

Prevalence and patterns of alcohol consumption among persons with dementia in Canada.

by

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A Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree of

Master of Health Science

in

The Faculty of Health Sciences Graduate Program

University of Ontario Institute of Technology

Oshawa, Ontario

July 2018

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ACKNOWLEDGMENTS

My journey towards this degree would not be possible without my thesis supervisor, Dr. Emma Bartfay. I would like to express my gratitude to for her unwavering support and encouraging me during difficult moments where I felt stumped, tested and didn't always believe in myself. Her patience and expertise not only empowered me to complete this dissertation but taught me to have confidence in my abilities, a lesson for which I am forever grateful.

I would like to thank the other members of my thesis committee, Dr. Wally Bartfay and Dr. Vicki Smye for lending me their expertise and valuable feedback that helped develop, guide and strengthen my thesis. I would further like to thank Dr. Janet McCabe for taking the time to sit as my external committee member.

To my eternal cheerleader my mother, who has always believed in me and been my number one fan, your love and support has never gone unnoticed. And to my brother Keegan, whose admiration constantly pushed me to do better and be better. Without my family and friends, I would not be who I am today.

Finally, to David my rock, my best friend and partner in crime. I thank you for being patient when I was frustrated, celebrating even the littlest of triumphs, and for being there whenever I needed you. I love you more than words can say.

ABSTRACT

Aim: To identify the prevalence of alcohol consumption and its impact on chronic disease, injury and hospital stays in persons with dementia (PWD).

Methods: Multivariate analysis was conducted using data collected from a nationwide population-based survey, Canadian Community Health Survey (CCHS).

Results: PWD consume alcohol at comparable rates to persons without dementia. A reported 60% of PWD consume alcohol. Males more often reported alcohol consumption than females. Multivariate analysis showed PWD who consumed alcohol were less likely to report chronic conditions such as heart disease (22% vs 30%) and diabetes (13% vs 24%) than their counterparts who abstained from consumption.

Conclusions: Lower rates of injury, hospital stays, and various chronic diseases demonstrates the importance of assessing alcohol consumption in PWD. A better understanding of drinking habits in PWD would allow for the development of recommendations and guidelines to alcohol consumption.

Keywords: Alcohol consumption, Alzheimer's disease, dementia

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LIST OF ABBREVIATIONS

ARD	Alcohol Related Dementia
BAC	Blood Alcohol Concentration
BMI	Body Mass Index
CAI	Computer-Assisted Interviews
CCHS	Canadian Community Health Survey
DALYs	Disability Adjusted Life Years
DSM-IV	Diagnostic and Statistical Manual of Disorders, 4 th
HDL	High-Density Cholesterol
HR	Health Region
NEARC	National Epidemiologic Survey on Alcohol and Related Conditions
NIAAA	National Institute of Alcohol Abuse and Alcoholism
PWD	Persons with Dementia
RDD	Random Digit Dialing
UK	United Kingdom
VaD	Vascular Dementia

CHAPTER 1: INTRODUCTION

Dementia is recognized as one of the greatest contributors to disability and dependency in older adults. Experts estimate that 47.5 million people are living with dementia worldwide, and 10 million new cases each year are projected [1, 2].

Dementia is not an individual disease but rather a collection of conditions distinguished by the deterioration of memory and other cognitive abilities [3].

Dementia is not one disease but rather a group of conditions distinguished by the deterioration of memory and other cognitive abilities [3]. Alzheimer's disease is responsible for 60–70% of all dementias. To be classified as dementia, the loss of cognitive functions must be severe enough to interfere with everyday tasks, and a memory deficit must be demonstrated objectively via cognitive testing. Cognitive deficits in dementia can include aphasia (abnormal speech), agnosia (impaired recognition of people or objects), apraxia (hindered motor skills), or executive function impairment (difficulty with planning, judgement, and problem solving) [3]. There is no known cure for most common forms of dementia, for example, Alzheimer's disease.

Early onset of dementia is uncommon as most of the people diagnosed are adults aged 65 and over. Between 2006 and 2011, the number of Canadians aged 65 and over increased by 14% [4]. By 2036, the number of older individuals is predicted to double, and they will represent between 23% and 25% of the population or almost 11 million people [4]. The rapidly aging population will present considerable problems for the Canadian healthcare system over the next 20 years. Dementia is a constant health concern, a consequence of the aging population. In 2011, 747,000 Canadians were living with Alzheimer's disease or related dementias. By 2031, dementia is projected to affect 1.4 million Canadians. The economic implications of

dementia are considerable, as the total economic burden of dementia in Canada is currently \$33 billion per year and is projected to increase to \$293 billion by 2040 predominantly due to the aging population and the subsequent increased incidence of dementia [5]. This thesis will critically assess the current state of alcohol consumption within the dementia population by reviewing the literature currently available, conducting a secondary data analysis, and providing recommendations based on the findings.

1.1 ALCOHOL

Alcohol is a transparent, colourless psychoactive substance that has been shown to have both positive and negative health outcomes. It is considered a “depressant” drug as it slows down the parts of the brain that affect cognition and behaviour [6]. The use of alcohol can be traced back to 8000 BC and is common in many cultures in the present day. People drink to socialize, celebrate, and relax [7]. Alcohol is a product which results from fermenting or distilling various fruits, vegetables, or grains. Individuals respond differently to alcohol depending on factors such as age, body weight, sex, sensitivity, and the frequency of drinking. Many people experience a feeling of reduced inhibition and stress, while others experience depression or hostile feelings [6, 7].

Alcohol has a considerable burden of disease and injury. Measured in disability-adjusted life years (DALYs), 5.1% of the global burden of disease and injury is estimated to be attributable to alcohol [8]. Approximately 3.3 million deaths annually are a consequence of the harmful use of alcohol. Research has demonstrated a causal relationship between excessive alcohol consumption and a spectrum of mental disorders, other non-communicable diseases, and injury; but moderate alcohol use is associated with a decrease in chronic diseases. In Canada, the estimated cost of

alcohol abuse was \$14.6 billion in 2002 [9]. There is no established national strategy for alcohol consumption in Canada. Alcohol is also associated with dementia. Several modifiable risk factors can improve the quality of life of PWD such as diet, exercise, and sleep management [10-12]. Alcohol consumption is another modifiable risk factor which can have an effect on a person's quality of life [13]. Dementia and cognitive impairment occur in an estimated 10% of alcohol-dependent individuals [14].

1.2 ALCOHOL CONSUMPTION IN OLDER ADULTS

Excessive drinking is defined as four or more drinks on any one occasion for adult women, and five or more drinks on a random occasion for adult men. Most institutions fail to identify drinking guidelines for adults over 65, and the definition of at-risk drinking varies and is defined differently by different institutions. The National Institute on Alcohol Abuse and Alcoholism (NIAAA) is one of the few institutions to define specific guidelines for older adults. They define at-risk drinking for persons over 65 years of age as consuming more than seven drinks per week or more than three drinks on any given day [15].

While moderate alcohol consumption has been associated with positive health outcomes, excessive alcohol consumption is most commonly associated with negative repercussions. As the aging "baby boomer" population and older adults comprise a higher proportion of the population than we have previously experienced, it is vital to explore the relationship between alcohol consumption and the quality of health [16]. The prevalence of excessive alcohol use in older individuals is predicted to increase, along with the associated healthcare costs [13]. It is therefore essential to examine the prevalence of alcohol consumption in the older population, but more specifically excessive drinking habits among the elderly around the world. Below, four countries are discussed in more detail.

UNITED KINGDOM

Most of the research literature currently available on the United Kingdom (UK) focuses on excessive drinking by younger adults rather than adults aged 65 and over [13, 17-19]. There is, however, some evidence from the UK that the current population of older individuals may be heavier drinkers than the previous generation. Importantly, this trend is anticipated to continue [16, 17]. In 1984, approximately 12% of males and 3% of females drank amounts exceeding “sensible limits.” By 1996, the numbers had risen to 18% of older males and 7% of older females [13].

AUSTRALIA

In 2006, Australia introduced a national alcohol strategy in response to patterns of high-risk alcohol consumption. It was estimated that each year approximately 3,200 deaths were caused by alcohol and AUD 15.3 billion spent as a result of alcohol-related social problems [20]. Every three years, the Australian National Drug Strategy Household Survey (NDSHS) reviews the patterns and trends in alcohol consumption across the country. Instituting a nation alcohol strategy showed some promising results, 2013 yielded a decrease in reports of risky drinking. Adults over the age of 69, however, were still at risk of experiencing long-term alcohol-related harm [21]. Currently, there are no intervention protocols in place for harmful drinking habits in older adults [22]. Among all age groups, males are found to drink alcohol in larger quantities and more frequently. An Australian study found that 18% males and 3.5% females aged 65 and older drank two or more drinks per day [23]. While risky drinking has lessened, Australians still consume more alcohol per capita (11.2 vs 10 litres) than Canadians do.

UNITED STATES OF AMERICA

According to the data collected from the United States National Epidemiologic Survey on Alcohol and Related Conditions (NEARC), 37% of older women and 55% of older men were current drinkers in 2001 [16]. The NEARC identified 6% of women, and 14% of men abused alcohol or had alcohol dependence as defined by the DSM-IV criteria [16]. A more recent study from the National Survey on Drug Use and Health found that 13% of men and 8% of women aged 65 and over reported consuming two or more drinks each day [13].

An American survey by Wilson *et al.* had 2,593 respondents aged 64 and older defined the harmful consumption of alcohol as two drinks per day and hazardous consumption as more than two drinks per day [24]. 37.4% of older adult drinkers were classified as falling under harmful consumption, and 53.3% had harmful or hazardous consumption habits. Overall, these drinkers made up 17.3% and 24.8%, not including older people who abstain, of the older population included in the study. Even though 85.5% of older adult drinkers did not exceed the recommended weekly limits, moderate drinking can still be deemed as harmful or hazardous because of the associated effects on health status, for example, through hypertension [24].

CANADA

A report from the World Health Organization notes that Canadians drink above than the global average. The average Canadian drank an average of 10 litres of alcohol per capita, ranking 20th worldwide. Canadians have a well-established history of alcohol use. Shifts in societal trends, such as social stigma, has moulded drinking patterns over time. In Canada, alcohol is widely promoted and accessible [25]. Long-term studies conducted in Canada have shown that an increase in alcohol sales is associated with increased rates of overall harm from alcohol [25]. Statistics Canada

documented the number of persons who were considered to indulge in heavy or excessive drinking, stratified by age and sex. In 2014, a total of 212, 815 males and 95, 207 females over the age of 65 consumed five or more drinks on one occasion, at least once in the past 12 months. [26]. The report offered no adjusted definition for heavy alcohol consumption in older populations.

Statistics Canada's definition for heavy drinking changed in a 2013 report on heavy drinking to conform to the World Health Organization's and Health Canada's guidelines for heavy drinking. Statistics Canada defined heavy drinking as males having five or more drinks and women having four or more drinks on one occasion at least once per month within the past year. It is critical to adjust the definitions of heavy drinking for older adults because the liver's ability to metabolize alcohol decreases with age [15]. Neglecting to adjust the definitions of heavy drinking for older adults could result in an underestimated prevalence of alcohol abuse among older persons, and potentially among persons with chronic conditions, including dementia.

It is significant to note that the literature search did not uncover any articles on the prevalence of PWD and alcohol consumption in Canada. Many studies have aimed to quantify the prevalence of alcohol consumption among older persons, but very few have looked at the drinking patterns of older adults who have specific chronic conditions. One of the few studies was conducted by Ryan *et al.* [13] they found that across seven different chronic diseases (hypertension, chronic obstructive pulmonary disease, depression, diabetes, heart failure, stroke, heart failure, and dementia), 22.3% of drinkers reported at-risk or above-guideline drinking. People with hypertension were the most prevalent sub-group partaking in at-risk drinking, with 6.9% of adults with hypertension reported to drink above the guidelines.

Dementia, on the other hand, was reported to be associated with the lowest rates of drinking, with 3.4% of PWD consuming alcohol at risky levels. The study in question, however, was limited due to a relatively small sample of only 518 [13]. To my knowledge, there are no other studies that attempt to examine the prevalence of drinking specifically among the dementia population.

1.3 PHYSIOLOGY OF OLDER ADULTS AND ALCOHOL CONSUMPTION

There are specific physiological changes which take place during the aging process that contribute to an increased sensitivity to alcohol. As we age, our bodies change and processes begin to slow down. For example, a decrease in blood circulation and kidney and liver function diminishes the body's ability to excrete toxins such as alcohol. With age, the body has less water available to dilute alcohol, yielding a higher blood alcohol concentration (BAC). As a result, there is a higher blood alcohol concentration in seniors after a standard drink compared to a younger person [27]. In addition to the body's decreased water content, the loss of lean body mass can reduce alcohol distribution, thus leading to an increased ethanol concentration per unit of alcohol consumed [18, 28]. An important enzyme responsible for breaking down alcohol is Dehydrogenase. Research has demonstrated that this enzyme is present in smaller quantities in older adults. The critical enzyme involved in the metabolism of alcohol by the liver, dehydrogenase, becomes less efficient over time, resulting in a high BAC which persists for longer than it would in a younger person [29]. These findings reinforce the notion that the body's ability to metabolize alcohol is compromised with age [18]. Due to deterioration, the NIAAA recommends that individuals over the age of 65 limit themselves to one drink per day, half of the recommended limit for young adults [15].

1.4 MOTIVES FOR DRINKING IN OLDER POPULATIONS

In Canada, the levels of alcohol consumption decrease with age [30]. Traditionally, as people aged, their consumption levels got lower, and abstinence became more prevalent [31, 32]. In the early 20th century, a national prohibition was established as a temporary wartime measure from 1918-1920. In recent decades, however, many socio-cultural changes have occurred, which has led to the increased availability and the social acceptability of alcohol consumption in Canada. Over time, alcohol has become an important societal custom and as a result is less stigmatized [17, 19, 33-36]. Women, in particular, have been affected by the shift in societal trends, as acceptance of drinking in public has increased [17, 33]. Some evidence has even suggested that older adults who have established alcohol problems are likely to relapse due to stressful age-related life events [33]. Despite the harm that can come from alcohol use, a body of evidence promotes light to moderate alcohol consumption as a primary preventative measure for chronic diseases such as cardiovascular illness [13, 34]. The increase in alcohol consumption among older adults is due to changes in attitudes toward alcohol, changed licensing laws, more advertising, and the fact that alcohol has become more affordable [33].

To date, there is no widely accepted theory as to the motivation of alcohol consumption in PWD. Extensive research has examined the motives for drinking alcohol among the general population, but, to my knowledge, there is little to no documentation as to why those with chronic diseases drink. An emerging theory proposes that older persons with chronic diseases such as dementia are turning to alcohol for self-medication. Immonen *et al.* [37] found that older individuals who deemed themselves unhealthy or very unhealthy are more likely to use alcohol for medicinal purposes than those who consider themselves healthy. They further found

that the use of alcohol for medicinal purposes was linked with a prior diagnosis of dementia [37]. Another study found that older adults have an array of reasons for alcohol consumption, including celebration, social reasons, depression, anxiety, and loneliness; as the population ages, the medicinal uses become more prevalent [35].

1.5 CONSEQUENCES OF EXCESSIVE ALCOHOL CONSUMPTION

A common issue is that many of the symptoms of alcohol abuse, such as more frequent falls, cognitive decline, and slower reactions, may mimic the symptoms of aging and becoming more physically frail [38]. It has been suggested that the risk of falls, motor vehicle injuries, and suicide brought on by alcohol misuse is underestimated; which is believed to be because those who drink excessively are found to report often report good health. Once health begins to deteriorate or comorbid health concerns arise, people often stop drinking during or under-report their drinking habits to medical professionals due to fear of adverse social perceptions or stigma [39].

FALLS AND INJURIES

Falling is a severe danger for older adults, and it is also a frequent acute side effect of drinking alcohol [18, 23, 39]. Deaths from falls are more likely to be associated with moderate-to-heavy drinking with women than among men [39]. Tait *et al.* [23] have found that compared to low-risk alcohol users, there is no increased risk for falls among the high-risk user group [23]. Cross-sectional data collected during a community-based study have shown that alcohol is inversely related to frequent falls: abstainers have the highest prevalence of falling, whereas those who consume at-risk levels of alcohol are at lowest risk for falls [23]. Overall, older adults who drink do report less frequent falls. It is important to note, after acute alcohol

consumption, older adults are still prone to falls, and evidence shows they are particularly susceptible after excessive levels of consumption [18].

HOSPITAL ADMISSIONS

A critical implication of excessive alcohol consumption for the healthcare system is the increased use of health services. While some preliminary studies examined the prevalence of alcohol consumption in older populations, there are limited studies that look at the outcomes of such consumption.[18, 23]. Tait *et al.* aimed to evaluate self-reported hospital admissions in light of Australian recommendations for alcohol consumption. The results demonstrated that older women who drink at high-risk levels are at higher risk for hospital admission in comparison to individuals consuming alcohol at low-to-moderate levels [23]. Older men who drink at high-risk levels were not found to have significantly more hospital admissions. These results could be an underestimation due to the current Australian drinking guidelines, which are not adjusted for older adults' limited ability to metabolize alcohol. Recent research has suggested that these guidelines should be reviewed to account for the physiological differences between younger and older adults [27].

Evidence indicates that older adults access healthcare services more often when they consume high levels of alcohol [18, 23]. There is also evidence that these individuals are more difficult to discharge once they have accessed the service. Persons with Alcohol-Related Dementia (ARD) are over-represented among patients who are difficult to discharge, and they have complex healthcare needs which are routinely overlooked. Evidence suggests that appropriate treatment offered through specialized services could improve cognitive and social function for persons with ARD [14], ultimately leading to a better quality of life and reduced acute healthcare

utilization costs [14, 18]. Increased service utilization due to alcohol consumption in older adults has substantial economic consequences. In the UK, the costs of alcohol-related inpatient hospital admissions in 2010/2011 were \$825.6 million for adults aged 55–74 years, whereas only \$63.8 million was spent on those aged 16–24 [18]. In the same country, those aged 65 and over accounted for 44% of all alcohol-related admissions yet made up only 17% of the total population [18]. To my knowledge, there is limited research that attempts to explore overall hospital utilization by older adults who have consumed high levels of alcohol or, more specifically, the resulting economic burden. Indeed, more research is needed to examine the impact.

MEDICATION INTERFERENCE

It is well known that alcohol can adversely interfere with medications that are used to treat conditions in the elderly, including hypertension and depression [13, 18]. Drinking alcohol, even within guidelines, can be detrimental to the proper management of chronic conditions. Prescriptions used to treat hypertension, hyperlipidemia, diabetes, and depression carry warning labels as the combination of these medications and alcohol can result in dizziness, irregular heartbeat, a drop in blood pressure (i.e., hypotension), and fainting [13]. Additionally, at-risk alcohol consumption may cause poor medication adherence, persistent hypertension, increased bleeding, and reduced self-management abilities [13].

1.6 POSITIVE HEALTH EFFECTS OF ALCOHOL CONSUMPTION

A variety of articles support the positive health outcomes of moderate alcohol consumption [40, 41]. According to Tait *et al.* [23], moderate alcohol use by older women is associated with beneficial effects on their overall health status, decreased hospitalization, and low incidence of heart disease. In contrast, moderate alcohol use

did not increase the rates of ER use or hospital days among women or men. Problematic alcohol abuse does increase healthcare utilization rates among older adults. Current drinkers, at moderate levels of consumption, were found to be healthier than former drinkers [16]. According to the NESARC, moderate American drinkers report less healthcare service utilization, fewer health concerns, and better health status than former drinkers and lifetime abstainers. These drinkers are also mostly white, married, college graduates, employed, and privately insured, all these variables that have been associated with better health outcomes [16]. It is widely accepted that moderate alcohol consumption helps to lower the risk of cardiovascular events by increasing high-density cholesterol (HDL) [40-42].

On the other hand, evidence from other studies suggested that heavy drinkers have elevated risks of injuries, falls, alcohol-induced cardiomyopathy, liver disease, cognitive impairment, ischemic stroke, and behavioural problems [27, 39, 43]. Older adults are at particular risk from consuming alcohol as age-related changes in the body's composition make them more vulnerable and because they often use medications that interact poorly with alcohol [23]. Although some research suggests specific benefits from moderate alcohol consumption, the exact mechanisms of the protective effects of alcohol are unclear and may not come without risk [13, 40-42].

1.7 ALCOHOL-RELATED DEMENTIA

Many studies suggest that alcohol may have a causal effect on developing dementia. The resulting disease is referred to as alcohol-related dementia (ARD) [34, 44, 45]. The clinical definition of ARD describes an extensive syndrome of impaired memory and cognition that follows excessive alcohol use [3, 46, 47]. The etiology of ARD is multifactorial and poorly understood. Deficits seen in ARD are similar to other forms of dementia that include impairment of cognition, memory, perception,

personality, and language [14, 46]. ARD is associated with an increased rate of challenging behaviours, including aggression and disinhibition. Furthermore, drinking in secret can lead to intoxication-related adverse events (e.g., incontinence and falls) [44].

ARD is believed to be the result of neurotoxic effects that develop into a dementia syndrome, but the exact mechanisms remain to be identified. Evidence of direct alcohol neurotoxicity is weak, and it is, therefore, unclear whether alcohol is the cause of the dementia-like deficits [44]. Many studies have suggested that ARD is identical with Wernicke-Korsakoff's syndrome rather than dementia [48]. Wernicke-Korsakoff's syndrome is defined by *The Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR) [3] as an alcohol-induced amnestic disorder [47]. ARD is caused by a thiamin deficiency and is most commonly seen in people with alcoholism as alcohol ingestion interferes with the absorption of nutrients from the digestive system [44].

Although ARD was listed in the DSM-V, the criteria for diagnosis is problematic for a multitude of reasons [3]. It is difficult to define excessive alcohol use as it varies by sex and age, which makes it challenging to identify heavy drinking that could result in ARD. Alcohol consumption is often under-reported or overlooked by physicians when determining a diagnosis of dementia. The qualitative symptoms presented in cases considered to be ARD are very similar to vascular dementia, therefore hard to differentiate clinically [44]. ARD remains the subject of considerable debate, and further research is needed to draw firm conclusions.

1.8 PREVALENCE OF ALCOHOL CONSUMPTION AMONG PWD

Lifestyle habits that have social stigmas, such as alcohol consumption, are believed to be underreported in PWD. Indeed, research literature suggests that there are several barriers to obtaining accurate data on alcohol consumption among the dementia population [37, 44, 49, 50]. One such barrier is that data collection often depends on self-reported alcohol consumption, which poses several challenges, especially given the nature of dementia. Furthermore, obtaining the informed consent necessary for any study is complicated with PWD as many individuals lack the cognitive capacity to consent and therefore often require a proxy respondent [51]. A response bias can result from the proxy respondents' inability to accurately account for the lifestyle factors of the older population with cognitive impairments [52]. Other challenges to identify the prevalence of alcohol use include variations in age limits, different definitions of alcohol consumption, and overlap with conditions that are misdiagnosed as other ailments (i.e., alcohol-related dementia) [53].

1.9 GAP IN KNOWLEDGE

As discussed above, research in dementia has traditionally had a heavy focus on etiology, treatment options, early detection, improving physical health, treating accompanying physical illness, and providing support for caregivers. To the best of my knowledge, no evidence has evaluated alcohol consumption for persons living with dementia or the impact of consumption. Research has shown that excessive alcohol consumption is a prevalent problem among older adults in countries such as Scotland, England, the U.S., Japan, India, and Australia [13, 16-19, 34]. While there was evidence of alcohol consumption in older adults, data for persons with dementia specifically was negligible. A consensus among researchers identified that alcohol used in low-moderate levels yields positive health outcomes and consuming alcohol

in excess or bingeing results in adverse outcomes. NESARC concluded that more research is needed to investigate the relationship between alcohol and older populations using longitudinal data and a broader range of measures for alcohol use and health service utilization [16].

1.10 RATIONALE

This study aims to address the gap in our knowledge of alcohol consumption in PWD, which is a result of inadequate data. Filling the knowledge gap would allow policymakers to formalize a national alcohol strategy in Canada that accounts for dementia. While many countries have adopted a nationwide alcohol strategy, Canada has yet formally adopted any national strategy addressing alcohol consumption in older adults. Currently, many provinces have adopted a provincial framework or guidelines for alcohol consumption, none of which account for persons with dementia. Many of these provincial drinking guidelines have not accounted for the decreased ability to break down alcohol in older adults, which most persons living with dementia are. A national dementia strategy is regarded as a critical instrument to rectify the current climate of dementia care and support across the country [54]. Seven provinces have adopted a dementia strategy, but all of failed to include content on alcohol or related substance use of PWD [55-57]. January 2017, Canada become the 30th country to launch a national dementia strategy by passing Bill C-233, *An Act respecting a national strategy for Alzheimer's disease and other dementias* [54]. This bill means the Government of Canada will address the scale, impact, and cost of dementia. Currently, to the best of my knowledge, there are no guidelines for alcohol abuse or consumption in dementia populations that could be of benefit to a national dementia strategy.

Given the aging population in Canada and the increasing incidence of dementia, it is critical for experts to correctly understand the unique vulnerability of PWD to better comprehend their healthcare needs and the associated direct and indirect healthcare costs [16]. The findings of the present study could have important benefits for healthcare planning, public health policy, and health promotion among the aging community [16]. More importantly, alcohol consumption is a known modifiable risk factor, and it is imperative that high-quality information be made available concerning safe levels of use especially among vulnerable populations (i.e. PWD). Alcohol use is a complex issue, especially among older individuals who are often already vulnerable and suffer from chronic ailments at elevated rates [50]. More research is therefore needed to draw inferences that can be applied clinically and reflected in healthcare management policies and directives [13]. This study aims to fill the gap in our knowledge by studying the prevalence of alcohol consumption and its impact on chronic diseases, injuries, and hospital stays.

1.11 OBJECTIVE

The primary objective of this study is to examine the prevalence of excessive alcohol consumption in the dementia population. This study further seeks to understand the effects of alcohol consumption on hospital stays, injuries, and chronic conditions among PWD.

1.12 RESEARCH QUESTIONS

This research study sets out to answer the following quantitative research questions:

- (i) What is the prevalence of alcohol consumption in the population?
- (ii) What is the prevalence of chronic disease among persons with dementia who consume alcohol?

- (iii) What is the prevalence of injuries among persons with dementia who consume alcohol?
- (iv) What are the effects of alcohol consumption on hospital stays in the population with dementia?

1.13 HYPOTHESES

This research study critically examines the following three hypotheses:

- (i) Alcohol consumption is more prevalent in the dementia population than in the general population.
- (ii) Among PWD, those who consume alcohol will have more chronic disease than those who do not consume alcohol.
- (iii) Among PWD, those who consume alcohol will have more injuries than those who do not consume alcohol.
- (iv) Among PWD, those who consume alcohol will have more extended hospital stays than those who do not consume alcohol.

CHAPTER 2: METHODOLOGY

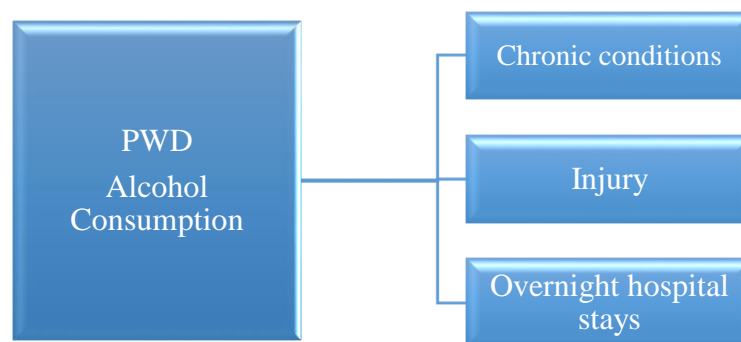
This chapter describes the broad philosophical underpinning which guided the methodological approach of this study. Quantitative data were obtained from the annual CCHS, a population-based cross-sectional survey. The 2013-2014, a combined two-year cycle of the CCHS, was used to capture a more robust sample size. As the CCHS collected data from all provinces and territories, it was an ideal selection to generalize results about the Canadian population. To objectively test the hypothesis presented in Chapter 1, secondary data analysis was completed. Descriptive and correlational statistical methods were employed to effectively observe the prevalence and relationships of alcohol consumption within the dementia population.

2.1 RESEARCH DESIGN

An analysis of secondary data was conducted to examine the prevalence of alcohol consumption, along with any potential implications for health. The 2013-2014 CCHS was a cross-sectional survey involving subjects from across Canada which efficiently provided a snapshot of many key elements of health [58]. The CCHS survey was designed in an attempt to provide reliable estimates of health outcomes across the nation. [59] One of the fundamental disadvantages of cross-sectional design is the inability to definitively determine causal relationships. Cross-sectional are limited as they have an inability to discern temporal relationships and so the findings cannot be used to develop trends. The use of secondary data derived from cross-sectional study design, such as the CCHS, was advantageous in many regards. Cross-sectional surveys allow for multiple associations between different variables to be studied at one time. The multivariate analysis enabled us to examine associations between alcohol consumption, dementia and many personal characteristics such as sex, age, and income. As the CCHS was previously administered, there was a short

period required to seek approval for access. Data collected on exposure, alcohol, and injury/disease was from the same individual. These findings allowed us to identify the prevalence of alcohol consumption [6]. The cross-sectional study did have limitations but was an ideal method for this study as it allowed access to a nationwide dataset quickly and cost-effectively. Figure 1 below is a conceptual model which visualizes the flow of analysis that was be undertaken in this study.

Figure 1: Conceptual model depicting analysis pathway for study outcomes.



2.2 SECONDARY DATA SOURCE

Secondary data represents a substantial resource to researchers as primary data collection of large populations can be expensive and difficult to obtain. Inherent to the nature of any secondary data, CCHS survey was not developed to address the particular research question in my study. Another limitation is data suppression to protect the confidentiality of respondents the primary researchers of the CCHS do not make the entirety of the dataset publically available and therefore suppressing some important variables. Secondary analysis of existing data helps to enhance the overall efficiency of health research in Canada as it provides multiple applications from a single health-data source.

The primary objective of the CCHS is to collect health-related data at the sub-provincial levels of health region (HR) or combined health regions. A sample of

130,000 respondents was required by the CCHS on a two-year basis [59]. The 2013-2014 CCHS survey included various questions about health care services, chronic conditions, lifestyle and social conditions, social and economic status, age, sex, mental health and well-being for the Canadian population. The target population encompassed persons residing in Canada over the age of 65 with and without a diagnosis of dementia. Individuals excluded from population eligibility included persons located on reserves and other Aboriginal Settlements, full-time members of the Canadian Forces, and persons residing in Quebec health regions of Region du Nunavik and Region des Terres-Cries-de-la-Baie-James, which represented less than 3% of the Canadian population 12 years and older [59]. The purpose of this survey was to provide a reliable data collection for the use of health surveillance programs and ultimately improvement of the health of the population from which the sample represented.

Each component of the CCHS questionnaire was rigorously constructed by the cooperative efforts of experts from Statistics Canada, other federal and provincial departments and some academic fields. The CCHS was designed with three components: the common content (core and theme), the optional content, and the rapid response content. Common content were questions that all survey respondents were asked. The optional content was selected on an as 'needed basis' of each province. The rapid response component was offered for emerging issues and released six months after data collection; this information is often of lower quality [59].

An integral component of the CCHS execution was the utilization of computer-assisted interviewing (CAI). Meaning, as questions for the CCHS were developed, the logical flow into and out of each question was programmed; which

was done by stipulating the type of answers required, minimum and maximum values, and online edits that were associated with incidences of non-responses. Modules and revisions to existing modules in the CCHS content were extensively tested with several methods. Qualitative tests were conducted using individual cognitive interviews, or on rare occasion, focus groups are utilized to ensure that the questions and concepts were appropriately phrased [59].

Interviewer bias was controlled for with the use of a standardized questionnaire. The interviewers were trained, and computer-assisted, and data were verified with previous records [59]. The survey was a structured questionnaire primarily delivered over the telephone, which contributed to the internal validity of the data. Another national cross-sectional survey on alcohol consumption found that telephone interviews yield results as accurate as in-person interviews and are more cost-effective [60]. Standardized questions were presented to the participants in the same way with no variation in their wording. It was not possible for interview administrators to input out-of-range values.

The first 88% of all CCHS samples from each HR frame were selected using a multistage stratified cluster; their interviews were completed face-to-face. The first step of the design was to list all of the dwellings in the area frame. The second step of the multistage stratified cluster design was to select the samples from the list of dwelling in the health region, thereby creating the sample of households. Respondents were then randomly selected from the household's sample [59]. The final 12% of survey respondents were selected via random digit dialling (RRD) and were interviewed over the phone [59]. The sampling method considered user needs, cost, efficiency, response burden and operation limitations. The size of the sample was also enlarged during the entire selection process to account for the anticipated non-

response and respondents outside of the coverage. These efforts were made to reach the goal of 130, 000 responses which allowed for better study validity [59].

Data for this study was collected from January 2013 to December 2014, using a questionnaire that was delivered using CAI. The survey data was collected by Statistics Canada directly from survey respondents. A portion of the data was collected using a proxy due to the physical or mental incapacity of the selected respondent [59]. The survey was administered by Statistics Canada trained interviewers via telephone and personal face-to-face. Interviews with survey respondents were voluntary. In the event of a non-response, CCSH interviewers were instructed to make all reasonable attempts to obtain interviews. Some methods used included escalation to a senior interviewer or contacting again at the end of a six month period [59].

Statistics Canada ensured a rigorous data quality evaluation process was embedded in the CCHS. A Steering Committee and an Advisory Board several authorities assembled from Health Canada, provincial and territorial ministries of Health, and the Public Health Agency of Canada determined the study focus. During data collection, control and monitoring measures were put in place, and corrective action plans include response rate evaluation, reported and non-reported data evaluation, on-site observation of interviews, and improved collection tools. Three data validations steps were undertaken once data processing was completed. A validation program was completed to compare estimates for the health indicators taken from the previous year. This validation was completed at various geographical levels, by age, and sex. Any significant differences were reviewed for further anomalies in the data. In the final step of the data validation process, external validation was completed. Share files were sent to each province and territory partner

for a two-week review period. At this time, a critical assessment of the data could be completed, and Statistics Canada could have been informed and questioned on any irregularities or concerns [59].

2.3 LIMITATIONS AND STRENGTHS OF THE CCSH

Retrospective studies are commonly at risk for recall bias, a systematic error rooted in the inaccuracy or incompleteness of recollections by the survey respondent [58]. In this study, recall risk could be the result of cognitive decline or the use of proxy respondents. As dementia is a progressive disease, with individuals becoming unable to communicate their habits such as alcohol consumption, proxies become an alternative for behavioural observations. Proxy respondents were included as participants in this study, which may have influenced the results as it can be difficult to report the behaviours of another person accurately. PWD who are still able to effectively communicate their behaviour could have errors in their recall due to the progressive nature of dementia. An astringent interview protocol was utilized to help minimize the impact of recall bias [59].

Cross-sectional surveys can be highly effective, but they have limitations. First and foremost, cross-sectional surveys cannot be used to draw causal inferences [58]. The survey was retrospective and therefore did not collect data on the temporal relationship between alcohol consumption, dementia, and injury or healthcare use [58]. Cross-sectional study designs can identify prevalence, but they cannot report on incidence or relative risk. The primary objective of the present study, i.e., finding out the prevalence of alcohol consumption among PWD, could be achieved.

Prevalence is defined as the proportion of persons in a population who had a specified disease or attribute at one specified point in time or over a specific period of

time [58]. Incidence differs from prevalence in that incidence is limited to new cases in a population only, while prevalence is both new and pre-existing cases. Prevalence and incidence are often mistaken due to their similarities. Prevalence is utilized frequently when measuring for chronic disease, like dementia that have long prognosis and onset dates which are hard to identify [58]. Cross-sectional survey designs, as used in this study, are only able to identify prevalence as they look at a single point in time and new cases are not distinguished from pre-existing conditions [58]. Identifying prevalence was an important first step to understanding drinking habits in PWD.

Even though the use of secondary data derived from a cross-sectional study design has its limitations, there are also some important advantages. Cross-sectional surveys allow for the study of several associations between multiple variables simultaneously. The multivariate analysis enabled us to examine associations between alcohol consumption, dementia, and many personal characteristics such as sex, age, and income [58]. The data collected on exposure to alcohol and injury or disease came from the same individual; this allowed us to identify the prevalence of alcohol consumption [2]. The survey was a cost- and time-efficient method to access nationwide data in a short period of time.

2.4 DATA ANALYSIS

The primary objective of this study was to determine the prevalence of excessive alcohol consumption in the dementia population and its associated effects on health care utilization. To answer the objectives of the study, I conducted a statistical analysis using Statistical Package for Social Science (SPSS Inc., Chicago, Illinois, USA) version 23. The first step in the statistical analysis would traditionally be a preliminary data inspection for extreme values, outliers, and invalid records.

Statistics Canada had completed this step before data analysis, as the master data file could not be released to a researcher. Statistics Canada provided recommendations for appropriate weights that could be applied when necessary to ensure that the sample could be representative of the Canadian population. For this study, a p-value of ≤ 0.05 was be deemed significant priori for all statistical measures.

The second step in the statistical analysis was comprised of descriptive statistics. All independent and dependent variables (see section 2.4 and 2.5 below) were reported. For continuous variables, a two t-test was used, and a chi-square test was used for categorical data. A chi-square test compares two categorical variables in a contingency table to identify any associations, which tests to see if distributions of categorical variables differs [58]. A t-test compares two means and identifies if the means are different from each other, and how significant the differences are [58]. This step was intended to answer the first research question, the prevalence of alcohol consumption in the dementia population compared to the general population. To examine the second research question, prevalence of chronic conditions, a chi-square test was used as all data on chronic diseases was categorical in nature.

The third and final step was to identify any associations between variables which was accomplished using inferential statistics. To identify any associations, a binary logistic regression was completed. The regression analysis compared persons with dementia who drank to persons with dementia who did not drink. This step answered the final two research questions, any association between persons with dementia who drank alcohol and frequency of injuries and prolonged hospital stays. The Pearson correlation coefficient was used to examine relationships between the additional various independent variables (i.e. age, income). The strengths and limitations of this statistical analysis are further explored later in chapter 4.

2.5 INDEPENDENT VARIABLES

Through the core competencies in the CCHS, the main independent variable of alcohol consumption is available. Data was provided in regards to dementia diagnosis and frequency of alcohol consumption by respondents. The respondents were categorized into two separate groups: (1) persons diagnosed with dementia who consumed alcohol and (2) persons with dementia diagnosis who do not consume alcohol. The variable alcohol was measured by core content “Alcohol Use” (ALC). In this category respondents are asked how often during the past 12 months did they drink an alcoholic beverage? Responses included less than once a month, once a month, two to three times a month, once a week, two to three times a week, four to six times a week, every day. Those who drank 1 or less drinks per month were considered ‘not regular drinkers/abstain’ for the purpose of this study. It was important to note, additional details, such as types of alcohol consumed, were available in an optional competency section (ALW) which P.E.I, Quebec, Ontario, Manitoba, Saskatchewan, and Yukon Territory all elected to ask [62]. In addition, the analysis included independent demographic variables such as age, marital status, sex, and family income. Other variables that were included were mood disorders (depression, anxiety), diabetes, BMI/self-report, presence of pain, heart disease and stroke.

2.6 OUTCOME VARIABLES

There were three main outcome variables which we attempted investigated in this study. The first main outcome variable was the type and frequency of injuries that were treated by a health professional. Injury based questions were coded under the theme content of Injuries (INJ). Injuries included categories such as broken bone, burns, cut, or sprain that were serious enough to limit daily activity. The category additionally asked respondents if “you have any injuries that were treated by a health

professional, but did not limit your normal activities”. Respondents were asked if the injury resulted from a fall, lead to a prolonged hospital stay or an ER visit. These variables were measured with a yes/no answer and a min/max value. This outcome variable was available in the core content of the survey and was asked to all survey respondents which was important to maintain sample size [62]. The second main outcome variable was a chronic disease. Chronic disease were categorized as CCC. In this category, respondents were asked which of a series of chronic disease they had a diagnosis for. This outcome variable was available in the core content of the survey and was asked to all survey respondents [62]. The third main outcome variable was overnight hospital stays. This variable was measured by responses under the category of contact with health professionals (INJ). In this category respondents were asked, “In the past 12 months have you been an overnight patient in a hospital, nursing home or convalescent home, if so for how many nights?” These variables were measured with a yes/no answer and a min/max value. This outcome variable was available in the core content of the survey and was asked to all survey respondents [62].

2.7 ETHICS

Under the Statistics Act (1970), Statistics Canada is legally prohibited from releasing any information collected that could identify a person, business or organization. In compliance with this legislation, Statistics Canada did not release information from the CCHS about persons identified with dementia to external researchers. Instead, I submitted a set of SPSS syntax files to Statistics Canada. Upon receipt, Statistics Canada ran the statistical analysis and returned the output the results. The CCHS had appropriate confidentiality controls in place. There was no need for secure storage of data as there was no access to identifiable variables.

Ethical approval was obtained from the University of Ontario Institute of Technology Research Ethics Board (REB) and complied with the Tri-Council Policy Statement II guidelines of ethical conduct for human research. No analysis was completed without the written approval from University of Ontario Institute of Technology Research Ethics Board.

2.8 SUMMARY

As explored in the literature review, there was a significant gap in scientific knowledge about the alcohol consumption of PDW [8, 14]. There was a vast amount of literature that indicates serious health consequences from excessive alcohol consumption for those aged 65 or older [22]. As a result, this study discovered the prevalence of alcohol consumption among those with Dementia. The study further explored data, provided by the CCHS, to identify any relationships between alcohol consumption in the dementia population and hospital stays, injuries/falls, chronic conditions, and ER visits. These three outcomes were explored to infer how health care services are affected by excessive alcohol consumption in a vulnerable population, PWD.

CHAPTER 3: RESULTS

This chapter presents the results of alcohol consumption of persons living with dementia, the main objective of the present study. A statistical analysis, outlined in Chapter 2, was conducted on data obtained from the CCHS. The results of this analysis are described in this chapter. Section 3.1 introduces the CCHS sample and describes the inclusion and exclusion criteria for used to identify the relevant participants for the present study. Section 3.2 discusses the demographic variables for individuals with dementia who do or do not consume alcohol. The remaining sections sought to answer the final three research questions of this study. Section 3.3 explores the prevalence of chronic disease among PWD. Section 3.5 summarizes the results of a binary logistic regression focused on injuries of PWD who consumed alcohol. In section 3.6, I summarized the results of a binary logistic regression focused on hospital stays of PWD who consumed alcohol. The results of this chapter will be discussed in chapter 4.

3.1 CCHS SAMPLE POPULATION AND PREVALENCE OF ALCOHOL CONSUMPTION

The data used in my study were collected in 2013–2014 via a nationwide cross-sectional survey administered by Statistics Canada. The agency issued 65,000 surveys each year, meaning that over a span of two years, it dispensed a total of 130,000 CCHS surveys. The agency determined that 128,310 survey responses in 2013-2014 meet the criteria for inclusion in the CCHS sample. For my study, the subjects were selected from the CCHS sample based on two criteria. First, the subjects must have a diagnosis of dementia. Second, the subjects must have answered the question on average daily alcohol consumption. All provinces were required to ask the survey

participants how often they consumed alcohol in the previous 12 months and how frequently they drank. This was part of the core content of the CCHS and therefore required for all provinces. Questions asked in the core content provided more data, decreasing the probability of data suppression. To further avoid data suppression and small sample sizes, responses were coded into two categories (see Table 1) based on the level of alcohol consumption. For the purpose of this study, alcohol consumption was defined as alcoholic beverage(s) consumed at least two to three times a month. The category of no alcohol consumption included survey participants who reported consuming alcoholic beverage(s) once or less per month. A beverage or a drink was defined by the CCHS as one bottle/can/glass of beer, one glass of wine or wine cooler, or one drink/cocktail with one-and-a-half ounces of liquor [46].

Table 1
Alcohol consumption categories.

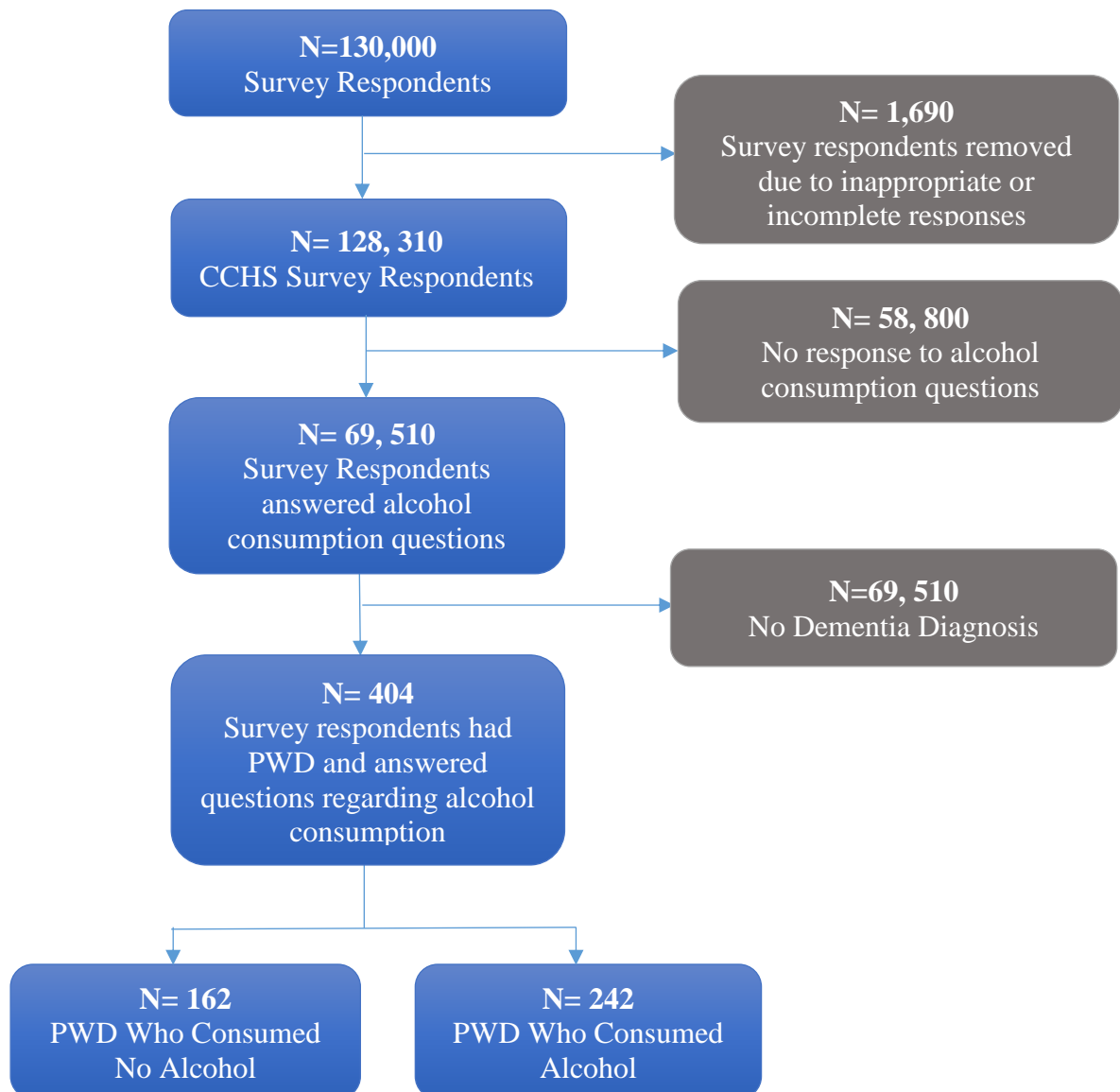
New categories	2013–2014 CCHS categories
No regular alcohol consumption	Less than once a month
	Once a month
	2 to 3 times a month
Alcohol consumption	Once a week
	2 to 3 times a week
	4 or 6 times a week
	Every day

As shown in Figure 2 below, 69,510 survey respondents answered the question of average daily alcohol consumption. After excluding subjects who were not relevant to this study, the final sample included 404 participants who reported a diagnosis of dementia. Participants were considered inappropriate to the study if they did not report the level of alcohol consumption, did not answer all questions, adhered

to the survey guidelines, or did not have a diagnosis of dementia. From the CCHS survey sample, alcohol consumption and presence of dementia was reported by 242 participants, compared to 162 who reported no alcohol consumption.

Figure 2

Study sample flow chart, CCHS 2013/2014.



Of the 404 study participants, 60% of PWD (n=242) reported consuming alcohol, and this was statistically significant yielding a p-value of 0.035. Table 2 illustrates the prevalence of alcohol consumption within my sample. Compared with the general population, alcohol consumption was not more prevalent among those with dementia. In the general population, 68% (47,001 out of 69,510) of people consumed alcohol. PWD were less likely to consume alcohol than those without dementia.

Table 2
Prevalence of daily alcohol consumption.

Average daily alcohol consumption	Has dementia		Total
	YES	NO	
No alcohol consumption	162 (40%)	22,509 (32%)	22,671
Alcohol consumption	242 (60%)	47,001 (68%)	47,243
Total	404	69,510	69,914

3.2 GENERAL CHARACTERISTICS OF THE STUDY SAMPLE

In this section, t-test and chi-square statistics are used to gain a better understanding of various demographic variables. For PWD who consumed alcohol, the mean age was 75.9 (SD = 12.3). The mean age for persons who did not consume alcohol was 78.0 (SD = 11.9). The difference was not statistically significant ($p = 0.711$). However, data analysis revealed that six other variables were statistically significant (see Table 3).

First, males with dementia were more likely to report alcohol consumption than females. There were 144 males and 98 females with dementia who reported consuming alcohol. A chi-square test for association was used for the variables “sex” and “alcohol consumption,” and the difference was found to be statistically significant ($p = 0.009$).

PWD who consumed alcohol were more likely to be married or in common-law marriages than PWD who did not consume alcohol. The “marital status” variable was classified into six categories: married, common-law, widowed, divorced, separated, single, or never married. To avoid small numbers and suppression, the six categories were collapsed into two categories: married or in a common-law marriage (1), and not married (2). Within the collapsed categories, there were 82 PWD who consumed alcohol, compared to 80 PWD who did not consume alcohol. The difference is statistically significant ($p = 0.003$).

Income was identified as statistically significant with a p -value of 0.003. In the CCSH sample, Statistics Canada divided the income variable into two categories: those who have a household income under \$30,000, and those who have a household income over \$30,000. PWD who consumed alcohol more frequently reported a higher income ($n = 61$, 46%) compared to those who did not consume alcohol ($n = 23$, 26%). Those who consumed no alcohol were more likely to report an income under \$30,000 ($n = 64$, 74%) compared to those who consumed alcohol ($n = 71$, 54%).

PWD who consumed alcohol were more likely to be free of pain. There were 166 participants who reported alcohol consumption and being pain-free, whereas 75 individuals reported no alcohol consumption and were not usually pain-free. The difference was found to be statistically significant ($p = 0.001$).

Interestingly, PWD who consume alcohol were more likely to have a lower BMI. A t -test for association was conducted between alcohol consumption and BMI in PWD ($t = 2.776$). It is important to note that this variable is self-reported. Our results show that PWD, on average, had a BMI of 25.4 ± 3.9 if they consumed some

alcohol. Those who reported no alcohol consumption reported a higher BMI of 27.3 ± 5.4 . This measure of association was found to be statistically significant ($p = 0.002$).

PWD who consumed alcohol were less likely to need support walking. A chi-square test for association was conducted between the ability to walk without assistance (i.e., cane, wheelchair) and alcohol consumption. A higher percentage of respondents who consumed alcohol reported being able to walk without support (75%) than respondents who did not consume alcohol (59%). There is a statistically significant association between walking ability and alcohol consumption ($\chi^2 (1) = 7.415, p = 0.006$).

Some of the variables tested did not yield statistically significant results. For example, differences in education are not statistically significant ($P = 0.142$). The education variable records the highest level of education currently held by the survey participant. There were seven categories of responses: a high school diploma or lower, a high school diploma or equivalent certificate, diploma, a college certificate, a university certificate, a university bachelor's degree, or a higher degree. To avoid small sample sizes and to cluster similar responses, the seven categories were collapsed. Three categories were attempted but the results were suppressed. Therefore, two categories were created: a diploma certificate or lower (1) and a bachelor degree or higher (2). Seventy-four respondents with dementia and a university degree did not consume alcohol, while 42 respondents with a university degree did. Interestingly, those who consumed alcohol reported a higher proportion of university education than those who abstained, participants more commonly reported having a university education. Other variables found that yield no statistically significant relationships were perceived life stress and overall self-perceived health.

Table 3

Characteristics of PWD sample who reported alcohol consumption.

Demographic Variables	Average daily alcohol consumption		χ^2 or t	P-value
	No alcohol Consumption N(%) or mean \pm SD ($n=162$)	Alcohol Consumption N(%) or mean \pm SD ($n=242$)		
Age	78.0 \pm 11.9	75.94 \pm 12.3	1.659	0.711
Sex			6.820	0.009
Male	75 (46%)	144 (60%)		
Female	87 (54%)	98 (41%)		
Marital Status			8.579	0.003
Married	80 (36%)	82 (49%)		
Not Married	155 (64%)	87 (51%)		
Income			8.673	0.003
Less \$30, 000	64 (74%)	71 (54%)		
More \$30, 000	23 (26%)	61 (46%)		
Education			2.160	0.142
Diploma/certificate or less	42 (36%)	14 (25%)		
Has University Degree	74 (64%)	42 (75%)		
BMI (<i>self-reported</i>)	27.3 \pm 5.4	25.4 \pm 3.9	2.776	0.002
Usually free of pain			10.569	0.001
Yes	85 (53%)	166 (69%)		
No	75 (47%)	74 (31%)		
Ability to Walk w/o Support			7.415	0.006
Yes	91 (35%)	167 (49%)		
No	167 (65%)	171 (51%)		
Perceived Life Stress			1.266	0.867
Not at all	30 (19%)	47 (20%)		
Not Very	45 (28%)	59 (25%)		
A Bit	51 (32%)	88 (37%)		
Quite a Bit/Extremely	33 (21%)	46 (18%)		

Overall Self-Perceived Health

8.703 0.069

Good	74 (46%)	145 (60%)
Fair	52 (32%)	65 (27%)
Poor	35 (22%)	32 (13%)

% is the proportion of PWD; SD, standard deviation; AD, Alzheimer's disease. N values for the three groups may not be equal to the final sample as a result of missing or suppressed data

3.3 CHRONIC DISEASE AND ALCOHOL CONSUMPTION AMONG PDW

The second half of my second research question pertains to chronic diseases and their prevalence among PWD who do and do not consume alcohol. Fourteen chronic disease variables were tested using a chi-square measure of association, and one variable was found to be statistically significant. The results are shown in Table 4.

Diabetes was less prevalent among PWD who consume alcohol. Diabetes has a statistically significant association with the level of alcohol consumption ($p = 0.008$) when tested using a chi-square measure of association. People with dementia who consume alcohol were less likely to have diabetes than those who do not. A total of 32 (13%) PWD who consume alcohol had diabetes, compared to 38 (24%) PWD who do not consume it. There was a lower prevalence of PWD who do not consume alcohol and do not have diabetes ($n = 124$, 77%), compared to PWD who consume alcohol and do not have diabetes ($n = 209$, 87%).

Two variables did not meet the threshold of $p \leq 0.05$ to be considered statistically significant, but they are important to discuss as they were close to the threshold. The first variable, heart disease, was the least likely among PWD to be reported among PWD, and the variable came close to having a statistically significant association ($\chi^2(1) = 3.634$, $p = 0.057$). PWD who reported alcohol consumption and

did not have heart disease numbered 188 (78%), compared to 112 (70%) PWD who did not consume alcohol and did not have heart disease. The second variable was mood disorder ($p = 0.068$). Alcohol consumption made it more likely a respondent had a mood disorder.

Some of the variables did not show statistically significant relationships. For example, high blood pressure was found to be comparatively similar across different levels of alcohol consumption, and as a result, the chi-square test did not show a statistically significant difference in occurrence ($p = 0.875$). Other variables that did not show statistically significant relationships include blood pressure, anxiety disorders, back problems, chronic obstructive pulmonary disorder, arthritis, bowel disorders, stroke, stomach ulcers, asthma, migraine headaches, and cancer.

Table 4

Chronic diseases in older adults with dementia based on level of alcohol consumption

Demographic Variables	Average daily alcohol consumption		χ^2 or t	P-value
	No alcohol Consumption N(%) or mean \pm SD ($n=162$)	Alcohol Consumption N(%) or mean \pm SD ($n=242$)		
Heart Disease			3.634	0.057
Yes	49 (30%)	53 (22%)		
No	112 (70%)	188 (78%)		
Diabetes			6.993	0.008
Yes	38 (24%)	32 (13%)		
No	124 (77%)	209 (87%)		
Blood Pressure			0.455	0.500
Yes	79 (49%)	110 (46%)		
No	82 (51%)	131 (54%)		

Anxiety Disorder			0.012	0.911
Yes	22 (14%)	32 (13%)		
No	139 (86%)	209 (87%)		
Has back problems			0.044	0.834
Yes	47 (29%)	73 (30%)		
No	114 (71%)	169 (70%)		
Has COPD			2.907	0.088
Yes	26 (16%)	25 (10%)		
No	135 (84%)	216 (90%)		
Arthritis			2.381	0.123
Yes	78 (48%)	102 (42%)		
No	84 (52%)	139 (58%)		
Stroke			2.381	0.123
Yes	25 (16%)	25 (10%)		
No	135 (84%)	215 (90%)		
Stomach or Intestinal Ulcers			2.128	0.145
Yes	12 (8%)	10 (4%)		
No	147 (92%)	231 (96%)		
Has a mood disorder			3.335	0.068
Yes	27 (17%)	59 (24%)		
No	134 (83%)	183 (76%)		
Has Asthma			1.463	0.226
Yes	16 (10%)	16 (7%)		
No	145 (90%)	226 (93%)		
Migraine Headaches			0.114	0.736
Yes	12 (8%)	16 (7%)		
No	147 (92%)	224 (93%)		
Has Bowel Disorder			0.176	0.675
Yes	15 (10%)	20 (8%)		
No	142 (90%)	220 (92%)		
Has Cancer			2.976	0.084
Yes	20 (13%)	17 (7%)		
No	132 (87%)	224 (93%)		

%, is the amount of PWD; SD, standard deviation; AD, Alzheimer's disease; N's for the three groups may not be equal to final sample as a result of missing data.

3.4 PWD WHO DRINK COMPARED TO PERSONS WITHOUT DEMENTIA WHO DRINK

Unlike the previous section that compared PWD who drank to PWD who abstained, this section explored the prevalence of chronic disease by comparing PWD who drank to persons without dementia who drank. To make this comparison, a chi-square test completed for each of the chronic diseases. Every respondent included in this test consumed alcohol. It is important to recognize that the number of respondents with dementia was much smaller ($n = 242$) than the number of respondents without dementia ($n = 47,243$). Out of the 14 chronic disease variables that were tested, 11 had a statistically significant relationship to dementia. The results of these tests are found in Table 6.

Persons living with dementia who drank were more likely to report the presence of many chronic diseases than their counterparts who did not have dementia. PWD were more likely to report heart disease ($n = 53, 22\%$), high blood pressure ($n = 110, 46\%$), anxiety disorders ($n = 32, 13\%$), COPD ($n = 25, 10\%$), arthritis ($n = 102, 42\%$), stroke ($n = 25, 10\%$), mood disorders ($n = 59, 24\%$), and cancer ($n = 17, 7\%$). All of these ailments were found to be statistically significant as they had a p -value of 0.000. In addition, diabetes was more likely to be reported by PWD who drank as 13% of PWD reported having diabetes, while 8% of persons without dementia. The measure of association was found to be statistically significant with a p -value of 0.001. Reports of chronic back pain were also less prevalent among persons without dementia who consume alcohol. The chronic back pain had a statistically significant association to dementia ($p = 0.003$) when tested using a chi-square measure of association. A total of 73 (30%) PWD who consumed alcohol had back pain, compared to 10,472 (22%) persons without dementia who consumed alcohol. The last

statistically significant association shown in Table 8 was bowel disease. Like other chronic diseases, bowel disease was most likely to occur among PWD who consume alcohol. Bowel disease was reported by 8% of PWD who consume alcohol, while 5% of persons without dementia who consumed alcohol reported having the disease. After the completion of a chi-square test for association, a *p*-value of 0.036 was calculated. Persons without dementia who drank did not report as many chronic disease or pain.

Some of the variables did not show statistically significant relationships. For example, chronic migraines were found to occur at comparatively similar rates among persons with and without dementia. PWD who drank and had migraines (*n* = 16, 7%) were similar to those persons without dementia who drank and had migraines (*n* = 3,296, 7%). The chi-square test did not show a statistically significant difference in proportions (*P* = 0.842). Two other variables did not show statistically significant differences: ulcers and asthma.

Table 6

Chronic disease in persons who consumed alcohol classified by the presence of dementia including Alzheimer's.

	No Dementia Diagnosis N(%) or mean ± SD (<i>n</i> =47001)	Dementia Diagnosis N(%) or mean ± SD (<i>n</i> =242)	<i>x</i> ² or <i>t</i>	P-value
Heart Disease			73.863	0.000
Yes	3477 (7%)	53 (22%)		
No	43524 (93%)	188 (78%)		
Diabetes			10.343	0.001
Yes	3638 (8%)	32 (13%)		
No	43463 (92%)	209 (87%)		
Blood Pressure			34.966	0.000
Yes	13357 (28%)	110 (46%)		
No	33665 (72%)	131 (54%)		

Anxiety Disorder			30.447	0.000
Yes	2486 (5%)	32 (13%)		
No	44598 (95%)	209 (87%)		
Has back problems			8.722	0.003
Yes	10472 (22%)	73 (30%)		
No	36605 (78%)	169 (70%)		
Has COPD			23.933	0.000
Yes	1926 (4%)	25 (10%)		
No	45147 (96%)	216 (90%)		
Arthritis			34.968	0.000
Yes	12052 (26%)	102 (42%)		
No	34967 (74%)	139 (58%)		
Stroke			145.427	0.000
Yes	626 (1%)	25 (10%)		
No	46481 (99%)	215 (90%)		
Stomach or Intestinal Ulcers			3.790	0.052
Yes	1069 (2%)	10 (4%)		
No	45980 (92%)	231 (96%)		
Has a mood disorder			110.578	0.000
Yes	3294 (7%)	59 (24%)		
No	43802 (93%)	183 (76%)		
Has Asthma			0.037	0.847
Yes	3263 (7%)	16 (7%)		
No	43842 (93%)	226 (93%)		
Migraine Headaches			0.040	0.842
Yes	3296 (7%)	16 (7%)		
No	43814 (93%)	224 (93%)		
Has Bowel Disorder			4.412	0.036
Yes	2488 (5%)	20 (8%)		
No	44568 (95%)	220 (92%)		
Has Cancer			12.132	0.000
Yes	1472 (3%)	17 (7%)		
No	45603 (97%)	224 (93%)		

%, is the amount of PWD; SD, standard deviation; AD, Alzheimer's disease; N's for the three groups may not be equal to final sample as a result of missing data.

3.5 PREVALENCE AND BINARY LOGISTIC REGRESSION OF INJURIES IN PWD WHO CONSUME ALCOHOL

In order to answer my second research question, two statistical tests were conducted. The first test sought to identify the prevalence of injuries in PWD who drink compared to those who do not drink. In Table 7, a chi square test for association was used between alcohol consumption and injury in the previous 12 months. No statistically significant associations were detected ($\chi^2(1) = 0.007, p = 0.931$). PWD who consume alcohol were less likely to have reported an injury over the previous 12 months.

Table 7

PWD reporting alcohol consumption and injuries over the previous 12 months.

Average daily alcohol consumption	Injuries over the previous 12 months		Total
	YES	NO	
No alcohol consumption	25 (16%)	136 (84%)	161
Alcohol consumption	27 (11%)	215 (89%)	242
Total	52	351	403

The second test, a binary logistic regression analysis, was performed to ascertain the factors associated with injuries among PWD. Table 7 summarizes the results of the analysis. Respondents were asked to answer whether they had experienced any injury inhibiting daily activity during the previous 12 months. This question was used in the analysis as the dichotomous dependent variable. The main independent variable was alcohol consumption. Other independent variables were age, sex, marital status, personal income, BMI, absence of pain, diabetes, and heart disease. Persons who consume alcohol were 6.2 times more likely to incur injuries that hindered daily activity. The odds-adjusted ratio was 6.20 (95% confidence

interval 0.125–3.082, $P = 0.559$), suggesting that the relationship was not statistically significant. None of the independent variables assessed in the binary logistic regression.

Table 8

Binary logistic regression predicting injuries among PWD in the past 12 months.

Independent variable	Odds ratio	95% confidence interval		p-value
		Lower	Upper	
Alcohol consumption	0.620	0.125	3.082	0.559
Age	0.982	0.922	1.046	0.571
Sex	2.645	0.559	12.514	0.220
Marital status	0.785	0.69	8.900	0.845
Personal income	2.014	0.439	9.229	0.367
BMI	0.944	0.790	1.127	0.552
Usually free of pain	0.475	0.079	2.861	0.417
Has diabetes	0.878	0.140	5.523	0.890
Has heart disease	2.799	0.269	29.099	0.389
Constant	131.162	0.181		

3.6 PREVALENCE OF OVERNIGHT HOSPITAL STAYS AND BINARY LOGISTIC REGRESSION OF PWD WHO CONSUME ALCOHOL

Two statistical tests were conducted in order to answer the last research question: What are the effects of alcohol consumption on hospital stays in the dementia population? The first test sought to identify the prevalence of overnight stays among persons with dementia who drink, compared to those who do not drink. Table 9 shows a cross tabulation of the results. A chi-square test for association

between alcohol consumption and overnight stays was used. No statistically significant associations were detected ($p = 0.190$).

Table 9

PWD reporting alcohol consumption and overnight hospital stays over the previous 12 months.

Average daily alcohol consumption	Overnight hospital stay over the previous 12 months		Total
	YES	NO	
No alcohol consumption	44 (27%)	117 (73%)	161
Alcohol consumption	52 (22%)	190 (78%)	242
Total	96	307	403

The second test, a binary logistic regression analysis, was performed to determine any factors associated with overnight hospital stays among PWD who drink. Table 10 summarizes the results of the analysis. Respondents were asked whether they had experienced an overnight stay in a hospital during the previous 12 months. The dichotomous dependent variable used was overnight hospital stays. The main independent variable was alcohol consumption. Other independent variables were age, sex, marital status, pain, diabetes, and heart disease.

The odds ratio for persons who consumed alcohol was 0.964 (CI 0.585–1.588). The odds ratio for diabetes was 0.552 (CI 0.307–0.994, $p = 0.048$), suggesting that PWD who consume alcohol were 45% less likely to have diabetes. Heart disease was 48% less likely among PWD who consumed alcohol. Persons who consume alcohol were 5.2 times more likely to experience an overnight hospital stay during the previous 12 months. This is concluded from the heart disease odds ratio of 0.520 (95% confidence interval 0.306–0.883, $p = 0.016$). The p -value did not meet the

threshold to be considered statistically significant. None of the independent variables analyzed were considered to have statistically significant relationship.

Table 10

Binary logistic regression predicting the overnight hospital stays among PWD in the past 12 months.

Independent Variable	Odds Ratio	95% Confidence Interval		<i>P</i> -value
		Lower	Upper	
Alcohol Consumption	0.964	0.585	1.588	0.886
Age	0.994	0.974	1.014	0.554
Sex	1.123	0.670	1.882	0.659
Marital Status	1.196	0.720	1.986	0.489
Usually Free of Pain	1.312	0.800	2.151	0.282
Has Diabetes	0.552	0.307	0.994	0.048
Has Heart Disease	0.520	0.306	0.883	0.016
Constant	5.139	0.054		

CHAPTER 4: DISCUSSION

4.1 INTRODUCTION

The primary aim of this study was to investigate the complex relationship of alcohol consumption in the dementia population. To the best of my knowledge, no previous studies have explored the prevalence of alcohol consumption among PWD. This chapter explores and provides a context for the current study's findings as presented in the previous chapter.

Dementia and alcohol are both increasingly prevalent and important health concerns in Canada. There are currently 564,000 PWD, and it costs Canadians \$10.4 billion to care for those living with dementia. Over the next 15 years, the number of Canadians living with dementia will increase to 937,000 as a result of the population aging [63]. A large body of evidence suggests that alcohol is the cause of a certain type of dementia, ARD. There is, however, a gap in our knowledge of the drinking habits of persons who already have a dementia diagnosis. Drinking habits are important to understand as older adults are nowadays more likely to consume alcohol than previous generations [2].

Alcohol is a top contributor to the global disease and injury burden, ranking third worldwide, and almost 4% of deaths worldwide can be attributed to it [64]. Nationwide, Canadians drink 50% more than the international average [65]. Most people in Canada drink without exceeding the thresholds for dangerous consumption, but approximately 20% of Canadians exceed the nationally established guidelines for low-risk consumption [66]. Alcohol abuse is estimated to cost Canadians \$14.6 billion per year [9]. A wealth of knowledge exists to help design alcohol consumption guidelines for younger adults, but there is a very small body of evidence on the drinking habits among older adults to help policymakers develop drinking guidelines.

4.2 CONTEXTUALIZING THE STUDY'S FINDINGS

4.2.1 DEMOGRAPHIC TRENDS AND RISK FACTORS

A primary objective of this study was to examine the prevalence of alcohol consumption among PWD. This study hypothesized that the prevalence of alcohol consumption is higher among PWD than among persons without dementia. Based on my analysis of the data provided by CCHS, the evidence available was not adequate to suggest that the null hypothesis is false at the 95% confidence level. The results of this study show that 60% of PWD consume alcohol, a figure comparable to the rate at which persons without a dementia diagnosis consume it (68%). These findings are consistent with those of a 2003 survey of the Canadian population, which indicated that 63% of older adults consume alcohol [61]. (No data were available for PWD specifically in the 2003 survey.)

SEX & GENDER

Males with dementia reported higher levels of alcohol consumption than their female counterparts, consistent with most of the research currently available.

Research specifically examining alcohol consumption among older adults substantiates the notion that males consume more alcohol [2]. It is important to understand how PWD consume alcohol by sex, as alcohol affects men and women differently. Females and males usually differ in their body fat percentage and in their ability to metabolize alcohol. Studies have shown a reduced amount of enzymes responsible for the metabolism of alcohol in females. As a result of the reduced enzymes and the differences in metabolism and body fat percentage, more alcohol enters the bloodstream of females than that of males when the same amount is consumed [67]. Guidelines for alcohol intake, set by the Canadian Center for Substance Abuse, recommend that females should only consume an average of two

drinks per day and males an average of three drinks per day [67]. Recent findings suggested that when females age, risks from alcohol use may increase as they become more sensitive to alcohol [67]. Females are at an increased risk for alcohol related liver disease, as they are more likely than males to develop alcoholic hepatitis (liver inflammation) and cirrhosis of the liver [67]. Some evidence suggests females are more vulnerable to alcohol-induced brain damage. Many studies concluded that heavy drinking increased the risk of breast cancer [67]. As females are particularly vulnerable to alcohol, females with dementia who drink could be particularly vulnerable as well.

From a gender based perspective, it has become more socially acceptable to consume multiple beverages on one or more occasion, particularly for women. Although women still drink less than men, in recent years the gender gap has narrowed as more women are consuming alcohol at higher rates. Risky drinking by women in Canada has increased, especially among women above the age of 35. Heavy drinking has been found to increase a woman's risk of violence and sexual assault. Women may be practically vulnerable to the stigma of being an alcoholic and hesitate to admit alcohol consumption. As a result, alcohol consumption could be underreported [67]. Recent findings, reinforced by the findings of my study, suggest that alcohol consumption by females needs to be further explored.

BMI

Interestingly, my data analysis showed that the average BMI for PWD who consume alcohol was lower than that of those who abstain. Recreational alcohol intake has increased, and alcohol calories are known to contribute to weight gain. Many prospective studies show that light-to-moderate alcohol consumption is not associated with weight gain while heavy alcohol consumption is associated with

increased weight. Alcoholic beverages are made of natural starch and sugar. Alcoholic beverages, especially those mixed with other sugary beverages, therefore yield a significant caloric intake. For example, a standard pint of 5% alcohol volume beer contains 215 calories [68]. If there is no compensation for the caloric intake from alcohol consumption, it is reasonable to suggest that alcohol could increase the risk of obesity or increased BMI [69]. Conversely, some studies also suggest that moderate alcohol consumer's lead healthier lifestyles in general, which could protect against normal weight gain and explain why the results from the present study showed a decrease of BMI in PWD who drank.

INCOME

The present study found that PWD who reported a lower income most frequently reported no alcohol consumption, while PWD who consume alcohol reported a higher income. Abstinence and binge drinking have been found to be most prevalent in the lowest socioeconomic cohorts [29, 70, 71]. Most research currently available suggests that those of a higher socioeconomic status drink more frequently but at moderate-to-low risk levels. The findings of the present study are consistent with current research on abstinence. This study, however, was not able to differentiate between moderate and excessive alcohol consumption due to data suppression. Additionally, the CCHS provided limited data on personal income. The survey stratified personal income into dichotomous variables, those making \$30,000 and over, and those making less than \$30,000.

It is important to understand the specific levels of alcohol consumption and income, as some literature suggests income considerably influenced levels of alcohol consumption. For example, Mossakowski has found that any duration of poverty and unemployment are associated with heavy drinking. Socioeconomic status (SES) has

been found to significantly predict heavy drinking, independent of gender, age, race/ethnicity, and marital status [72].

Socioeconomic status, or SES, is a combination of economic and sociological measures of a person that makes up the social standing or class of the person. SES is frequently measured using a mixture of education, income, and occupation. [71]. Interestingly, studies found that alcohol consumption in excess or abstention is often associated with low SES. However, alcohol consumption in moderation is most often associated with higher levels of SES [71]. Lifetime SES trends have been hypothesized to have an indirect association with alcohol, mediated by current SES [70]. Alternatively to alcohol consumption, preliminary literature findings have shown an association with low SES and risk of dementia, specifically women were associated with an increased risk of dementia-related death [82]. Both alcohol and dementia have demonstrated connections with SES and most specifically negative consequences for low SES with both alcohol and dementia.

PAIN

Chronic use of alcohol is known to cause pain and discomfort. In my study, however, PWD who consume alcohol reported feeling free of pain more often than those who do not consume it. It is important to note that respondents self-reported their perception of pain. Alcohol is known to have analgesic effects, which might account for respondents reporting alcohol consumption also feeling free of pain. Research suggests that some seniors who live with severe chronic pain may use alcohol to relieve their discomfort [14].

Chronic pain can be a challenge to treat in persons with dementia. Studies have found that various side effects could manifest in PWD who experience chronic

pain such as anxiety, confusion, depressed mood, anorexia, apathy, and impaired sleep [15]. Chronic pain might be a cause of alcohol consumption; this could be dangerous, as the best pain-reducing effects occur when alcohol is consumed in doses that exceed the guidelines for moderate use. Tolerance to alcohol's pain-relieving effects develops with use, which leads to an increase in consumption to achieve the same results [16]. The relationship between alcohol use and pain should be investigated further in future research, as evidence suggests that excessive alcohol consumption could be the a way to cope with loneliness, loss, and pain among older adults [14].

MOBILITY

Mobility is a constant concern for the aging population. Surprisingly, as acute intoxication is known to decrease short-term mobility, my study found that PWD who consume alcohol were less likely to report using mechanical assistance (i.e., cane, wheelchair, walker) to walk. Some studies do provide evidence of a positive relationship between moderate alcohol consumption and mobility in older adults [73]. However, an alternative study has suggested that the difference in lifestyle factors such as education, income, physical activity, and weight account for the improved mobility rather than alcohol [73]. The results of the current study suggest that there is a need to understand how alcohol impacts mobility, with particular attention to injury from falls, as PWD are more vulnerable falls.

4.2.2 CHRONIC DISEASE

The second objective of my study was to understand chronic disease trends in dementia stratified by the level of alcohol consumption. I hypothesized that there would be a higher prevalence of chronic disease among PWD who consume alcohol.

Excessive alcohol consumption has been linked to many chronic diseases, including but not limited to brain damage, liver disease, various cancers, pancreatitis, mental health disorders, suicide, stomach ulcers, hypertension, stroke, cardiovascular disease, and diabetes [2]. The results of the data analysis indicate that PWD who drink alcohol show lower prevalence of chronic disease than PWD who abstain.

Evidence suggests alcohol consumption has protective effects against many chronic diseases such as cardiovascular disease and diabetes. The data provided insufficient evidence to reject the null hypothesis. The findings could be due to data suppression, as the study was unable to distinguish between moderate and excessive alcohol consumption. It is reasonable to suggest that excessive alcohol consumption could be dangerous and moderate consumption might have protective properties.

DIABETES

The results of my analysis suggest diabetes is more common among PWD who do not consume alcohol. This corresponds well with findings from a systematic review and meta-analysis completed. Baliunas *et al.* found that moderate alcohol consumption is protective for type 2 diabetes in both men and women [29]. The investigation reviewed 20 cohort studies and found that a moderate amount, or 24g/day, of alcohol was most effective in reducing the risk of type 2 diabetes, while excessive drinking of 50g/day was harmful.

Beer, many wines, and mixed drinks contain carbohydrates that can raise blood sugar levels. Moderate amounts of alcohol have been found to cause blood sugar levels to increase, while excessive alcohol use can decrease blood sugar to dangerous levels. Alcohol can have intricate effects on blood sugar as it can dehydrate the body, increase blood pressure, and reduce the liver's effectiveness in producing

glucose [74, 75]. Alzheimer's disease and related dementias show evidence of beta-amyloid plaque buildup, which has been shown to prevent the insulin receptors in the brain from functioning optimally [76].

Interestingly, some research suggests diabetes is a risk factor for dementia [64, 71, 72]. Diabetes has been associated with cognitive changes mainly affecting learning, memory, mental flexibility, and mental speed [71]. Several longitudinal population-based studies have also shown that older adults with type 2 diabetes have an accelerated rate of cognitive decline [72]. Some people with diabetes may go on to develop dementia, but conflicting research shows that many will not [76].

HEART DISEASE

Heart disease was found more commonly among PWD who do not consume alcohol. This is consistent with other studies that associate moderate amounts of alcohol consumption with a lower risk of cardiovascular disease [70]. Mukamal *et al.* have suggested that 14 or more drinks per week are associated with the lowest risk of coronary heart disease. Alcohol consumption should not be recommended to prevent heart disease based on this evidence alone, however, as current guidelines suggest that older adults should limit their alcohol intake to one drink per day due to their compromised ability to metabolize alcohol.

As with diabetes, a body of evidence suggests that heart disease could be a risk factor for the development of dementia [72, 77, 78], specifically in people with peripheral arterial disease [72]. Vascular dementia (VaD) or multi-infarct dementia is a result of oxygen deprivation in brain cells. If the network of blood vessels that supply the brain with blood are blocked, restricted, or diseased, blood cannot reach the brain cells and they die, resulting in VaD [22]. In one study, heart failure was

found to be associated with a more than 80% increase in the risk of dementia [72].

Alcohol and heart disease have a complex relationship, which requires further review.

4.2.3 RISK OF INJURY

My third research question sought to identify an association between alcohol consumption and injuries among PWD. My hypothesis postulated there would be more injuries present among PWD who consume alcohol than among those who abstain. In 2013, an estimated 3.1 million Canadians drank enough alcohol to be at risk of immediate injury and harm [2]. Acute alcohol drinking has been identified as a significant risk factor for injuries in adults as it impairs cognitive function, motor abilities, and judgement [29].

The data used in my study were inadequate to suggest the null hypothesis was false at the 95% confidence level. PWD reported occurrences of injuries less often. The findings from my study are consistent with previous research on alcohol consumption in the elderly population by Ortolá *et al.* [70]. They found that some drinking patterns, especially drinking with meals only, was associated with a lower risk of frailty and injury in older adults [70]. Their study was not limited to persons with dementia, but the sample was comprised of participants with a comparable age demographic to the present study.

I was not able to reject the null hypothesis when comparing drinkers to non-drinkers. Current literature, however, indicates that the rates of falls and injury in older persons who consume alcohol are different among those who drink at moderate-to-excessive levels when compared to those using alcohol at light levels. As this study was unable to differentiate between light, moderate, and excessive drinking, it is

possible that injury was more prevalent among PWD who consume alcohol excessively.

4.2.4 HOSPITAL STAYS

My final hypothesis predicted that PWD who consume alcohol would have longer hospital stays than those who abstained. In Canada, the number of hospital stays due to alcohol-related disorders increased by more than 15% and the days spent in the hospital as a result of alcohol-related disorders increased by 8% between 2006-2011 [79]. A large body of evidence suggests alcohol consumption has protective health effects while other evidence suggests the negative consequences of alcohol consumption lead to more hospital stays. Research indicates that PWD are often considered difficult to discharge, which results in more frequent and more extended healthcare service utilization. Research further shows that once discharged, dementia patients are more likely to be readmitted than other older adults [58].

Emergency room visits would have potentially been more beneficial to examine. While this study was only able to examine overnight hospital stays, there could be many more PWD accessing emergency rooms compared to those who are admitted to hospitals. It is likely that the persons reporting overnight hospital stays were complex cases, in order to be admitted cases are most often complex due to the current hospital bed shortage [23]. Emergency room visits would give researchers a more clear understanding of acute needs of alcohol consumption in PWD that may have been overlooked by only examining overnight hospital stays. In 2016, the median wait of 20 weeks for “medically necessary” treatments and procedures was the longest recorded and more than double as long as in 1993 [80]. As wait times for emergency care and hospital beds form an increasing obstacle within the Canadian

healthcare system, it would be beneficial to have a better understanding of people who are difficult to discharge, such as PWD.

4.3 LIMITATIONS AND STRENGTHS OF THE STUDY

The study design was rigorously developed, but as with any research, there are always limitations that must be taken into account. The study design utilized quantitative data derived from a nationwide cross-sectional survey which examined the prevalence of alcohol consumption among PWD. This section explores the limitations and strengths of the present study's design as they pertain to the quality of research on alcohol consumption among PWD.

The sample size was relatively small when compared to previous national epidemiological studies on alcohol consumption in Canada. Disclosure control was a formidable obstacle during this study, as it resulted in the suppression of data and ultimately a small sample. Suppression was applied to any statistical tests that yielded fewer than 10 respondents. Data concealment prohibited this study from exploring alcohol intake by level of alcohol consumption. In the future, more precise stratification of the alcohol consumption variables would be very beneficial. It is conceivable that the dangers of excessive alcohol consumption may have been under-reported as a result of sizes leading to suppression of data.

In general, older adults with dementia represent a unique demographic for alcohol consumption research as they report alcohol differently than younger adults. Proxy respondents for example, are more common in PWD due to progressive deterioration of memory and other cognitive functions. While the alcohol-consumption measures used in population-based surveys can be effective for the

general population, they are limited and may not effectively capture and identify light-to-excessive levels of alcohol consumption in PWD.

The survey covered a very large portion of the Canadian population, but some important demographics were excluded. The data did not include indigenous people and military personnel, and there are undoubtedly lessons to be learned from the excluded populations. While the Indigenous community has lower drinking rates than the general population, the rates of heavy drinking are substantially higher than the Canadian average [68]. The Indigenous community is known to have higher rates of substance abuse. This community also experiences a rate of dementia 34% higher than that for non-indigenous persons in Canada. This demographic could be particularly vulnerable, and the findings of this study are not generalizable to Indigenous persons in Canada [81]. There is a growing need to comprehend how Indigenous social determinants of health contribute to overall health among PWD.

Chapter 1 highlighted a severe gap in our knowledge due to inadequate data from PWD on alcohol consumption. As there is no evidence to support the results of my study, it is challenging to generalize the findings or make policy recommendations. However, the findings do identify preliminary relationships and provide a foundation for future reviews of alcohol and PWD.

4.4 RECOMMENDATIONS FOR FUTURE RESEARCH

An extensive body of knowledge on alcohol consumption among younger adults already exists, but there is a need for an evidence-based understanding of alcohol use among PWD and older adults in general. A comprehensive survey of the current available research, combined with the findings of this study, has led to two overarching directions for future research: positive and negative health implications.

While controversial, studies have demonstrated that alcohol has some beneficial health effects. It is important to note that the benefits are dose-dependent and apply to a very specific set of diseases and ailments and a specific portion of the population, with the positive effects predominantly associated with wine. It is widely accepted that alcohol can have health benefits for specific populations. Alcohol has been linked with a reduction in heart disease, stroke, and diabetes. These links are associated with moderate alcohol consumption and could be the result of the overall healthy lifestyle factors of individuals who report drinking in moderation. The interaction of alcohol and dementia is poorly understood, rendering it unwise to advise any level of alcohol consumption as a healthy lifestyle choice for PWD until further research is available.

It has been well established that alcohol in excess has detrimental short term and long term health consequences. The results from this study did show that when PWD who drink are compared to PWD who abstain, there was a reduced likelihood of reporting negative health outcomes in respondents who drank, such as heart disease and diabetes. However, when you compare PWD who drink to persons without dementia who drink, PWD more often reported negative health consequences compared to those without dementia.

Although the findings of this study cannot resolve the positive vs. negative dilemma, they do establish a framework for the study of alcohol and dementia, which future research can build upon. It appears that alcohol has a dose-dependent relationship with health, with low dose yielding benefits and higher doses being toxic. More studies should use longitudinal data to explore the temporal dimension of alcohol consumption in the dementia population. Intervention-based studies and qualitative studies are also necessary to comprehend the implications of alcohol

consumption fully. Although my research noted some interesting trends, the sample size was too small to allow for the findings to be generalized or fully realized.

Drinking alcohol is a social behaviour embedded into Canadian culture with many layers influencing drinking patterns. There is a great variability across individuals and communities, meaning there is no universally effective way to address alcohol consumption. It is important that future research account for these variations.

4.5 RECOMMENDATIONS FOR EDUCATING HEALTH PROVIDERS

Currently, there are no recommended guidelines or specific training related to alcohol consumption offered to health professionals who work with PWD. Previously, it was thought that PWD did not consume alcohol. As a result, alcohol related illness and injury could be overlooked and grossly underreported [14]. This problem is particularly compounded, as dementia yields similar symptoms to alcohol abuse and misuse, such as falls, memory loss, and slurred speech [14]. Furthermore, there is a lack of specialized care that meets the complex needs of a comorbid diagnosis such as dementia and alcohol abuse [14]. A concerning notion that health providers may not be aware that PWD are consuming alcohol and consequently fail to identify adverse interactions with medications related to aging or dementia [13]. As this study is the first to confirm there is a prevalence of alcohol consumption in PWD, it is critical that health providers become informed on the unique needs of this vulnerable population.

4.6 CONCLUSION

In conclusion, this study's primary objective was to examine the prevalence of alcohol consumption among PWD. It further sought to understand the impact alcohol consumption has on chronic disease, injury, and hospital stays. Contrary to popular belief that older persons are more likely to abstain or use lower levels of alcohol, our

results demonstrate that PWD consume alcohol at a similar rate to the general population. The dementia population is a vulnerable segment at a specific risk for under-reporting alcohol consumption, which could mean that the prevalence of alcohol consumption is underestimated. The study also shows a lower prevalence of some chronic diseases, such as heart disease and diabetes, among PWD who consume alcohol than among those who do not drink. While the findings indicate a possible protective health benefit from alcohol consumption, our understanding of the dose-dependent health effects in older adults continues to evolve. Less risky and better-understood health behaviours can be adopted to achieve the same health benefits as those offered by low-to-moderate alcohol consumption: for example, healthy eating and an active lifestyle.

As momentum toward a new interdisciplinary approach and a national dementia-care strategy increases, a better understanding of health behaviours such as alcohol consumption would contribute to a better quality of life for PWD. The findings of this study are preliminary and should be treated with caution. As preliminary relationships have been identified in this study, future research on alcohol consumption and dementia is recommended. Research should strive to differentiate between low-moderate-excessive levels of alcohol consumption with the intention of establishing a recommended drink limit for PWD. Health-focused, evidence-based public policy could help mitigate the potentially harmful effects of alcohol and maximize any potential benefits among PWD.

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APPENDIX A: GLOSSARY

Abstinence: No consumption of beverages with ethyl alcohol.

Agnosia: The inability to process sensory information often resulting in a loss of ability to recognize objects, persons, sounds, shapes or smells.

Alcohol: A colourless psychoactive agent produced by the natural fermentation of sugars with dependence-producing properties and has been widely accepted in many cultures.

Alcohol consumption: The ingestion of a beverage which contains ethyl alcohol.

Alcohol Related- Dementia: A type of dementia with neurological damage and impaired cognitive function that results from long term excessive

Alzheimer's disease: A type of dementia that presents with progressive cognitive deterioration that is severe enough to hinder daily functions.

Aphasia: a language disorder that is characterized the inability to comprehend and formulate language due to brain damage to a specific region of the brain. It results in difficulty speaking, reading and writing.

Apraxia: A motor disorder caused by damage to a specific region of the brain that results in difficulty with motor planning to perform tasks or movements.

Dementia: A broad spectrum term for diseases that cause long term decline in cognitive functions, usually progressive in nature.

Diabetes: A long-term metabolic disorder defined by high blood sugar, insulin resistance and relative lack of insulin.

Canadian Community Health Survey: A nationwide cross-sectional survey that collections information from the Canadian population on health status, health care utilization and health determinants.

Comorbidity: The simultaneous existence of two chronic diseases in one individual.

Chronic Disease: Condition or illness that are not transmitted from person to person, they are long in duration and typically process slowly.

Cross-sectional study: A type of observational study that analyzes data collected from a specific point in time from a population.

Drink: One standard drink is defined in the CCHS as one bottle or can of beer, glass or draft, glass of wine, wine cooler, and cocktail with one and a half ounces of liquor.

Executive Function: A set of cognitive process that allow for cognitive control of behaviour, these mental skills are controlled by the specific location in the brain referred to as the frontal lobe.

Gender: A set of socially constructed characteristics of males and females.

Excessive Alcohol Consumption: For males, 5 or more drinks on any day or 14 per week. For females, 4 or more drinks on any day or 7 per week.

Health care utilization: A measure of the population's health care services accessed by persons in the population.

Heart Disease: A board term that often refers to the conditions that involve narrowed or blocked vessels which can lead to myocardial infarction, chest pain, or stroke.

Income: A measure of money received by a person.

Injury: Physical harm or damage to a person caused by an act.

Mobility: A measure of the ability of a person to move or be moved freely and easily.

Moderate Alcohol Consumption: For males, at least one drink but no more than 4 drinks per day. For females, at least 1 drink but no more than 3 drinks per day.

Mood Disorder: A psychological disorder defined by debilitating illnesses that cause mental anguish and often manifest physical symptoms.

Proxy interview: A respondent who answers survey questions on behalf of the target subject.

Prolonged hospital stay: An extended length of stay in a hospital.

Sex: A category into which humans are organized on the basis of their reproductive functions.

Wernicke-Korsakoff Syndrome: A potentially reversible neurodegenerative syndrome characterized by a severe acute deficiency of thiamine.

APPENDIX B: ETHICS APPROVAL

Date:	<i>June 28, 2016</i>
To:	<i>Emma Bartfay</i>
From:	<i>Shirley Van Nuland, REB Chair</i>
REB # &	<i>(15-134) The Prevalence of Alcohol Consumption and the Effects</i>
Title:	<i>on Health Care Utilization</i>
Decision:	<i>APPROVED</i>
Current	<i>June 01, 2017</i>
Expiry:	

Notwithstanding this approval, you are required to obtain/submit, to UOIT's Research Ethics Board, any relevant approvals/permissions required, prior to commencement of this project.

The University of Ontario, Institute of Technology Research Ethics Board (REB) has reviewed and approved the research proposal cited above. This application has been reviewed to ensure compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2 (2014)) and the UOIT Research Ethics Policy and Procedures. You are required to adhere to the protocol as last reviewed and approved by the REB.

Continuing Review Requirements (forms can be found on the [UOIT website](#)):

- **Renewal Request Form:** All approved projects are subject to an annual renewal process. Projects must be renewed or closed by the expiry date indicated above ("Current Expiry"). Projects not renewed within 30 days of the expiry date will be automatically suspended by the REB; projects not renewed within 60 days of the expiry date will be automatically closed by the REB. Once your file has been formally closed, a new submission will be required to open a new file.
- **Change Request Form:** Any changes or modifications (e.g. adding a Co-PI or a change in methodology) must be approved by the REB through the completion of a change request form before implemented.
- **Adverse or Unexpected Events Form:** Events must be reported to the REB within 72 hours after the event occurred with an indication of how these events affect (in the view of the Principal Investigator) the safety of the participants and the continuation of the protocol (i.e. un-anticipated or un-mitigated physical, social or psychological harm to a participant).
- **Research Project Completion Form:** This form must be completed when the research study is concluded.

Always quote your REB file number (15-134) on future correspondence. We wish you success.

APPENDIX C: STATISTICS CANADA APPROVAL



Health Statistics Division - Population Health Surveys

National Population Health Survey - Canadian Community Health Survey

Application for Remote Access to NPHS and CCHS Master Data Files

Project title: The Prevalence of Alcohol Consumption and the Effects on Health Care Utilization
Goal of the project: The primary objective of this study is to examine the prevalence of alcohol consumption in the dementia population and the associated negative health effects and injuries. In addition, this study will examine the effects of excessive alcohol consumption on hospital stays, falls/injuries, chronic conditions, and emergency room (ER) visits among persons with dementia.
Project summary: Based on the literature available globally, and specially in Canada, there is enough evidence to support that alcohol consumption and could be prevalent within the dementia population. A large gap within the literature is a result of little to no data available on the combination of alcohol and chronic diseases, such as dementia [8, 14]. There is a vast amount of literature that has suggested there are negative implications of alcohol use among older populations. However, there also are many findings that suggest moderate alcohol consumption will yield positive health results in older individuals.[40-42]. Alcohol use is a complex issue, especially among older individuals who are often already vulnerable and suffer from chronic ailments. [22]. Therefore, more research is needed to draw inferences that can be applied clinically and reflected in health care management policies and directives [8]. Current research on dementia focuses on etiology, treatment options, early detection, improved physical health, treating accompanying physical illness, and support for caregivers. Previous research has even identified that excessive alcohol consumption is a prevalent problem within older populations in countries such as Scotland, UK, U.S. Japan, India and Australia [8, 11, 14-16, 26]. However, research has typically neglected to explore the potential danger of excessive alcohol consumption within the dementia population, who are already at an increased risk for falls and cognitive decline [13]. Findings from the NESARC study concluded that more research is needed to investigate the relationship of alcohol and older populations using longitudinal data and a broader range of measures for alcohol use and health service utilization [11].

Data set(s) to which access is required - specify survey(s) and cycle(s): Canadian Community Health Survey (2013-2014 data)
Explain why the project requires access to the master data rather than the Public Use Microdata File(s): Access to sensitive variables not provided in the PUMF is required for the analysis. As the Public Use Microdata File excludes the data pertaining to the respondents with Dementia.

Applicant's name:	Applicant's given name:	Initials:
Chantal	James	N. M.
Applicant's affiliation: The University of Ontario Institute of Ontario		
Name and affiliation of other researchers involved in the project - who may submit computer programs and/or contact us with respect to the project: N/A		
E-mail address: Chantal.James@uoit.ca		

Expected results - will the results be submitted for publication?:

This research study will critically examine the following four primary hypotheses and anticipated results:

- 1) Excessive alcohol consumption is more prevalent in the dementia population than in the general population.
- 2) Among PWD, those who consume excessive amounts of alcohol will have more injuries and falls than those who do not consume excessive amounts of alcohol.
- 3) Among PWD, those who consume excessive amounts of alcohol will have longer hospital stays than those who do not consume excessive amounts of alcohol.
- 4) Among PWD, those who consume excessive amounts of alcohol will have more visits to the ER than those who do not consume excessive amounts of alcohol.

Regardless of the results that come from this study, I have the intention of submitting the findings for publication.

Period during which remote access is expected to be required (yyyy/mm/dd):

Start: June 24, 2016

End: December 30, 2016