in olive oil and red wine may play a protective effect against vascular incidents (Arranz et al., 2012). Additional MeDi components, such as omega-3 polyunsaturated fatty acids, are thought to play a role in mediating neuroinflammatory response, which is an additional risk factor for dementia (Culum et al., 2012; Helton & Espot, 2001). However, there are other studies that have shown little to no benefit of omega-3s individually as prevention for dementia (Sydenham, Dangour, & Lim, 2012), suggesting that we are not at present able to identify the precise components of the MeDi which are beneficial in protecting against dementia and that a whole-diet approach (focusing on dietary

change) is far more beneficial than individual supplementation (focusing on individual nutritional supplementation, such as omega-3 capsules). However, a whole-diet approach is inherently more difficult to prescribe than a supplement as changing a person's diet involves changing her/his behaviour.

Behaviour

Behaviour change is another line of inquiry that has received considerable academic study, initially in psychology, but its reach has since expanded into many other areas of study, including the study of physical health. Researchers have used models of behaviour change to reduce a number of undesirable health behaviours, such as substance dependency or abuse (i.e. nicotine use, drinking) (DiClemente & Prochaska, 1982), or physical inactivity (Marshall & Biddle, 2001), and most importantly (for the purpose of this study) unhealthy eating habits (Kristal, Glanz, Curry, & Patterson, 1999). There is no standard model for behaviour change, but the common element across different models is that behaviour change takes time (Webb & Sheeran, 2006). For the purpose of this study, Prochaska and DiClemente's (1984) Transtheoretical Model (TTM) of behaviour change (also referred to as the Stages of Change Model) was selected as an adequate model through which to frame the process of behavioral change. The TTM has remained relevant in the literature since the 1970s, but its use is not strictly necessary in order to promote the adoption of the MeDi. The TTM and its relevance to MeDi promotion and adherence is discussed in Part 4 of this thesis. As behaviour change is difficult to sustain (Bouton, 2014), it is important to examine the various factors that contribute to or detract from the desired outcome(s).

Statement of Problem

What is known empirically at present about the MeDi relative to dementia is that it may have roles to play in reducing the risk factors as well as the overall risk for developing dementia (Lourida et al., 2013). However, what remains unknown is how the average Canadian diet (CanDi) differs from the average Mediterranean diet (MeDi). Also unknown is how difficult it may be to promote a shift from the CanDi to the MeDi in Canadian older adults, especially for those who are at risk for developing dementia. While previous research has focused primarily on the health benefits of either living in the Mediterranean region (Trichopoulou & Lagiou, 1997) or the adoption of the MeDi in different regions worldwide (Knoops et al., 2004), no published studies have examined how dietary habits of Canadian older adults compare to those of a Mediterranean population. Once the differences between the CanDi and the MeDi have been identified, an examination of Canadian older adults' knowledge and perceptions of the MeDi is required to determine whether there are unique challenges to these individuals, particularly for those with dementia, those who are at-risk for developing dementia, or those who are otherwise healthy.

Purpose of Study

The purpose of this dissertation research, that includes both retrospective and prospective design elements, is to fill this knowledge gap concerning Canadian older adults' dietary habits. This is achieved through a macronutrient assessment derived from food recall, to examine the extent of familiarity with the MeDi among older Canadian adults (50+ years of age) as well as to explore barriers and facilitators to changing dietary behaviour (including, but not limited to the MeDi. These are done both generally and in relation to an individual's age and risk for developing dementia (through focus group interviews).

Research Questions

The following research questions are posed for this study:

Study 1 - Quantitative

1. What is the macronutrient composition of the typical diet of Canadian older adults (50+ years) according to the CCHS Cycle 2.2 (2004) data set?
2. Are there differences in dietary patterns between different Canadian older adult participant groups?
 - a. Is there a difference in dietary patterns between:
 - i. the young-old (51 to 70) vs. the older adult (71+) cohorts
 - ii. men vs. women in each of the two cohort age groups?
3. Are there differences in dietary patterns relative to geographical location (i.e., province and rural/urban areas) in Canada?
4. Are there differences in dietary patterns between “at-risk” (cognitively intact, but with vascular risk factors such as metabolic syndrome) and “healthy” groups?

Study 2 – Qualitative

5. How knowledgeable are older Canadian adults about the MeDi?
6. How willing are older Canadian adults with regard to adopting the MeDi into their lifestyle?
7. Are there any barriers and facilitators to MeDi adoption/adherence?
 - a. Are any of these specific to “memory impaired” (any mild cognitive impairment, diagnosed or self-reported), “at-risk” (cognitively intact, but with vascular risk factors), or “healthy” persons?

References

- Agazzi, E. (2012). *The Problem of Reductionism in Science: (Colloquium of the Swiss Society of Logic and Philosophy of Science, Zürich, May 18–19, 1990)* (Vol. 18). New York, NY: Springer Science & Business Media.
- Alzheimer's Association. (2018). *2018 Alzheimer's Disease Facts and Figures*. Retrieved from Alzheimer's Disease International. (2018). *World Alzheimer Report 2018*. Retrieved from London, UK: <https://www.alz.co.uk/research/world-report-2018>
- Alzheimer Society of Canada. (2016). *Prevalence and Monetary Costs of Dementia in Canada*. Retrieved from http://alzheimer.ca/sites/default/files/Files/national/Statistics/PrevalenceandCostsofDementia_EN.pdf
- Arranz, S., Chiva-Blanch, G., Valderas-Martínez, P., Medina-Remón, A., Lamuela-Raventós, R. M., & Estruch, R. (2012). Wine, beer, alcohol and polyphenols on cardiovascular disease and cancer. *Nutrients*, 4(7), 759-781.
- Bouton, M. E. (2014). Why behavior change is difficult to sustain. *Preventive Medicine*, 68, 29-36.
- Charlton, K. E. (2002). Eating well: ageing gracefully! *Asia Pacific Journal of Clinical Nutrition*, 11, S607-S617.
- Chrysohoou, C., Panagiotakos, D. B., Pitsavos, C., Das, U. N., & Stefanadis, C. (2004). Adherence to the Mediterranean diet attenuates inflammation and coagulation process in healthy adults: The ATTICA Study. *Journal of the American College of Cardiology*, 44(1), 152-158.

- Culum, I., Orange, J. B., Forbes, D., & Borrie, M. (2012). *Omega-3 Polyunsaturated Fatty Acids and Mixed Dementia*. Paper presented at the 27th International Conference of Alzheimer's Disease International, London, UK.
- DiClemente, C. C., & Prochaska, J. O. (1982). Self-change and therapy change of smoking behavior: A comparison of processes of change in cessation and maintenance. *Addictive Behaviors, 7*(2), 133-142.
- Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Journal of Medicine, 303*(3), 130-135.
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 163-194). London: Sage.
- Helton, W. S., & Espat, N. J. (2001). Defining mechanisms of omega-3 fatty-acid activity. *Nutrition, 17*(7-8), 674.
- Knoops, K. T., de Groot, L. C., Kromhout, D., Perrin, A.-E., Moreiras-Varela, O., Menotti, A., & Van Staveren, W. A. (2004). Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: the HALE project. *JAMA, 292*(12), 1433-1439.
- Kristal, A. R., Glanz, K., Curry, S. J., & Patterson, R. E. (1999). How can stages of change be best used in dietary interventions? *Journal of the Academy of Nutrition and Dietetics, 99*(6), 679.
- Kuhn, T. S. (1963). *The structure of scientific revolutions* (Vol. 2). Chicago, IL: University of Chicago Press.
- Kumar, A., & Singh, A. (2015). A review on Alzheimer's disease pathophysiology and its management: an update. *Pharmacological Reports, 67*(2), 195-203.

- Lourida, I., Soni, M., Thompson-Coon, J., Purandare, N., Lang, I. A., Ukoumunne, O. C., & Llewellyn, D. J. (2013). Mediterranean diet, cognitive function, and dementia: a systematic review. *Epidemiology*, *24*(4), 479-489.
- Marshall, S. J., & Biddle, S. J. (2001). The transtheoretical model of behavior change: a meta-analysis of applications to physical activity and exercise. *Annals of Behavioral Medicine*, *23*(4), 229-246.
- McKhann, G. M., Knopman, D. S., Chertkow, H., Hyman, B. T., Jack Jr, C. R., Kawas, C. H., . . . Mayeux, R. (2011). The diagnosis of dementia due to Alzheimer’s disease: Recommendations from the National Institute on Aging-Alzheimer’s Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia*, *7*(3), 263-269.
- Middleton, L. E., & Yaffe, K. (2009). Promising strategies for the prevention of dementia. *Archives of Neurology*, *66*(10), 1210-1215.
- Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research*, *34*(5 Pt 2), 1189.
- Petersson, S. D., & Philippou, E. (2016). Mediterranean Diet, Cognitive Function, and Dementia: A Systematic Review of the Evidence-. *Advances in Nutrition*, *7*(5), 889-904.
- Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Prochaska, J. O., & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy*. Homewood, Illinois: Dow Jones-Irwin.
- Rowland, D. T. (2012). *Population aging: the transformation of societies* (Vol. 3). New York, NY: Springer Science & Business Media.

- Scarmeas, N., Stern, Y., Mayeux, R., Manly, J. J., Schupf, N., & Luchsinger, J. A. (2009). Mediterranean diet and mild cognitive impairment. *Archives of Neurology*, *66*(2), 216-225.
- Singh, R. B., Dubnov, G., Niaz, M. A., Ghosh, S., Singh, R., Rastogi, S. S., . . . Berry, E. M. (2002). Effect of an Indo-Mediterranean diet on progression of coronary artery disease in high risk patients (Indo-Mediterranean Diet Heart Study): a randomised single-blind trial. *The Lancet*, *360*(9344), 1455-1461.
- Statistics Canada. (2018). *Leading causes of death, total population, by age group*. Retrieved November 02, 2018, from <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1310039401&pickMembers%5B0%5D=2.29&pickMembers%5B1%5D=3.1>
- Sydenham, E., Dangour, A. D., & Lim, W.-S. (2012). Omega 3 fatty acid for the prevention of cognitive decline and dementia. *Sao Paulo Medical Journal*, *130*(6), 419-419.
- Trichopoulou, A., & Lagiou, P. (1997). Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. *Nutrition Reviews*, *55*(11), 383-389.
- United Nations (UN). (2017). *World population prospects: the 2017 revision*. New York, NY: United Nations.
- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*(2), 249.
- Whitmer, R. A., Sidney, S., Selby, J., Johnston, S. C., & Yaffe, K. (2005). Midlife cardiovascular risk factors and risk of dementia in late life. *Neurology*, *64*(2), 277-281.

World Health Organization. (2012). *Dementia: a public health priority*. Geneva, Switzerland:

World Health Organization.

World Health Organization. (2017). 10 facts on dementia. Retrieved November 02, 2019, from

<https://www.who.int/features/factfiles/dementia/en/>

PART 2. SYNTHESIS

Mixed Dementia: Common Threads between Alzheimer's Dementia and Vascular Dementia

It has been over one hundred and ten years since Alzheimer's disease, the most common of all dementia types, was first diagnosed and described by Dr. Alois Alzheimer (Alzheimer, 1906). Vascular dementia (VaD), which has also been called multi-infarct dementia (Hachinski, Lassen, & Marshall, 1974) and vascular cognitive impairment (Hachinski & Bowler, 1993) is a less common type of dementia. When Alzheimer's dementia (AD) and VaD co-occur, the condition is termed mixed dementia (MD). Few published studies focus on mixed dementia. Current approved medical and behavioural non-pharmacological treatments for persons with suspected AD offer marginal and temporary benefits (Roberson & Mucke, 2006). Treatment options for persons with VaD, much like those for persons with other types of dementia, mainly are preventive and focus on secondary prevention (Kirshner, 2009). The current treatments for persons with MD focus primarily on specific dementia components (e.g., Alzheimer's components or vascular components) rather than treating MD per se (Zekry, Hauw, & Gold, 2002). As both types of dementia co-occur rather frequently (Neuropathology Group of the Medical Research Council Cognitive Function and Ageing Study [MRC-CFAS], 2001), encouraging researchers not to always focus on the specific type of dementia (and instead focus their research on MD in general) may present new useful and pragmatic research opportunities. The purpose of this paper is to illustrate the connection between AD and VaD within the context of MD to help shape future research and treatment of mixed dementia. In order to achieve this, the literature was examined to compare causes, risk factors, symptoms and dementia progression, diagnosis, and treatment of AD and VaD.

Causes of Dementia

Alzheimer's Dementia (AD)

Alzheimer's dementia is a progressive neurodegenerative dementia for which the aetiology remains largely unknown. Genetic mutations are responsible for less than 1% of cases (Alzheimer's Association [AA], 2015; Cole & Vassar; 2009; Schellenberg et al., 1992; St. George-Hyslop et al., 1990). While the cause of the majority of AD cases is still unknown, its pathology is much clearer. The most common defining characteristic of Alzheimer's disease is the extra-neuronal formation of the beta amyloid ($A\beta$) peptide and the subsequent accumulations of $A\beta$ in the brain known as amyloid plaques. In addition to amyloid plaques there is a presence of intra-neuronal protein (tau) aggregates, known as neurofibrillary tangles. While pure Alzheimer's disease consists of both of these pathologies, the pathology does not have to include the neurofibrillary tangles (Kalaria & Ballard, 1999). Functionally, the transfer of information at the synapses begins to fail leading to a loss in the number of synapses and eventually cellular death. Neuroinflammation and oxidative damage also are observed in the brains of persons with AD (AA, 2008).

There are three major competing hypotheses regarding the aetiology of Alzheimer's disease. These include the cholinergic hypothesis, the amyloid hypothesis, and the tau hypothesis. The cholinergic hypothesis is the oldest of the three and is responsible for the development of most current available pharmacological treatments of AD. This hypothesis proposes that Alzheimer's disease is caused by reduced synthesis of acetylcholine (Francis, Palmer, Snape, & Wilcock, 1999). Acetylcholine is a neuromodulator that has an effect on synaptic plasticity (specifically relating to memory) as well as effects on arousal and reward (Francis et al., 1999). The amyloid hypothesis proposes that the disease is a result of $A\beta$ deposits

(Hardy & Allsop, 1991) which are found throughout the brain but are particularly prevalent in the medial temporal lobe (Selkoe, 1991). The A β deposits also are prevalent in the inferior temporal complex, posterior parietal cortex, and prefrontal cortex. A β deposits in the medial temporal lobe structures are associated typically with various memory impairments, while A β deposits in the inferior temporal, posterior parietal, and prefrontal cortices are associated typically with impairments in cognition (e.g., comprehension, decision-making) (Pinel, 2003). Finally, the tau hypothesis proposes that tau protein abnormalities leading to the formation of neurofibrillary tangles are the ultimate cause of the disease (Goedert, 1993; Mudher & Lovestone, 2002). Neurofibrillary tangles are associated with the clinical expression and severity of AD, meaning that the number of tangles present in the brain is positively correlated to the severity of AD (Arriagada, Growdon, Hedley-Whyte, & Hyman, 1992; Bierer et al., 1995).

Vascular Dementia

Vascular dementia refers to the presence of dementia symptoms associated with neuronal cell death due to a cerebrovascular event. The aetiology of “pure” VaD is relatively clear, in contrast to the amyloid plaque and neurofibrillary tangles of Alzheimer’s disease. VaD is caused by multiple ischemic, haemorrhagic, or hypoperfusive ischemic cerebral injuries resulting from cerebrovascular disorders (Cole & Vassar, 2009). The pathology of VaD is not as well defined as the pathology of “pure AD” (Jellinger, 2007). A variety of lesions in the brain are found in all persons with VaD. Examples include (a) multiple large cortical and white matter infarcts near large cerebral arteries, (b) smaller infarcts in functionally important regions of the brain (thalamic, hippocampal, basal forebrain, angular gyrus), (c) multiple micro-infarcts (multi-lacunar, sub-cortical arteriosclerotic leukoencephalopathy Binswanger), (d) granular cortical atrophy), (e) white matter lesions, post-ischemic lesions, (f) hippocampal sclerosis or (g) gliosis,

inflammatory angiopathy, or combined cerebrovascular/ischemic lesions (Jellinger, 2008). In contrast to AD which is profiled as a gradual progressive decline, the progression in VaD is step-wise (Jellinger, 2008). As with AD, neuroinflammation is observed within VaD (Jellinger, 2008).

Mixed Dementia

AD and VaD in their pure forms are not as common as previously thought. Cerebrovascular pathology, such as cerebral amyloid angiopathy (where amyloid deposits form in the walls of blood vessels in the central nervous system), is observed frequently in AD and at least a third of persons with AD may exhibit a variety of cerebral vascular lesions (Kalaria & Ballard, 1999). Kalaria and Ballard (1999) suggest that equal proportions of persons with AD have concurrent VaD pathology (approximately 1/3 in each case). Furthermore, the concurrent pathologies have additive effects, where AD related dementia is worsened by the presence of VaD pathology (Snowdon et al., 1997). The presence of two or more distinct dementia pathologies (e.g., both AD and VaD) is classified as mixed dementia (MD). AD and VaD pathologies co-occur frequently (MRC-CFAS, 2001) regardless of how the dementia may be classified. For the purpose of this paper, MD is referred to in the context of concurrent AD-VaD pathology. MD has become the standard term but sometimes is classified as AD (or VaD) with concurrent VaD (or AD) pathology. MD remains a controversial issue as well as a very difficult diagnostic challenge, perhaps due to a lack of consensus regarding its diagnosis (Zekry et al., 2002). The cause(s) for the frequent co-morbidity of AD and VaD has not been hypothesized as extensively as the cause(s) of AD. Both AD and VaD share common risk factors.

Risk Factors for Dementia

While the exact cause of AD is unknown, there is a consensus that AD results from multiple factors rather than from a single cause (Kumar & Singh, 2015). One of the greatest risk factors for developing AD is advancing age, with the majority of persons with AD being over 65 years of age. While there are cases of “early-onset” AD (before 65), these are rare. As mentioned earlier, less than 1% of AD is caused by rare genetic mutations. In these rare cases, AD has an earlier onset, sometimes as early as 30 years of age (AA, 2015). The genetic cause for these early onset cases are mutations in any of the three genes: presenilin 1 (PSEN1), presenilin 2 (PSEN2), and amyloid precursor protein (APP) (Williamson, Goldman, & Marder, 2009). A genetic risk factor for developing AD after 65 is Apolipoprotein E (APOE) which is a gene that can be expressed in three different versions (e2, e3, e4). Persons possessing the e4 version of this gene have increased risk of developing AD. Those who inherit two APOE e4 genes (one from each biological parent) are at even greater risk to develop AD than those with one copy. It is important to note that while the expression of this gene is a risk factor for developing AD, there is no evidence to suggest that a person possessing this gene expression is certain to develop AD (AA, 2015). Additional risk factors include being female, history of cardiovascular disease (CVD), and Down syndrome (Lindsay et al., 2002). Some risk factors are not modifiable because there is little that can be done to alter them aside from acknowledging their presence. Modifiable risk factors for AD also exist and include type 2 diabetes mellitus, depression, cognitive inactivity, physical inactivity, and poor diet (i.e., high in saturated fat and low in vegetables), present smoking (Barnes & Yaffe, 2011), and to a lesser extent excessive alcohol consumption and drug abuse (Lindsay et al., 2002). Lower levels of formal education and lower level of mental stimulation have been also implicated as risk factors (Lindsay et al., 2002).

Since VaD is caused primarily by cerebrovascular disease, the risk factors for VaD are the same as for other cardiovascular diseases (CVD). Advancing age, gender, as well as prior history of CVD are all non-modifiable risk factors for VaD (Heart and Stroke Association of Canada [HSAC], 2014). Unlike for AD, men are more likely to suffer a stroke, and women are less likely to survive a stroke. Pregnancy and use of birth control pills are additional risk factors for stroke for women (HSAC, 2014). Modifiable risk factors for stroke include hypertension, smoking, diabetes mellitus, unhealthy diet, physical inactivity, and obesity (HSAC, 2014). As with AD, there are other suggested, albeit less well documented risk factors, which include geographic location, low socioeconomic status, and substance abuse (i.e. alcohol). It is important to note that all CVD risk factors also are risk factors for AD (Lindsay et al., 2002).

Symptoms and Progression of Dementia

Alzheimer's Dementia

There is some variation in the symptoms that manifest in persons with AD though most of the following become evident as the dementia progresses. There are multiple variations on classifying AD stages and progression. Persons with AD are most generally classified as mild AD (early clinical stage), moderate AD (intermediate clinical stage), or severe AD (advanced/late clinical stage) (AS, 2014a). The symptoms emerge and become worse as the dementia progresses. The most common first symptom is an increasingly worsening ability to retain new information (working memory). This can lead to communication difficulties as the person with AD often will repeat questions or statements. In persons with pure AD, there is difficulty with language but not speech production (Bayles & Tomoeda, 2007). Functional problems emerge (e.g., abilities to perform instrumental activities of daily living [IADL]) but most individuals are capable of their personal care in the early/mild clinical stage. Instrumental

ADL (IADL) (e.g., light housework, meal preparation, shopping, telephone use, money management, medication adherence) are affected first. These are not necessary for the most basic functioning but are important nonetheless (Bookman, Harrington, Pass, & Reisner, 2007).

Neuropsychiatric symptoms such as depression or apathy may become evident with dementia progression (AA, 2015). The duration of the early/mild clinical stage varies from person to person and can last as long as four years (AA, 2009).

As AD progresses into the moderate/intermediate clinical stage, persons with AD will begin to experience confusion, disorganized thinking, impaired judgment, difficulty with language expression and comprehension, and disorientation (time, space, and/or location) (Bookman et al., 2007). These symptoms can lead to socially inappropriate behaviours and unsafe activities such as wandering (Bookman et al., 2007). Memory symptoms worsen and are no longer limited to working memory systems and processes. Persons with AD may experience trouble recognizing familiar people. Language symptoms also worsen and become more pronounced (decreased vocabulary and verbal fluency) although the basic forms of words and sentences remains relatively stable (i.e., phonotactics, syntax, grammar) (Taler & Phillips, 2008). Function is more impaired; persons progressively lose the ability to care for themselves. During the moderate clinical stage basic ADLs become impaired (such as eating, dressing, voluntary urination/defecation, personal ADLs, and movement) (Bookman et al., 2007). Neuropsychiatric symptoms (such as depression or apathy) can develop (or become more pronounced). New neuropsychiatric symptoms such as aggression, labile affect, as well as delusions also can begin to manifest (Forstl & Kurz, 1999). Physical symptoms develop as well, such as urinary incontinence. This stage may last as long as ten years (AA, 2009).

As AD evolves to the advanced/severe clinical stage symptoms worsen resulting in more impaired communication, recognition of themselves, others and their environment, and the need for constant supervision/care. At the late stage of AD there is a loss of muscle mass preventing mobility and self-care and necessitating constant bed rest (Forstl & Kurz, 1999). People with advanced AD show poor expressive language and rely heavily on visual and auditory inputs for comprehension, primarily of nonverbal and prosodic elements of spoken language (Bayles & Tomoeda, 2012; Forstl & Kurz, 1999; Frank, 1994). The severe stage usually lasts between one to three years, and ultimately leads to death. Eating becomes slow and swallowing becomes compromised requiring verbal cueing from caregivers. Progressive calorie protein malnutrition may occur because of poor oral intake. The cause of death is due typically to a secondary infection such as aspiration pneumonia (AA, 2009). The Global Deterioration Scale outlines AD progression through seven stages (Reisberg, Ferris, Leon, & Crook, 1982) using behavioural symptoms to classify status. Stages one through three correspond to mild AD, stages four through six correspond to moderate AD, with the seventh stage corresponding to severe AD (AS, 2014a).

Vascular and Mixed Dementia

Persons with VaD also exhibit cognitive, linguistic, neuropsychiatric, and physical impairments. Exact symptoms vary according to lesion location since VaD is caused by multiple small strokes throughout cortical and subcortical regions. Depending on lesion size and location, symptoms can be more or less profound with new symptoms coincident with a new lesion (or lesions). While both AD and VaD can eventually produce similar symptoms, the order in which the symptoms emerge is different. For example, disturbances in gait and sudden cognitive impairment may occur in the early stages of VaD, whereas cognitive impairment in AD is

gradual and gait disturbances appear in the later stages of dementia. Parkinson-like symptoms (tremors, gait and mobility problems) may occur as well in VaD (McKhann et al., 2011). VaD progresses in steps, with additional cerebrovascular events. Additional strokes typically worsen the symptoms of VaD, as well as add additional VaD symptoms.

Persons with MD are likely to exhibit a combination of AD and VaD symptoms. As many of the AD and VaD symptoms are similar, patients are more likely to be classified as AD or VaD depending on their initial symptoms. Unfortunately, there are few standard diagnostic tools for MD.

Diagnosis of Dementia

Alzheimer's Dementia

Established guidelines exist for both AD and VaD. The National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) AD criteria were first proposed in 1984 and were revised in 2011 (McKhann et al., 2011). According to the revised version of these criteria, a person may be classified as “probable AD dementia”, “possible AD dementia”, or “probable or possible AD dementia with evidence of the AD pathophysiological process”. It is important to note that “definite” AD cannot be determined without histopathological confirmation, either via biopsy or autopsy (Dubois, et al, 2007). This diagnostic difficulty is why the term Alzheimer's dementia (AD) is preferred to that of Alzheimer's disease, as the most precise diagnosis for the latter is made after death. The major distinction between “probable” and “possible” AD is that for the latter, there is evidence of cerebrovascular disease and that this is temporally related to the onset of (or increase in) cognitive impairment (McKhann et al., 2011). Both of these classifications are made after a thorough clinical and neuropsychological examination. The third classification

(probable or possible AD dementia with evidence of the AD pathophysiological process) is used primarily for research purposes (AA, 2015). Other criteria exist, such as the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Psychiatric Association [APA], 2013) and the International Statistical Classification of Diseases and Related Health Problems Tenth Revision (ICD-10) (WHO, 1992). These guidelines are not exclusive to AD. It is important to note that in the DSM-V dementia was re-classified as “major neurocognitive disorder” (APA, 2013), but the use of the term dementia remains prominent in published literature.

Vascular and Mixed Dementia

In 1993, the National Institute of Neurological Disorders and Stroke - Association Internationale pour la recherche et l'Enseignement en Neurosciences (NINDS-AIREN) criteria for probable VaD were proposed. According to these criteria, a clinical diagnosis of “probable” VaD must include: the sudden onset of dementia that is severe enough to interfere with IADLs, evidence of cerebrovascular disease through both neurological examination and neuroimaging, and an established relationship between the previous two criteria (e.g. onset of dementia not exceeding three months following a recognized stroke) (Roman et al., 1993). The Consortium of Canadian Centres for Clinical Cognitive Research (C5R) also proposed criteria for diagnosis of VaD and emphasized that no current criteria were superior (Rockwood et al., 1994). The Hachinski Ischemic Score is used sometimes to differentiate between AD and VaD (Pantoni & Inzitari, 1993). As with AD, The DSM-5 and ICD-10 also can be used to diagnose VaD. For MD (unlike AD or VaD), there are no widely accepted criteria. It has been suggested that the DSM-IV-TR (which has since been supplanted by the DSM-5) and/or ICD-10 (meeting criteria for both AD and VaD), as well as the Hachinski Ischemic Score (intermediate score of 5 or 6) can be

used to diagnose MD (Zekry et al., 2002). The NINDS-AIREN criteria do not refer to MD, but rather classify MD as AD with cerebrovascular disease (Roman et al., 1993)

Treatment Options for Dementia

Alzheimer's Dementia

Currently, there is no treatment available that stops or reverses the neuronal deterioration associated with Alzheimer's disease (Kumar & Singh, 2015). The current pharmacological treatments have been shown to slow the worsening of dementia symptoms in approximately half the persons with AD for up to twelve months. In Canada, there are four drugs that are approved for use for persons with AD (donepezil, rivastigmine, galantamine hydrobromide, and memantine hydrochloride) (AS, 2014). All but one of these treatments (memantine) are based on the cholinergic hypothesis for AD. Donepezil (marketed as Aricept™) is a reversible cholinesterase inhibitor (ChEI). It functions by inhibiting acetylcholinesterase, an enzyme that breaks down acetylcholine, which in turn increases cortical acetylcholine (Birks & Harvey, 2006). Donepezil is administered orally and easily crosses the blood-brain barrier. Like donepezil, rivastigmine (marketed as Exelon™) is a ChEI. It inhibits acetylcholinesterase as well as butyrylcholinesterase (Camps & Munoz-Torrero, 2002). Like donepezil, it is administered orally, but also can be administered via a trans-dermal patch (Winblad et al., 2007). Galantamine (marketed in Canada as Reminyl™) is another ChEI that inhibits acetylcholinesterase (like donepezil) and is taken orally (Birks & Harvey, 2006). Memantine (marketed as Ebixa® in Canada) is the only current drug for AD that is not a ChEI. Memantine is a glutamatergic antagonist targeting N-methyl D-aspartic acid (NMDA) receptors that is thought to reduce cell death associated with increased levels of glutamate (Rogawski & Wenk, 2003).

Donepezil is the most tolerated ChEI and its side-effects can include bradycardia, nausea, diarrhea, abdominal pain, and vivid dreams (Birks & Harvey, 2006). Side effects of rivastigmine usually include nausea and vomiting but these effects are significantly lower when rivastigmine is administered trans-dermally (Winblad et al., 2007). Galantamine is generally less tolerated by patients and its side-effects are similar to those of rivastigmine and donepezil (Birks & Harvey, 2006). Finally, memantine is generally well-tolerated with common side-effects being confusion, dizziness, drowsiness, headache, insomnia, agitation, and hallucinations (McShane, Areosa Sastre, & Minakaran, 2006). Vomiting, anxiety, hypertonia, cystitis, and increased libido are less common side-effects (McShane et al., 2006).

Vascular and Mixed Dementia

VaD treatment differs from those used for persons with AD. Pharmacological therapies are aimed at reducing cardiovascular risk factors (e.g., statins for regulating cholesterol or angiotensin-converting-enzyme (ACE) inhibitors for hypertension). Lifestyle modifications are recommended as well (e.g., smoking-cessation, exercise and physical activity, or healthier diet). There is a suggestion that galantamine treatment also can yield some cognitive benefits for patients with VaD, but further research is needed (Craig & Birks, 2009).

There are no standard treatments for MD. Treatments for these persons are generally a combination of AD and VaD treatments, varying from person to person. A reason for this may be that despite acknowledging MD as a type of dementia, MD is viewed as a sum of its parts rather than a distinct dementia type. Due to a lack of effective treatments for dementia, prevention of dementia has become a focus in research and practice. One preventive approach to dementia is through healthy eating.

Diet and Dementia

A healthy diet is associated with compression of morbidity (Fries, 1980), which refers to the postponement of the onset of time spent living with chronic illness at the end of one's life. In the absence of effective pharmacological treatments for dementia, focusing of dietary changes may improve the efficiency of health-care systems by reducing the incidence and prevalence of dementia, and enhance the quality of life for those with chronic illnesses and for their caregivers. Evidence suggests that the adoption of a healthy diet can increase overall life expectancy and can contribute to better overall health (Charlton, 2002). Conversely, unhealthy dietary habits (e.g., increased saturated fat intake) can lead to obesity that increases an individual's chances of developing a variety of negative health outcomes (e.g., cardiovascular disease, hypertension, hyperlipidemia, and diabetes). These conditions increase the risk of dementia in older adults and are identified as risk factors (Middleton & Yaffe, 2009; Whitmer, Sidney, Selby, Johnston, & Yaffe, 2005). Minimizing these risk factors should be a key component in healthy aging.

While there is no single healthy diet, the WHO recommends a diet that favours unsaturated fat consumption over saturated fat consumption (WHO, 2004). The WHO recommends that such a diet also includes increasing the overall consumption of fruits and vegetables, legumes, and nuts/grains, while decreasing the intake of sodium and free sugars (WHO, 2004). A diet that is compatible with many of the WHO recommendations and of considerable interest to researchers interested in dementia is the Mediterranean diet (MeDi).

The MeDi commonly features a high consumption of fish, fruits/vegetables/legumes, and grains, coupled with a moderate dairy and alcohol consumption, and low meat consumption (Trichopoulou & Lagiou, 1997). The MeDi has received increasing scientific attention, starting with its association with a reduced risk of hypertension and coronary heart disease (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004; Singh et al., 2002; Widmer, Flammer, Lerman,

& Lerman, 2015), obesity (Schröder et al., 2004), as well as overall mortality (Dinu, Pagliai, Casini, & Sofi, 2017; Knoops et al., 2004). Researchers suggest that the MeDi may be beneficial in reducing the risk of AD regardless of vascular comorbidity (Scarmeas, Stern, Tang, Mayeux, & Luschinger, 2006). There have been some suggestions that antioxidants in olive oil and red wine (common components of MeDi) mediate vascular pathology (Carluccio et al., 2003; Chiva-Blanch et al., 2012). Additionally, polyunsaturated fatty acids (such as omega-3 fatty acids, found in fish which is a common MeDi component) also play an important role in mediating inflammatory response thereby further reducing the risk of vascular pathology (Culum et al., 2012; Helton & Espat, 2001). In a recent meta-analysis of studies in which a MeDi intervention was used researchers reported that an increase in MeDi adherence translated to a 10% reduction in death and/or incidence of vascular diseases as well as a 13% reduction of the incidence of neurodegenerative diseases (Sofi, Abbate, Gensini & Cassini, 2010). There also is evidence that adopting the MeDi reduces the risk of mild cognitive impairment (MCI) and the conversion of MCI to dementia (Hardman, Kennedy, Macpherson, Scholey, & Pipingas, 2016; Lourida et al., 2013; Scarmeas, Stern, & Mayeux, 2009).

Conclusion

Both AD and VaD in “pure” forms are less common than previously thought (Kalaria & Ballard, 1999). The simultaneous presence of both dementia types in so many cases suggests that research needs to shift focus from purely AD or VaD and focus on MD. A significant number of individuals with both AD and VaD are excluded from dementia-specific studies because the investigators focus on either the AD or the VaD component. This focus also applies to studies where the effect of an experimental treatment is being tested among persons with AD alone or with VaD alone. Before participants with MD are excluded from these studies, careful

consideration should be made with regard to the effects of the experimental treatment on MD. Since there are common pathologies in both AD and VaD, MD interventions targeting these common threads should be explored. Increased study of mixed dementia may yield new therapies (both non-pharmacological and pharmacological) designed to address both AD and VaD pathology and co-occurring symptoms. Additionally, persons with MD may gain access to studies which would expose them to potentially beneficial treatments that would otherwise be inaccessible to them.

References

- Alzheimer, A. (1906). Über einen eigenartigen schweren erkrankungsprozeß der hirnrinde. *Neurol Central*, 25, 1134.
- Alzheimer's Association. (2008). 2008 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 4(2), 110-133.
- Alzheimer's Association. (2009). 2009 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 5(3), 234-270.
- Alzheimer's Association. (2015). 2015 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 11(3), 332-384.
- Alzheimer Society of Canada. (2014). Drugs approved for Alzheimer's disease. Retrieved May 21, 2015, from <http://www.alzheimer.ca/en/About-dementia/Treatment-options/Drugs-approved-for-Alzheimers-disease>
- Alzheimer Society of Canada. (2014a). The progression of Alzheimer's disease - overview. Retrieved May 21, 2015, from <http://www.alzheimer.ca/en/About-dementia/Alzheimer-s-disease/Stages-of-Alzheimer-s-disease>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed.). Arlington, VA: American Psychiatric Publishing, Inc.
- Arriagada, P. V., Growdon, J. H., Hedley-Whyte, E. T., & Hyman, B. T. (1992). Neurofibrillary tangles but not senile plaques parallel duration and severity of Alzheimer's disease. *Neurology*, 42(3), 631-639.
- Barnes, D.E, & Yaffe, K. (2011). The projected effect of risk factor reduction on Alzheimer's disease prevalence. *Lancet Neurology*, 10(9), 819-828.

- Bayles, K. A., & Tomoeda, C. K. (2007). *Cognitive-communication disorders of dementia*. San Diego: Plural Pub.
- Bierer, L. M., Hof, P. R., Purohit, D. P., Carlin, L., Schmeidler, J., Davis, K. L., & Perl, D. P. (1995). Neocortical neurofibrillary tangles correlate with dementia severity in Alzheimer's disease. *Archives of Neurology*, 52(1), 81-88.
- Birks, J. S., & Harvey, R. (2003). Donepezil for dementia due to Alzheimer's disease. *Cochrane Database of Systematic Reviews*, (3), 001190.
- Bookman, A., Harrington, M., Pass, L., & Reisner, E. (2007). *Family caregiver handbook*. Cambridge, MA: Massachusetts Institute of Technology.
- Camps, P., & Munoz-Torrero, D. (2002). Cholinergic drugs in pharmacotherapy of Alzheimer's disease. *Mini-Reviews in Medicinal Chemistry*, 2(1), 11-25.
- Carluccio, M. A., Siculella, L., Ancora, M. A., Massaro, M., Scoditti, E., Storelli, C., . . . De Caterina, R. (2003). Olive oil and red wine antioxidant polyphenols inhibit endothelial activation: Antiatherogenic properties of Mediterranean diet phytochemicals. *Arteriosclerosis, Thrombosis & Vascular Biology*, 23(4), 622-629.
- Charlton, K. E. (2002). Eating well: ageing gracefully! *Asia Pacific Journal of Clinical nutrition*, 11, S607-S617.
- Chiva-Blanch, G., Urpi-Sarda, M., Llorach, R., Rotches-Ribalta, M., Guillen, M., Casas, R., . . . Estruch, R. (2012). Differential effects of polyphenols and alcohol of red wine on the expression of adhesion molecules and inflammatory cytokines related to atherosclerosis: A randomized clinical trial. *American Journal of Clinical Nutrition*, 95(2), 326-334.
- Chrysohoou, C., Panagiotakos, D. B., Pitsavos, C., Das, U. N., & Stefanadis, C. (2004). Adherence to the Mediterranean diet attenuates inflammation and coagulation process in

- healthy adults: The ATTICA Study. *Journal of the American College of Cardiology*, 44(1), 152-158.
- Cole, S. L., & Vassar, R. (2009). Linking vascular disorders and Alzheimer's disease: Potential involvement of BACE1. *Neurobiology of Aging*, 30(10), 1535-1544.
- Craig, D., & Birks, J. (2006). Galantamine for vascular cognitive impairment. *Cochrane Database of Systematic Reviews*, (1), 004746.
- Culum, I., Orange, J. B., Forbes, D., & Borrie, M. (2012). Omega-3 Polyunsaturated Fatty Acids and Mixed Dementia. Paper presented at the 27th International Conference of Alzheimer's Disease International, London, UK.
- Dubois, B., Feldman, H. H., Jacova, C., Dekosky, S. T., Barberger-Gateau, P., Cummings, J., . . ., Scheltens, P. (2007). Research criteria for the diagnosis of Alzheimer's disease: Revising the NINCDS-ADRDA criteria. *Lancet Neurology*, 6(8), 734-746.
- Forstl, H., & Kurz, A. (1999). Clinical features of Alzheimer's disease. *European Archives of Psychiatry & Clinical Neuroscience*, 249(6), 288-290.
- Francis, P. T., Palmer, A. M., Snape, M., & Wilcock, G. K. (1999). The cholinergic hypothesis of Alzheimer's disease: A review of progress. *Journal of Neurology, Neurosurgery and Psychiatry*, 66(2), 137-47.
- Frank, E. M. (1994). Effect of Alzheimer's disease on communication function. *Journal - South Carolina Medical Association*, 90(9), 417-423.
- Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Journal of Medicine*, 303(3), 130-135.
- Goedert, M. (1993). Tau protein and the neurofibrillary pathology of Alzheimer's disease. *Trends in Neurosciences*, 16(11), 460-465.

Hachinski, V.C., & Bowler, J.V. (1993). Vascular dementia. *Neurology*, 43(10), 2159-2160.

Hachinski, V.C., Lassen, N.A., & Marshall, J. (1974). Multi-infarct dementia. A cause of mental deterioration in the elderly. *Lancet*, 2(7874), 207-210.

Hardy, J., & Allsop, D. (1991). Amyloid deposition as the central event in the aetiology of Alzheimer's disease. *Trends in Pharmacological Sciences*, 12(10), 383-388.

Heart and Stroke Association of Canada. (2014). Stroke prevention. Retrieved May 21, 2015, from

http://www.heartandstroke.com/site/c.iQIQLcMWJtE/b.3483939/k.16FB/Stroke_Stroke_prevention_and_risk_factors.htm

Helton, W. S., & Espat, N. J. (2001). Defining mechanisms of omega-3 fatty-acid activity. *Nutrition*, 17(7-8), 674.

Jellinger, K. A. (2007). The enigma of mixed dementia. *Alzheimer's & Dementia*, 3(1), 40-53.

Jellinger, K. A. (2008). The pathology of "vascular dementia": A critical update. *Journal of Alzheimer's Disease*, 14(1), 107-123.

Kalaria, R. N., & Ballard, C. (1999). Overlap between pathology of Alzheimer disease and vascular dementia. *Alzheimer Disease & Associated Disorders*, 13(Suppl 3), S115-23.

Kirshner, H. S. (2009). Vascular dementia: A review of recent evidence for prevention and treatment. *Current Neurology & Neuroscience Reports*, 9(6), 437-442.

Knoops, K. T., de Groot, L. C., Kromhout, D., Perrin, A.-E., Moreiras-Varela, O., Menotti, A., & Van Staveren, W. A. (2004). Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: the HALE project. *JAMA*, 292(12), 1433-1439.

Kumar, A., & Singh, A. (2015). A review on Alzheimer's disease pathophysiology and its management: an update. *Pharmacological Reports*, 67(2), 195-203.

- Lindsay, J., Laurin, D., Verreault, R., Hebert, R., Helliwell, B., Hill, G. B., & McDowell, I. (2002). Risk factors for Alzheimer's disease: A prospective analysis from the Canadian study of health and aging. *American Journal of Epidemiology*, 156(5), 445-453.
- McKhann, G. M., Knopman, D. S., Chertkow, H., Hyman, B. T., Jack, C. R., Jr, Kawas, C. H., . . ., Phelps, C. H. (2011). The diagnosis of dementia due to Alzheimer's disease: Recommendations from the national institute on aging - Alzheimer's association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia*, 7(3), 263-269.
- McShane, R., Areosa Sastre, A., & Minakaran, N. (2006). Memantine for dementia. *Cochrane Database of Systematic Reviews*, (2), 003154.
- Middleton, L. E., & Yaffe, K. (2009). Promising strategies for the prevention of dementia. *Archives of Neurology*, 66(10), 1210-1215.
- Mudher, A., & Lovestone, S. (2002). Alzheimer's disease-do tauists and baptists finally shake hands? *Trends in Neurosciences*, 25(1), 22-26.
- Neuropathology, G., & Medical Research Council Cognitive Function and Aging Study. (2001). Pathological correlates of late-onset dementia in a multicentre, community-based population in England and Wales. Neuropathology group of the medical research council cognitive function and ageing study (MRC-CFAS). *Lancet*, 357(9251), 169-175.
- Pantoni, L., & Inzitari, D. (1993). Hachinski's ischemic score and the diagnosis of vascular dementia: a review. *Italian Journal of Neurological Sciences*, 14(7), 539-546.
- Pinel, J. P. J. (2003). *Biopsychology* (5th ed.). Toronto: Allyn and Bacon.

- Reisberg, B., Ferris, S. H., de Leon, M. J., & Crook, T. (1982). The global deterioration scale for assessment of primary degenerative dementia. *American Journal of Psychiatry*, *139*(9), 1136-1139.
- Roberson, E. D., & Mucke, L. (2006). 100 years and counting: Prospects for defeating Alzheimer's disease. *Science*, *314*(5800), 781-784.
- Rockwood, K., Parhad, I., Hachinski, V., Erkinjuntti, T., Rewcastle, B., Kertesz, A., . . . , Phillips, S. (1994). Diagnosis of vascular dementia: consortium of Canadian centres for clinical cognitive research consensus statement. *Canadian Journal of Neurological Sciences*, *21*(4), 358-364.
- Rogawski, M. A., & Wenk, G. L. (2003). The neuropharmacological basis for the use of memantine in the treatment of Alzheimer's disease. *CNS Drug Reviews*, *9*(3), 275-308.
- Roman, G. C., Tatemichi, T. K., Erkinjuntti, T., Cummings, J. L., Masdeu, J. C., Garcia, J. H., . . . Hofman, A. (1993). Vascular dementia: Diagnostic criteria for research studies. report of the NINDS-AIREN international workshop. *Neurology*, *43*(2), 250-260.
- Scarmeas, N., Stern, Y., Mayeux, R., Manly, J. J., Schupf, N., & Luchsinger, J. A. (2009). Mediterranean diet and mild cognitive impairment. *Archives of Neurology*, *66*(2), 216-225.
- Scarmeas, N., Stern, Y., Tang, M. X., Mayeux, R., & Luchsinger, J. A. (2006). Mediterranean diet and risk for Alzheimer's disease. *Annals of Neurology*, *59*(6), 912-921.
- Schellenberg, G. D., Bird, T. D., Wijsman, E. M., Orr, H. T., Anderson, L., Nemens, E., . . . , Alonso, M. E. (1992). Genetic linkage evidence for a familial Alzheimer's disease locus on chromosome 14. *Science*, *258*(5082), 668-671.

- Schröder, H., Marrugat, J., Vila, J., Covas, M. I., & Elosua, R. (2004). Adherence to the traditional Mediterranean diet is inversely associated with body mass index and obesity in a Spanish population. *The Journal of Nutrition*, *134*(12), 3355-3361.
- Selkoe, D. J. (1991). Amyloid protein and Alzheimer's disease. *Scientific American*, *265*(5), 68-71.
- Singh, R. B., Dubnov, G., Niaz, M. A., Ghosh, S., Singh, R., Rastogi, S. S., . . . Berry, E. M. (2002). Effect of an Indo-Mediterranean diet on progression of coronary artery disease in high risk patients (Indo-Mediterranean Diet Heart Study): a randomised single-blind trial. *The Lancet*, *360*(9344), 1455-1461.
- Snowdon, D. A., Greiner, L. H. B. S. N., Mortimer, J. A., Riley, K. P., Greiner, P. A. D. N. S., & Markesbery, W. R. (1997). Brain infarction and the clinical expression of Alzheimer disease: The nun study. *JAMA*, *277*(10), 813-817.
- Sofi, F., Abbate, R., Gensini, G. F., & Casini, A. (2010). Accruing evidence on benefits of adherence to the Mediterranean diet on health: An updated systematic review and meta-analysis. *American Journal of Clinical Nutrition*, *92*(5), 1189-1196.
- St. George-Hyslop, P. H., Haines, J. L., Farrer, L. A., Polinsky, R., Van Broeckhoven, C., Goate, A., . . ., FAD Collaborative Study, G. (1990). Genetic linkage studies suggest that Alzheimer's disease is not a single homogeneous disorder. *Nature*, *347*(6289), 194-197.
- Taler, V., & Phillips, N. A. (2008). Language performance in Alzheimer's disease and mild cognitive impairment: a comparative review. *Journal of Clinical & Experimental Neuropsychology: Official Journal of the International Neuropsychological Society*, *30*(5), 501-556.

Trichopoulou, A., & Lagiou, P. (1997). Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. *Nutrition Reviews*, 55(11), 383-389.

Whitmer, R. A., Sidney, S., Selby, J., Johnston, S. C., & Yaffe, K. (2005). Midlife cardiovascular risk factors and risk of dementia in late life. *Neurology*, 64(2), 277-281.

Williamson, J., Goldman, J., & Marder, K. S. (2009). Genetic aspects of Alzheimer disease. *Neurologist*, 15(2), 80-86.

Winblad, B., Grossberg, G., Frolich, L., Farlow, M., Zechner, S., Nagel, J., & Lane, R. (2007). IDEAL: A 6-month, double-blind, placebo-controlled study of the first skin patch for Alzheimer disease. *Neurology*, 69(4 Suppl 1), S14-22.

World Health Organization. (2004). Global strategy on diet, physical activity and health.

Retrieved November 02, 2018, from

http://www.who.int.proxy1.lib.uwo.ca/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf

World Health Organization. (1992). *International statistical classification of diseases and related health problems: ICD-10* (10th revision ed.). Geneva: World Health Organization.

Zekry, D., Hauw, J. J., & Gold, G. (2002). Mixed dementia: epidemiology, diagnosis, and treatment. *Journal of the American Geriatrics Society*, 50(8), 1431-1438.

PART 3. STUDY 1 – QUANTITATIVE*Differences between Canadian and Mediterranean Diets: An assessment of macronutrients in the diets of Canadian older adults using data from the Canadian Community Health Survey 2.2*

Global average life expectancy has increased steadily from the early 20th century from 46.5 years to 70 years (United Nations [UN], 2012). According to experts in the United Nations Population Division, this pattern will continue into the near future. There also will be an increasing worldwide proportion of individuals over 65 years of age with those aged 85+ being the fastest growing cohort of all (UN, 2012). In concert with the increasing global prevalence of older adults is the rise of chronic diseases among older adults, such as dementia, which are the leading causes of mortality among those 65 years of age and older in Canada (Statistics Canada, 2011; Wilkins, 2006).

Dementia is a syndrome in which there are persistent and progressive declines in memory, language and communication, personality, visuospatial skills and other cognitive processes such as executive functions (McKhann et al., 2011). It is estimated that by 2038 approximately 1.1 million Canadians (2.8% of the overall population) will exhibit dementia (Alzheimer Society of Canada [ASC], 2010). These estimates mean that the number of persons with dementia in Canada will more than double in just three decades (from approximately 480,000 in 2008 to approximately 1,125,000 in 2038) (ASC, 2010). The incidence of Alzheimer's disease (AD), the most prevalent type of dementia, also is rising. There are 7.7 million new cases of dementia worldwide, which translates to approximately one new case every four minutes (World Health Organization [WHO], 2012). It is estimated that AD will occur in 1 out of 85 persons worldwide by 2050 (Brookmeyer, Johnson, Ziegler-Graham, & Arrighi, 2007). The worldwide prevalence of AD was estimated to be 35.5 million in 2010 (Alzheimer's Disease

International [ADI], 2010) with a quadrupling projected for 2050 (Brookmeyer et al., 2007).

However, others have suggested that dementia incidence and prevalence has been on the decline in high-income European and North American nations (Langa et al., 2008; Manton, Gu, & Ukraintseva, 2005; Schrijvers et al., 2012). While this is certainly a bit of good news, meaning that the aforementioned projections of absolute numbers of people with dementia may be a bit less dramatic, this does not mean that dementia will not remain a healthcare, economic, societal, emotional burden for years to come.

AD is the most prevalent type of dementia, followed by vascular dementia (VaD), Lewy-body dementia (LBD), and frontotemporal dementia (FTD) (WHO, 2012). AD and VaD account for most of the dementia cases worldwide. “Pure” AD and “pure” VaD occur less frequently than previously thought. It is common to find pathology relating to more than one dementia type in the brains of persons with dementia (PWD). The combination of pathologies of AD and VaD is called mixed dementia (MD) though no standard diagnostic tools exist for this type of pathology (Culum, Orange, Forbes, & Borrie, 2012).

To compound the rising global prevalence of dementia and the monumental care needs for those with dementia are the staggering costs of current care which are significant and increasing sharply. Estimates in 2010 for the total worldwide societal costs for dementia were USD 604 billion (ADI, 2010; WHO, 2012), up from 315 billion in 2005 (Wimo, Winblad, & Jönsson, 2007). Estimates based on data from the Canadian Study on Health and Aging (CSHA) reveal that annual societal costs of caring for older adults with dementia in Canada range from approximately CAD 10,000 for mild cases to CAD 38,000 for severe cases (Pasture & Onkia, 1994). Over 80% of these costs are attributed to institutionalization (Hux et al., 1998). Overall, Canadian dementia economic burden was estimated to be approximately CAD 15 billion in 2008

and is projected to increase to approximately CAD 870 billion by 2038 (ASC, 2010).

Researchers estimated the annual cost of caring for a person with VaD to be USD 14,000 (Hill, Fillit, Shah, Del Valle, & Futterman, 2005). Statistics Canada estimated the annual Canadian household per capita income to be CAD 42,600 (Chawla, 2008) reinforcing further the severity and the importance of the economic impact of dementia on caregivers and to Canadian society in general. The financial burden to Canadians because of dementia, in all its forms, now and in the coming future simply cannot be ignored.

Diet and Aging

Preventive approaches designed to limit the development of chronic illnesses, such as dementia, are becoming increasingly important to researchers, clinicians, policy makers and caregivers. The preventive approaches, such as diet modifications, are most effective well before a disease manifests (primary prevention) but can be useful even after the disease emerges (secondary prevention). Prevention also can be cost-effective. While a healthy diet versus an unhealthy diet is more expensive in an immediate sense, societal and personal economic savings can be realized based on delaying disease onset. Adhering to a healthy diet can compress morbidity, that is, the overall reduction of end-of-life disease length (Fries, 1980). Therefore, reducing the incidence and prevalence of chronic diseases through dietary changes may improve the efficiency of health-care systems, and enhance the quality of life for those with chronic illnesses and for their caregivers.

Healthy eating is a key component in healthy aging. Charlton (2002) demonstrates that the adoption of a healthy diet can increase overall life expectancy and can contribute to better overall health. While adopting a healthier diet is most effective earlier in life, it is important to note that protective benefits of a healthier diet can occur at any age (Chernoff, 2001). Unhealthy

dietary habits (e.g., increased saturated fat intake) can lead to obesity that increases an individual's chances of developing a variety of negative health outcomes such as cardiovascular disease, hypertension, hyperlipidemia, and diabetes. These conditions increase the risk of dementia in older adults and are identified as risk factors (Middleton & Yaffe, 2009; Whitmer, Sidney, Selby, Johnston, & Yaffe, 2005). Minimizing these risk factors should be a key component in healthy aging.

A person's metabolism slows down with advancing age where less energy is required to maintain normal functions. The adoption of healthier eating habits, particularly in response to age-related metabolic needs, can reduce directly the risk factors for vascular disease, which in turn can help reduce the development of dementia in most forms (e.g., AD, VaD and mixed). Findings from several longitudinal studies showed that healthier eating can result in reduced cholesterol levels (Dayton et al., 1968; Jacobs Jr et al., 1986; James, Henrikson, Tyler, & Christian, 1991) and systolic blood pressure (Jacobs Jr et al., 1986). While there is no single healthy diet, the WHO recommends a diet that is limited in saturated fat consumption versus one in which there is unsaturated fat consumption (WHO, 2004). The WHO recommends that a healthy diet also includes: limiting overall energy intake from all fat sources, increasing the overall consumption of fruits and vegetables, legumes, and nuts/grains, and decreasing the intake of sodium and free sugars (WHO, 2004). A diet that is compatible with the WHO recommendations and of considerable interest to researchers interested in dementia is the Mediterranean diet (MeDi).

The Mediterranean Diet

The MeDi, which varies slightly among Mediterranean regions, commonly includes components such as high consumption of fish, fruits/vegetables/legumes, and grains, coupled

with moderate dairy and alcohol consumption, and low meat consumption (Trichopoulou & Lagiou, 1997). Researches from Greece estimated that the average daily macronutrient intake in a MeDi consists of 255.0 g of carbohydrates, 74.5 g of proteins, 110.7 g of fats (29.8 g of saturated fats, 63.8 g of monounsaturated fats, and 9.9 g of polyunsaturated fats), as well as 14 g of alcohol, and have an average energy value of 2473 Kcal (Trichopoulou, Vasilopoulou, Georga, Soukara, & Dilis, 2006). Furthermore, the energy breakdown by macronutrient in a “typical” MeDi is estimated as follows: 47% from carbohydrates, 15% from proteins, and 38% from fats (10% saturated, 22% monounsaturated, and 6% polyunsaturated fats) (de la Puebla et al., 2003). In comparison, the “typical” Western diet provides 42% of daily energy from carbohydrates, 20% from proteins, and 38% from fats (17% saturated, 14% monounsaturated, and 7% polyunsaturated fats) (Sacks & Katan, 2002).

Since the 1960s the MeDi has received increasing scientific attention because of its association with a reduced risk of hypertension (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004), coronary heart disease (R. B. Singh et al., 2002), obesity (Schröder, Marrugat, Vila, Covas, & Elosua, 2004), as well as overall mortality (Knoops et al., 2004). Researchers suggest that the MeDi may be beneficial in reducing the risk of AD and related dementias regardless of vascular comorbidity (Scarmeas et al., 2009). Others suggest that the antioxidants typically found in olive oil compounds and red wine, components common in the MeDi, mediate vascular pathology (Arranz et al., 2012; Carluccio et al., 2003). Additionally, polyunsaturated fatty acids (PUFAs) (specifically omega-3 fatty acids) also may play an important role in mediating inflammatory response thereby further reducing the risk of vascular pathology (Culum et al., 2012; Helton & Espot, 2001). It is likely that the MeDi is more than just a sum of its

components and that its benefits are a result of multiple components working in tandem, although definitive evidence remains needed.

There is a growing body of evidence in favour of adopting the MeDi to help optimize health status and to reduce the risk of dementia. In a recent meta-analysis of studies in which a MeDi intervention was used, researchers reported that a higher adherence to the MeDi was associated with better cognitive function (and lower rate of cognitive decline), as well as an overall reduction of AD risk (Lourida et al., 2013). In an earlier meta-analysis, researchers reported that an increase in MeDi adherence translated to a 10% reduction in death and/or incidence of vascular diseases as well as a 13% reduction of the incidence of neurodegenerative diseases (Sofi, Abbate, Gensini, & Casini, 2010). There also is evidence that adopting the MeDi reduces the risk of mild cognitive impairment (MCI) and the conversion of MCI to dementia (Scarmeas et al., 2009). It is important to note that while MeDi research interest has been increasing over the past decade the relationship between MeDi and dementia risk remains a rising area of research activity.

Statement of Problem

What is known empirically at present about the MeDi and dementia is that it may have roles to play in reducing the risk factors as well as the overall risk for developing dementia. However, what remains unknown is how the average Canadian diet (CanDi) differs from the average Mediterranean diet (MeDi) and the implications of such differences on the development of dementia among Canadians. While previous research has focused primarily on the health benefits of either living in the Mediterranean region or the adoption of the MeDi in different regions worldwide, no investigators have published studies that examined how dietary habits of older Canadians compare to the MeDi. This is a necessary first step toward a clearer

understanding of how much effort may be necessary to promote a shift toward the MeDi among Canadian older adults, particularly for those with dementia, those who are at-risk for developing dementia, or those who are otherwise healthy.

The aim of this retrospective study was to fill this knowledge gap concerning the dietary habits of Canadian older adults. The following research questions were posed.

Research Questions

1. What is the macronutrient composition of the typical diet of Canadian older adults (50+ years) according to the CCHS Cycle 2.2 (2004) data set?
2. Are there differences in dietary patterns between different Canadian older adult participant groups?
 - a. Is there a difference in dietary patterns between:
 - i. the young-old (51 to 70) vs. the older adult (71+) cohorts
 - ii. men vs. women in each of the two cohort age groups?
3. Are there differences in dietary patterns relative to geographical location (i.e., province and rural/urban areas) in Canada?
4. Are there differences in dietary patterns between “at-risk” (cognitively intact, but with vascular risk factors such as metabolic syndrome) and “healthy” groups?

Method

Study Design

Nutritional data were mined from the Canadian Community Health Study Cycle 2.2 (Canada, 2004) for this between groups retrospective study. These data represent the most current and comprehensive profile of dietary habit of Canadians. Permission from and authorization to access the restricted Statistics Canada database was obtained from the Research

Data Centre (RDC) through a proposal submitted to the Social Sciences and Humanities Research Council of Canada (SSHRC) by the first author (IC).

Participants

Participant responses were obtained from the existing CCHS 2.2 data set (2004) (N = 10,524). The CCHS 2.2 employed a multistage stratified cluster design that provided a sample representative of the general Canadian population in terms of age, gender, geographical location, as well as socioeconomic status (Canada, 2004). The computer-assisted interviews were conducted from January 14, 2004 to January 21, 2005, with a random subset of Canadian participants selected for a second interview (24-hour dietary recall). All initial interviews were conducted in respondents' homes, with the majority of the follow-up interviews conducted over telephone (others were conducted in-person). For the purpose of this study, respondents were placed into one of two groups based on their age at the time of their interview (51 to 70 inclusive or over 70) in order to correspond with the top two age bands as outlined in the Estimated Energy Requirements section of Canada's Food Guide (Health Canada, 2014).

Materials and Measures

The respondents' dietary habits were assessed via a computer-aided-interview as well as a 24-hour dietary recall in the CCHS 2.2. These data were used to determine the macronutrient composition of the CanDi for older adult Canadians.

Ethics and Permissions

Permission to use CCHS 2.2 data was obtained from Statistics Canada through the local Research Data Centre (RDC) at Western University. The statistical analyses were vetted by the Senior Analyst at the RDC to ensure that no participant could be identified due to sub-group analysis. In accordance with RDC regulations, no raw data were removed from the RDC office.

Data Collection

Relevant data from the CCHS 2.2 were mined at the Western University RDC and exploratory data analyses were performed. The dataset was selected because it is the most current, large survey of its kind in Canada that contains relevant dietary information. Variables of interest were age (categorized), gender, province, geographical classification (urban or rural), daily macronutrient intakes (in grams), alcohol intake (in grams), energy from all food sources (in kilocalories), percentage of energy from specific macronutrients, and dementia risk status (healthy or at-risk). The only inclusion criteria for the sample selection was age (over 50) and not missing any responses pertaining to the abovementioned variables of interest. Respondents with incomplete or missing variables of interest were not considered for this study. The macronutrient variables include carbohydrates, proteins, fats, saturated fats (SFs), monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs). SFs, MUFAs, and PUFAs are a subset of fats and these values are not added to the overall daily fat intake. Furthermore, there are other types of fats not accounted for by this breakdown and the total daily fat intake value, therefore, is greater than the sum of these three types. The study variables were derived from questionnaire and interview responses and are only an estimate of the macronutrient composition of the respondents' diets. The variables were selected because they are the best available method of quantifying the CanDi given the available data.

Data Analyses

The CCHS 2.2 data were used to estimate the macronutrient composition of the CanDi. The normality of the sample was tested using the Kolmogorov–Smirnov and test (and the Shapiro–Wilk test in one case where a sub-group size was too small for the former test). With the exception of one small sub-group (respondents from Prince Edward Island), the responses were

not distributed normally. Non-parametric tests were conducted on the data. IBM SPSS Statistics 22.0 for Microsoft Windows® (IBM Corp., Armonk, USA) was used to perform the exploratory data analysis, as well as independent samples Mann-Whitney U and Kruskal-Wallis tests (corrected for tied ranks).

Results

The inclusion criteria identified 10,524 relevant respondents. Due to missing data, 21 respondents were not used in the analyses (N = 10,503). The younger cohort (51 to 70) included 7,570 respondents (3,712 men, 3,858 women) while the older cohort (>70) included 2,933 respondents (1,243 men, 1,690 women). The mean age is 58.9 years for the younger cohort and 78.2 years for the older cohort.

The macronutrient composition of the CanDi for the respondents is presented in Table 1. The male respondents reported consuming significantly more carbohydrates, proteins, fats, SFs, MUFAs, PUFAs, and alcohol by weight (g) vs. the female respondents. Men also had a significantly higher daily caloric intake than women. Carbohydrates were the largest source of energy for both genders, followed by fats, with proteins being responsible for the least amount of energy from food sources (Table 2). Younger respondents consumed significantly more carbohydrates, proteins, fats, SFs, MUFAs, PUFAs, and alcohol by weight (g) than older respondents (Table 1). Younger respondents also had a significantly higher daily caloric intake than older respondents. Carbohydrates were the largest source of energy for both cohorts (Table 2) as well as by gender within cohorts (Table 4), followed by fats, with proteins being responsible for the least amount of energy from food sources (Tables 2 and 4).

Within the younger respondent group, men consumed significantly more carbohydrates, proteins, fats, SFs, MUFAs, PUFAs, and alcohol by weight (g) vs. women (Table 3). Men also

had a significantly higher daily caloric intake than women. Carbohydrates were the largest source of energy for both genders, followed by fats, with proteins being responsible for the least amount of energy from food sources (Table 4). Within the older respondent group, men again consumed significantly more carbohydrates, proteins, fats, SFs, MUFAs, PUFAs, and alcohol by weight (g) vs. women (Table 3). Men in the older cohort also had a significantly higher daily caloric intake vs. women in the older cohort. Carbohydrates were the largest source of energy for both genders, followed by fats (Table 4), with proteins being responsible for the least amount of energy from food sources.

Rural respondents consumed significantly more carbohydrates, proteins, fats, SFs, MUFAs, PUFAs, and alcohol by weight (g) vs. urban respondents (Table 1). Rural respondents also had a significantly higher daily caloric intake vs. their urban counterparts. Among provinces, there were statistically significant differences in daily carbohydrate, protein, fat, SF, MUFA, PUFA, and alcohol intakes by weight (g) (Table 5). Carbohydrates were the largest source of energy regardless of geographical classification (Table 2) or province (Table 6), followed by fats, with proteins being responsible for the least amount of energy from food sources.

Respondents who were identified to be at-risk for developing dementia (i.e., diagnosed with diabetes and/or hypertension and/or hypercholesterolemia) consumed significantly fewer carbohydrates, proteins, fats, SFs, MUFAs, PUFAs, and alcohol by weight (g) vs. those who were otherwise healthy (Table 1). These respondents also had a significantly lower daily caloric intake vs. those who are otherwise healthy. Carbohydrates functioned as the largest source of energy regardless of dementia risk status (Table 2), followed by fats, with proteins being responsible for the least amount of energy from food sources. There was an estimated 3,638,971

individuals over the age 50 in Canada who are at-risk for developing dementia (1,489,170 over the age of 70) out of an estimated 8,897,946 Canadians over the age of 50. This represents approximately 41% of all individuals over the age of 50 and 60% of all individuals over the age of 70.

Discussion

The aim of this study was to estimate the dietary habits of Canadian older adults by examining the macronutrient composition of the CanDi using the most current Canada-wide survey data. Results show a median daily intake of 212.2 g of carbohydrates, 70.5 g of proteins, and 59.1 g of fats (including 18.3 g of SFs, 23.1 g of MUFAs, and 10.1 g of PUFAs). These values translate into 49.3% of daily energy from carbohydrates, 16.0% from proteins, and 31.0% from fats. The CanDi estimate differs from the MeDi estimate based on a lower daily carbohydrate intake (-42.8 g), slightly lower protein intake (-4.0 g), and a much lower total fat intake (-51.6 g). When comparing specific fat types, the CanDi is characterized by a lower daily SF intake (-11.5 g), much lower MUFA intake (-40.7 g), and a slightly higher PUFA intake (+0.2 g). The CanDi also can be characterized by a lower daily alcohol consumption (5.7 g less than in the MeDi estimate). It is important to note that many respondents did not report that they consume any alcoholic beverages on a regular basis. When comparing mean daily energy values, the CanDi provides ~756 Kcal less energy than the MeDi (Table 7).

The CanDi, based on the Canadian Community Health Study Cycle 2.2 data used in this study, is estimated to provide 2% more energy from carbs and 1% more energy from proteins than the MeDi. The CanDi provides 7% less energy from fats. Particularly notable is the comparison between energy intake by fat types, where both the CanDi and the MeDi provide 10% of daily energy from SFs (Table 8). The CanDi varies significantly among the various

comparison sub-groups (age group, gender, geographical classification, province, and dementia risk status). However, it is important to note that neither age group meets the daily energy requirements for their respective group as outlined in Canada's Food Guide (Health Canada, 2014) for even the most sedentary lifestyle, let alone an active one. The difference in daily energy requirements is even greater when comparing group medians to the recommended guideline values. However, this is not sufficient cause for alarm due to respondents' tendency to underestimate their overall food intake (Mertz & Kelsay, 1984). The higher daily energy intake values among men vs. women also are not surprising due to their relatively larger body size, but the difference becomes smaller between genders in the older age group (though no less significant). Differences among macronutrient intakes by province are also not surprising, possibly due to Canada's varied geography, different cultural and ethnic backgrounds, and the sheer size of the country. Further analysis should involve a comparison based on likeness of region rather than provincial borders and should include the northern territories as well (though no territorial data is available in the CCHS 2.2 and this should be kept in mind when collecting new data). While the "healthy" sub-group consumes more of each macronutrient (even the SFs), it is unlikely that their "at-risk" counterparts owe their status to a lower overall food and energy intake. It is possible that these respondents are less active and may in fact still be consuming more relative to their counterparts. This is, however, the most important finding of our study relative to dementia as it suggests that the link between diet and dementia risk merits further exploration, which has also been suggested in recent meta-analyses (Cooper, Sommerlad, Lyketsos, & Livingston, 2015; B. Singh et al., 2014). Further investigation is necessary, particularly since there is a limited availability of pharmacological treatment options for cognitive impairment and dementia (Psaltopoulou et al., 2013).

Furthermore, it is important to note that the CCHS 2.2 nutritional data is based on a single 24-hour dietary recall, with a smaller sample being invited for a follow-up interview. As such, we advise that these results be interpreted with caution, as multiple recalls are recommended in order to accurately depict an individual's nutrient intake (Basiotis, Welsh, Cronin, Kelsay, & Mertz, 1987).

Limitations

A limitation of this study is the age of the data. Due to increasing globalization additional foods are making their way into Canadians' diet and this may result in significant changes of the CanDi composition. Unfortunately, no newer data exist at this time. The Canadian Federal government has not undertaken more recent national surveys of the dietary habits of Canadians. In addition, comparing PUFA intakes in this study is problematic because the CCHS 2.2 data does not provide a ratio of omega-6 to omega-3 PUFAs, though this is an inherent limitation of previous Western diet estimates as well. Bearing in mind the variance in data collection methods and sample sizes, these comparisons should be interpreted with caution and further exploration of the topic is necessary. It also is important to remember that these are only estimates of CanDi composition that are derived from responses to a questionnaire and an interview (which as noted above is another limitation in itself). Finally, the required daily energy estimates are based on a dated food guide.

Conclusion

Based on the available data set, the average Canadian (over the age of 50) has a mean daily intake of 212.2 g of carbohydrates, 70.5 g of proteins, and 59.1 g of fats. This includes 18.3 g of SFs, 23.1 g of MUFAs, and 10.1 g of PUFAs. This represents a 49.3% of daily energy intake from carbohydrates, 16.0% from proteins, and 31.0 from% fats. The macronutrient

composition of the CanDi differs not only from the MeDi, but also from previous Western diet generalizations (Pineo & Anderson, 2008). This is not entirely unexpected. There are regional variations of the MeDi and such should be expected in the Western diet as well. Of particular interest is the finding that respondents identified as being “at-risk” for developing dementia consumed significantly less of each macronutrient and less food overall than those who were identified as otherwise healthy. Newer and richer data are needed in order to make a more accurate estimate of the current CanDi. Further research should be focused on physical activity levels in tandem with food intake, as well as taking cognitive impairment (and being at-risk for such impairment) into account in the design phase of the study.

References

- Alzheimer's Disease International. (2010). *World Alzheimer Report 2010*. Retrieved from London, UK: <https://www.alz.co.uk/research/world-report-2018>
- Alzheimer Society of Canada. (2010). *Rising tide: The impact of dementia on Canadian society*. Alzheimer Society.
- Alzheimer Society of Canada. (2016). *Prevalence and Monetary Costs of Dementia in Canada*. Retrieved from http://alzheimer.ca/sites/default/files/Files/national/Statistics/PrevalenceandCostsofDementia_EN.pdf
- Arranz, S., Chiva-Blanch, G., Valderas-Martínez, P., Medina-Remón, A., Lamuela-Raventós, R. M., & Estruch, R. (2012). Wine, beer, alcohol and polyphenols on cardiovascular disease and cancer. *Nutrients*, 4(7), 759-781.
- Basiotis, P. P., Welsh, S. O., Cronin, F. J., Kelsay, J. L., & Mertz, W. (1987). Number of days of food intake records required to estimate individual and group nutrient intakes with defined confidence. *The Journal of Nutrition*, 117(9), 1638-1641.
- Brookmeyer, R., Johnson, E., Ziegler-Graham, K., & Arrighi, H. M. (2007). Forecasting the global burden of Alzheimer's disease. *Alzheimer's & Dementia*, 3(3), 186-191.
- Carluccio, M. A., Siculella, L., Ancora, M. A., Massaro, M., Scoditti, E., Storelli, C., . . . De Caterina, R. (2003). Olive oil and red wine antioxidant polyphenols inhibit endothelial activation: antiatherogenic properties of Mediterranean diet phytochemicals. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 23(4), 622-629.
- Charlton, K. E. (2002). Eating well: ageing gracefully! *Asia Pacific Journal of Clinical Nutrition*, 11, S607-S617.

- Chawla, R. K. (2008). *Changes in family wealth*. Ottawa, ON: Statistics Canada.
- Chernoff, R. (2001). Nutrition and health promotion in older adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(suppl_2), 47-53.
- Chrysohoou, C., Panagiotakos, D. B., Pitsavos, C., Das, U. N., & Stefanadis, C. (2004). Adherence to the Mediterranean diet attenuates inflammation and coagulation process in healthy adults: The ATTICA Study. *Journal of the American College of Cardiology*, 44(1), 152-158.
- Cooper, C., Sommerlad, A., Lyketsos, C. G., & Livingston, G. (2015). Modifiable predictors of dementia in mild cognitive impairment: a systematic review and meta-analysis. *American Journal of Psychiatry*, 172(4), 323-334.
- Culum, I., Orange, J. B., Forbes, D., & Borrie, M. (2012). Omega-3 Polyunsaturated Fatty Acids and Mixed Dementia. Paper presented at the 27th International Conference of Alzheimer's Disease International, London, UK.
- Dayton, S., Pearce, M., Goldman, H., Harnish, A., Plotkin, D., Shickman, M., . . . Dixon, W. (1968). Controlled trial of a diet high in unsaturated fat for prevention of atherosclerotic complications. *The Lancet*, 292(7577), 1060-1062.
- de la Puebla, R. F., Fuentes, F., Perez-Martinez, P., Sanchez, E., Paniagua, J., López-Miranda, J., & Pérez-Jiménez, F. (2003). A reduction in dietary saturated fat decreases body fat content in overweight, hypercholesterolemic males. *Nutrition, Metabolism and Cardiovascular Diseases*, 13(5), 273-277.
- DiClemente, C. C., & Prochaska, J. O. (1982). Self-change and therapy change of smoking behavior: A comparison of processes of change in cessation and maintenance. *Addictive Behaviors*, 7(2), 133-142.

- Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Journal of Medicine*, 303(3), 130-135.
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 163-194). London: Sage.
- Health Canada. (2004). Canadian Community Health Survey Cycle 2.2, Nutrition (2004): Income-Related Household Food Security in Canada. In: Office of Nutrition Policy and Promotion, Health Products and Food Branch, Health Canada Ottawa.
- Health Canada. (2014). Estimated Energy Requirements. Retrieved on November 08, 2018, from <https://www.canada.ca/en/health-canada/services/food-nutrition/canada-food-guide/food-guide-basics/estimated-energy-requirements.html>.
- Helton, W. S., & Espat, N. J. (2001). Defining mechanisms of omega-3 fatty-acid activity. *Nutrition*, 17(7-8), 674.
- Hill, J., Fillit, H., Shah, S. N., Del Valle, M. C., & Futterman, R. (2005). Patterns of healthcare utilization and costs for vascular dementia in a community-dwelling population. *Journal of Alzheimer's Disease*, 8(1), 43-50.
- Hux, M. J., O'Brien, B. J., Iskedjian, M., Goeree, R., Gagnon, M., & Gauthier, S. (1998). Relation between severity of Alzheimer's disease and costs of caring. *Canadian Medical Association Journal*, 159(5), 457-465.
- Jacobs Jr, D. R., Luepker, R. V., Mittelmark, M. B., Folsom, A. R., Pirie, P. L., Mascioli, S. R., . . . Carlaw, R. W. (1986). Community-wide prevention strategies: evaluation design of the Minnesota Heart Health Program. *Journal of Chronic Diseases*, 39(10), 775-788.

- James, R., Henrikson, D., Tyler, C., & Christian, J. (1991). The North Coast Cholesterol Check Campaign. Results of the first three years of a large-scale public screening programme. *The Medical journal of Australia*, *154*(6), 385-391.
- Knoops, K. T., de Groot, L. C., Kromhout, D., Perrin, A.-E., Moreiras-Varela, O., Menotti, A., & Van Staveren, W. A. (2004). Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: the HALE project. *JAMA*, *292*(12), 1433-1439.
- Kristal, A. R., Glanz, K., Curry, S. J., & Patterson, R. E. (1999). How can stages of change be best used in dietary interventions? *Journal of the Academy of Nutrition and Dietetics*, *99*(6), 679.
- Kuhn, T. S. (1963). *The structure of scientific revolutions* (Vol. 2). Chicago, IL: University of Chicago Press.
- Kumar, A., & Singh, A. (2015). A review on Alzheimer's disease pathophysiology and its management: an update. *Pharmacological Reports*, *67*(2), 195-203.
- Langa, K. M., Larson, E. B., Karlawish, J. H., Cutler, D. M., Kabeto, M. U., Kim, S. Y., & Rosen, A. B. (2008). Trends in the prevalence and mortality of cognitive impairment in the United States: is there evidence of a compression of cognitive morbidity? *Alzheimer's & Dementia*, *4*(2), 134-144.
- Lourida, I., Soni, M., Thompson-Coon, J., Purandare, N., Lang, I. A., Ukoumunne, O. C., & Llewellyn, D. J. (2013). Mediterranean diet, cognitive function, and dementia: a systematic review. *Epidemiology*, *24*(4), 479-489.
- Manton, K., Gu, X., & Ukraintseva, S. (2005). Declining prevalence of dementia in the US elderly population. *Advances in Gerontology*, *16*.

- Marshall, S. J., & Biddle, S. J. (2001). The transtheoretical model of behavior change: a meta-analysis of applications to physical activity and exercise. *Annals of Behavioral Medicine*, 23(4), 229-246.
- McKhann, G. M., Knopman, D. S., Chertkow, H., Hyman, B. T., Jack Jr, C. R., Kawas, C. H., . . . Mayeux, R. (2011). The diagnosis of dementia due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia*, 7(3), 263-269.
- Mertz, W., & Kelsay, J. L. (1984). Rationale and design of the Beltsville one-year dietary intake study. *The American Journal of Clinical Nutrition*, 40(6), 1323-1326.
- Middleton, L. E., & Yaffe, K. (2009). Promising strategies for the prevention of dementia. *Archives of Neurology*, 66(10), 1210-1215.
- Pasture, O., & Onkja, O. (1994). Canadian Study of Health and Aging: study methods and prevalence of dementia. *Canadian Medical Association Journal*, 150(6), 899-913.
- Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research*, 34(5 Pt 2), 1189.
- Petersson, S. D., & Philippou, E. (2016). Mediterranean Diet, Cognitive Function, and Dementia: A Systematic Review of the Evidence—. *Advances in Nutrition*, 7(5), 889-904.
- Pineo, C. E., & Anderson, J. J. (2008). Cardiovascular benefits of the Mediterranean diet. *Nutrition Today*, 43(3), 114-120.
- Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Philadelphia, PA: Lippincott Williams & Wilkins.

- Prochaska, J. O., & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy*. Homewood, Illinois: Dow Jones-Irwin.
- Psaltopoulou, T., Sergentanis, T. N., Panagiotakos, D. B., Sergentanis, I. N., Kosti, R., & Scarmeas, N. (2013). Mediterranean diet, stroke, cognitive impairment, and depression: a meta-analysis. *Annals of Neurology*, *74*(4), 580-591.
- Rowland, D. T. (2012). *Population aging: the transformation of societies* (Vol. 3). New York, NY: Springer Science & Business Media.
- Sacks, F. M., & Katan, M. (2002). Randomized clinical trials on the effects of dietary fat and carbohydrate on plasma lipoproteins and cardiovascular disease. *The American Journal of Medicine*, *113*(9), 13-24.
- Scarmeas, N., Stern, Y., Mayeux, R., Manly, J. J., Schupf, N., & Luchsinger, J. A. (2009). Mediterranean diet and mild cognitive impairment. *Archives of Neurology*, *66*(2), 216-225.
- Schrijvers, E. M., Verhaaren, B. F., Koudstaal, P. J., Hofman, A., Ikram, M. A., & Breteler, M. M. (2012). Is dementia incidence declining? Trends in dementia incidence since 1990 in the Rotterdam Study. *Neurology*, WNL. 0b013e3182553be3182556.
- Schröder, H., Marrugat, J., Vila, J., Covas, M. I., & Elosua, R. (2004). Adherence to the traditional Mediterranean diet is inversely associated with body mass index and obesity in a Spanish population. *The Journal of Nutrition*, *134*(12), 3355-3361.
- Singh, B., Parsaik, A. K., Mielke, M. M., Erwin, P. J., Knopman, D. S., Petersen, R. C., & Roberts, R. O. (2014). Association of mediterranean diet with mild cognitive impairment and Alzheimer's disease: a systematic review and meta-analysis. *Journal of Alzheimer's Disease*, *39*(2), 271-282.

- Singh, R. B., Dubnov, G., Niaz, M. A., Ghosh, S., Singh, R., Rastogi, S. S., . . . Berry, E. M. (2002). Effect of an Indo-Mediterranean diet on progression of coronary artery disease in high risk patients (Indo-Mediterranean Diet Heart Study): a randomised single-blind trial. *The Lancet*, 360(9344), 1455-1461.
- Sofi, F., Abbate, R., Gensini, G. F., & Casini, A. (2010). Accruing evidence on benefits of adherence to the Mediterranean diet on health: an updated systematic review and meta-analysis. *The American Journal of Clinical Nutrition*, 92(5), 1189-1196.
- Statistics Canada. (2011). *Percentage distribution for the 5 leading causes of death in Canada, 2011*. Retrieved from <http://www.statcan.gc.ca.proxy1.lib.uwo.ca/pub/82-625-x/2014001/article/11896/c-g/c-g01-eng.htm>
- Statistics Canada. (2018). Leading causes of death, total population, by age group. Retrieved November 02, 2018, from <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1310039401&pickMembers%5B0%5D=2.29&pickMembers%5B1%5D=3.1>
- Sydenham, E., Dangour, A. D., & Lim, W.-S. (2012). Omega 3 fatty acid for the prevention of cognitive decline and dementia. *Sao Paulo Medical Journal*, 130(6), 419-419.
- Trichopoulou, A., & Lagiou, P. (1997). Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. *Nutrition Reviews*, 55(11), 383-389.
- Trichopoulou, A., Vasilopoulou, E., Georga, K., Soukara, S., & Dilis, V. (2006). Traditional foods: Why and how to sustain them. *Trends in Food Science & Technology*, 17(9), 498-504.
- United Nations. (2012). *World population prospects: the 2012 revision*: United Nations.

United Nations (UN). (2017). World population prospects: the 2017 revision. New York, NY:

United Nations.

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*(2), 249.

Whitmer, R. A., Sidney, S., Selby, J., Johnston, S. C., & Yaffe, K. (2005). Midlife cardiovascular risk factors and risk of dementia in late life. *Neurology*, *64*(2), 277-281.

Wilkins, K. (2006). Predictors of death in seniors. *Health Reports*, *16*, 57.

Wimo, A., Winblad, B., & Jönsson, L. (2007). An estimate of the total worldwide societal costs of dementia in 2005. *Alzheimer's & Dementia*, *3*(2), 81-91.

World Health Organization. (2004). Global Strategy on Diet, Physical Activity and Health.

Geneva, Switzerland: World Health Organization.

World Health Organization. (2012). *Dementia: a public health priority*. Geneva, Switzerland:

World Health Organization.

World Health Organization. (2017). 10 facts on dementia. Retrieved November 02, 2019, from

<https://www.who.int/features/factfiles/dementia/en/>

Author Note

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Table 1

Macronutrient intake (in grams) by age group, gender, geographical classification and dementia risk

Macronutrient Intake									
(by Age)									
Group	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
51-70	7570	216.8 (130.4)	73.5 (46.5)	62.4 (50.5)	19.1 (17.5)	24.5 (21.7)	10.7 (10.1)	0.0 (11.9)	1771.7 (1047.9)
70+	2933	200.9 (113.0)	62.5 (41.8)	51.8 (41.6)	16.3 (14.3)	20.5 (17.7)	9.2 (8.2)	0.0 (0.27)	1556.9 (885.7)
<i>z(p)</i>		-6.91 (.000)	-13.06 (.000)	-11.10 (.000)	-8.31 (.000)	-11.59 (.000)	-8.99 (.000)	-5.47 (.000)	-12.93 (.000)
(by Gender)									
Gender	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
Men	4955	235.2 (139.2)	80.4 (50.2)	61.8 (55.2)	21.1 (19.8)	27.0 (23.4)	11.8 (10.3)	0.0 (15.0)	1970.0 (1102.2)
Women	5548	193.3 (110.0)	62.8 (41.1)	52.6 (40.0)	16.0 (14.4)	20.6 (17.5)	9.2 (8.3)	0.0 (0.2)	1549.5 (836.4)
<i>z(p)</i>		-21.75 (.000)	-22.56 (.000)	-20.32 (.000)	-17.53 (.000)	-20.12 (.000)	-17.53 (.000)	-17.35 (.000)	-27.21 (.000)
(Urban/Rural)									
Group	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
Urban	8460	210.3 (125.3)	70.1 (45.9)	57.3 (47.7)	17.8 (16.7)	22.5 (19.9)	9.9 (9.2)	0.0 (8.8)	1700.0 (990.1)
Rural	2043	222.0 (125.8)	72.4 (48.8)	65.1 (49.0)	20.0 (16.5)	26.2 (21.8)	11.2 (9.8)	0.0 (8.9)	1803.0 (1013.6)
<i>z(p)</i>		4.46 (.000)	3.04 (.002)	8.06 (.000)	8.02 (.000)	8.15 (.000)	5.86 (.000)	2.56 (.011)	6.13 (.000)
(by Dementia Risk)									
Group	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
At-Risk	4295	205.5 (118.3)	68.2 (47.1)	55.8 (46.5)	17.4 (15.6)	21.9 (19.8)	9.9 (8.6)	0.0 (1.8)	1648.6 (965.3)
Healthy	6208	218.1 (130.9)	72.3 (46.0)	61.5 (49.4)	19.0 (17.7)	24.0 (21.1)	10.4 (9.8)	0.0 (10.9)	1771.4 (1041.2)
<i>z(p)</i>		6.35 (.000)	5.56 (.000)	6.18 (.000)	5.80 (.000)	5.60 (.000)	4.29 (.000)	4.31 (.000)	7.42 (0.0)
ALL	10503	212.2 (126.7)	70.5 (46.2)	59.1 (48.3)	18.3 (16.7)	23.1 (20.3)	10.1 (9.4)	0 (8.91)	1717.1 (999.9)

* Median value is near zero due to many respondents' non-consumption of alcohol on a daily basis

Table 2

Percentage of daily energy by source (by age group, gender, geographical classification and dementia risk)

% Energy (Daily)							
<i>(by Age)</i>							
Median (IQR)							
Group	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs
<i>51-70</i>	7570	48.5 (14.8)	16.1 (7.1)	31.2 (13.1)	9.5 (5.8)	12.2 (5.9)	5.2 (3.2)
<i>70+</i>	2933	51.1 (13.8)	15.7 (6.8)	30.2 (12.4)	9.4 (5.5)	11.6 (5.4)	5.2 (2.9)
<i>(by Gender)</i>							
Median (IQR)							
Gender	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs
<i>Men</i>	4955	47.7 (15.4)	15.9 (7.1)	31.3 (13.3)	9.5 (6.0)	12.3 (5.9)	5.2 (3.0)
<i>Women</i>	5548	50.5 (14.2)	16.0 (7.0)	30.6 (12.5)	9.4 (5.6)	11.9 (5.7)	5.2 (3.2)
<i>(Urban/Rural)</i>							
Median (IQR)							
Group	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs
<i>Urban</i>	8460	49.5 (15.1)	16.1 (7.1)	30.8 (12.9)	9.4 (5.9)	11.8 (5.8)	5.2 (3.2)
<i>Rural</i>	2043	48.4 (13.2)	15.5 (6.5)	31.7 (12.7)	9.9 (5.4)	12.7 (6.0)	5.4 (2.9)
<i>(by Dementia Risk)</i>							
Median (IQR)							
Group	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs
<i>At-Risk</i>	4295	49.6 (14.6)	16.1 (6.9)	30.6 (12.7)	9.5 (5.6)	12.0 (6.1)	5.3 (3.1)
<i>Healthy</i>	6208	49.0 (14.6)	15.9 (7.1)	31.2 (13.0)	9.5 (5.9)	12.1 (5.7)	5.2 (3.1)
ALL	10503	49.3 (16.7)	16.0 (7.1)	31.0 (12.9)	9.5 (5.8)	12.0 (5.8)	5.2 (3.1)

Table 3

Macronutrient intake (in grams) by age group and gender

		Macronutrient Intake (by Age and Gender)								Median (IQR) in Kcal/day
Group	Gender	N	Median (IQR) in grams/day							Energy
			Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	
51-70	Men	3712	240.8 (141.5)	84.0 (51.4)	70.8 (58.1)	22.1 (20.6)	28.3 (25.1)	12.2 (11.0)	0.0 (19.2)	2059.3 (1144.0)
	Women	3858	195.6 (113.5)	65.0 (41.1)	55.9 (41.6)	16.8 (15.1)	21.8 (18.1)	9.6 (8.8)	0.0 (0.3)	1611.0 (850.2)
		<i>z(p)</i>	<i>-19.38</i> (.000)	<i>-20.24</i> (.000)	<i>-17.84</i> (.000)	<i>-16.02</i> (.000)	<i>-17.47</i> (.000)	<i>-15.00</i> (.000)	<i>-14.81</i> (.000)	<i>-24.22</i> (.000)
70+	Men	1243	223.5 (128.9)	70.9 (49.1)	60.2 (47.6)	18.8 (17.2)	23.4 (18.9)	10.7 (8.8)	0.0 (11.3)	1765.2 (926.6)
	Women	1690	188.5 (104.3)	57.0 (35.2)	47.2 (35.1)	14.6 (12.8)	18.3 (14.8)	8.4 (6.9)	0.0 (0.1)	1428.6 (784.0)
		<i>z(p)</i>	<i>-9.92</i> (.000)	<i>-9.33</i> (.000)	<i>-9.2</i> (.000)	<i>-6.89</i> (.000)	<i>-9.38</i> (.000)	<i>-8.41</i> (.000)	<i>-8.93</i> (.000)	<i>-11.95</i> (.000)

* Median value is near zero due to many respondents' non-consumption of alcohol on a daily basis

Table 4

Percentage of daily energy by source (by age group and gender)

% Energy (Daily) by Age and Gender

Group	Median (IQR)							
	Gender	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs
51-70	Men	3712	47.1 (15.4)	16.0 (7.2)	31.5 (13.4)	9.5 (6.1)	12.3 (5.9)	5.2 (3.1)
	Women	3858	50.0 (14.3)	16.2 (7.0)	31.0 (12.8)	9.5 (5.6)	12.1 (6.0)	5.2 (3.4)
70+	Men	1243	50.1 (13.9)	15.5 (7.0)	30.9 (13.2)	9.5 (5.5)	11.8 (5.9)	5.3 (2.9)
	Women	1690	51.6 (13.4)	15.8 (6.7)	29.8 (12.1)	9.2 (5.6)	11.4 (5.2)	5.2 (2.9)

Table 5

*Macronutrient intake (in grams) by province***Macronutrient Intake (by Province)**

<i>Province</i>	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
<i>Newfoundland</i>	186	208.8 (148.2)	72.4 (49.9)	54.7 (46.9)	16.4 (14.4)	21.1 (21.1)	9.5 (10.7)	0.0 (0.2)	1680.0 (1058.6)
<i>P.E.I.</i>	48	213.9 (118.0)	69.2 (45.5)	64.0 (49.6)	19.7 (17.4)	24.4 (20.4)	10.7 (9.0)	0.0 (0.2)	1718.8 (1031.2)
<i>Nova Scotia</i>	339	216.2 (120.8)	72.8 (46.1)	59.4 (50.3)	18.2 (17.05)	23.4 (20.0)	10.5 (9.1)	0.0 (0.3)	1692.0 (928.6)
<i>New Brunswick</i>	267	208.1 (124.8)	69.0 (46.7)	61.5 (46.1)	17.6 (15.8)	25.5 (20.7)	11.1 (9.3)	0.0 (0.3)	1725.0 (1013.2)
<i>Quebec</i>	2640	221.5 (136.0)	71.7 (46.9)	65.0 (50.8)	21.0 (19.4)	25.2 (21.5)	10.9 (9.5)	0.0 (13.2)	1848.2 (1044.3)
<i>Ontario</i>	3986	209.2 (122.8)	68.8 (43.8)	55.9 (44.3)	17.0 (15.1)	22.3 (19.2)	9.7 (9.0)	0.0 (10.5)	1699.3 (952.7)
<i>Manitoba</i>	375	194.3 (117.1)	69.1 (48.0)	53.8 (46.4)	17.1 (17.8)	20.9 (19.6)	8.9 (8.8)	0.0 (0.2)	1574.2 (964.0)
<i>Saskatchewan</i>	322	214.5 (122.3)	71.7 (52.4)	66.4 (47.1)	18.6 (18.8)	26.7 (20.1)	11.8 (9.8)	0.0 (0.2)	1724.7 (1044.2)
<i>Alberta</i>	893	202.1 (117.4)	72.5 (47.5)	57.3 (46.7)	17.9 (16.2)	22.6 (21.3)	9.5 (9.1)	0.0 (0.1)	1693.5 (891.9)
<i>British Columbia</i>	1446	214.1 (138.7)	72.7 (50.5)	57.8 (54.3)	18.6 (18.5)	22.4 (20.9)	10.1 (9.6)	0.0 (11.0)	1697.1 (1116.0)
	$\chi^2(p)$	139.59 (.000)	28.13 (.001)	105.17 (.000)	139.59 (.000)	90.55 (.000)	70.22 (.000)	86.77 (.000)	80.95 (.000)
	<i>df(N)</i>	9(9786)	9(9786)	9(9786)	9(9786)	9(9786)	9(9786)	9(9786)	9(9786)

* Median value is near zero due to many respondents' non-consumption of alcohol on a daily

basis

Table 6

Percentage of daily energy by source (by province)

<i>Province</i>	<i>% Energy (Daily)</i>						
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs
<i>Newfoundland</i>	186	49.3 (15.7)	16.9 (7.9)	29.2 (13.8)	8.8 (4.9)	11.6 (6.4)	4.9 (3.2)
<i>P.E.I.</i>	48	49.0 (14.6)	16.2 (7.4)	32.5 (12.7)	10.2 (5.9)	12.6 (6.2)	5.2 (3.3)
<i>Nova Scotia</i>	339	49.9 (16.5)	15.6 (7.1)	31.2 (13.4)	9.5 (5.2)	12.5 (5.5)	5.3 (3.4)
<i>New Brunswick</i>	267	49.8 (13.9)	15.4 (6.3)	32.4 (12.3)	9.6 (5.2)	13.0 (6.2)	5.9 (3.1)
<i>Quebec</i>	2640	48.5 (13.6)	15.4 (6.8)	31.8 (12.3)	9.9 (6.1)	12.5 (5.7)	5.4 (3.1)
<i>Ontario</i>	3986	49.9 (14.7)	16.1 (7.1)	30.2 (12.7)	9.2 (5.6)	11.7 (5.9)	5.1 (3.2)
<i>Manitoba</i>	375	50.2 (15.0)	16.4 (7.3)	30.5 (13.0)	9.4 (5.7)	11.8 (6.3)	5.1 (3.4)
<i>Saskatchewan</i>	322	48.0 (15.7)	16.1 (6.3)	32.9 (12.8)	10.2 (5.5)	12.9 (6.0)	5.7 (3.2)
<i>Alberta</i>	893	48.0 (15.1)	16.7 (7.6)	31.6 (14.4)	9.9 (5.8)	12.2 (6.6)	5.2 (3.3)
<i>British Columbia</i>	1446	49.5 (15.7)	16.2 (7.6)	30.0 (13.1)	9.2 (6.2)	11.5 (5.6)	5.2 (3.0)

Table 7

Macronutrient intake (in grams) by diet type

<i>(g)</i>	CanDi	MeDi*
<i>Carbs</i>	212.2	255.0
<i>Proteins</i>	70.5	74.5
<i>Fats</i>	59.1	110.7
<i>SFs</i>	18.3	29.8
<i>MUFAs</i>	23.1	63.8
<i>PUFAs</i>	10.1	9.9
<i>Alcohol**</i>	8.3	14.0
<i>Energy (Kcal)</i>	1717	2473

* From Trichopoulou et al. (2006)

** Median value is near zero due to many respondents' non-consumption of alcohol on a daily basis. Mean value used instead for comparison.

Table 8

Percentage of daily energy by source (by diet type)

	CanDi	MeDi*
<i>Carbs</i>	49	47
<i>Proteins</i>	16	15
<i>Fats</i>	31	38
<i>SFs</i>	10	10
<i>MUFAs</i>	12	22
<i>PUFAs</i>	5	6

* From Sacks & Katan (2002)

PART 4. STUDY 2 – QUALITATIVE*Mediterranean Diet Adoption and Adherence among Healthy, At-risk, and Cognitively Impaired**Adults*

The percentage of Canadian older adults continues to rise, with a projected 68% increase by 2036 (Canadian Institute for Health Information [CIHI], 2018). As advancing age is one of the greatest risk factors for developing dementia, it is not surprising that the prevalence of dementia in Canada is rising along with the increase in the percentage of older adults.

Approximately 1% of Canadians aged 65 to 69 years have been diagnosed with dementia whereas 25% of those over the age of 85 years have been diagnosed with dementia (CIHI, 2018). Globally, there is an estimated 50 million individuals living with dementia (Alzheimer's Disease International, 2018), with a projected 75 million living with dementia by 2030 (World Health Organization [WHO], 2017). In Canada, there are approximately 500,000 individuals presently living with dementia, with a projected 66% increase by 2031 (Alzheimer Society of Canada [ASC], 2016). Statistics Canada lists Alzheimer's dementia (AD) as the 7th leading cause of death overall (4th in those aged 85+), with approximately 6500 individuals dying from AD in 2016 (Statistics Canada, 2018b). These figures do not include other dementias, suggesting a larger problem.

Dementia is a syndrome manifesting as a combination of symptoms including predominant impairments in memory and other components of cognition. Alzheimer's dementia is the most common dementia (estimated to be 60-80% of all dementia), followed by vascular dementia (VaD) (WHO, 2012). Other less common types of dementia exist as well which predominate in those younger than 65 years of age, whereas AD and VaD predominate in those over 65 years of age (Alzheimer's Association [AA], 2018). Alzheimer's dementia involves a

gradual decline in cognitive abilities, whereas VaD involves a stepwise decline corresponding with vascular injuries (e.g., stroke). The term mixed dementia (MD) usually refers to those with concurrent AD/VaD pathologies but is not defined precisely (Part 2 of this dissertation research). It is estimated that 1/3 of individuals with AD have concurrent VaD pathology, and vice versa (Kalaria & Ballard, 1999). As AD and VaD share certain common pathologies, coupled with the frequent co-occurrence of AD/VaD as MD, it has been suggested that research does not have to focus simply on one or the other (Part 2 of this dissertation research).

There are numerous and significant costs associated with dementia. In 2016, an estimated C\$10.4 billion was spent caring for people with dementia, accounting for out of pocket expenses in addition to total healthcare system costs, which is projected to double by 2031 (ASC, 2016). The global costs associated with dementia have risen from ~US\$ 280 billion in 2000 to ~\$950 billion in 2016, representing ~16% growth rate during that time period (Xu, Zhang, Qiu, & Cheng, 2017). The current global cost of dementia is estimated at \$US 1 trillion, which is projected to double by 2030 (ADI, 2018). It is important to note that estimating the true monetary cost of dementia is difficult because there are different types of costs involved (e.g., cost of medical care, cost of supplies, informal caregiver costs, and more) (ASC, 2016). Nonetheless, dementia presents a significant economic burden in Canada and abroad. However, the burden of dementia is not merely economic. Providing informal care to a person with dementia is very demanding. In 2011, it was estimated that 19.2 million hours were spent providing informal, unpaid care in Canada (ASC, 2016). It has been suggested that costs will continue to rise with the increasing proportion of older adults within the overall population (ASC, 2016).

Current medical and nonpharmacological treatments for AD, as well as for other types of

dementia, are not able to stop nor to reverse neuronal deterioration observed in AD (Kumar & Singh, 2015). Treatments for VaD involve minimizing vascular risk factors in order to prevent further cerebral injury (Birks & Craig, 2006). There are no standard treatments for MD (MD paper). Until researchers and clinicians are able to address these treatment gaps, greater clinical emphasis should be placed on dementia prevention (Part 2 of this dissertation research), such as nonpharmacological options such as exercise and diet, the latter of which is explored in this study.

Diet and Aging

Adherence to a healthy diet is associated with compression of morbidity (i.e., reduction of disease length at the end of life, meaning less time spent living with chronic illness) (Fries, 1980). Additionally, the adoption of a healthy diet is associated with better life expectancy and overall health (Charlton, 2002), whereas an unhealthy diet is associated with an increase in negative health outcomes, such as diabetes, hypertension, hyperlipidemia, and cardiovascular disease, all of which are identified as risk factors for developing dementia in older age (Middleton & Yaffe, 2009; Whitmer, Sidney, Selby, Johnston, & Yaffe, 2005). Evidence shows that the adoption of a healthy diet leads to a reduction of several risk factors for dementia, such as reducing cholesterol and systolic blood pressure (Dayton et al., 1968; Jacobs Jr et al., 1986; James, Henrikson, Tyler, & Christian, 1991). Though adherence to a healthy diet is typically perceived to be more expensive (Peterson, Dodd, Kim, & Long Roth, 2010), it may be possible to achieve cost savings both directly to individuals as well as indirectly to society reduction of healthcare costs. One diet that has seen considerable scientific scrutiny over the past several decades is the Mediterranean diet (MeDi).

The Mediterranean Diet. Although regional variations of the MeDi exist, this diet

emphasizes high consumption of plant foods (vegetables, legumes, grains, and fruits) and fish, while limiting red meat consumption (Trichopoulou & Lagiou, 1997). Dairy, poultry, and alcohol are consumed in moderation. Decades of research highlight the usefulness of the MeDi to reduce overall mortality (Dinu, Pagliai, Casini, & Sofi, 2017; Knuops et al., 2004), with specific benefits in reducing hypertension and cardiovascular disease (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004; Singh et al., 2002; Widmer, Flammer, Lerman, & Lerman, 2015) as well as reducing the risk for developing diabetes (Schwingshackl, Missbach, König, & Hoffmann, 2015). In addition to its usefulness in reducing some risk factors for dementia, MeDi adherence is implicated in improving cognitive function, slowing the rate of cognitive decline, as well as overall AD risk reduction (Hardman, Kennedy, Macpherson, Scholey, & Pipingas, 2016; Lourida et al., 2013). Of particular interest is the suggested reduction of mild cognitive impairment (MCI), and the subsequent progression from MCI to dementia (Scarmeas et al., 2009). Previous research has indicated that the average older Canadians' diet (referred to as the Canadian diet [CanDi]) differs from MeDi regarding macronutrient composition and energy intake (Part 3 of this dissertation research), meaning that efforts must be made by individuals to adopt and adhere to the MeDi. As a person's diet is a representation of that person's behaviour, it is important to frame dietary change as behaviour change.

Behaviour Changes

Changing behaviours, particularly with respect to one's diet, is a complex process. There are several relevant theories/models that attempt to explain the process of behavioural change, though three theories have achieved particular prominence over the last few decades. These include the Health Belief Model (HBM) (Rosenstock, 1974), the Theory of Planned Behaviour (TPB) (Ajzen, 1991), and the Transtheoretical Model of Behaviour Change (TTM) (Prochaska &

DiClemente, 1984). The TTM was selected for the purpose of this study due to its more extensive use in dietary and physical activity research as well as its usefulness as a possible lifestyle intervention focusing on diet (van Sluijs, van Poppel, & van Mechelen, 2004). Additionally, neither the HBM nor the TPB take into consideration emotional factors involved in decision-making (Janz & Becker, 1984; Sniehotta, 2009). In addition, the HBM neglects extrinsic factors (factors outside an individual's control) (Janz & Becker, 1984). Regardless of the model used to explain behavioural changes, behaviour changes, especially related to one's diet, take time.

According to the Transtheoretical Model of Behaviour Change (TTM), there are five stages of behavioural change: precontemplation, contemplation, decision, action, and maintenance (Prochaska & DiClemente, 1984). During the precontemplation stage, persons are either unaware of a problematic behaviour (in this case, an unhealthy diet) or actively resist changing the behaviour(s) which renders any change very difficult to implement. Changing one's diet during this stage is difficult, because while an unhealthy diet results in negative health outcomes, those outcomes often are not immediate. Once individuals recognize that a negative behaviour should be changed, they enter the contemplation stage. During this stage, they seek to improve their knowledge on the behaviour in question but may take a long time to implement change. Once a decision to change the negative behaviour is made, individuals are considered to be in the next stage referred to as the decision stage. In this stage, individuals accept that there is a need for change and will begin changing their behaviour. The decision stage then evolves into the action stage, which is a brief yet crucial step in changing behaviour (Prochaska & DiClemente, 1984). People who enter the action stage often are very enthusiastic about changing their behaviour. However, this enthusiasm is short-lived for many as relapse is common at this

stage (Prochaska & DiClemente, 1984) The final stage is maintenance, during which individuals maintains their new behaviour until they are no longer afraid of reverting to their old habit. This stage may span the remaining entirety of the person's lifetime in some cases. However, this is not always the case and this stage has two possible outcomes: relapse or termination. In the context of dietary change, individuals who relapse revert back to their old unhealthy dietary habits. This is obviously not the desired outcome. The desired outcome is termination, in which individuals are no longer tempted to revert to their old habits.

Prochaska and DiClemente's model provides a useful understanding of mechanisms of behavioural change, and has been used in research for different behaviours, most notably as a basis for smoking cessation intervention (DiClemente & Prochaska, 1982). Other researchers suggested that this stage-based model can be applied to dietary habit change (Curry, Kristal, & Bowen, 1992). Kristal, Glanz, Curry and Patterson (1999) developed strategies for those whose aim is to promote a successful dietary habit change. For individuals in the precontemplative stage, the primary focus should be on information exchange and promoting awareness while fostering emotional acceptance. When an individual has progressed to the contemplation stage, the focus should shift to increasing individuals' confidence in their own ability to change by providing positive feedback and discussing the barriers to change. During the decision stage (or preparation, the term used by Kristal et al. (1999)), a commitment to change including a specific action plan is necessary to progress to the action stage in which the focus is on training and support. Finally, for the maintenance stage, the individual should be taught to solve any potential problems that may arise after the desired behaviour becomes the norm.

Motivation plays a key role in behaviour change (Gollwitzer & Bargh, 1996), meaning that changing undesirable behaviour is not an equal priority to all individuals. For example,

negative health outcomes related to diet can take years to manifest. It is important to examine differences among different groups of individuals (i.e. groups based on age, dementia risk, cognitive impairment) to see if there are differences regarding the motivation to change.

Statement of Problem

It is unknown, at present, how difficult it may be to promote a shift from the CanDi to the MeDi in Canadians, especially for those at risk for developing dementia. The aim of this descriptive qualitative study was to examine the extent of familiarity with the MeDi among older Canadian adults (50+ years of age) as well as to explore any barriers and facilitators to changing dietary behaviour (including, but not limited to the MeDi), both generally and in relation to an individual's age and risk for developing dementia. The following research questions (RQ) were posed for this study:

1. How familiar are Canadian older adults with the MeDi?
2. How willing are Canadian older adults to adopt the MeDi into their lifestyle?
3. Are there any barriers and facilitators to MeDi adoption/adherence? If so, what are they?
 - a. Are any of these specific to “memory impaired” (any mild cognitive impairment, diagnosed or self-reported), “at-risk” (cognitively intact, but with vascular risk factors), or “healthy” persons?

Method

Study Design

The current study was framed as a descriptive interpretive qualitative study (Thorne, Kirkham, & MacDonald - Emes, 1997; Thorne, Kirkham, & O'Flynn-Magee, 2004). Thematic analysis (Polit & Beck, 2008) was performed to understand better how to facilitate a shift from the CanDi to the MeDi for young-old (50-70 years of age) and older (71+ years of age)

Canadians. The design and method provided data derived from focus groups from which to examine their differing experiences. Focus groups, versus individual interviews (in-person or via telephone) were chosen as the mechanism of data collection in order to provide richer data by offering opportunities to participants to react to and to expand upon one another's statements (Polit & Beck, 2008). Three groups of people were clustered into those considered "memory impaired" (one group aged 50+ years old), "at-risk" (one group per each age cohort), or "healthy" (one group per each age cohort).

Participants

The inclusion criteria for participants were English speaking adults who are over 50 years of age (for the healthy and at-risk groups), as well as having been previously identified (through previous visits of the recruitment site) as having mild cognitive impairment (MCI) or having a memory complaint that causes them concern. Participants for the focus groups were recruited through the Aging Brain and Memory Clinic at St. Joseph's Health Care - Parkwood Hospital in London, Ontario (for the "memory impaired" group), as well as via community ads for the "at-risk" and "healthy" groups (such as postings in community shops, health professionals' offices, and specialized clinics).

A total of 28 participants split into 5 focus groups participated in the focus groups that formed the basis of the study: healthy 50-70 year olds (n=8), healthy 71+ year olds (n=7), at-risk 50-70 year olds (n=4), at-risk 71+ year olds (n=5), and MCI 50+ year olds (n=4). Potential participants recruited for the healthy and at-risk groups were asked to self-report any pre-existing medical, neurological or psychiatric conditions. Presence of risk-factors for dementia (such as diabetes, obesity, hypertension, or metabolic syndrome) resulted in the placement of the participant in the at-risk group based on their age (R50, R71). The absence of risk-factors

resulted in the placement of the participant in the healthy group based on their age (H50, H71). Participants recruited through the Aging Brain and Memory clinic were placed in the MCI group (MCI). Out of the 28 participants, 12 were women and 16 were men (see Table 1 for the demographic breakdown by gender and age).

Materials and Measures

Focus group interviews were conducted by the primary investigator (IC) and were guided by open-ended questions (see Appendix A for the focus group interview guide). These interviews were digitally audio recorded and transcribed verbatim orthographically by the primary investigator (IC) in accordance with Canadian English standards for spelling and punctuation. Names and other identifying information were redacted from the transcripts. Prior to coding analyses by the primary investigator (IC), a transcription agreement study was conducted to determine the accuracy of transcription. Each of the digital audio recordings from each of the five focus group sessions were split into five equal parts, with one part (i.e., 20%) randomly selected and transcribed by another independent, blinded transcriptionist who was a second year graduate student in speech-language pathology at Western University. The transcripts from the second transcriptionist then were compared to the corresponding segments of the original transcripts using Microsoft Word 2017 (Microsoft Corporation, Redmond, United States of America). While there were minor discrepancies between the original and re-transcribed transcriptions, these were mechanical (i.e., using contractions, typographical errors, different placement of time stamps). Overall, there were no content differences.

Ethics and Permissions

Ethics approval for this study was obtained from the Research Ethics Board (REB) at Western University as well as from Lawson Health Research Institute in accordance to the

Declaration of Helsinki (protocol #106047) (see Appendix B). Consent was obtained from all participants since all were deemed by their attending physician and/or family member to be able to provide consent (see Appendices C and D for letter of information and consent form examples). Data were stored in secure, locked facilities and on a Western University Information Technology Services supported network linked to an encrypted computer in the International Consortium for Communication, Aging, and Neurodegeneration (ICCAN) laboratory at Western University.

Data Collection

The focus group interviews were conducted over an 18 month period at Elborn College, Western University by the primary investigator (IC). Each focus group interview lasted approximately two hours, including rest and refreshment breaks. MeDi-friendly refreshments were provided (e.g., mixed nuts).

Data Analysis

Editing analysis style followed the protocol as described by (Crabtree & Miller, 1999). The transcripts were analyzed independently first by the primary investigator (IC) and then separately and independently by the PI's research supervisor (JBO) for emerging themes that then were sorted and categorized using NVivo 12 (2018) for Microsoft Windows® (QSR International, Melbourne, Australia). Open, axial, and selective coding methods were used to analyze the collected data (adapted from (Strauss & Corbin, 1990)).

Open Coding – Codes. Initial analyses were performed using an open coding method. The PI (IC) developed codes that best described the content of the participants' responses in the transcript. No codes were developed a priori. Open coding was performed independently by the PI (IC) and his supervisor (JBO) to ensure the credibility of the data. The researchers then held

debriefing sessions to resolve any discrepancies in the codes until consensus was achieved. The agreed-upon code list was used for the next transcript. The researchers used existing codes where appropriate and were instructed to develop a new code in case no previous code applied. The protocol was used even for seemingly negligible differences, as the need for such codes was evaluated later in subsequent coding stages. The method was repeated for each focus group transcript up to the point where subsequent analysis yielded no further codes (known as data saturation) at which point the PI moved on to axial coding.

Axial Coding – Themes. For axial coding, the primary investigator (IC) looked for relationships among the agreed upon codes to identify common themes. The results of this initial axial coding were used by the other researcher (JBO) for review and for feedback during a debriefing session that was held to resolve any noted issues or concerns with this level of analyses. The coding and re-coding of themes was repeated between IC and JBO until saturation (no new themes emerging).

Selective Coding – Domains. After establishing themes, selective coding was conducted. Selective coding involved grouping similar themes together to describe the experiences of the participants as they related to the MeDi. As with axial coding, debriefing sessions between IC and JBO were held to resolve any noted issues or concerns with their analyses. It was at the end of this process that the domains emerged and the analysis was concluded (see Appendix E for a visual representation of this process). Results are represented in the following hierarchy:

1. Domain
2. Theme
3. Code

Each domain consists of themes, which in turn consist of codes (standardized representation of

data collected through focus group interviews). A visual representation of the domains and their themes is included in Appendix F. The domains are not hierarchical, and the individual is at the centre of the data as the findings stem from individual responses. A complete list of codes within each theme is included in Appendix G.

Trustworthiness of Qualitative Data

To ensure the trustworthiness of the qualitative data, the researchers (IC and JBO) followed the recommendations as outlined by Guba and Lincoln (1981): that the data are *credible*, *transferable*, *dependable*, and *confirmable*. For example, the credibility of the qualitative data was ensured through multiple debriefing sessions held between the researchers. Transferability was ensured through detailed descriptions of the participants (see *Socioeconomic Profile of Participants* section of the analysis below), to highlight the applicability of findings to similar groups of participants. It is acknowledged fully that it is not possible to draw generalizations based on the research design used in this study. Dependability was ensured through documentation of the data gathering process to enable other researchers to repeat the same data collection process: the focus group questions are available in Appendix A, the coding methods are outlined above, and a complete list of codes is available in Appendix E. Finally, an “audit trail” (a graphical representation of the data collection steps) was created (see Appendix H) so that other researchers can assess the confirmability of the study (Lincoln & Guba, 1985).

Results

Data were analyzed with the aims of describing the extent of familiarity with the MeDi among Canadian older adults (50+ years of age) and willingness to adopt such a diet (RQs 1 and 2) as well as to explore any barriers and facilitators to changing dietary behaviour (including, but not limited to the MeDi), both generally (RQ3) and in relation to an individual’s age and risk for

developing dementia (RQ3a). Overall, three domains emerged from the data analyses:

1. *Knowledge and Skills*
2. *Socioeconomics*
3. *Adoption of Habits*.

Knowledge and skills highlights the effects of knowledge and learned skills on MeDi adoption or adherence. Items in this domain primarily align with RQs 1 and 2. *Socioeconomics* includes factors mostly or completely beyond an individual's control (e.g., cost of food, availability of food, healthcare system). *Adoption of Habits* includes all factors influencing dietary habits or dietary habit change, limited to those referring to either the participant or a family member cohabiting with the participant. Items in the latter two domains primarily align with RQ3, and RQ3a. Any observed group differences are presented in each of the following sections. In addition to describing these domains, a socioeconomic profile of the participants is included to highlight the applicability of the findings.

Knowledge and Skills

The codes comprising the domain of *Knowledge and Skills* were grouped according to the emergent themes and refer to the effects of knowledge and learned skills on MeDi adoption or adherence. Four themes were identified within this domain: Knowledge, Beliefs and Perceptions, Information Seeking, and Education.

Knowledge. The theme of Knowledge consists of codes pertaining to participants' knowledge about the MeDi specifically, as well as nutrition in general, including statements that described gaps in their knowledge. Most of the participants stated that they are somewhat familiar with the MeDi, but most did not demonstrate in-depth knowledge. There were no

differences among groups, with the exception of one MCI group participant (MCI-A) demonstrating greater MeDi knowledge:

Well, Mediterranean diet is a lot of fruits and vegetables, it's fish and seafood and small portions of meat or any kind of meat. It's using olive oil when you're making it, it's supposed to be part of it. And it's just really bright, diverse food, and when I look at some of the things like hummus and some of the dishes you make from the eggplants, it's very, I'm gonna say happy, clean food.

A participant from the at-risk group demonstrated a limited knowledge with regard to information technology, which also is identified as a barrier to information acquisition. For example, R50-C thought that she would have to use her computer at a particular time, which is not true in most cases:

I would not, I probably wouldn't participate, because I'm not home at a specific time, or my schedule's crazy. Well I guess that's sort of contradictory because I would say that I'll come to a 2:00 class but I don't know if I'd sit in front of the computer at 2:00.

Many stated that their lack of knowledge on the subject prompted them to participate in the study, demonstrating information seeking behaviour.

Information Seeking. The theme of Information Seeking consists of codes that identified instances when individuals stated they were seeking further knowledge related to nutrition including means to acquire such knowledge. Most of these codes refer to instances where participants used the focus group in order to ask questions specifically about the MeDi. For the healthy groups, most of their questions were closed-ended, asking about specific food components (e.g., fish, grains, oils). Participants in the at-risk and MCI groups asked more detailed, open-ended questions. For example, MCI-B asked:

Is there anything that would cancel or counteract the Mediterranean diet, like some of the things that would counteract that we should be aware of?

He also was interested in getting more specific information, such as:

I'd like to have a list of the vegetables that is in the Mediterranean diet, because I've got a garden of my own, and I've been growing a lot of vegetables and I freeze an awful lot of vegetables.

Instances of questions specifically concerning disliked foods also were noted. For example, R50-E asked:

Now you said about the fish, and I don't like fish per se, but there's also chicken, so but by not eating any fish, does that take away from anything?

Participants in the MCI group asked more general questions about nutrition. For example, participant MCI-C asked if coconut oil is healthier than grapeseed oil and MCI-A asked about avocado oil. Facilitators to information seeking included statements related to instances of accessible information, primarily through means of information technology:

I go to the internet. And I also can go to Facebook, a couple of my cousins are culinary nuts and they often post recipes and how-tos on their Facebook account so I go there to find recipes I could enjoy. (R71-D)

Several mentions were made regarding difficulties they encountered while seeking information. For example, H71-A stated:

I searched this past Christmas for a cookbook that was specific to the Mediterranean diet and they are virtually non-existent... What we've found, or have found is that there's no, unlike other diet books, there's not a lot of information there on how to prepare a specific meal... There was, perhaps, two or three [books] in the thirty feet of cookbooks on the

shelves. And they were not particularly food books in my opinion.

There was no central authority responsible for curating MeDi information, and participants were unable to discern expert information from information that was unsupported by research. For example, R50-D expressed concerns about the expertise of individuals who are trying to promote certain diets:

The thing is, when you're out in the real world, separating the rip-offs from the good people that are charging [money for classes].

To further compound matters, there were statements about information overload from conflicting sources. Participant H50-B stated:

But there's so many supplements and so many things it's hard to know who to believe. The word "diet" itself held a negative connotation for many, due to constant appearance of fad diets and difficulty adjusting to changing dietary information. For example, R50-B also remarked:

But then you think over the years, like ones on the Mediterranean or all these diets, and then they come back and say oh no, don't follow that, that's not even good anymore. You know there's been so many cases over the years where you know like the different oils the different whatever, and then they'll come back and say oh no that wasn't the right information. So I think sometimes you get a little, oh yeah in two years they're gonna say there's something wrong with that, or in a year's time or whatever.

While the statement from R50-B is not true with regard to the MeDi, it does highlight the importance of personal beliefs and perceptions.

Beliefs and Perceptions. The theme of Beliefs and Perceptions consists of codes that identified any ideas (values, positive or negative beliefs and/or perceptions) that can affect

participants' dietary behaviours including MeDi adoption or adherence. There was a primarily negative effect of beliefs and perceptions on the participants' dietary habits. These included concepts such as the belief that premade food equals unhealthy in all cases, the negative connotation of the word diet, the belief that weight gain is solely a product of inactivity, or that cost is not a barrier to healthy eating for everyone. For example, H50-B stated:

I guess I just don't like the idea of a diet, there is a branding to that whole diet, and it sounds very restrictive rather than positive. I think someone else [in the focus group] has touched on that as well. There's something about that diet phenomenon.

Most of the identified barriers for these themes were coded as perceived barriers, meaning that the participant's belief was identified as the root cause of the suggested barrier, rather than as a representation of an actual barrier. The responses pertaining to beliefs and perceptions were highly heterogeneous. For example, R50-C talked about her brother's belief about medication offsetting poor dietary decisions:

So you have a strong constitution [in response to another participant's statement], some people don't, they go in denial. Like my brother, he's a diabetic and he eats candies and I look at him, "what are you doing?" "Oh, metformin will offset that." So it's denial.

The participants' beliefs/perceptions did not always represent a barrier. For example, H71-B stated:

The one thing I find attractive about the concept of the Mediterranean diet is, as you say it, evolved naturally over the centuries. Not as a diet, but just the way people ate.

Whereas what I sense in our way of life nowadays, our diets have evolved as technology has changed the way foods are produced on farms and processed...My sense is when we call it a diet it's really just a common sense approach to eating more natural foods.

Education. The theme of Education consists of codes that identified personal educational experience, both formal (such as receiving didactic instruction) and informal (such as experiential knowledge opportunities). Education was seen mostly as a facilitator, with only one mention of a barrier. Participant R50-B stated being too fatigued to attend classes on top of other demands:

With all the conditions I find by supper time, I'm done. Like I wouldn't be going out to any cooking classes or that in the evening...I think there'll come a time where maybe there won't be any classes like that, it'll be on the computer or something else.

Availability of classes was the most stressed facilitator. Participant R50-E stated:

Like the Weight Watchers, where we can go once a week and learn oh okay this is you know, and you've got other people here, I got this recipe. So sometimes seeing it applied, is easier than reading a book or someone to motivate you, I'd do good with groups.

Several participants asked about and showed interest in attending MeDi-specific classes, like MCI-C:

Is there anything like cooking lessons or seminars on you know discussions and learning about the diet for the general public? I would go to something like that.

As illustrated above, only the younger at-risk and MCI individuals were interested in MeDi education, albeit some stated they would prefer less formal settings, like in the case of R50-B:

In an ideal world, just give me a book and show me what to do or show me on the computer, but do I want [classes]? Some people would be really good at it because they would go "oh, okay, I'm gonna be learning this" and they'll get right to it. I'm not that great [in those situations] personally, I'll slip back to my regular ways.

Many participants identified that they would like to see information in their preferred format,

with several preferring just having access to information and learning at their own pace (like R50-B), while others favoured a more hands-on approach, like R50-C:

I definitely need the group, that's where I would learn best. I would never go online. I go online all the time [referring to regular internet use] but I look at it, I'm better in like, a physical group.

There was a mention of information technology as an educational tool, particularly for the younger generations, with R50-B giving examples from her family and social life:

I know my kids if they wanna learn anything they go on the computer. I'm just starting to do that, so I'm more old ways, but I think in the future we will learn much more about the computer. I mean I heard a girl say, that works at [REDACTED], if they're told to learn to do something, they go on the computer. They don't have classrooms to teach them. So I think that's what it's gonna come down to.

Travel was identified by one participant (MCI-A) as an educational experience, referring to travel for leisure rather than for work:

It was a combination of events, but a major thing was travelling. And the major thing, I used to be incredibly skinny, I couldn't keep the food down. So when I travelled I found how different I felt and how energetic I felt, so that was probably one of the major events for me, was travelling.

Socioeconomics

The codes in the domain of *Socioeconomics* were grouped according to the emergent themes and refer to factors that are mostly or completely beyond an individual's control. Three themes were identified: access to food, economics, and healthcare and society.

Access to Food. The theme of Access to Food consists of codes that refer to physical

availability and access to required foods, without consideration of cost, which is a separate theme within this domain. Several barriers were identified by participants, most important of which are: (a) the abundance of unhealthy processed food options, (b) the inability to purchase specific food items because they are not available in stores, and (c) accessibility of stores (including safety considerations with regard to winter driving and travel). The barriers are illustrated in the following examples. For example, MCI-B talked about why he never learned to cook before marriage, and how he did not need to learn after getting married:

The pizza place is down there and the hot dog place is there and the hamburger place is over there, and processed foods. Go get a dinner for, what is it the Hungry Man dinner at the grocery store. You'll survive, until you get married.

H50-C noted difficulties getting certain foods:

It's hard to find, like, fish is here – isn't that wonderful. If you go to the east or west coast it's another story. So, from fats I think the hardest part is the fish.

R50-B noted difficulties associated with shopping for food when living in less densely populated areas:

Could it be where you live as well? When I lived in the country, I stocked up. And maybe I wasn't getting, you know, the fresh fish.

Participant R71-E brought up issues about transportation difficulties for people who live in climate zones where temperatures fall below freezing during the winter:

I hate driving in the winter when I am not sure of the roads...I mean I don't want to risk my life on a slippery road.

Though not identified as a personal barrier by any of the participants, lack of personal transportation can present as a barrier to access, especially to adults who do not drive or have

limited or no access to public transportation. For example, participants R71-A and R71-B (both of whom are retired) mentioned how they make multiple weekly trips for fresh vegetables:

We have more time to make quick trips to the grocery store to buy the fresh vegetables and I, we do it twice a week as a rule, or as a game. When we were working, we didn't have time.

When asked if these trips would be possible without personal transportation, R71-A stated that they would be more difficult, while R71-B stated that he “probably would not” make these trips. While time is also mentioned here, it is discussed as a separate concept later. Proximity to stores and fresh markets, as well as those receiving good and accommodating service from their grocers was identified as a facilitator to obtaining desired food items, making their geographical location a facilitator with regard to access. For example, R71-D stated:

I would much prefer it [living close to the store]... you know, walk for a couple of blocks with my shopping bags or shopping card as opposed to having to drive seven kilometres both ways.

Participant H71-D, who lives alone, noted that his grocer's service enables him to have fish on a regular basis by enabling him to make fewer trips to the store:

They have a very good fish department there and I buy rainbow trout cutlets. I get the gentleman there, or the lady depending on who's working there, to cut individual portions for me, which they will do, and wrap it separately. So I'll take it home, get about four or five at a time, and then just put them in a freezer.

Additionally, proximity to sources of local produce also was identified as a facilitator, with R50-B noting:

I think would be good for you to have more plant based, to have more of the, actually to

have it more like they're talking about the fifty mile diet, or seventy five mile, whatever it is, but that's almost like it was in Italy or Spain, like the products that are within your district, so I think that is better than having it from a thousand miles away.

It is important to note that while something is physically available, it does not equate with being accessible, especially if economic considerations are not addressed.

Economics. The theme of Economics consists of codes that refer to how cost can affect dietary habits, including the adoption and adherence to the MeDi. It is important to note that none of the participants stated that cost was an insurmountable barrier to them. Cost of healthy food was stated to be higher for the most part, but many participants remarked that they can see the cost of healthy eating as a large barrier to those of lower socioeconomic status. For example, H50-A stated:

There's a lot of people in the lower socioeconomic groups and I can tell you that cost would be a huge issue because if they had to go out and think of buying, you know, a nice piece of salmon versus, you know, a \$1.50 box of KD [Kraft Dinner] that's what they can afford.

Cost of education also was reported as not being a barrier to the participants due to their ability to pay out of pocket (R71-B: "no it's not a matter of affording it"). In fact, relative affluence enabled some to realize savings by buying in bulk, as mentioned by R71-D:

Yeah definitely, I think you know the fact that we are retired and we have reasonable pension, certainly contributes to our ability to buy or provide healthy food, and yeah you can pay long dollars, you know if you wanted a special kind of wheat. For my son's 49 birthday this year he wanted to cook a beef tender loin, he went to Costco and bought one of these gigantic whole meat tenderloins, I think the price tag was \$129.

Most participants stated that they did not suffer barriers regarding cost, with some stating (e.g., H71-G) that at their advanced age cost is not a barrier.

Healthcare and Society. The theme of Healthcare and Society consists of codes that refer to how MeDi adoption or adherence is or can be affected by current social standards (e.g., appearance of food) as well as healthcare and governmental policies. The food industry was considered to be the most significant barrier due to ethical reasons, such as misleading marketing practices and labels. H50-G offered an example about olive oil:

Even olive oil there's all this research that half of the olive oils you buy at the supermarket aren't even olive oil. There's all 3 of the other oils in that too.

H50-F expressed a concern regarding food origin due to varying standards in food safety:

The source: like where did it really come from, where was it processed, and what is in it because you read a lot of things and you think you know where did that really come from? Because it will say prepared for Loblaw's let's say or whatever. But, that doesn't tell me was it from Canada? Was it from China? I avoid Chinese food. A lot of times you don't really know where it came from and it's difficult.

While it was acknowledged that processed foods are unhealthy, participants reported that rather than addressing the problem many companies employ marketing practices that highlight a lack of artificial ingredients as a sole indicator of the apparent healthiness of a product. For example, R50-C stated:

What kills me is when you see all the commercials, and they'll say real food, I would say to my husband "what were they eating before?", like this real food business.

In addition to the issues within the food industry, others within the healthcare system were brought up. Physicians are seen as lacking in nutritional expertise and health professional

education is perceived as lacking nutritional focus, as mentioned by H50-B:

So if the doctors take this oath to do no harm, how come they aren't trained in nutrition?... Physicians get about, I don't know, a week's worth of training in nutrition over their 12 years of studies. They are not the people, they are the coach. I can be a catalyst. It's got to be a person who studied this and understands it to a much greater extent. And I think by and large physicians are incompetent, as a generalization. Mark Twain said, "no generalization is worth a damn, not even this one". But, you know, they aren't the people who can really counsel.

Government policy also was seen as a barrier in this regard since the Canadian healthcare system is still built primarily around acute care delivery, in which physicians have only a short allotment of time per patient per visit. Outside of healthcare, societal norms such as traditional gender roles are seen as a barrier. While there has been a shift from traditional roles over the past half-century, issues around these roles have not disappeared from the older population. For example, some of the male participants reported not being expected to know or learn how to cook, as in the earlier example provided by MCI-B regarding how he "survived" on fast food and processed food before marriage and was not expected to learn to cook afterward. For these individuals, this task was passed on to the spouse, and possibly resulted in less control over nutritional choices. However, it was suggested that many of these issues could be addressed at the systemic and societal levels, which could turn these barriers into facilitators. For example, MCI-C suggested:

I'd love to see in the school system, the younger the children are, when you get them younger they can grow up with the idea that their bodies are important, their diet is important. I'd love to see the home economics classes again in elementary school.

The finding suggests that a preventive nutritional approach within the current primary education

system could be utilized. While currently mentioned as a barrier, it was suggested that physicians assume a more educational role and give greater consideration to prevention of disease. For example, H50-B stated:

I think in the schools the doctors will have to advocate their role to promote the healthy people, healthy individuals. I mean they're good, don't get me wrong, they're very, very good in many, many ways. They're very well intentioned, but if the goal is to have a healthy person then it is a very different role that the traditional doctors need to take on.

It was acknowledged that while being more difficult that personal habit change, societal change was possible through concerted effort. MCI-A had professional experience with advocacy:

If you advocate with the right people you can get changes done. Especially if you have it backed up with research, it's always the issue. When you go forward because they don't think in societal terms, for politicians, but they do think in research terms and financial terms, so you have to make your argument in those ways.

Though socioeconomic factors play a significant role with regard to dietary decisions, it is of greater immediate importance to examine how intrinsic factors (i.e., those within an individual's control) can influence diet adoption and adherence.

Adoption of Habits

The codes in the domain of *Adoption of Habits* were grouped according to the emergent themes. They refer to factors influencing dietary habits or dietary habit change, limited to those referring to either the participant or to a family member cohabiting with the participant. Eight themes were identified: health, action and intent, adherence, food preparation, personal food preferences, relationships, strategies, and time.

Health. The theme of Health consists of codes that refer to health factors affecting MeDi

adoption/adherence. This includes statements pertaining to the participants' awareness of their (and/or their family's) food consumption as well as their awareness of the importance diet plays in personal health. These were the most frequent codes in this domain. The participants from the healthy groups demonstrated greater awareness of food consumption and made specific mentions of foods, like H50-E:

I do eat a lot of nut, fish and vegetables, lot of vegetables. Leafy, leafy stuff like lettuce and spinach. (H50-E)

At-risk participants, like R50-D, made more general statements, such as:

We eat really, really well.

Suggested health benefits of the MeDi were primary facilitators for most participants. Issues with one's health (R71-C mentioned changing dietary habits following cardiac issues and surgery), or the health of one's spouse were identified as motivators for change:

Well my husband just went through, is in cardio rehab and the Mediterranean diet is what he is supposed to be eating. (H50-D)

It is important to note that health benefits were not only identified by those reporting a specific health problem and were of interest to those taking a preventative approach to their own health, like H50-B:

Would I adopt a Mediterranean diet? Yes. I've become more interested in lifestyle recently. Things like sleep, reducing stress, exercise, and improving nutrition...it's a quality of life issue for me.

Only participants from the healthy groups identified seeking a healthy diet without specific health concerns, like H50-C:

I guess I'm just trying to eat healthy, and it turns out that eating healthy is along the lines

of the Mediterranean diet and the kinds of foods that I like to eat. So, so I think it is for me more about the healthy diet rather than the Mediterranean diet, if that makes sense.

While the category of health primarily covered facilitators for diet change, H50-B mentioned a lack of observable results as a potential barrier:

Some of this is like punching fog. The time delay from doing one thing and seeing the result can be days, months, and can be years. So there's the whole question of how do you really know what is best for you?

The larger barrier to dietary change was the underestimation of the importance of prevention. For example, H50-G stated:

If you go in and your doctor says you are starting to show pre-diabetes signs, you need to lose 20 pounds etc., you need to do this, you know, people just don't do it. Then you come back 6 months later and now I have to put you on some medication. I am a pharmacist like H50-A and I'm exposed to people who want to take pills to fix things but what they need is a hard change in their life, and that's why it's better to learn when you are younger to live more healthy.

Having two pharmacists as participants offered some insight into people's relationship with health and medications. They reported that most people come to the pharmacy seeking a fix for an existing problem and that there is minimal discussion around prevention. Some participants made statements that indicated a desire to change, or that they have already begun to change their habits, as outlined in the following theme.

Action and Intent. The theme of Action and Intent consists of codes that identified statements about actions or intended actions, such as those referring to active dietary modification, evidence-based action, a lack of self-discipline, vigilance (leading to action), and

the willingness to try and/or adopt the MeDi. As expected, some of the participants reported trying to change their dietary habits, as stated by H71-A:

We recently gave up regular yogurt and are just on to the Greek or Icelandic yogurt now, so we are gradually making changes such as cutting out a lot more carbs, very little bread. At-risk and MCI participants were particularly concerned with switching to healthier sources of fat, as evidenced by R50-C's and MCI-C's statements:

I thought canola oil was good, but I've since read that it's not so good for you so I've gotten rid of it. I was reading some articles that it's not very healthy so I got rid of that, and then I heard coconut oil's very good so I use a lot of coconut oil and olive oil. (R50-C);

I was thinking we've been using, we have used olive oil, but we switched to grape seed oil, on account of the high heat, something about the high heat with the other oils (MCI-C)

Aside from the difference noted above regarding specific macronutrients statements about dietary modification were present among all participant groups. Health status (i.e., healthy, at risk or cognitive impairment) or age (i.e., 50 vs 70+) did not differentiate groups. Though aware of benefits of healthier diets, some participants reported struggling with improving their diet:

So I'd need a proper diet but I just haven't been able to force myself to get onto it. (H71-C);

We should, but there's always an excuse not to. (R50-C)

Participants H50-E and H71-C mentioned a lack of self-discipline or knowledge as a possible barrier for adoption, for example:

I'm not very disciplined enough to know, or educated enough to know a lot about it.

(H50-E);

I'd need a proper diet but I just haven't been able to force myself to get onto it. (H71-C)

Some participants mentioned that they are interested in making healthier choices, particularly if they had more evidence that supports health claims of particular diets, like H50-B:

There's something about trying to sense what is appropriate and what's right and can be backed up by some scientific proof. Testing, and things along that line.

Upon learning that wine (or other alcoholic beverages) are not recommended for individuals with cognitive impairment, despite being identified as a component of the MeDi, a participant (MCI-C) stated that she intended to reduce her consumption in light of this information:

So that's a negative for me, because I was enjoying red wine for the last number of years, and now I'm going to reduce, which is okay I'm used to sacrifice that's okay, builds character.

Not all participants were equally enthusiastic about adopting the MeDi, ranging from willing to try the MeDi to those who were already following a similar diet. One participant (H50-B) identified that hearing about the benefits of the MeDi in the past:

I'm certainly willing to give it a try if they can look at it. When I hear so many people talking about it, maybe there is some truth to it.

It was noted that several participants were successful in maintaining a healthier diet, as outlined in the following theme.

Adherence. The theme of Adherence consists of codes that identified factors relating to the adoption and adherence to the MeDi. Adherence codes included not only stated adherence to the MeDi, but also partial, selective, motivated, and unintentional adherence. One participant (MCI-A) remarked that she has been adherent to the MeDi for nearly half a century. It is

noteworthy to mention that most of the individuals reporting an adherence to the MeDi were not aware that their dietary habits were in line with MeDi recommendations. It is important to note that there was an effort made by these participants to follow a healthier diet, and these statements were made mostly in the healthy participant groups. For example, H50-H noticed that his diet closely resembles the MeDi due to his family's effort to eat more healthily:

I guess gradually over the last 20 years or so we have moved to a Mediterranean diet. Not by choice, I think just healthier living.

Participant H50-E mentioned that they may be adherent to the MeDi without a conscious effort:

I probably do it [follow the MeDi] already, I don't, without being you know fully aware of it I mean I do eat a lot of nut, fish and vegetables, lot of vegetables. Leafy, leafy stuff like lettuce and spinach.

It is important to note that some participants who reported consuming less of a variety of MeDi foods appear to have made unconscious additions of select MeDi components to their diet. For example, H50-B stated:

I eat a fair amount of salmon already, usually salad in the day, and my fruit smoothie in the morning.

Participant H50-F made a similar statement:

I have shifted somewhat towards it with more salmon, more fish, more rice, more salads, more fruits, and things along that line.

Some participants remarked that they are not particularly interested in adopting the MeDi completely but would incorporate MeDi elements based on their alignment with personal food preferences. For example:

It's not necessarily adopting the Mediterranean diet as is, but it's what really fits for me.

(H50-B);

I would just use what I have, and whatever I make is going to have that. Whole grain rice, a chicken breast, and a spinach salad; that's what I'm going to have for dinner. (R50-E)

Two facilitators for adoption/adherence were identified: ease of transition (referring to cases where switching to the MeDi required less effort due to the personal food preferences which were not overly misaligned with the MeDi), and enjoyment (referring to a stated enjoyment of foods available within the MeDi). For example, H50-G noted that MeDi adoption would not require a major change in his diet:

It's mostly what we are used to eating the only change was taking significant amounts of carbohydrates out.

After a follow-up question, he reported that this change was not a difficult one to make. Another participant (H50-D) echoed this sentiment:

It's stuff we eat all the time so it wasn't different but I am just one of those people who wants to know a little bit more.

Enjoyment of food was reported as a motivator. For example, MCI-A stated

It increases my enjoyment of eating...when I have beautiful fruits and vegetables and seafood, I get inspired, it inspires me to make something really nice for dinner.

Adherence can be affected by a number of factors, positively or negatively, most notably by time, as outlined in the following theme.

Time. The theme of Time consists of codes that were used to describe instances where participants stated that time was an important consideration with regard to food acquisition and/or preparation. Overall, time (or rather lack thereof) was mentioned as having a negative effect on dietary habits, making it an important barrier to consider. Time barriers that were most

frequently highlighted included competing demands, travel, and food preparation time. Competing demands included both family and workplace responsibilities. Travel also was mentioned as a barrier, referring to travelling for work purposes, including commuting to work.

R50-C described one such scenario:

I think it's society in general today, when I look at my children who are running their children to soccer games, so it's likely everybody's grabbing food or you know you're working all day and you get home, and it's easier to stop in at Wendy's or a pizza place and grab something. And then again you get home, and eat, and there's a course you're gonna take, so everybody's running more.

Participant MCI-A also stated that working had a negative effect on her diet:

I used to forget to eat when I was working.

Several reported having to resort to fast food options or eating while driving, none of which enabled them to have proper, nutritious meals. For example, R71-B stated:

Maybe grab something at a fast food place for lunch, maybe had something for breakfast. And now it's 8:00 in the evening, you're dead tired, and you're in a strange town, you see the McDonalds on the corner.

There was brief mention of advance meal preparation as a way to overcome this barrier.

However, there were no indications that this was a possibility for everyone. For example:

If I'm grilling a chicken breast I would do two or three and then have the other ones cold with a salad. (H71-E)

It is important to note that retirement was seen as a facilitator with most participants reporting that they have a lot more time post retirement. Participant R71-D gave an example:

You know when I was working I would have never been able to be... to contribute the

kind of time that I do today to prepare my own meals, you know, life really changed when I retired, you know, my wife is still working at the time, I took over the culinary responsibility, you know it's just snowballed after that, she enjoyed me taking over the reins like your family and at the same time it's a blessing a lot of times.

While time for food preparation was mentioned often, time was not the only issue surrounding the theme of food preparation.

Food Preparation. The theme of Food Preparation consists of codes that refer to issues pertaining to preparing food (e.g., knowledge, skills, equipment, etc.), excluding preparation time, since time was identified as a separate category within this domain. Overall, codes pertaining to the theme Food Preparation were identified as either barriers or facilitators to dietary change. Food preparation is seen by some as too great of a challenge, while some had stated that they have limited to no interest in cooking, like R50-E:

I couldn't, you know what I hate cooking, I wish my culinary skills were better.

For others, the barrier was not the act of food preparations, but rather the preferences of their family members that they considered while preparing meals. For example, R50-B stated:

My daughter-in-law, she was vegan, now she's vegetarian. So she's been living with us, and it was really hard as vegan to cook, because there was so many things she didn't have, but we worked around it and now she's vegetarian, it's a lot easier.

Participant H50-A made a similar statement:

My daughter is very anti-fish so while she's at home I always feel compelled to make something that all three of us will eat, so we don't eat that much fish and I would like to get more of that in a bit.

Shelf-life of food was another identified barrier in food preparation, as the MeDi features an

abundance of fresh ingredients, which are not always on hand. For example:

Lettuce, green onions, some of these things that you want them fresh. They don't keep very well. (H71-C)

Food preparation also was a facilitator for some, like MCI-B:

Some people feel that, just preparing it, well it's gonna be really fancy it's gonna be a special way to prepare this, it's not.

MCI-B also stated his belief that education is key to food preparation in order to show people that healthier eating is not as complicated as it seems:

I think if you educate the people to understand a little bit more of how simpler it is with a Mediterranean diet, I think you get a lot of more people going for it. That's how I feel anyway, that's how I felt, you gotta, have to prepare it a certain way and it wasn't, it's simpler.

Other participants identified the use of specialized kitchen appliances as a facilitator to dietary change, where the appliances either enabled them to simplify preparation (H71-D gave an example of a countertop oven, which was easier to operate and used less electricity) or to enable them to cook foods they enjoy in a healthier way (R50-D gave an example of an air fryer). Those who were completely or jointly responsible for food preparation reported fewer issues with dietary change (H71-D, H71-E), with one participant (R71-D) reporting her enjoyment of joint preparation as a further motivator:

I love cooking with my wife and I spend a lot of time in the kitchen together.

Not being responsible for own food preparation was identified as either a barrier or a facilitator, being highly dependent on the habits of the person who was responsible for choices and preparation. Furthermore, some participants reported that they relied on pre-made meals due the

aforementioned lack of food preparation skills, as in the case of H71-C, who stated that he consumes 2 to 3 frozen meals per week. The preparation was identified as a barrier as most of the meals available to him do not fall within MeDi recommendations:

In fact, you don't see those in freezers. (H71-C)

Overall, food preparation was not a strong barrier to the adoption/adherence to the MeDi, regardless of participant group. Several factors can have an impact on food preparation, one of which is personal food preference.

Personal Food Preferences. The theme of Personal Food Preferences included statements made about self-oriented choices that may affect adoption of or adherence to the MeDi. As expected, an aversion to fish was the largest barrier to the MeDi. For example, R50-E stated:

I don't like fish per se...the only thing for me in this diet that I wouldn't, apart from the red wine cause I could incorporate that you know we have Sunday meals we drink, is the fish.

This included cohabiting family members' aversion as well, as in the example given by H50-A:

My daughter is very anti-fish.

Taste was mentioned as a reason for avoiding fish, like for R50-C:

I don't like the Atlantic salmon, to me is too strong.

Taste as a barrier was not limited to fish. Participant H71-B stated that he is not interested in food that does not taste good, regardless of health benefits:

I'm not going to be encouraged particularly, unless it tastes awfully good I'm not going to do it.

Though mentioned as a problem for one of the participants, the prominent feature of vegetables

within the MeDi was seen as a facilitator. For example, MCI-D stated:

Sometimes my sole meal is a salad, and a variety of leafy and shredded carrots, or whatever else happens to be in it, and I always add raisins and sunflower seeds.

Participants R71-A, R71-B, and R71-D echoed this sentiment:

I love vegetables... not so much carrots and beets but a lot of vegetables. (R71-A);

I like fruits and vegetables like all my life we always had them at home. (R71-B);

I love vegetables. I love fruit. (R71-D)

Individuals from the healthy groups did not speak much about vegetables, positively nor negatively. Interestingly, the one participant who mentioned vegetables as a problem (H50-C) took issue with the amount of vegetables that are recommended, rather than disliking vegetables outright. Dislike for fried and processed foods, along with a preference for fresh and whole foods were noted among some participants, which facilitated a change in their habits. For example, MCI-A stated:

I like taking the time to prepare, 'cause I don't like processed food.

Those who mentioned liking a variety of foods were more receptive of the MeDi than those who admitted a narrow food interest, such as R50-B:

I only had, I think, spaghetti when I was in school (nursing). I never had anything different. My husband's tastes are so wide and mine are so narrow. Like, I really don't try much, you know? My kids do, they eat all kinds of food so I think I'm just stuck in my ways.

One participant, H50-E, expressed a concern regarding how the MeDi would fit into his rigid breakfast preferences because he was not interested in completely changing the meal:

Breakfast is quite important to me so it would be a case of where I fit into that particular

meal.

There was no apparent difference among the participant groups with regard to personal food preferences. As noted in some of the abovementioned examples, relationships influenced dietary habits.

Relationships. The theme of Relationships consists of codes that were developed to describe how relationships may effect dietary change including the adoption and adherence to the MeDi. Relationships are not limited to familial or to romantic relationships, and include relationships based around online interactions. Relationships were found to be both barriers and facilitators to dietary change, being highly dependent on the individual's case. One participant (R71-D) stated that his dietary habits stemmed from his grandmother's habits during the participants' childhood since the grandmother was his caregiver at the time. The grandmother came to Canada over a century ago from the Mediterranean region, and R71-D reported unintentional adherence to the MeDi. In this case, the participant's relationship with the grandmother is viewed as a facilitator. Another participant (R71-B) noted that fish was not a staple in his childhood home and that he did not consume fish until later in life. In this case, the habits developed in childhood were a barrier to dietary change. Two participants (H71-F, H71-B) reported having no responsibility for food selection and preparation, and resultingly having no input regarding how food is selected and/or prepared. This can be a barrier if their spouses are not in favour of dietary change but can be a facilitator if spouses are open to change. The finding highlights further the dependency of the nature of the relationship with regard to dietary habits and whether changes are possible. One cognitively impaired participant (MCI-C) reported that her spouse was averse to consuming many vegetables and fruits. Fortunately, she reported that she was still primarily responsible for meal preparation and that the spouse's aversion did not

affect her own preference for vegetable and fruit consumption. As MCI-C's impairment progresses, this may become a barrier for her. Several participants made statements that demonstrated how spousal support can be a facilitator. For example, when asked about how her spouse helped with dietary change, H50-D remarked:

My husband wasn't [interested at first]. But now he's in with me. It's wonderful. So, we're doing okay.

Participant R71-C mentioned that his spouse would gather information at his request regarding diet and food preparation, indicating a level of spousal commitment. Beyond the family, cultural expectations were mentioned as a possible barrier to dietary change by R71-E. However, the situations where cultural expectations for meals dictated what was served were limited to gatherings, such as weddings:

If you wanted to throw a splash for your daughters' wedding, you would certainly have five different kinds of meat and lots of it, and that showed that you are prosperous. So there is a whole social strata thing that comes in many countries regarding meat.

Some participants mentioned that connecting with other people and talking about diet and food gave them a chance to learn a lot and helped them make changes. For example, R50-D stated:

What I'm also thinking too is that in your case, you're online and like "oh, I need somebody else" and so forth. And there you go, you've got somebody else that can be there for you to give you the motivation.

There was a mention by R70-E of how employer initiatives can be a facilitator, if the employer implements strategies that enable their employees access to healthy foods, as in the case of Google:

Google, apparently is trying to set up places where their workers can, in fact, take off

from the hurly-burly kind of thing and eat a meal and digest and they make it a necessity for the job so they acknowledge it as a problem but they say you got to take the time to look after yourself, here's some quiet time.

The finding suggests that the relationship of an individual with their employer may affect dietary habits. While relationships did play a part in dietary choices, these codes were not prominently featured in the overall analysis. There was no apparent difference among the participant groups in this regard. Several participants identified strategies they had used to attempt to overcome some of the previously mentioned barriers.

Strategies. The theme of Strategies consists of codes that refer to mentions of specific ways to overcome barrier to adoption and adherence. The most common identified strategy involved substituting unhealthy or disliked foods for similar foods. For example, MCI-A stated:

When I bake, it inspires me to change the recipe, so instead of putting in all the oil I put in things like shredded zucchini in there, I would use all the sugar, I put in extra things I grind like wheat germ and seeds, and I just find when I eat these it's so good.

One participant (MCI-C) reported accommodating varying family meal preferences within the same meal:

Fruits and vegetables not too much yeah, that's a problem. And he likes his margarine and of course that's not the right thing to eat. We eat separately, we eat together but I mean you know he's got his likes and I have mine we kind of work that out.

Another identified strategy included combining disliked foods with liked foods to offset the taste barrier (R50-C):

My girlfriend, every morning she takes kale, and blueberries and, 'cause she doesn't like the taste of kale when she when puts it in her smoothie every morning, so she's giving in,

that's what she tells me all the time but I don't mind it I like kale. But to do, if you don't like it, put it in your morning smoothie or your lunch smoothie, and just cram it, she said you know with your blueberries, and kale, and flax seeds, and she puts psyllium husks, so that's a good thing.

Cost of food and shelf life were identified as barriers. Strategies to overcome the barriers included using frozen foods or buying in bulk and freezing as a potential strategy to save on cost and increase shelf life (R71-E), or making more frequent trips to the store, which also deals with shelf life limitations (H71-E):

I find shopping a couple times a week for fresh produce is best. So you don't keep it around for too long.

Emphasizing the nutritional value of produce over size and shape was mentioned as way to overcome cost, as it is possible for some to purchase this kind of produce at a significantly reduced cost.

[REDACTED] coming up with that now, "ugly fruit" or I don't know what they call it.
(R50-B)

Also, some participants mentioned that growing vegetables themselves helped with cost reduction. For example, MCI-B stated:

I grow Swiss chard and the spinach and the carrots, onions, but I know that there's things that I could probably put in my garden that would be added to, so it would be good for me to take out of the garden or put it in the garden and put it in the freezer and cook it during the winter time.

As evidenced above, the at-risk and MCI participants reported more strategies, but this theme was not prominently featured in the overall analysis.

Socioeconomic Profile of Participants

It is important to identify the socioeconomic profile of the participants in this study in order to be able to understand the applicability of these results to various other situations. Fifteen participants completed at least a post-secondary diploma or degree, with many completing post-graduate degrees (n=8), meaning that 23 out of 28 participants completed higher education. Most of the latter came from the healthy groups, with only a single participant from the older at-risk group having a post-graduate degree. Most participants declined to provide their annual household income, but there are few facts worth reporting here. The highest reported incomes corresponded with the healthy groups (1 individual in H50 reported over \$200,000/year; 2 individuals in H71 reported over \$100,000/year. Only two participants in R50 reported annual income: \$50,000 and \$80,000 per year. No R71 participants reported their income. Two participants from the MCI group reported annual income: \$50,000 and \$60,000 per year. The overwhelming majority of the participants were of Caucasian descent and were born in Canada. Out of those not born in Canada, all but one are of Caucasian European descent. The remaining participant is from Sri Lanka. Those born outside of Canada spent the majority of their lives living in Canada, and all but three have English as their first language, though the remaining three are fluent English speakers.

Discussion

The aim of the study was to address the following research questions:

1. How familiar are Canadian older adults with the MeDi?
2. How willing are Canadian older adults with regard to adopting the MeDi into their lifestyle?
3. Are there any barriers and facilitators to MeDi adoption/adherence?

- a. Are any of these specific to any participant groups?

The *Knowledge and Skills* domain serves to answer RQ1, while the remaining domains of *Socioeconomics* and *Adoption of Habits* serve to answer the remaining research questions.

Older Canadian adults appear to have only a cursory knowledge of the MeDi. Many are willing to at least attempt the MeDi to see if it works for them. There are numerous barriers and facilitators associated with adopting the MeDi (and healthy eating in general), none of which are specific to a participant's study group (healthy vs. at-risk vs. memory-impaired). The participants' age group was more relevant in this regard.

Knowledge and Skills

The MeDi is perhaps the most widely-studied and recommended diet due to decades of scientific scrutiny. It was not surprising that most of the study participants had some familiarity with this diet. At the very least, their collective responses (regardless of participant group) indicated that they had heard of the MeDi prior to being recruited. Most participants reported hearing about the MeDi and that it was a “good diet” but were not familiar with its components, as highlighted in the theme of Knowledge within the *Knowledge and Skills* domain. Though most participants had heard of the MeDi, the majority were not very familiar with it. There were no observable differences among the three groups with regard to health status. While some participants were more eager to change their dietary habits, mostly due to issues around health (i.e., theme of Health) there were no meaningful differences regarding nutritional knowledge among the different participant groups. The lack of group differences suggests that increased knowledge alone is not enough to predict health outcomes regarding diet.

All participants, regardless of group, were interested in furthering their knowledge on the MeDi and nutrition in general, as evidenced through their responses indicating information

seeking behaviours (e.g., either referring to events outside the focus group, or by asking certain questions during the focus groups). Barriers emerged relative to the theme of Knowledge within the domain of *Knowledge and Skills*. The lack of knowledge in itself did not appear to be a barrier since no participants stated that they were unable to locate information on the MeDi specifically, or nutrition generally. However, curating the information became a problem for some, as they had difficulties in distinguishing “good information” from “bad information”. As far as they were concerned, there was a lack of authoritative information on the subject. It is important to note that participants were talking about this from their own layperson perspective, and not referring to the current state of the literature. In fact, for many of the participants, agreeing to participate in this study was motivated by a desire to learn more about the MeDi, specifically about its health benefits.

Some participants stated that they were concerned with the legitimacy of dietary claims because of past experiences with fad diets, and highlighted the negative connotation associated with the word “diet”, which was partly attributed to this. The inability to distinguish between actual scientific evidence and sensationalist claims could be a barrier for many who have the initiative to seek information. Most participants were willing to seek education and pay for classes if they could help them fill the knowledge gaps that their own individual information seeking attempts could not. While many stated they would prefer formal settings that featured experiential learning, there was a variety of formats deemed acceptable, which varied among individuals. Many participants preferred in-person instruction to online instruction, citing their age as the reason. The literature on optimal adult learning strategies shows experiential tasks and role playing, among other supportive strategies facilitate learning in adults (Yardley, Teunissen, & Dornan, 2012). Those who reported greater familiarity with information technology were

more open to non-traditional education, suggesting the possibility that increasing IT literacy among this population may be an indirect strategy to effect positive change. In the meantime, greater promotion of existing traditional educational initiatives may be beneficial. This type of initiative would have to be sensitive to the preferences of this age group. It is important to note that special consideration should be given to addressing individuals' beliefs and perceptions, as those can influence both knowledge and behaviour.

Participants' beliefs and perceptions had a mostly negative effect on dietary habits. Some of these beliefs may stem from the aforementioned lack of knowledge, or rather their ability to evaluate the found information. There was a noted belief in some that premade (processed) food is automatically unhealthy. While the majority of processed food available for purchase is not healthy (Stuckler & Nestle, 2012), the method of preparation and the ingredients used should be used to evaluate the healthiness of a food rather than who prepared the food. For example, some perceived a salad made "from scratch" to be healthier than a premade salad (with comparable ingredients). This can be a larger barrier for individuals who stated that a lack of preparation time as a concern when attempting to follow a healthy diet because they may be discarding a valuable strategy (providing that the additional cost is not an issue). Broadbent, Donkin and Stroh (2011) indicated that individuals' perceptions are an important predictor of diet adherence. The implication is that efforts must be made to change perceptions where necessary to optimize diet adoption and adherence.

Once an understanding of the participants' background knowledge was obtained, it was possible to examine their experiences with food, from having physical access to places where they can purchase healthy food, to being able to afford healthy food and how other sociocultural factors affect their experience with food. The domains of *Socioeconomics* and *Adoption of*

Habits were used to answer RQ3 and 3a, with the former representing extrinsic factors and the latter representing intrinsic factors.

Socioeconomics

Despite the fact that most participants acknowledged that healthy food costs more than unhealthy food, none stated that this was a barrier for them. It is important to note that the participants were not representative of the general population, with most having higher than average socioeconomic status. One participant stated that she believed that healthier eating is less expensive than unhealthy eating. This can be seen as a problem, if those with fewer means are seen to be unhealthy due to intrinsic factors instead of not being able to afford healthy food. An example of this can be seen in the Government of Ontario's publication of a shopping list in 1995 for individuals receiving social assistance (subsequently dubbed the "welfare diet") (Stapleton & Yuan, 2018). Most participants were sensitive to the economic struggles of those with less means, and supported initiatives that could make food more accessible and affordable. Though cost was not a stated barrier for them, the consensus was that food is too expensive, particularly healthy food. The implication of this finding is that individuals with lower income levels can struggle to afford adhering to a healthy diet such as the MeDi.

For these participants, most of the barriers identified here involved factors beyond the individual's control. The food industry was not mentioned in a positive light. Participants expressed frustration with the apparent lack of ethics in the food industry, namely misleading advertising (e.g. "real ingredients") and food labelling. Misleading information was not a facilitator to making informed decisions and evaluating the healthiness of a food subsequently required considerable effort on their part, from reading complicated labels to trying to understand the information presented on these labels. This is a bigger problem to the younger participants,

many of whom are still employed and struggle to meet the various demands of their day. Addressing these issues remains a pressing matter, as other researchers demonstrated that many consumers have a knowledge gap when it comes to making informed decisions when selecting food (Poole, Marti, & Giménez, 2007). Poole and colleagues (2007), among other investigators, concluded that policy change would be beneficial not only for consumers, but for the food industry as society in general as well (Stuckler & Nestle, 2012). More than a decade has passed, but little to no progress has been observed in practice. As nutrition claims are known to influence the perception of food items (Gravel et al., 2012), policy initiatives regarding validity of claims are necessary to prevent unethical conduct in the food industry. The importance of policy intervention cannot be overstated, with an apparent failure of large corporations to effectively self-regulate (Moodie et al., 2013).

The healthcare system was not seen to be a positive facilitator for dietary change among the participants. This was partly due to a lack of consultation time with a physician about diet as well as their dissatisfaction with the amount of nutritional information the physician was able to provide, with some suggesting that they believe that physicians are not well-equipped presently to deliver this type of information. It is important to note that many stated they would like to see their physicians improve their capabilities in this regard. However, in the present acute delivery system this type of intervention may not be a good fit. One reason for this was brought up, namely that many individuals are not proactive about their health and in many instances seek a simple remedy, usually in the form of pharmacotherapy. Benefits of a positive diet are not as tangible to individuals, and it often takes time to see positive results. This remains a significant barrier to dietary change, suggesting a sustained emphasis on the importance of prevention. Many of the participants cited various health issues as their “wake up call” (e.g. heart attack,

stroke). None reported that they were not told about preventive strategies, but those were featured less prominently during their experiences with the healthcare system. There was a stated desire for societal change on top of individual habit change. If there are fewer socioeconomic barriers to adopting a healthy diet such as the MeDi, the adoption of better dietary habits would be less difficult to the individual.

As there is an important correlation between lower socioeconomic status and negative health outcomes (Stringhini et al., 2017), it is important that policy makers are aware that those of lower socioeconomic status need special consideration. If the actual cost of healthy food remains a barrier to good health for many, no amount of additional knowledge can help an individual overcome this barrier. While there are many societal factors that can influence an individual's dietary habits, there are other important individual factors contributing to dietary behaviour and the adoption of dietary habits.

Adoption of Habits

The younger age groups reported more significant individual barriers to healthier eating, which seemed to have a relationship with their employment status. This was reinforced by statements made by the older groups about their past experiences while they were still working. This is important because an increasing number of Canadians are working longer before retirement, with women increasing the average hours worked per week (Carrière & Galarneau, 2011). The participants also reported paying more attention to disease prevention and healthy eating as they aged. The healthy older participants reported having the overall healthiest dietary habits, some of whom inadvertently adhered to the MeDi to varied extent, display the least desire to formally adopt the MeDi into their lifestyle. This was not surprising due to their good health status and positive dietary habits. Among those at-risk for dementia or with MCI, they reported

commonly that adverse health outcomes were motivators for dietary change. Among the healthy participants, prevention of such outcomes was cited as a motivator for adhering to a healthy diet. There was a variety of health concerns reported during the interviews. Consequently, it may be wiser to promote diets such as the MeDi in relation to good health overall rather than the more traditional approach of recommending the MeDi for cardiovascular health or for improving cognitive functioning. Just as it was highlighted to examine common threads between AD and VaD on related health status issues (Culum, Orange, Forbes, & Borrie, 2012), it is important to broaden the applicability of the MeDi with regard to a general preventive health strategy rather than addressing a particular disease or syndrome. A part of the appeal of the MeDi was the evidence of its usefulness in preventing or delaying certain conditions (Chrysohoou et al., 2004; Singh et al., 2002), and its wider applicability (Knoops et al., 2004) was interesting to many of the participants in this study.

Several instances of unintentional and partial MeDi adherence were observed. These participants were surprised to hear that they could adopt the MeDi with less effort than they initially thought. This ease of transition could be seen as a facilitator for MeDi adoption. Rather than emphasizing the components of the MeDi without additional concept, initiatives that compare the degree of change required to adopt the MeDi may yield additional success. It is important to note that personal food preferences play a key role with regard to food selection, with fish and vegetables being cited as issues for some participants. While fish is considered to be an important component of the MeDi, there are alternative sources of beneficial fatty acids, such as flax, that may be used in instances where the individual is unwilling or unable to consume fish and seafood for any reason (e.g. food allergy, pregnancy). Vegetables, on the other hand, are an unavoidable part of the MeDi. There were very few mentions of complete aversion

to vegetables (mostly pertaining to family members' dietary habits). In this case, it may be beneficial to create materials that can inform individuals about proper vegetable substitutions, as vegetables vary considerably with regard to their nutritional value. However, as personal food preferences have a demonstrated affect on fruit and vegetable intake (Kvaavik, Lien, Tell, & Klepp, 2005), it is crucial that all interventions recognize and address this barrier. Since many individuals reported some level of confusion as to what they should select while shopping for food, they could benefit from information that would simplify this process for them.

Additionally, some participants mentioned how their caregivers instilled certain dietary habits in them during their childhood, which is in line with previous research which suggested that family food consumption can have a lasting effect on a person's diet (Atkins et al., 2015). One implication here is that it is possible for adults that grew up with less financial means during childhood can maintain unhealthy eating habits even if their SES improves in their later years.

As participants became more informed about MeDi components during the focus group interviews, there was increased interest in adoption, or at least a willingness to try the diet. Participants stated that they discovered that the diet is not as restrictive as they had previously thought and their level of interest appeared to rise as they received more detailed information. As the participants became aware of the many choices they can make while following the MeDi, they were more interested in trying to see if they can make this type of diet work for them, especially for those who stated that they had to accommodate other family members' food preferences as well. The implication here is that dietary interventions should consider emphasizing choice versus restriction. While certain restrictions (i.e., saturated fats) are necessary, emphasizing the various healthy substitutions is more important if the goal is to make sustainable dietary change. Participants were less focused on restrictions when their choices of

recommended foods were extensive. Cultural considerations and mealtime rituals were brought up and were considered by some to be a barrier to MeDi adoption. These individuals expressed an interest in trying the MeDi in order to see if they can make it work under these conditions. There were several instances where participants stated that they may have a hard time following the MeDi because they do not live in the Mediterranean, which again emphasized the powerful role of perception in dietary decisions (Paquette, 2005). Once emphasis was placed on flexibility instead of restriction, the willingness to try the MeDi increased. There are obviously multiple factors influencing food selection, and a universal approach to effect dietary change may not be beneficial to all. Most importantly, SES should always be considered when making dietary change recommendations as it is an unsurmountable barrier for some.

There were several instances where participants mentioned strategies they have used to overcome various barriers to healthy meal preparation, such as using specialized equipment for cooking, or strategies to save cost and time (such as freezing of food). As preparation of food and time were identified as significant barriers to healthy eating, providing individuals with diverse strategies (i.e. those tailored for working vs. non-working individuals) may be more beneficial than providing a general guide to healthy eating or the MeDi. As individuals are already willing to make these changes, providing them with additional tools can help ease their transition. As behavioural changes involve time and effort special consideration should be given to how individuals can change their dietary behaviour in addition to providing them with the information on what to eat.

Behaviour Changes

According to the TTM, behaviour change takes time and should not be viewed as a single event (Prochaska & DiClemente, 1984). With regard to adoption of healthy dietary habits,

individuals are frequently able to access information through various sources, as mentioned in the focus group interviews. There was no mention of a temporal process, nor tracking of one's progress over time. This is important because it was mentioned that a lack of observable results when trying to eat healthy was a barrier with regard to healthier eating. Behavioural change is a complex process that is dependent on multiple variables (both intrinsic and extrinsic to the individual). There were no participants who were unaware of the importance of diet on health, indicating that none of these participants are in the precontemplation stage of the TTM and are at least contemplating changing their diet. They were much less aware of how to make a positive, sustainable change in this case. In their case, greater benefits can be realized by providing them information on how to change as a complement to information on what to and what not to eat. There were several statements that suggested preparation (intending to take action), but a lack of information seemed to prevent the progress to this stage for some. Few of the participants could be considered to be in the action stage of the TTM with regard to healthy diet adoption, as they have made mention of significant progress, but had to remain vigilant about their diet. Fewer still made statements corresponding with the final stage (maintenance). The healthy older participants were most likely to be in this stage, suggesting a possibility that their health status is a result of their positive dietary habits, but it is equally possible that their positive dietary habits are a result of other variables, which are discussed below.

Study Limitations

There are some noteworthy limitations of this study. Due to the chosen research method and sample size, it is not possible to generalize these results to a broader population. It also is possible that participants were not completely truthful about their dietary habits because they may have chosen more socially desirable answers in a group setting, which is an inherent

limitation of this method. Another limitation of the group format is that more dominant ideas (i.e., those expressed by several or outspoken group members) can suppress lesser dominant ideas (i.e., those expressed by fewer members) (Acocella, 2011). Additionally to size, the demographics of the sample are not representative of the general older adult population in Canada. There were fewer women than men in the sample, and most had an apparent higher socioeconomic standing than that of the average Canadian older adult, which is estimated at CA\$37,000 (StatCan, 2018a). Most participants completed higher education, with the healthier groups having reached higher degrees (i.e. post-graduate) than the rest. This is an important observation as an individual's level of education is linked with SES (Winkleby, Jatulis, Frank, & Fortmann, 1992) and SES in turn linked with health outcomes (Smith, 2004). Most of the participants were native speakers of English and came from similar cultural backgrounds. Today's multicultural landscape introduces additional considerations for the future, as newer immigrants from more diverse cultural backgrounds age in Canada. Additionally, while those of lower socioeconomic status are at a greater risk for adverse health outcomes (Smith, 2004; Winkleby et al., 1992), recruitment of those individuals into studies like this remains a challenge, as they may have less time to volunteer for study. The purpose of this study was not to generalize, but rather to examine perceptions of Canadian older adults they find helpful or detrimental when trying to make a positive dietary change. The goal was to suggest possible new approaches to dealing with a continued problem, in this case the proliferation of negative dietary habits. As these habits have been implicated long ago as contributors to negative health outcomes in general, and dementia more specifically, continued study is warranted. The findings suggest that despite considerable awareness efforts regarding the links between diet and health, significant barriers remain when trying to change one's own behaviour.

Conclusion

The results of this study suggest that changing one's behaviour, such as adopting a healthy diet, can be a difficult process, with the difficulty varying based on each individual's situation (i.e., attitudes, family, health, budget, education). It is important to consider these individual factors when designing future studies and policies. While individuals may be aware of the MeDi and that it may be beneficial to them, continued education is necessary, as evidenced by the lack of in-depth MeDi knowledge among the participants. The findings from the current study identified numerous barriers to dietary change, indicating that very few are considered to be unsurmountable where the issue is intrinsic to the individual (i.e., food preference vs. cost of food), and that continued education should be a priority for those with the means to make positive change. However, both intrinsic and extrinsic factors should be considered when making dietary recommendations. Individuals at-risk for developing dementia and those with MCI are more motivated to change and can face greater obstacles to change. Results suggest that making these kinds of changes earlier in life may be more beneficial, as our older healthy group participants reported following healthier diets than most. This is supported by previous findings that demonstrate the influence of childhood circumstances on later-life behaviour (Atkins et al., 2015).

Future Implications

Additional studies should examine barriers and facilitators to the MeDi in other groups of adults and older adults, particularly those who are more vulnerable such as lower socioeconomic status, cultural ethnicity, among other parameters. As cost was identified as a potential barrier, it is necessary to examine if it is at all possible for such individuals to make this change and what needs to be done in those cases. Furthermore, additional study with a larger, more diverse sample

is required in order to identify specific vulnerable populations, as well as to make any generalizations.

References

- Acocella, I. (2012). The focus groups in social research: advantages and disadvantages. *Quality & Quantity*, 46(4), 1125-1136.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Alzheimer's Association. (2018). *2018 Alzheimer's Disease Facts and Figures*. Retrieved from <https://www.alz.org/alzheimers-dementia/facts-figures>
- Alzheimer's Disease International. (2018). *World Alzheimer Report 2018*. Retrieved from London, UK: <https://www.alz.co.uk/research/world-report-2018>
- Alzheimer Society of Canada. (2016). *Prevalence and Monetary Costs of Dementia in Canada*. Retrieved from http://alzheimer.ca/sites/default/files/Files/national/Statistics/PrevalenceandCostsofDementia_EN.pdf
- Atkins, J. L., Ramsay, S. E., Whincup, P. H., Morris, R. W., Lennon, L. T., & Wannamethee, S. G. (2015). Diet quality in older age: the influence of childhood and adult socio-economic circumstances. *The British Journal of Nutrition*, 113(9), 1441-1452.
doi:10.1017/S0007114515000604
- Birks, J., & Craig, D. (2006). Galantamine for vascular cognitive impairment. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.CD004746.pub2
- Broadbent, E., Donkin, L., & Stroh, J. C. (2011). Illness and treatment perceptions are associated with adherence to medications, diet, and exercise in diabetic patients. *Diabetes Care*, 34(2), 338-340.
- Canadian Institute for Health Information. (2018). *Dementia in Canada: Summary*. Retrieved

November 02, 2018, from <https://www.cihi.ca/en/dementia-in-canada/dementia-in-canada-summary>

Carrière, Y., & Galarneau, D. (2011). Delayed retirement: A new trend. Ottawa, ON: Statistics Canada.

Charlton, K. E. (2002). Eating well: ageing gracefully! *Asia Pacific Journal of Clinical Nutrition, 11*, S607-S617.

Chrysohoou, C., Panagiotakos, D. B., Pitsavos, C., Das, U. N., & Stefanadis, C. (2004).

Adherence to the Mediterranean diet attenuates inflammation and coagulation process in healthy adults: The ATTICA Study. *Journal of the American College of Cardiology, 44*(1), 152-158.

Crabtree, B. F., & Miller, W. L. (1999). *Doing qualitative research*. Thousand Oaks, CA: Sage Publications.

Culum, I., Orange, J. B., Forbes, D., & Borrie, M. (2012). *Omega-3 Polyunsaturated Fatty Acids and Mixed Dementia*. Paper presented at the 27th International Conference of Alzheimer's Disease International, London, UK.

Curry, S. J., Kristal, A. R., & Bowen, D. J. (1992). An application of the stage model of behavior change to dietary fat reduction. *Health Education Research, 7*(1), 97-105.

Dayton, S., Pearce, M., Goldman, H., Harnish, A., Plotkin, D., Shickman, M., . . . Dixon, W. (1968). Controlled trial of a diet high in unsaturated fat for prevention of atherosclerotic complications. *The Lancet, 292*(7577), 1060-1062.

DiClemente, C. C., & Prochaska, J. O. (1982). Self-change and therapy change of smoking behavior: A comparison of processes of change in cessation and maintenance. *Addictive Behaviors, 7*(2), 133-142.

- Dinu, M., Pagliai, G., Casini, A., & Sofi, F. (2017). Mediterranean diet and multiple health outcomes: an umbrella review of meta-analyses of observational studies and randomised trials. *European Journal of Clinical Nutrition*, 72, 30-43.
- Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Journal of Medicine*, 303(3), 130-135.
- Gollwitzer, P. M., & Bargh, J. A. (1996). *The psychology of action: Linking cognition and motivation to behavior*. New York, NY: Guilford Press.
- Gravel, K., Doucet, É., Herman, C. P., Pomerleau, S., Bourlaud, A.-S., & Provencher, V. (2012). “Healthy,” “diet,” or “hedonic”. How nutrition claims affect food-related perceptions and intake? *Appetite*, 59(3), 877-884.
- Guba, E. G., & Lincoln, Y. S. (1981). *Effective evaluation: Improving the usefulness of evaluation results through responsive and naturalistic approaches*. San Francisco, CA: Jossey-Bass.
- Hardman, R. J., Kennedy, G., Macpherson, H., Scholey, A. B., & Pipingas, A. (2016). Adherence to a Mediterranean-style diet and effects on cognition in adults: a qualitative evaluation and systematic review of longitudinal and prospective trials. *Frontiers in Nutrition*, 3, 22.
- Jacobs Jr, D. R., Luepker, R. V., Mittelmark, M. B., Folsom, A. R., Pirie, P. L., Mascioli, S. R., . . . Carlaw, R. W. (1986). Community-wide prevention strategies: evaluation design of the Minnesota Heart Health Program. *Journal of Chronic Diseases*, 39(10), 775-788.
- James, R., Henrikson, D., Tyler, C., & Christian, J. (1991). The North Coast Cholesterol Check Campaign. Results of the first three years of a large-scale public screening programme. *The Medical Journal of Australia*, 154(6), 385-391.

- Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly*, *11*(1), 1-47.
- Kalaria, R. N., & Ballard, C. (1999). Overlap between pathology of Alzheimer disease and vascular dementia. *Alzheimer Disease & Associated Disorders*, *13*(Suppl 3), S115-123.
- Knoops, K. T., de Groot, L. C., Kromhout, D., Perrin, A.-E., Moreiras-Varela, O., Menotti, A., & Van Staveren, W. A. (2004). Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: the HALE project. *JAMA*, *292*(12), 1433-1439.
- Kristal, A. R., Glanz, K., Curry, S. J., & Patterson, R. E. (1999). How can stages of change be best used in dietary interventions? *Journal of the Academy of Nutrition and Dietetics*, *99*(6), 679.
- Kumar, A., & Singh, A. (2015). A review on Alzheimer's disease pathophysiology and its management: an update. *Pharmacological Reports*, *67*(2), 195-203.
- Kvaavik, E., Lien, N., Tell, G. S., & Klepp, K.-I. (2005). Psychosocial predictors of eating habits among adults in their mid-30s: The Oslo Youth Study follow-up 1991–1999. *International Journal of Behavioral Nutrition and Physical Activity*, *2*(1), 9.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Thousand Oaks, CA: Sage Publications.
- Lourida, I., Soni, M., Thompson-Coon, J., Purandare, N., Lang, I. A., Ukoumunne, O. C., & Llewellyn, D. J. (2013). Mediterranean diet, cognitive function, and dementia: a systematic review. *Epidemiology*, *24*(4), 479-489.
- Middleton, L. E., & Yaffe, K. (2009). Promising strategies for the prevention of dementia. *Archives of Neurology*, *66*(10), 1210-1215.
- Moller, A. C., Merchant, G., Conroy, D. E., West, R., Hekler, E., Kugler, K. C., & Michie, S.

- (2017). Applying and advancing behavior change theories and techniques in the context of a digital health revolution: proposals for more effectively realizing untapped potential. *Journal of Behavioral Medicine*, 40(1), 85-98.
- Moodie, R., Stuckler, D., Monteiro, C., Sheron, N., Neal, B., Thamarangsi, T., . . . Group, L. N. A. (2013). Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra-processed food and drink industries. *The Lancet*, 381(9867), 670-679.
- Paquette, M.-C. (2005). Perceptions of healthy eating: state of knowledge and research gaps. *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*, S15-S19.
- Peterson, S. L., Dodd, K. M., Kim, K., & Long Roth, S. (2010). Food Cost Perceptions and Food Purchasing Practices of Uninsured, Low-Income, Rural Adults. *Journal of Hunger & Environmental Nutrition*, 5(1), 41-45.
- Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Poole, N. D., Marti, L., & Giménez, F. V. (2007). Quality perceptions under evolving information conditions: Implications for diet, health and consumer satisfaction. *Food Policy*, 32(2), 175-188.
- Prochaska, J. O., & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy*. Homewood, IL: Dow Jones-Irwin.
- Rosenstock, I. M. (1974). The health belief model and preventive health behavior. *Health Education Monographs*, 2(4), 354-386.
- Scarmeas, N., Stern, Y., Mayeux, R., Manly, J. J., Schupf, N., & Luchsinger, J. A. (2009). Mediterranean diet and mild cognitive impairment. *Archives of Neurology*, 66(2), 216-225.

- Schwingshackl, L., Missbach, B., König, J., & Hoffmann, G. (2015). Adherence to a Mediterranean diet and risk of diabetes: a systematic review and meta-analysis. *Public Health Nutrition*, 18(7), 1292-1299.
- Singh, R. B., Dubnov, G., Niaz, M. A., Ghosh, S., Singh, R., Rastogi, S. S., . . . Berry, E. M. (2002). Effect of an Indo-Mediterranean diet on progression of coronary artery disease in high risk patients (Indo-Mediterranean Diet Heart Study): a randomised single-blind trial. *The Lancet*, 360(9344), 1455-1461.
- Smith, J. P. (2004). Unraveling the SES: health connection. *Population and Development Review*, 30, 108-132.
- Sniehotta, F. (2009). An experimental test of the theory of planned behavior. *Applied Psychology: Health and Well - Being*, 1(2), 257-270.
- Stapleton, J., & Yuan, Y. (2018). Ontario's "welfare diet" in 2018. *Policy Options*. Retrieved November 02, 2018, from <http://policyoptions.irpp.org/magazines/august-2018/ontarios-welfare-diet-2018/>.
- Statistics Canada. (2018a). *Income of individuals by age group, sex and income source, Canada, provinces and selected census metropolitan areas*. Retrieved November 02, 2018, from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110023901&pickMembers%5B0%5D=1.1&pickMembers%5B1%5D=2.8&pickMembers%5B2%5D=3.1&pickMembers%5B3%5D=4.1>
- Statistics Canada. (2018b). *Leading causes of death, total population, by age group*. Retrieved November 02, 2018, from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039401&pickMembers%5B0%5D=2.29&pickMembers%5B1%5D=3.1>

- Strauss, A., & Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Thousand Oaks, CA: Sage Publications.
- Stringhini, S., Carmeli, C., Jokela, M., Avendaño, M., Muennig, P., Guida, F., . . . Bochud, M. (2017). Socioeconomic status and the 25× 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1· 7 million men and women. *The Lancet*, 389(10075), 1229-1237.
- Stuckler, D., & Nestle, M. (2012). Big food, food systems, and global health. *PLoS Medicine*, 9(6), e1001242.
- Thorne, S., Kirkham, S. R., & MacDonald - Emes, J. (1997). Interpretive description: a noncategorical qualitative alternative for developing nursing knowledge. *Research in Nursing & Health*, 20(2), 169-177.
- Thorne, S., Kirkham, S. R., & O'Flynn-Magee, K. (2004). The analytic challenge in interpretive description. *International Journal of Qualitative Methods*, 3(1), 1-11.
- Trichopoulou, A., & Lagiou, P. (1997). Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. *Nutrition Reviews*, 55(11), 383-389.
- van Sluijs, E. M., van Poppel, M. N., & van Mechelen, W. (2004). Stage-based lifestyle interventions in primary care: are they effective?. *American Journal of Preventive Medicine*, 26(4), 330-343.
- Whitmer, R. A., Sidney, S., Selby, J., Johnston, S. C., & Yaffe, K. (2005). Midlife cardiovascular risk factors and risk of dementia in late life. *Neurology*, 64(2), 277-281.
- World Health Organization. (2012). *Dementia: a public health priority*. Geneva, Switzerland: World Health Organization.
- World Health Organization. (2017). 10 facts on dementia. Retrieved November 02, 2018, from

<https://www.who.int/features/factfiles/dementia/en/>

- Widmer, R. J., Flammer, A. J., Lerman, L. O., & Lerman, A. (2015). The Mediterranean diet, its components, and cardiovascular disease. *The American Journal of Medicine*, 128(3), 229-238.
- Winkleby, M. A., Jatulis, D. E., Frank, E., & Fortmann, S. P. (1992). Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *American Journal of Public Health*, 82(6), 816-820.
- Xu, J., Zhang, Y., Qiu, C., & Cheng, F. (2017). Global and regional economic costs of dementia: a systematic review. *The Lancet*, 390(S47). doi:10.1016/S0140-6736(17)33185-9
- Yardley, S., Teunissen, P. W., & Dornan, T. (2012). Experiential learning: transforming theory into practice. *Medical Teacher*, 34(2), 161-164.

Appendix A

Focus Group Interview Guide

1. Ask group about any previous familiarity/experiences with the Mediterranean diet (MeDi). If some respond with yes, probe for extent of familiarity and/or experiences.
2. Introduce group to the MeDi, highlighting its components.
3. What would be some reasons for adopting the MeDi into your lifestyle?
4. What would be some reasons (barriers or hurdles) against adopting the MeDi? Include specific MeDi components that may be of particular concern to you.
5. What can be done to encourage you to adopt the MeDi into your lifestyle?

Appendix B

Ethics Approval



Research Ethics

Western University Health Science Research Ethics Board HSREB Delegated Initial Approval Notice

Principal Investigator: Dr. Joseph D. Orange
Department & Institution: Health Sciences/Communication Sciences & Disorders, Western University

Review Type: Expedited
HSREB File Number: 16697
Study Title: Cognitive Impairment and the Mediterranean Diet: A Canadian Perspective
Sponsor:

HSREB Initial Approval Date: February 23, 2016
HSREB Expiry Date: February 23, 2017

Documents Approved and/or Reviewed for Information:

Document Name	Comments	Version Date
Advertisement	Revised Ad - Healthy	2015/11/01
Advertisement	Revised Ad - MCI	2015/11/01
Advertisement	Revised Ad - At Risk	2015/11/01
Letter of Information & Consent	Healthy	2015/11/01
Letter of Information & Consent	MCI	2015/11/01
Letter of Information & Consent	At Risk	2015/11/01
Instruments	Demographic Form	2015/11/05
Instruments	Focus Group Guide	2014/10/28
Western University Protocol	Protocol (Clean)	2015/11/19

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above named study, as of the HSREB Initial Approval Date noted above.

HSREB approval for this study remains valid until the HSREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review.

The Western University HSREB operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2), the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use Guideline for Good Clinical Practice Practices (ICH E6 R2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), Part 4 of the Natural Health Product Regulations, Health Canada Medical Device Regulations and Part C, Division 5, of the Food and Drug Regulations of Health Canada.

Members of the HSREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 0000940.

Ethics Officer, on behalf of Dr. Joseph Gilbert, HSREB Chair

Direct Office Contact by Email: Information: _____ Date: _____ Name: _____ Date: _____ Name: _____ Date: _____

For more information, please contact the HSREB at _____

Appendix C

Letter of Information Example

Project Title: Cognitive Impairment and the Mediterranean Diet: A Canadian Perspective

Principal Investigator: JB Orange, PhD, Western University, School of Communication Sciences and Disorders.

Co-Investigators:

Dorothy Forbes, PhD, University of Alberta, Faculty of Nursing.

Michael Borrie, MB ChB, FRCPC, Parkwood Hospital, St. Joseph's Health Care.

Ivan Culum, PhD candidate, Western University, Health and Rehabilitation Sciences Program.

Letter of Information - Individuals without cognitive impairment

Invitation to Participate

You are being invited to participate in a research study that explores important issues and challenges that older adults with mild cognitive impairment (MCI) may face when adopting a Mediterranean diet. You are being asked to participate in this study because you do not have a diagnosis of MCI.

Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

Purpose of this Study

The purpose of this study is to explore important issues and challenges that older adults may face when adopting a Mediterranean diet. Specifically, the goal of this study is to examine if there are any differences in the issues and challenges faced by older adults with MCI versus older adults at risk for developing MCI or dementia, and older adults who are otherwise healthy

Inclusion Criteria

Individuals who meet the following criteria are eligible to participate in this study:

- Speak English
- Over 50 years old at recruitment
- No diagnosis of mild cognitive impairment
- No subjective cognitive complaint

Exclusion Criteria

Individuals that do not meet all of the criteria listed above are not eligible to participate in the study.

Study Procedures

If you agree to participate in this study, you will be asked to complete a 1 page demographic form and to participate in a focus group discussion with up to 9 other individuals who also do not have a diagnosis of MCI. You may be invited for an individual follow-up interview.

If you choose to participate, the research study will require approximately 2 hours of your time, including rest and refreshment breaks. The focus group interview will be conducted in the Qualitative Research Lab (Room EC2534) at Elborn College, Western University. Complimentary refreshments will be provided as well as complimentary parking passes for those that require them. If you are invited for the follow-up interview, it will require an additional 1 hour of your time.

The interviews will be audio recorded. This is mandatory and responses will be kept confidential.

There will be a total of 50 participants in this study, 10 individuals with MCI, 20 individuals at-risk for MCI or dementia, and 20 individuals who are otherwise healthy.

Possible Risks and Harms

There is a possible risk of fatigue given the length of the protocol. Rest breaks will be offered every 30 to 40 minutes in order to minimize fatigue.

There is a possible risk for stress or anxiety for some individuals due to use of audio. Audio recording equipment will be placed as unobtrusively as possible to minimize stress and anxiety associated with this component of the protocol.

Possible Benefits

You may not benefit directly from participating in this study. However, information from this study may provide benefits to society as a whole including improving knowledge dietary challenges for individuals living with MCI, at-risk for developing MCI or dementia, and otherwise healthy older adults. Information from this study may help other researchers and clinicians (e.g., physicians, nurses, therapists) develop options for reducing the risk of developing MCI and slow the progression from MCI to dementia.

Compensation

You will not be compensated for your participation in this research study, but complimentary refreshments and parking passes are available.

Confidentiality

All data collected will remain confidential and accessible only to the investigators of this study. All data collected will remain confidential. Participants will be encouraged to keep their discussions confidential. Any personal identifiers will be removed from the audio recordings.

The hardcopy paper research records of your data will be stored in the following manner: locked in a cabinet in a locked, secured room (Elborn College Room EC2208). Electronic research records will be stored in the following manner: firewall protected on the Western University network drive accessible only from a password-protected computer located in the Aging and Communication Laboratory (Room EC2208) in Elborn College at Western University. Audio recordings will be reviewed only by members of the research team and they will be destroyed after 10 years in accordance with our professional college regulations for data management.

If the results of the study are published, your name and audio recordings will not be used. If you choose to withdraw from this study, your data will be removed and destroyed from our database.

Representatives of Western University Health Sciences Research Ethics Board may contact you or require access to your study-related records to monitor the conduct of the research.

Contacts for Further Information

If you require any further information regarding this research project or your participation in the study you may contact any of the following individuals:

- JB Orange, PhD: Phone (519) 661-2111 extension 88921; e-mail jborange@uwo.ca
- Ivan Culum: e-mail iculum@uwo.ca

If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Research Ethics (519) 661-3036, email: ethics@uwo.ca.

Publication

If the results of this study are published, your name and audio recording will not be used. The results of this study may be presented at research conferences or community meetings. The results of this study may be published in the form of research articles and the PhD dissertation of Mr. Culum.

This letter is yours to keep for future reference.

Appendix E

Qualitative Analysis Process

Selective Coding

Results of entire analysis are discussed in debriefing sessions

Analysis is final when saturation is reached (i.e., no new data emerge)

IC examines relationship among themes for similarities
Domains emerge

Axial Coding

Debriefing sessions between IC and JBO are held to discuss themes until complete agreement is reached

IC examines relationships among codes to identify themes

Open Coding

IC and JBO perform independent thematic analysis of transcribed focus group interviews for each group until no new codes emerge

Debriefing sessions between IC and JBO are held until no discrepancies in coding remain

Appendix F

Data Analysis – Relationship of Domains and Themes to Individual



Appendix G

Qualitative Analysis – Complete List of Codes

Domain	Category	Codes
Knowledge and Skills	<i>Beliefs & Perceptions</i>	Barrier, aversion to IT
		Barrier, belief that medication compensates for poor diet
		Barrier, negative connotation of diet
		Belief that cost is not a problem for healthy eating
		Belief that people make irresponsible food choices
		Belief that preventive health strategies help reduce overall health expenditures
		Belief that weight gain is due solely because of inactivity
		Dietary habits from childhood persist into later life
		Endorsement of MeDi
		Facilitator, moderation
		Perceived barrier, belief that premade equals unhealthy
		Perceived barrier, complete restriction of sweets
		Perceived barrier, food component(s)
		Perceived barrier, lack of green grocers
		Perceived barrier, large corporations
Perceived barrier, limited vegetable choices		

Domain	Category	Codes
		Perceived barrier, meal ritual
		Perceived barrier, taste
		Perceived facilitator, accessible information
		Perceived facilitator, cost of food
		Personal values regarding food or diet
		Potential barrier, belief that habits are ingrained
		Potential barrier, no social media use
		Potential barrier, political correctness
		Potential facilitator, meal ritual
	<i>Education</i>	Barrier, too fatigued to attend classes
		Education, lack
		Facilitator, age-sensitive presentation format
		Facilitator, educational grocer initiatives
		Facilitator, experiential learning
		Facilitator, in-person instruction
		Facilitator, travel
		Potential facilitator, access to relevant experts
		Potential facilitator, access to structured plan
		Potential facilitator, availability of classes
		Potential facilitator, classes provide specific strategies
		Potential facilitator, education

Domain	Category	Codes
		Potential facilitator, instructional video
		Potential facilitator, IT
		Potential facilitator, preferred learning format
	<i>Information Seeking</i>	Barrier, difficulty adjusting to changing diet information
		Barrier, information overload
		Barrier, lack of authoritative information
		Barrier, online information can be unclear
		Facilitator, accessible information
		Facilitator, IT
		Information seeking, availability of classes
		Information seeking, food handling
		Information seeking, food preparation
		Information seeking, food source
		Information seeking, IT
		Information seeking, MeDi
		Information seeking, MeDi and MCI
		Information seeking, nutrition
		Potential facilitator, accessible information
		Potential facilitator, authoritative information
		Qualified need for more information
	<i>Knowledge</i>	Barrier, limited MeDi knowledge

Domain	Category	Codes
		Composition, MeDi
		Experiential dietary knowledge acquisition
		Facilitator, life experience
		Information acquisition
		Information sharing
		Knowledge, limited (IT)
		Knowledge, limited (MeDi)
		Knowledge, limited (nutrition)
		Knowledge, MeDi
		Knowledge, none (MeDi)
		Knowledge, nutrition
		Knowledge, qualified
		Misconception, MeDi
		Thinking critically
		Uncertainty
Socio-economics	<i>Access to Food</i>	Barrier, abundance of processed, unhealthy foods
		Barrier, accessibility
		Barrier, availability
		Barrier, lack of accessible fresh markets
		Barrier, sourcing quality ingredients

Domain	Category	Codes
		Facilitator, access to high quality premade meals
		Facilitator, access to high quality produce
		Facilitator, access to personal transportation
		Facilitator, accessibility
		Facilitator, accommodating service
		Facilitator, convenience
		Facilitator, local produce
		Facilitator, proximity to discount grocer(s)
		Facilitator, seasonal availability
		Potential barrier, lack of personal transportation
		Potential barrier, winter driving
		Potential facilitator, accessible fresh market
		Potential facilitator, accommodating service
		Potential facilitator, availability of premade MeDi meals
<i>Economics</i>		Adherence in spite of cost barrier
		Barrier, cost of food
		Barrier, cost of programs
		Barrier, low SES
		Facilitator, higher SES
		Facilitator, no out-of-pocket expense

Domain	Category	Codes
		Lack of barrier, cost of food
		Lack of barrier, out of pocket expense
		Potential barrier, cost of food
		Potential barrier, out of pocket expense
		Potential barrier, previous SES
		Potential barrier, profitability of community grocers
		Potential barrier, transportation cost
<i>Healthcare & Society</i>		Barrier, emphasizing food appearance (size, shape, colour) over quality
		Barrier, food industry ethics
		Barrier, food industry marketing
		Barrier, food labelling
		Barrier, food packaging
		Barrier, health professional education
		Barrier, healthcare system
		Barrier, insufficient consultation time
		Barrier, lack of single person portions
		Barrier, limited medical training in nutrition
		Barrier, traditional gender roles
		Facilitator, inter-professional collaboration
		Facilitator, substituting fresh food for frozen food to reduce cost

Domain	Category	Codes
		Lobby government for change
		Perceived facilitator, reduced health expenditures
		Potential barrier, government policies
		Potential facilitator, community support
		Potential facilitator, education system
		Potential facilitator, existing nutritional policies
		Potential facilitator, food banks
		Potential facilitator, food subsidy for consumers
		Potential facilitator, funding for community grocers
		Potential facilitator, improved medical education
		Potential facilitator, minimizing food waste
		Potential facilitator, physicians as teachers
Adoption of Habits	<i>Action & Intent</i>	Active dietary modification
		Evidence-based action
		Self-discipline, lack
		Vigilance, leading to action
		Willingness to adopt MeDi
		Willingness to try MeDi
	<i>Adherence</i>	Adherence, MeDi

Domain	Category	Codes
		Adherence, motivated
		Adherence, partial
		Adherence, selective
		Adherence, unintentional
		Facilitator, ease of transition
		Facilitator, enjoyment
	<i>Food Preparation</i>	Barrier, cooking for family affects individual adherence
		Barrier, food preparation
		Barrier, lack of confidence in food preparation
		Barrier, limited interest in cooking
		Barrier, shelf life
		Facilitator, ease of preparation
		Facilitator, equipment
		Facilitator, not responsible for food preparation
		Facilitator, responsible for own food preparation
		Facilitator, shared responsibility for food preparation
		Facilitator, shelf life
		Potential barrier, not responsible for food preparation
		Potential barrier, reliance on premade meals

Domain	Category	Codes
	<i>Health</i>	Awareness of food consumption, family
		Awareness of food consumption, self
		Awareness of importance of diet on health
		Awareness of importance of lifestyle on health
		Awareness of rising healthcare costs
		Awareness of the complexity of diet change
		Barrier, underestimating importance of prevention
		Diet sought after health concern
		Facilitator, health (medical status)
		Facilitator, health benefits
		Facilitator, perceiving positive health outcomes
		Family history of disease
		Health benefits
		Health, allergy
		Health, death of spouse
		Health, spouse
		Health, spouse (influences diet change)
		Potential barrier, lack of observable results
		Preventive measure
		Reasons for dietary change (HRQoL)
		Seeking a healthy diet, family

Domain	Category	Codes
		Seeking a healthy diet, self
	<i>Personal Food Preferences</i>	Barrier, amount of vegetables
		Barrier, aversion to fish
		Barrier, food component(s)
		Barrier, narrow food interest
		Barrier, personal food preference
		Barrier, taste
		Facilitator, avoidance of fried foods
		Facilitator, dislike of processed food
		Facilitator, food component(s)
		Facilitator, fresh food
		Facilitator, love of food
		Facilitator, taste
		Facilitator, variety of food
		Lack of barrier, MeDi
		Potential barrier, rigid meal preference
	<i>Relationships</i>	Caregiver influences dietary habits
		Facilitator, employer initiatives
		Facilitator, not responsible for food shopping
		Facilitator, positive feedback from family on prepared food
		Facilitator, social connections or interactions

Domain	Category	Codes
		Facilitator, social connections or interactions (online)
		Facilitator, spousal commitment
		No input regarding food selection
		Potential barrier, childhood dietary habits
		Potential barrier, cultural expectations
		Potential barrier, spousal aversion to vegetables
		Potential facilitator, family support
		Potential facilitator, spousal support
	<i>Strategies</i>	Accommodating different food preferences within family meals
		Attempted solution ineffective
		Eating disliked foods mixed with liked foods to overcome taste barrier
		Facilitator, emphasizing food quality over appearance (size, shape, colour)
		Facilitator, food substitution
		Facilitator, own means of food production
		Importance of purchasing quality food
		More frequent shopping
		Reducing portion sizes to reduce cost
		Repurposing space for food production
		Shared responsibility for food decisions

Domain	Category	Codes
		Smaller portion to reduce cost
		Substituting fresh food for frozen food to save time
<i>Time</i>		Barrier, competing demands
		Barrier, food preparation time
		Barrier, shopping time
		Barrier, travel
		Facilitator, advance meal preparation
		Facilitator, retirement

Appendix H

Audit Trail

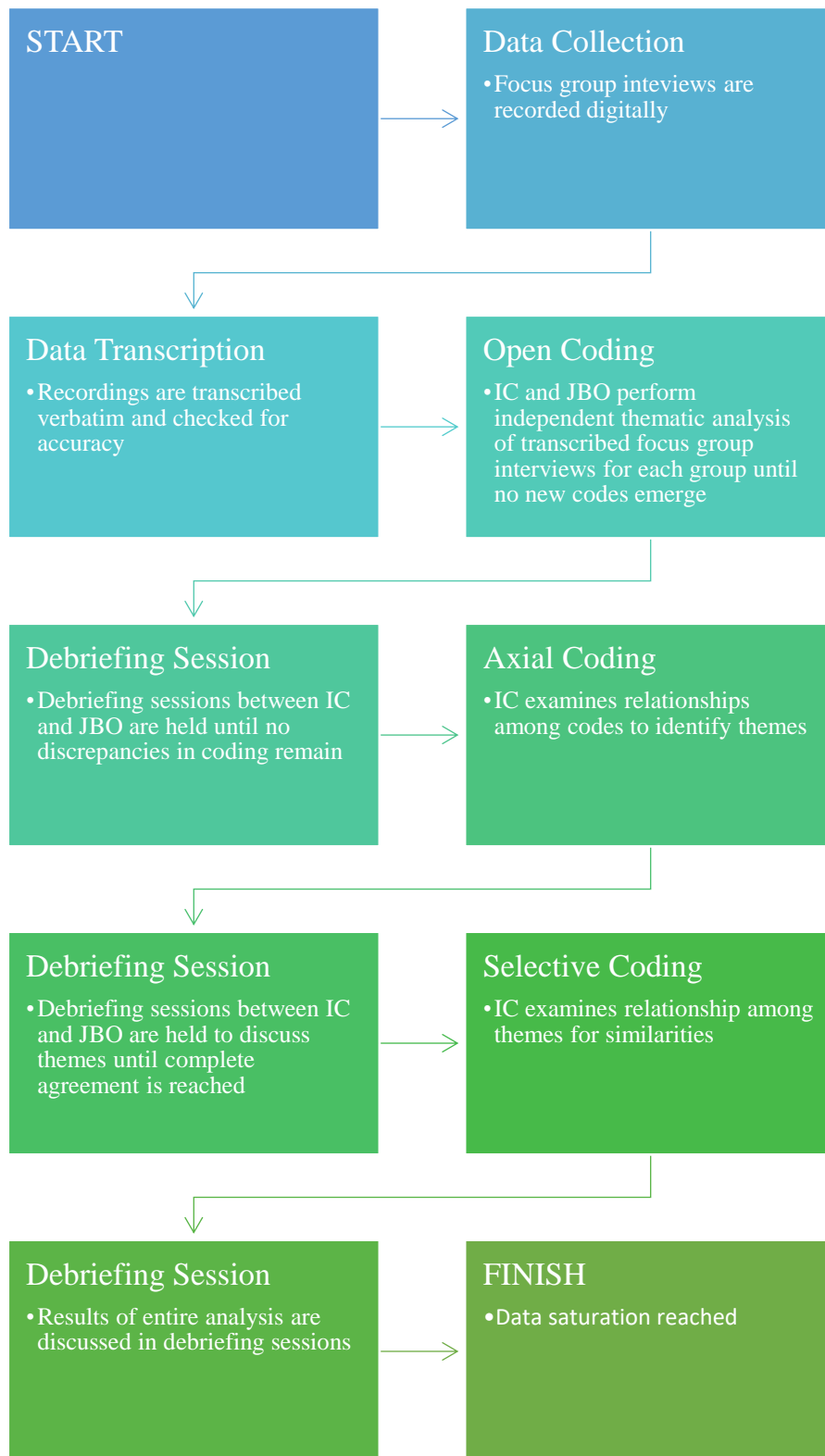


Table 1

Participant Profile by Gender

<i>Group</i>	N	Women	Men
<i>H50</i>	8	4	4
<i>H71</i>	7	1	6
<i>R50</i>	4	3	1
<i>R71</i>	5	2	3
<i>MCI</i>	4	2	2

PART 5. DISCUSSION

The purpose of this dissertation research was threefold. The first purpose was to fill a knowledge gap concerning Canadian older adults' dietary habits. The second purpose to examine the extent of familiarity with the MeDi among older Canadian adults (50+ years of age). The third purpose to explore barriers and facilitators to changing one's dietary behaviours (including, but not limited to the MeDi), both generally and in relation to an individual's age and risk for developing dementia.

To achieve this purpose, the primary investigator (IC) performed an initial synthesis of knowledge on the aetiology, risk factors, disease symptoms and progression, diagnosis, and available treatment options for the most prevalent types of dementia, Alzheimer's dementia (AD) and vascular dementia (VaD) (outlined in Part 2 of this dissertation study). The synthesis gathered up to date knowledge on dementia to identify the relevant target participant population for this dissertation research study. During the synthesis, the PI discovered that there was significant overlap of AD and VaD pathology. The presence of both disease pathologies is referred to as mixed dementia (MD) (Culum, Orange, Forbes, & Borrie, 2012). The PI noted that few research studies focused on MD with authors preferring to instead study each of the dementia components (AD or VaD) as a separate entity (discussed in Part 2 of this dissertation study).

Mixed Dementia

Mixed dementia is fairly common, with a third of persons with AD estimated to have concurrent VaD pathology, and vice versa (Kalara & Ballard, 1999). The concurrent pathology has an additive effect for persons with dementia, meaning that the dementia is worsened under these conditions (Snowdon et al., 1997). The pathology of MD, as well as the component AD

and VaD parts, was reviewed and discussed in Part 2 of this dissertation research. One noted common thread between these two components is increased neuroinflammatory response (Jellinger, 2008). According to the amyloid hypothesis for AD, beta amyloid (A β) deposits in the brain are believed to be the cause of AD. Pathologically, these deposits elicit an inflammatory response which is believed to cause further neurodegeneration (McGeer & McGeer, 1999), as well as exacerbating tau pathology observed with Alzheimer's disease (Kitazawa, Oddo, Yamasaki, Green, & LaFerla, 2005). As tau pathology is believed by some to be the cause of Alzheimer's disease (tau hypothesis) (Maccioni, Farías, Morales, & Navarrete, 2010), this reinforces further the need to examine the role of neuroinflammation in AD. Neuroinflammation also is observed in cases of VaD (Jellinger, 2008). This investigator (IC) does not suggest that inflammation is the cause of dementia but highlights the important role it represents in observed MD pathology, as outlined in Part 2 of this dissertation study. The conclusion drawn from this was that substances with known anti-inflammatory properties, such the omega-3 polyunsaturated fatty acids (PUFAs) and antioxidants can be of benefit to persons with MD (Culum et al., 2012).

The synthesis outlined in Part 2 led to both the selection of the Mediterranean diet (MeDi), a well-researched diet that features multiple components with known anti-inflammatory properties (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004) as preventive treatment option, as well as to the decision not to exclude persons with MD during the participant recruitments and selection process. As the MeDi may be of benefit with regard to both AD and VaD pathology, prospective research participants gain a chance to be exposed to a potentially beneficial education and/or treatment, while researchers gain access to a larger participant population.

In the absence of effective treatments for dementia as described in Part 2 of this dissertation research, emphasis now is placed on preventive strategies, such as a healthy diet (Pineo & Anderson, 2008), to further reduce the incidence of dementia (Singh et al., 2014). Since this push for dementia prevention, there has been an observed reduction in the incidence of dementia and growth projections are not as dire as they were a decade ago (Alzheimer's Disease International, 2018).

Diet and Aging

The idea that our health is related to the quality of our diet is far from novel, as food has been used for medical purposes for millennia. Nutrition is a key component in the traditional Indian medical practice of Ayurveda and has greatly influenced the development of western naturopathic medicine. The importance of nutrition also is highlighted in other traditional medicines, such as those from China and the Middle East (Micozzi, 2015). More recently, nutritional interventions have made their way into mainstream medicine with mounting evidence appearing in the literature showing their benefits. Not only is there ample evidence that nutritionally poor diets are associated with negative health outcomes (Sacks & Katan, 2002), there is increasing evidence of a benefit of the adoption of healthier diet for a variety of chronic conditions and neurodegenerative diseases (Petersson & Philippou, 2016; Pineo & Anderson, 2008; Psaltopoulou et al., 2013; Singh et al., 2014). These diseases are of particular concern with regard to an aging population in Canada as well as globally, as discussed in Part 1 of this dissertation research, and sustained research and policy efforts should be maintained. As outlined in Parts 1 and 3 of this dissertation, the MeDi is a particularly beneficial diet with regard to preventing negative health outcomes prevalent in the older adult population (Psaltopoulou et al., 2013), including dementia (Scarmeas et al., 2009).

Mediterranean Diet

Despite regional variations of the MeDi, this diet features a high consumption of fish and plant foods, with moderate dairy and alcohol consumption as well as limited red meat consumption (Trichopoulou & Lagiou, 1997). The average daily macronutrient intake in a MeDi consists of 255.0 g of carbohydrates, 74.5 g of proteins, 110.7 g of fats (29.8 g of saturated fats, 63.8 g of monounsaturated fats, and 9.9 g of polyunsaturated fats), as well as 14 g of alcohol, and have an average energy value of 2473 Kcal (Trichopoulou, Vasilopoulou, Georga, Soukara, & Dilis, 2006). Additional MeDi nutritional details were discussed in Part 3 of this dissertation research. The MeDi is a high-fat diet, with 38% of nutritional energy coming from the consumption of fats (de la Puebla et al., 2003). This is no different than the estimated consumption of fats in a “typical” Western (i.e., North American, North, Central, and East European) (Sacks & Katan, 2002). However, the MeDi features a greater proportion of the healthier monounsaturated fatty acids (MUFAs) and PUFAs within the total fat consumption (Culum, Orange, Forbes, & Borrie, 2015) and these are widely accepted as healthier sources of dietary fat (Willett & Stampfer, 2003). PUFAs, in particular, are known for their anti-inflammatory properties which can be beneficial for both AD and VaD (Culum et al., 2012). Additionally, the MeDi features foods rich in antioxidants, which is important as increased oxidative stress amplifies inflammatory response (Hajjar & Gotto Jr, 2013; Khansari, Shakiba, & Mahmoudi, 2009).

It is important to mention that it is currently impossible to account for all of the interconnected variables regarding the observed positive health effects of MeDi adherence. Further research is needed in order to explain further how MeDi protects against disease in order to simplify the process of dietary change. This complexity was discussed in Part 4 of this

dissertation. Not all parts of the MeDi are of equal importance with regard to proposed protective health effects and reducing information overload can be seen as a facilitator to positive dietary change (Part 4). Furthermore, as there are regional variations in both the MeDi and Western diets, the degree of dietary change required for older Canadians was unknown prior to the first research study of this dissertation. In order to examine the degree of dietary modification required for older Canadian adults to adopt the MeDi, a secondary data analysis of a large national survey (Canadian Community Health Survey 2.2, 2004) was performed by the primary investigator to estimate the macronutrient composition of the average diet of older Canadians (CanDi). This analysis was performed to answer research questions (RQs) 1 to 4 (as outlined in Part 1 of this dissertation research), and its implications are discussed in the following section.

Study 1 – The Canadian Diet

The primary purpose of Study 1 was to explore the macronutrient composition of the CanDi among older Canadian results. This was made possible via secondary data analysis of data gathered in Cycle 2.2 of the Canadian Community Health Survey. A strength of this approach was access to a large sample in order to generalize to a larger Canadian population. The availability of such data made it possible to conduct this type of analysis, as gathering this level of data is not feasible for individual researchers nor small teams.

Research Question 1 – CanDi Composition

The first research question of the dissertation study examined the macronutrient composition of the CanDi for older adults. The results from Study 1 (outlined in detail in Part 3 of this dissertation) are presented in Table 1. These results show a lower average daily energy intake from the CanDi than the MeDi (~750 fewer Kcal/day). For older adults following the CanDi, 49.3% of daily energy comes from carbohydrates, 16.0% comes from proteins, and

31.0% comes from fats. This CanDi estimate differs from the MeDi estimate based on a lower daily carbohydrate intake (-42.8 g), slightly lower protein intake (-4.0 g), and a much lower total fat intake (-51.6 g). When comparing specific fat types, the CanDi is characterized by a lower daily SF intake (-11.5 g), much lower MUFA intake (-40.7 g), and a slightly higher PUFA intake (+0.2 g). The CanDi is estimated to provide 2% more energy from carbs and 1% more energy from proteins than the MeDi. The CanDi provides 7% less energy from fats. Particularly notable is the comparison between energy intake by fat types, where both the CanDi and the MeDi provide 10% of daily energy from SFs (Part 3).

Research Question 2 – CanDi by Age and Gender

The second research question of the dissertation study addressed whether there are any differences in CanDi composition among specific groups based on age and gender. The investigation found that while younger participants consumed more of each macronutrient and energy overall, there were no significant differences regarding the proportion of each macronutrient among different groups. Additionally, men consumed more food than women though again there was no significant difference regarding the proportions. These findings suggest that while there are important considerations regarding age and gender relating to dietary behaviour, it is not necessary to differentiate among these groups when designing a dietary intervention other than accounting for differing energy requirements. However, it is important to note that neither age group met the daily energy requirements for their respective group as outlined in Canada's Food Guide (Health Canada, 2014) for even the most sedentary lifestyle, let alone an active one. The difference in daily energy requirements is even greater when comparing group medians to the recommended guideline values. However, this is not sufficient cause for alarm due to respondents' tendency to underestimate their overall food intake

(Mertz & Kelsay, 1984). The higher daily energy intake values among men vs. women also are not surprising due to their relatively larger body size, but the difference becomes smaller between genders in the older age group (though no less significant).

Research Question 3 – Geographic Factors

The third research question of the dissertation study examined regional differences to the CanDi. Like the MeDi, the CanDi itself is not monolithic and varies significantly among the various comparison sub-groups (i.e., urban vs. rural, province). As with research question 2, there was no significant difference with regard to the proportion of the macronutrients, though significant regional differences were found. Considering Canada's vast geographical mass and diverse cultural landscape, these findings were not surprising. Also, it is important to mention that there are regional differences in diets among people living in different parts of the Mediterranean as well (Trichopoulou & Lagiou, 1997).

Research Question 4 – Dementia Risk

The fourth research question of the dissertation study addressed differences regarding dementia risk status. While the “healthy” sub-group consumed more of each macronutrient (even the SFs), it is unlikely that their “at-risk” counterparts owe their status to a lower overall food and energy intake. It is possible that these respondents are less active and may in fact still be consuming more relative to their more active counterparts. Additionally, these respondents are likely receiving medication for their condition(s) (e.g., statins), which can contribute to weight gain (Sugiyama, Tsugawa, Tseng, Kobayashi, & Shapiro, 2014) and could be an explanation for reduced caloric intake.

Overall, the results of Study 1 indicated that a shift from a CanDi to the MeDi requires a special focus on dietary fat intake as older Canadian adults consumed, on average, much less

dietary fat. It was surprising to note that PUFA intakes were comparable between the two diets, but older Canadians consume fewer MUFAs in their diet, which also have been implicated in positive health outcomes (Mashek & Wu, 2015). This is in line with the reasoning outlined in Part 1 of this dissertation where it was suggested that overly reductionist examination of beneficial dietary components is less effective than a whole-diet approach (e.g., omega-3 supplementation versus MeDi adoption). This finding, in turn, influenced how the MeDi was presented to the participants in Study 2 of this dissertation research, where the goal was to answer the remaining research questions (RQs 5-7, outlined in Part 1 of this dissertation research) which involved an examination of the experience of dietary change for older Canadian adults.

Study 2 – Diet Behaviour

The purpose of Study 2 was to explore dietary behaviour of Canadian older adults with a focus on the MeDi. As discussed in Parts 1 and 4 of this dissertation research, the complex nature of dietary intervention made it impossible, or at least unfeasible, to explore this topic via traditional qualitative methods at this stage. This was the primary reason for opting to use qualitative methods together with quantitative analysis. This dissertation research is the intended foundation for future research on this topic, and its purpose is not only to provide additional knowledge to the body of literature on this topic but to inform future research.

In the analysis of data from Study 2, three domains emerged which helped explain how older Canadians experience diet and dietary change, with special consideration given to the MeDi. These three domains were: (a) *Knowledge and Skills*, (b) *Socioeconomics*, and (c) *Adoption of Habits*. Each of these domains consisted of related themes derived from codes that emerged during the initial qualitative analysis (see Part 4 for a detailed description of the

analysis process). All three domains relate to the knowledge and perception of dietary change among Canadian older adults both generally and in relation to the MeDi. The first domain, *Knowledge and Skills*, helps answer RQ5.

Research Question 5 – MeDi Knowledge

The fifth research question of the dissertation study sought to determine the extent of the familiarity of the MeDi among Canadian older adults. Results derived from five focus groups representing three diagnostic groups (healthy, at risk, memory impaired) and two age groups (50-70 years, + 70 years) showed that the participants mostly have a cursory knowledge of the MeDi. They reported that they had at least heard of the diet and its benefits, but most had no in-depth knowledge and were not sure what MeDi adoption (i.e., choosing to follow the MeDi) would require of them at the outset of the focus groups. All participants were interested in furthering their knowledge of MeDi, as well as the practice of healthy eating in general. Neither participant category nor age played a meaningful role regarding the amount of nutritional and MeDi knowledge evident among the participants. This was a surprising finding because the primary investigator expected to find the healthy groups to be more knowledgeable regarding nutrition. The finding is important because it suggests that explicit knowledge regarding the quality of a person's diet is not enough to predict health outcomes for that person. However, the larger issue that was discovered was that participants reported difficulties curating the information available to them both regarding the MeDi and to nutrition in general. While this barrier relates to *Knowledge and Skills* domain, its relevance is to research question 7 and is discussed in the appropriate section.

Research Question 6 – Willingness to Adopt MeDi

The sixth research question of the dissertations study focused determining the willingness to adopt the MeDi among Canadian older adults. Most of the participants reported that they were at least willing to try the MeDi to see if it is a good fit for them. A common reported reason for wanting to participate in this research study was a desire to learn about how to make such a change, due to several barriers that are discussed in the following section as they relate to research question seven.

Research Question 7 – Barriers and Facilitators to MeDi Adoption/Adherence

The seventh research question of the dissertation study sought to identify barriers and facilitators to MeDi adoption and/or adherence among Canadian older adults, with specific interest in determining if there are notable differences among different participant groups (younger and older healthy groups, younger and older at-risk for developing dementia groups, and memory-impaired). It was important to determine whether there were issues unique to the different groups in order to inform decisions in research or policy. Barriers and facilitators are presented in their relation to each of the three domains identified from the qualitative analyses.

Knowledge and Skills. The amount of information regarding nutrition and health was identified as a barrier in the theme of *Information Seeking*. However, contrary to investigator expectations, participants reported that there was too much information in many cases. The problem is that the participants reported that they have no effective way to process and to evaluate the large amount of information currently available. There was a noted concern regarding the legitimacy of nutritional claims as participants were confused by changing dietary guidelines. The word diet itself held a negative connotation as the participants were accustomed to this word in the context of temporary restriction and dubious fad diets. However, a few participants expressed difficulty in gathering information on the MeDi via more traditional

means (i.e., books). This highlights the value of disseminating information through a variety of media, as there were multiple mentions of preferring information to be in a particular format.

It is important to note that participants' *Beliefs and Perceptions* were a significant barrier to MeDi adoption. This is in line with previously published work (Broadbent, Donkin, & Stroh, 2011). In the absence of extensive nutritional knowledge, individuals fill this gap with beliefs that are not fact-based but have evolved from isolated pieces of knowledge acquired over their life course. For example, there was a (mis)association that pre-made food is unhealthy. While it is true that most industrially processed foods are not the healthiest option, the belief that prepared food has to be unhealthy can be a barrier. It is possible for a pre-made meal to be free of many harmful substances. In these cases, individuals may skip a viable time-saving option dismissing it as unhealthy. This has important implications in that *Time* was identified as an important theme pertaining to barriers and is discussed within the *Adoption of Habits* domain. It is not suggested that there are many such healthy time-saving options currently available, but it is likely that more options will become available with increased societal pressure to provide healthier eating options. Not all individuals will benefit from such options, as there is an inherent cost to providing healthier prepared food, and socioeconomic factors must be acknowledged in order to ensure that people have access to a healthy diet such as the MeDi.

Socioeconomics. For the study participants, most of the barriers within the *Socioeconomics* domain were identified as beyond an individual's control. While none of the participants reported not being able to afford healthy food, the cost of food was a theme that arose within the *Socioeconomics* domain. The participants acknowledged that the cost of food would be a barrier for individuals with low incomes. Participants' perceptions play a role within this domain as well, with one participant reporting that she believes healthy food to be less

expensive than unhealthy food. Perceptions like these can cause people to infer that a person's diet is unhealthy purely due to that individual's choices. An example of this can be seen in the Government of Ontario's publication of a shopping list in 1995 for individuals receiving social assistance (subsequently dubbed the "welfare diet") (Stapleton & Yuan, 2018). Policy on nutrition should be rooted in fact rather than perception. When the cost of healthy eating exceeds the individual's financial means, there are few options (s)he can do personally to avoid such a barrier short of taking support from a food bank, should one be located near where they live. Lower socioeconomic status is correlated with multiple negative health outcomes (Stringhini et al., 2017), which in turn increases the amount of healthcare spending. In addition to systemic issues, there were industrial barriers to MeDi adoption and proper nutrition in general.

Participants expressed a number of issues relating to an apparent lack of ethics within the food industry, such as misleading advertising (e.g., "using real ingredients") and food labelling. Participants reported that the labelling information was often confusing and/or misleading and resulted in frustration due to increased efforts to make informed decisions. This was of particular concern to younger participants since many were still employed and reported less time available for grocery shopping. This is in line with previous findings that consumers have a knowledge gap in making informed decisions when selecting food (Poole, Marti, & Giménez, 2007). There is a need to address this issue from a policy perspective, as nutritional claims have been shown to influence the perception of food items, regardless of their validity (Gravel et al., 2012). This was the only instance in this domain where the age group of the participants became relevant.

Participants noted that the healthcare system was not a facilitator to positive dietary change, chiefly due to inadequate consultation time with physicians and limited nutritional information provided by attending physicians. This finding is in line with previous research

(Vetter, Herring, Sood, Shah, & Kalet, 2008). Vetter and colleagues (2008) found that many physicians felt under-trained to provide nutritional advice to their patients despite a belief that such recommendations are a necessity. While many participants would like to see this addressed, with physicians improving their nutritional knowledge, this kind of physician-driven intervention is not a good fit within current practice. Improved physicians' knowledge on diet is certainly necessary, but this investigator does not see the need for physicians to act as nutritional advisors. The preferred recommendation is that more referrals be made instead to other healthcare professionals such as dietitians and nutritionists. It also is recommended that nutrition becomes more prominently featured in all aspects of healthcare, in the education system (e.g., featured prominently in K-12 curricula), and on common media outlets as well as social media platforms due to its many links with both positive (Singh et al., 2014) and negative health outcomes (Whitmer, Sidney, Selby, Johnston, & Yaffe, 2005). This is of particular importance because there were many mentions of adverse health events motivating dietary change and a stated delay of observable results as a barrier to change (e.g., quitting a dietary plan before observing positive outcomes, which are not immediately apparent). This is something that needs to be addressed proactively, with strategies implemented to motivate individuals without a pressing health concern. For example, implementing regular nutritional assessments within preventive health assessments could be one such strategy, where individuals receive feedback regarding the quality of their diet and projected health outcomes based on the assessment. As funding and resources are of concern in current primary care, it would be of value to explore alternative sites for such assessments, like public libraries or community centres, where individuals could be trained in administering nutritional assessments. This approach would leverage existing infrastructure (e.g., libraries), possibly easing some primary care burden and reducing health care costs.

Adoption of Habits. Barriers and facilitators relating to intrinsic factors (i.e., primarily within an individual's control) were identified by participants and coded within this domain. The age group of the participants was an important factor, especially when it came to the theme of *Time* with older participants reporting that they have more time to spend on food shopping and preparation than did the younger participants, most of whom were still working. Furthermore, the older participants stated that time was a significant barrier to good nutrition prior to retirement. The healthy older participant group reported having the best dietary habits, with many at least partly following the MeDi, though this was not a conscious decision. Due to what is known about the relationship between good nutrition and positive health outcomes, this finding was not at all surprising.

The participants from the at-risk and memory-impaired groups cited health concerns as motivators to make dietary change whereas the healthy participants reported that disease prevention was their primary motivation. Further emphasis on prevention is needed, especially due to perceptions that medications can compensate for poor dietary habits. As the MeDi has many noted health benefits, it is suggested that it and other similar diets be promoted to all individuals, rather than those who are assessed as at-risk or diagnosed with a particular medical or mental health-related condition. During the promotion of the MeDi, choices should be emphasized as participants reported struggling with restrictions. Furthermore, consideration should be given to the availability of recommended food items in a particular geographic location, and ample examples of acceptable substitutions for unavailable food items should be provided (e.g., locally available vegetable and grain substitutions of similar nutritional value to those historically available in the Mediterranean region).

Acceptable food and nutrition substitutions should be mentioned even if the ideal choices are available, particularly regarding omega-3 PUFA sources and vegetables. Fish was mentioned as a problem to some participants, and microalgae would be an adequate substitution in their case (Ryckebosch, Bruneel, Muylaert, & Foubert, 2012). Vegetables were another concern for some. While there are no substitutions for vegetables overall, there is adequate choice within vegetables and specific guidelines would be beneficial in helping individuals substitute disliked vegetables in favour of less disliked (or liked) vegetables of similar or better nutritional value and benefit. Personal food preferences play a powerful role in food selection, especially with regard to fruit and vegetable intake (Kvaavik, Lien, Tell, & Klepp, 2005), and not providing individuals with strategies can make them more likely to abandon their attempt at a healthier diet. Additionally, as other family members' food preferences play an important role in a person's diet, this further reinforces the need to provide individuals with additional information in order to simplify their decision-making process, which was already reported as cumbersome by some participants. Some participants reported that their caregivers in youth had an enduring influence on their current dietary habits. This implies that the cycle can continue, without regard to the objective quality of the diet in question. Helping to improve an adult's dietary habits can in turn improve multiple individuals' dietary habits especially if this is done in the early developmental years. Changing a diet involves changing behaviour, which takes time, and more emphasis should be placed on behavioural aspects of changing one's diet in addition to providing them with nutritional information in isolation.

Behaviour Change

The Transtheoretical Model (TTM) of behaviour change (Prochaska & DiClemente, 1984) was selected as the underpinning theoretical framework for the purpose of this dissertation

research. The TTM was used not to frame the design study but rather to help with interpretation of the findings, as there is a long history of its use with regard to behaviour modification (Kristal, Glanz, Curry, & Patterson, 1999). As illustrated in Part 4 of this dissertation research, the behaviour change required for MeDi (and other healthy diet) adoption depended on multiple variables (both intrinsic and extrinsic). It was apparent that the more recent healthcare emphasis on nutrition yielded some success, with no participants being unaware of negative health outcomes associated with a poor diet. According to the TTM, none of these participants were found to be in the precontemplation stage because they are aware of the issue. Their responses correspond to the contemplation stage of behaviour change. A lack of knowledge **on how to make sustained change** was preventing many participants from progressing beyond contemplation. As evidenced by the responses in the healthy group, some individuals are able to make change, but it is recommended that increased advice regarding how to sustain such a change would be of benefit to many, not just older adults who are regarded or who self-report as being healthy.

Limitations

This dissertation is not without limitations. From the quantitative side, there is an issue with data that were available for the analysis. Due to the nature of secondary data analysis, researchers are inherently limited to what data were collected and made available. It was not possible to determine if any of the survey respondents had a diagnosis of dementia and therefore impossible to estimate the dietary intake of individuals with dementia. While there is dementia information that was collected during other CCHS cycles, these did not include nutritional information and were therefore not relevant for the purpose of this study. The age of the data is an additional limitation, as a decade had passed between collection and this analysis. However,

this dataset was still used due to the lack of availability of newer data for analysis as well as the infeasibility of collecting such data as an individual investigator. Furthermore, it is important to note that these nutritional data are based on a single 24-hour dietary recall, with a smaller sample being invited for a follow-up interview. As such, it is advised that these results be interpreted with caution, as multiple recalls are recommended in order to accurately depict an individual's nutrient intake (Basiotis, Welsh, Cronin, Kelsay, & Mertz, 1987). Further studies should incorporate the use of food diaries, as they have been found to be more accurate than 24-hour recall in estimating energy intake (Prentice et al., 2011).

From the qualitative side, there are limitations relating to the chosen research method, the use of focus groups, gender representation, socioeconomic representation, and education level, among other concerns. Due to the chosen research method, it is not possible to generalize to a broader population, but this is not concerning since the purpose of the Study 2 study was not to generalize. There may be some concerns regarding the truthfulness of the participants' responses, as they could be selecting more socially desirable responses in a group setting. There were fewer female than male participants. It would have helped to have more women participate – not for generalization purposes but to capture richer data in order to examine if there are any additional considerations pertaining to gender. Furthermore, while many participants declined to provide income information, some reported incomes far above the national average (mostly in the healthy older group). Despite the lack of income reporting, it was evident from participant responses that their incomes are sufficient enough to not represent a barrier to healthy eating. Most of the participants were highly educated, with a tendency for lower education levels in the at-risk and memory-impaired groups. Recruiting participants of lower socioeconomic status remains a challenge, particularly among those who are still working because they can have less time to

volunteer for a study. While it is theoretically possible to account for these issues in the design phase of the study, it was not possible to recruit such a sample in a reasonable amount of time.

Summary and Future Implications

The findings of this dissertation research indicate that dementia is and will continue to be a significant healthcare problem with increasing cost. As there are no cures available for dementia of any kind, preventive approaches are of utmost importance. An estimate of the CanDi is now available to act as a guide for future research and has indicated that nutritional change would be beneficial to many Canadians, though the estimate is not without limitations which were discussed in Part 3 of this dissertation research. In order to effect this change, lifestyle modifications (such as the MeDi) are required and likely will have a positive effect on a number of health conditions, including dementia. These should be promoted to a wider population early in life since there are common elements among many chronic diseases in later life as a result of poor dietary habits. The frequent co-morbidity of AD and VaD as MD is only one example of a common element (neuroinflammation). From a policy perspective, such initiatives should be expanded to target overall disease reduction, with dementia prevention becoming a feature in healthcare long before an impairment is suspected – ideally prior to development of conditions that are deemed risk factors for developing dementia.

The adoption and adherence to the MeDi requires a change in an individual's behaviour and thinking. Many of the participants reported not knowing about how to change effectively their habits. It is recommended that consideration be given to issues about behaviour change when promoting preventive approaches to health such as the MeDi. Furthermore, extrinsic barriers to health such as lower socioeconomic status also should be considered when making policy decisions. It is important for decision makers not to confuse extrinsic factors with intrinsic

factors, as poor lifestyle choices (e.g., a poor diet) is not necessarily an indication of a poor personal choice. Finally, in order to make informed policy decisions, newer and richer health data should be collected nationwide despite the cost of gathering such data. These data are invaluable for healthcare decisions and successful prevention represents cost savings in healthcare, the cost of which continues to increase with an aging population in Canada as well as worldwide.

References

- Alzheimer's Disease International. (2018). *World Alzheimer Report 2018*. Retrieved from London, UK: <https://www.alz.co.uk/research/world-report-2018>
- Basiotis, P. P., Welsh, S. O., Cronin, F. J., Kelsay, J. L., & Mertz, W. (1987). Number of days of food intake records required to estimate individual and group nutrient intakes with defined confidence. *The Journal of Nutrition*, *117*(9), 1638-1641.
- Broadbent, E., Donkin, L., & Stroh, J. C. (2011). Illness and treatment perceptions are associated with adherence to medications, diet, and exercise in diabetic patients. *Diabetes Care*, *34*(2), 338-340.
- Chrysohoou, C., Panagiotakos, D. B., Pitsavos, C., Das, U. N., & Stefanadis, C. (2004). Adherence to the Mediterranean diet attenuates inflammation and coagulation process in healthy adults: The ATTICA Study. *Journal of the American College of Cardiology*, *44*(1), 152-158.
- Culum, I., Orange, J. B., Forbes, D., & Borrie, M. (2012). *Omega-3 Polyunsaturated Fatty Acids and Mixed Dementia*. Paper presented at the 27th International Conference of Alzheimer's Disease International, London, UK.
- Culum, I., Orange, J. B., Forbes, D., & Borrie, M. (2015). Differences between Canadian and Mediterranean Diets: An assessment of macronutrients in the diets of Canadian older adults using data from the Canadian Community Health Survey 2.2. *Journal of Aging Research & Clinical Practice*, *4*(4), 205-213.
doi:<http://dx.doi.org/10.14283/jarcp.2015.73>
- de la Puebla, R. F., Fuentes, F., Perez-Martinez, P., Sanchez, E., Paniagua, J., López-Miranda, J., & Pérez-Jiménez, F. (2003). A reduction in dietary saturated fat decreases body fat

- content in overweight, hypercholesterolemic males. *Nutrition, Metabolism and Cardiovascular Diseases*, 13(5), 273-277.
- Gravel, K., Doucet, É., Herman, C. P., Pomerleau, S., Bourlaud, A.-S., & Provencher, V. (2012). “Healthy,” “diet,” or “hedonic”. How nutrition claims affect food-related perceptions and intake? *Appetite*, 59(3), 877-884.
- Hajjar, D. P., & Gotto Jr, A. M. (2013). Biological relevance of inflammation and oxidative stress in the pathogenesis of arterial diseases. *The American Journal of Pathology*, 182(5), 1474-1481.
- Jellinger, K. A. (2008). The pathology of “vascular dementia”: a critical update. *Journal of Alzheimer's Disease*, 14(1), 107-123.
- Kalaria, R. N., & Ballard, C. (1999). Overlap between pathology of Alzheimer disease and vascular dementia. *Alzheimer Disease & Associated Disorders*, 13(Suppl 3), S115-123.
- Khansari, N., Shakiba, Y., & Mahmoudi, M. (2009). Chronic inflammation and oxidative stress as a major cause of age-related diseases and cancer. *Recent Patents on Inflammation & Allergy Drug Discovery*, 3(1), 73-80.
- Kitazawa, M., Oddo, S., Yamasaki, T. R., Green, K. N., & LaFerla, F. M. (2005). Lipopolysaccharide-induced inflammation exacerbates tau pathology by a cyclin-dependent kinase 5-mediated pathway in a transgenic model of Alzheimer's disease. *Journal of Neuroscience*, 25(39), 8843-8853.
- Kristal, A. R., Glanz, K., Curry, S. J., & Patterson, R. E. (1999). How can stages of change be best used in dietary interventions? *Journal of the Academy of Nutrition and Dietetics*, 99(6), 679.

- Kvaavik, E., Lien, N., Tell, G. S., & Klepp, K.-I. (2005). Psychosocial predictors of eating habits among adults in their mid-30s: The Oslo Youth Study follow-up 1991–1999. *International Journal of Behavioral Nutrition and Physical Activity*, 2(1), 9.
- Maccioni, R. B., Farías, G., Morales, I., & Navarrete, L. (2010). The revitalized tau hypothesis on Alzheimer's disease. *Archives of Medical Research*, 41(3), 226-231.
- Mashek, D. G., & Wu, C. (2015). MUFAs. *Advances in Nutrition*, 6(3), 276-277.
- McGeer, P. L., & McGeer, E. G. (1999). Inflammation of the brain in Alzheimer's disease: implications for therapy. *Journal of Leukocyte Biology*, 65(4), 409-415.
- Mertz, W., & Kelsay, J. L. (1984). Rationale and design of the Beltsville one-year dietary intake study. *The American Journal of Clinical Nutrition*, 40(6), 1323-1326.
- Micozzi, M. S. (2015). *Fundamentals of Complementary and Alternative Medicine* (5th ed.). St. Louis, MO: Elsevier Health Sciences.
- Petersson, S. D., & Philippou, E. (2016). Mediterranean Diet, Cognitive Function, and Dementia: A Systematic Review of the Evidence. *Advances in Nutrition*, 7(5), 889-904.
- Pineo, C. E., & Anderson, J. J. (2008). Cardiovascular benefits of the Mediterranean diet. *Nutrition Today*, 43(3), 114-120.
- Poole, N. D., Martı, L., & Giménez, F. V. (2007). Quality perceptions under evolving information conditions: Implications for diet, health and consumer satisfaction. *Food Policy*, 32(2), 175-188.
- Prentice, R. L., Mossavar-Rahmani, Y., Huang, Y., Van Horn, L., Beresford, S. A., Caan, B., ... & Thomson, C. (2011). Evaluation and comparison of food records, recalls, and frequencies for energy and protein assessment by using recovery biomarkers. *American Journal of Epidemiology*, 174(5), 591-603.

- Prochaska, J. O., & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy*. Homewood, IL: Dow Jones-Irwin.
- Psaltopoulou, T., Sergentanis, T. N., Panagiotakos, D. B., Sergentanis, I. N., Kosti, R., & Scarmeas, N. (2013). Mediterranean diet, stroke, cognitive impairment, and depression: a meta-analysis. *Annals of Neurology*, *74*(4), 580-591.
- Ryckebosch, E., Bruneel, C., Muylaert, K., & Foubert, I. (2012). Microalgae as an alternative source of omega-3 long chain polyunsaturated fatty acids. *Lipid Technology*, *24*(6), 128-130.
- Sacks, F. M., & Katan, M. (2002). Randomized clinical trials on the effects of dietary fat and carbohydrate on plasma lipoproteins and cardiovascular disease. *The American Journal of Medicine*, *113*(9), 13-24.
- Scarmeas, N., Stern, Y., Mayeux, R., Manly, J. J., Schupf, N., & Luchsinger, J. A. (2009). Mediterranean diet and mild cognitive impairment. *Archives of Neurology*, *66*(2), 216-225.
- Singh, B., Parsaik, A. K., Mielke, M. M., Erwin, P. J., Knopman, D. S., Petersen, R. C., & Roberts, R. O. (2014). Association of mediterranean diet with mild cognitive impairment and Alzheimer's disease: a systematic review and meta-analysis. *Journal of Alzheimer's Disease*, *39*(2), 271-282.
- Snowdon, D. A., Greiner, L. H., Mortimer, J. A., Riley, K. P., Greiner, P. A., & Markesbery, W. R. (1997). Brain infarction and the clinical expression of Alzheimer disease: the Nun Study. *JAMA*, *277*(10), 813-817.
- Stapleton, J., & Yuan, Y. (2018). Ontario's "welfare diet" in 2018. *Policy Options*.

Stringhini, S., Carmeli, C., Jokela, M., Avendaño, M., Muennig, P., Guida, F., . . . Bochud, M.

(2017). Socioeconomic status and the 25× 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1· 7 million men and women. *The Lancet*, 389(10075), 1229-1237.

Sugiyama, T., Tsugawa, Y., Tseng, C. H., Kobayashi, Y., & Shapiro, M. F. (2014). Different time trends of caloric and fat intake between statin users and nonusers among US adults: gluttony in the time of statins?. *JAMA Internal Medicine*, 174(7), 1038-1045.

Trichopoulou, A., & Lagiou, P. (1997). Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. *Nutrition Reviews*, 55(11), 383-389.

Trichopoulou, A., Vasilopoulou, E., Georga, K., Soukara, S., & Dilis, V. (2006). Traditional foods: Why and how to sustain them. *Trends in Food Science & Technology*, 17(9), 498-504.

Vetter, M. L., Herring, S. J., Sood, M., Shah, N. R., & Kalet, A. L. (2008). What do resident physicians know about nutrition? An evaluation of attitudes, self-perceived proficiency and knowledge. *Journal of the American College of Nutrition*, 27(2), 287-298.

Whitmer, R. A., Sidney, S., Selby, J., Johnston, S. C., & Yaffe, K. (2005). Midlife cardiovascular risk factors and risk of dementia in late life. *Neurology*, 64(2), 277-281.

Willett, W. C., & Stampfer, M. J. (2003). Rebuilding the food pyramid. *Scientific American*, 288(1), 64-71.

Table 1

Macronutrient intake (in grams) by age group, gender, geographical classification and dementia risk

Macronutrient Intake									
(by Age)									
Group	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
51-70	7570	216.8 (130.4)	73.5 (46.5)	62.4 (50.5)	19.1 (17.5)	24.5 (21.7)	10.7 (10.1)	0.0 (11.9)	1771.7 (1047.9)
70+	2933	200.9 (113.0)	62.5 (41.8)	51.8 (41.6)	16.3 (14.3)	20.5 (17.7)	9.2 (8.2)	0.0 (0.27)	1556.9 (885.7)
<i>z(p)</i>		-6.91 (.000)	-13.06 (.000)	-11.10 (.000)	-8.31 (.000)	-11.59 (.000)	-8.99 (.000)	-5.47 (.000)	-12.93 (.000)
(by Gender)									
Gender	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
Men	4955	235.2 (139.2)	80.4 (50.2)	61.8 (55.2)	21.1 (19.8)	27.0 (23.4)	11.8 (10.3)	0.0 (15.0)	1970.0 (1102.2)
Women	5548	193.3 (110.0)	62.8 (41.1)	52.6 (40.0)	16.0 (14.4)	20.6 (17.5)	9.2 (8.3)	0.0 (0.2)	1549.5 (836.4)
<i>z(p)</i>		-21.75 (.000)	-22.56 (.000)	-20.32 (.000)	-17.53 (.000)	-20.12 (.000)	-17.53 (.000)	-17.35 (.000)	-27.21 (.000)
(Urban/Rural)									
Group	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
Urban	8460	210.3 (125.3)	70.1 (45.9)	57.3 (47.7)	17.8 (16.7)	22.5 (19.9)	9.9 (9.2)	0.0 (8.8)	1700.0 (990.1)
Rural	2043	222.0 (125.8)	72.4 (48.8)	65.1 (49.0)	20.0 (16.5)	26.2 (21.8)	11.2 (9.8)	0.0 (8.9)	1803.0 (1013.6)
<i>z(p)</i>		4.46 (.000)	3.04 (.002)	8.06 (.000)	8.02 (.000)	8.15 (.000)	5.86 (.000)	2.56 (.011)	6.13 (.000)
(by Dementia Risk)									
Group	Median (IQR) in grams/day								Median (IQR) in Kcal/day
	N	Carbs	Proteins	Fats	SFs	MUFAs	PUFAs	Alcohol*	Energy
At-Risk	4295	205.5 (118.3)	68.2 (47.1)	55.8 (46.5)	17.4 (15.6)	21.9 (19.8)	9.9 (8.6)	0.0 (1.8)	1648.6 (965.3)
Healthy	6208	218.1 (130.9)	72.3 (46.0)	61.5 (49.4)	19.0 (17.7)	24.0 (21.1)	10.4 (9.8)	0.0 (10.9)	1771.4 (1041.2)
<i>z(p)</i>		6.35 (.000)	5.56 (.000)	6.18 (.000)	5.80 (.000)	5.60 (.000)	4.29 (.000)	4.31 (.000)	7.42 (0.0)
ALL	10503	212.2 (126.7)	70.5 (46.2)	59.1 (48.3)	18.3 (16.7)	23.1 (20.3)	10.1 (9.4)	0 (8.91)	1717.1 (999.9)

* Median value is near zero due to many respondents' non-consumption of alcohol on a daily basis

Ivan Culum, PhD Candidate*Health and Rehabilitation Sciences (Health and Aging)***EDUCATION**

- 09/2008 – Present PhD Candidate, Western University**
Health and Rehabilitation Sciences (Health and Aging)
Supervisors: Dr. Joseph B. Orange, Dr. Dorothy A. Forbes
Thesis: *Cognitive Impairment and the Mediterranean Diet: a Canadian Perspective*
- 09/2007 – 08/2008 MSc Candidate, Western University**
Health and Rehabilitation Sciences (Health and Aging)
Supervisor: Dr. Dorothy A. Forbes
Degree not conferred; fast-track to doctoral program
- 09/2003 – 05/2007 Honours BA, Wilfrid Laurier University**
Psychology, Research Specialist

AWARDS

- 05/2009 – 04/2012 Frederick Banting and Charles Best Doctoral Research Award**
Canadian Institutes for Health Research (CIHR)
Award value: \$105,000

RESEARCH INTERESTS

Age-associated cognitive decline, age-associated neurological pathology, Mediterranean diet, healthy aging, diet and fitness, lifestyle/behavioural modification, omega-3 fatty acids, caregiver burden, chronic disease epidemiology, quality of life, health care satisfaction

SCHOLARLY ACTIVITIES

- 01/2018 – 05/2018 Lecturer**
COMMSCI 4411a Intro to Communication Sciences and Disorders
Western University
- 05/2017 – Present Sessional Instructor**
MHST/NURS601 Foundations of Health Systems in Canada
MHST/NURS603 Facilitating Inquiry
Athabasca University
- 01/2018 – 05/2018 Lecturer**
RS3601b Foundations in Rehab. Sciences
Western University
- 01/2017 – 05/2017 Lecturer**
HS3704b Population Aging & Health
Western University

- 09/2016 – 12/2016 Assistant Professor**
HS3025a Integrative Health
Western University
- 01/2015 – 05/2015 Lecturer**
RS3601b Foundations in Rehab. Sciences
Western University
- 01/2014 – 03/2015 Deemed Employee**
Statistics Canada (Western Research Data Centre)
Western University
- 01/2012 – 05/2012 Graduate Teaching Assistant**
HS2610 Introduction to Ethics in Health
Western University
- 01/2009 – 05/2009 Graduate Teaching Assistant**
HS2450 Models of Health & Health Care Delivery
Western University
- 05/2009 Pfizer Investigator Training Program**
Western University and Lawson Health Research Institute
- 01/2008 – 01/2012 Online database of bio-psycho-social assessments**
Supervisor: Dr. Aleksandra Zecevic
Western University
- 09/2008 – 08/2011 Researcher Training Sub-Committee**
Chair: Dr. Martha Donnelly
National Initiative for the Care of the Elderly
- 09/2008 – 05/2009 Professional Development Sub-Committee**
Chair: Dr. Sandy L. Campbell
National Initiative for the Care of the Elderly
- 08/2007 – 03/2012 Research Assistant**
Supervisor: Dr. Dorothy A. Forbes
Western University

Teaching Workshops

- 06/2015 – 02/2017 Certificate in University Teaching and Learning**
Western University
- 09/2015 – 12/2015 The Teaching Mentor Program**
Western University

06/2015 – 07/2015 Advanced Teaching Program
Western University

- Using Active Learning Strategies in the University Classroom

09/2009 – 07/2015 Future Professor Series
Western University

- Flourishing as a TA: Principles from Positive Psychology
- From Surviving to Thriving: Mental Health and Well-Being in Graduate School
- Accommodating Learning Styles in Language Classrooms
- Women in Academe
- Fostering Active Learning in the Classroom
- Building a Successful Graduate Student/Supervisor Relationship
- Evaluating Oral Participation
- Designing Your Own Course: Components of a Great Syllabus
- Using Social Media Effectively in the University Classroom
- Professionalism: Networking at Academic Conferences

Professional Society Memberships

National Initiative for the Care of the Elderly (NICE)

Peer Review

Peer Reviewer for The Cochrane Database of Systematic Reviews

Articles in peer-reviewed publications:

Culum I, Orange JB, Forbes D, Borrie M. (2015). *Differences between Canadian and Mediterranean diets: An assessment of macronutrients in the diets of Canadian older adults using data from the Canadian Community Health Survey 2.2*. The Journal of Aging Research & Clinical Practice, 4(4), 205-213. <http://dx.doi.org/10.14283/jarcp.2015.73>

Forbes D, Blake CM, Thiessen E, Finkelstein S, Gibson M, Morgan DG, Markle-Reid M, **Culum I**. (2013). *Dementia Care Knowledge Sharing within a First Nations Community*. Canadian Journal on Aging, 32(4), 360-374.

Forbes D, Finkelstein S, Blake CM, Gibson M, Morgan DG, Markle-Reid M, **Culum I**, Thiessen E. (2012). *Knowledge exchange throughout the dementia care journey by Canadian rural community-based health care practitioners, persons with dementia, and their care partners: an interpretive descriptive study*. Rural and remote health, 12(4), 2201.

Culum I, Orange JB, Forbes D, Borrie M. *Omega-3 polyunsaturated fatty acids and mixed dementia*. 27th International Conference of Alzheimer's Disease International 2012, Medimond International Proceedings.

Forbes D, Blake C, Salonen E, Finkelstein S, Morgan DG, Markle-Reid M, Gibson M, **Culum I**, Leskovar C, Little B. (2011). *What is Required to Ensure Quality Dementia Care in Rural Settings?* *Alzheimer's & Dementia*, 7(4), S638.

Forbes D, **Culum I**, Lischka AR, Morgan DG, Peacock S, Forbes J, Forbes S. (2009). *Light therapy for managing symptoms of dementia: A Cochrane review.* *Alzheimer's & Dementia*, 5(4S), P408.

Forbes D, **Culum I**, Lischka AR, Morgan DG, Peacock S, Forbes J, Forbes S. *Light Therapy for Managing Sleep, Behaviour, and Mood Disturbances in Dementia.* *Cochrane Database of Systematic Reviews.* Art. No.: CD003946. DOI: 10.1002/14651858.CD003946.pub2.

Forbes SC, Forbes DA, Morgan DG, Markle-Reid M, Wood J, **Culum I**. (2008). P2-431: *Effects of physical activity programs on persons with dementia: A Cochrane review.* *Alzheimer's & Dementia*, 4(4), T500.

Culum I, Forbes D. *Posatirelin (l-pyro-2-aminoadipyl-l-leucyl-l-prolinamide) treatment for persons with dementia [Protocol].* *Cochrane Database of Systematic Reviews* 2008, Issue 4, DOI: 10.1002/14651858.CD007347

Forbes D, Forbes S, Markle-Reid M, Morgan D, Taylor B, Wood J, **Culum I**. *Physical activity programs for persons with dementia.* *Cochrane Database of Systematic Reviews* 2008, Issue 3, Art. No.: CD006489. DOI: 10.1002/14651858.CD006489.pub2.

Published abstracts:

Culum I, Orange JB, Forbes D, Borrie M. *Dietary habits of older Canadians: An assessment of macronutrients in the diets of Canadian older adults using data from the Canadian Community Health Survey 2.2* Western University Faculty of Health Sciences Research Day, London, ON, March 2015.

Culum I, Orange JB, Forbes D, Borrie M. *Omega-3 polyunsaturated fatty acids and mixed dementia.* 27th International Conference of Alzheimer's Disease International, London, UK, March 2012.

Culum I, Orange JB, Forbes D, Borrie M. *Omega-3 fatty acids and mixed dementia.* Alzheimer's Association International Conference on Alzheimer's Disease, Paris, France, July 2011

Forbes D, Blake C, Salonen E, Finkelstein S, Morgan DG, Markle-Reid M, Gibson M, **Culum I**, Leskovar C, & Little B. *What is Required to Ensure Quality Dementia Care in Rural Settings?* Alzheimer's Association International Conference on Alzheimer's Disease, Paris, France, July 2011

Culum I, Klooseck M. *ω -3 Polyunsaturated Fatty Acids and Dementia: A Comprehensive Literature Review.* 39th Annual Scientific & Educational Meeting of the Canadian Association on Gerontology, Montreal, Quebec, December 2010.

Culum I, Forbes D, Orange JB, Borrie M. *Docosahexanoic Acid (DHA) for Dementia: A Double-blind, Placebo-controlled Randomized Control Trial Design*. 5th Annual Canadian Conference on Dementia, Toronto, Ontario, October 2009.

Culum I, Kloseck M. *ω -3 Polyunsaturated Fatty Acids and Dementia: A Comprehensive Literature Review*. 5th Annual Canadian Conference on Dementia, Toronto, Ontario, October 2009.

Culum I, Zecevic A. *Knowledge Exchange in Gerontology: Supporting Research via the BioPsychoSocial Assessments in Aging Website*. 38th Annual Scientific & Educational Meeting of the Canadian Association on Gerontology, Winnipeg, Manitoba, October 2009.

Culum I, Forbes D, Lischka AR, Morgan DG, Peacock S, Forbes J, Forbes S. *Light Therapy for Managing Sleep, Behaviour, and Mood Disturbances in Dementia*. 38th Annual Scientific & Educational Meeting of the Canadian Association on Gerontology, Winnipeg, Manitoba, October 2009.

Culum I, Forbes D. *Posatirelin (l-pyro-2-aminoadipyl-l-leucyl-l-prolinamide) treatment for persons with dementia*. 19th IAGG World Congress of Gerontology and Geriatrics, Paris, France, July 2009.

Culum I, Forbes D, Forbes S, Markle-Reid M, Morgan D, Taylor B, Wood J. *Physical activity programs for persons with dementia*. Annual Aging, Rehabilitation, & Geriatric Care Research Centre/Faculty of Health Sciences Symposium, The University of Western Ontario, London, Ontario, February 2009.

Culum I, Forbes D. *Posatirelin (l-pyro-2-aminoadipyl-l-leucyl-l-prolinamide) treatment for persons with dementia*. 37th Annual Scientific & Educational Meeting of the Canadian Association on Gerontology, London, Ontario, October 2008.

McDonald L, Lombardo A, Campbell SL, Chatterson M, **Culum I**. *Professional Development: National Initiative for the Care of the Elderly*. Social Work National Conference 2008, Toronto, Ontario, May 2008.

Culum I, Forbes D. *Posatirelin (l-pyro-2-aminoadipyl-l-leucyl-l-prolinamide) treatment for persons with dementia*. Annual NICE Knowledge Exchange 2008, University of Toronto, Toronto, Ontario, June 2008.

Culum I, Forbes D. *Posatirelin (l-pyro-2-aminoadipyl-l-leucyl-l-prolinamide) treatment for persons with dementia*. Faculty of Health Sciences Research Day, University of Western Ontario, London, Ontario, March 2008.

Culum I, Forbes D. *Posatirelin (l-pyro-2-aminoadipyl-l-leucyl-l-prolinamide) treatment for persons with dementia*. "Bridging Partnerships in Aging and Rehabilitation Research", Aging, Rehabilitation, & Geriatric Care Research Centre, Parkwood Hospital, London, Ontario, February 2008.

Other Relevant Activities:

CURRICULUM VITAE

CV6

Session Co-chair – *Evidence Based Care Paper Presentations*

37th Annual Scientific & Educational Meeting of the Canadian Association on Gerontology, London, Ontario, October 2008.

Johnston A, Sapergia S, Symes B, McCleary L, Mukhi J, **Culum I.** *Leadership And Networking Opportunities For Canadian Gerontology Students.* 37th Annual Scientific & Educational Meeting of the Canadian Association on Gerontology, London, Ontario, October 2008.