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Cognition, Neurocognitive disorder, Psychotropic Group of Medication, and Fall among Canadians Aged 65+ Years

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Walden University
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Abstract

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by

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Master's degree in Adult Education

Yorkville University, New Brunswick, Canada 2018

Bachelor of Medicine and Bachelor of Surgery, MB, BS,

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

Despite the high incidence of fall among the elderly in residential care, this problem has been minimally explored and reported. This study examined the association between (cognitive performance, dementia, four groups of psychotropic medication-hypnotics, antidepressants, antianxiety medication, and antipsychotics) and fall among Canadian elderly in residential care. A multi–variate logistic regression was used for the analysis. The Social Cognitive Theory was used to interpret the findings of an analysis on 180,231 Canadian residents from 2018–2019. Cognitive performance at intact level (OR=1.114, $p<0.001$), cognitive performance at moderate level (OR=1.192, $p<0.001$), dementia diagnosis (OR=1.075, $p<0.001$), antipsychotics (OR=2.571, $p<0.001$), antidepressants (OR =1.486, $p<0.001$) and antianxiety prescription (OR=3.284, $p<0.001$) increased the odds ratio of fall. However, cognitive performance at severe level (OR=0.898, $p<0.001$), no dementia diagnosis (OR=0.001, $p<0.001$) and hypnotics prescription (OR=0.389, $p<0.001$) decreased the odds ratio of fall. Findings indicate that cognitive performance at the intact and moderate levels, antianxiety, antipsychotic and antidepressant medications and dementia were strong predictors of fall among the elderly in residential care in Canada. A limitation of the study was that the dataset used captured data from 7 out of 13 Canadian provinces and territories therefore, limiting external validity. The potential positive social change impact of this study is that it would guide caregivers, enhance fall prevention practices, and decrease fall occurrence in this population.

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Dedication

This dissertation is dedicated to my father, late (Mr.) Alexander Olorunfemi Momoh and my mother, Mrs. Zenebu Alexander Momoh for their unparalleled love and support for quality education.

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Chapter 1: Introduction to the study

Fall among the elderly in residential care and associated predisposing conditions have been reported across the literature. In this study, I focused on the relationship between cognitive decline, dementia, psychotropic group of medications, and fall in the context of age, gender, jurisdiction, and ethnicity among individuals 65 years and above in residential care in Canada. Contributory to unintentional fall among the elderly are a wide range of predisposing factors including cognitive decline, dementia, use of psychotropic medications, a history of fall, use of antihypertensives, use of bedrails, low–income household, unsafe environment, inadequate built–in environment, and post–surgical complications among others reported in the literature (Canadian Institute for Health Information [CIHI], 2016; Do et al., 2015; Dykeman, et al., 2018; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; World Health Organization [WHO], 2021; Winnipeg Regional Health Authority [WRHA], 2018). Reportedly, approximately 40% of elderly Canadians who received residential care services (inclusive of those with and without a dementia diagnosis) and home care had a fall within a space of 3 months before their assessment, with men higher in number than women, as observed in the literature (CIHI, 2020; CIHI, 2016; Public Health Ontario, 2020). On the use of psychotropic medication in the contextual age–group, according to CIHI (2016) and WRHA (2018), the use of an antipsychotic amongst seniors in a Canadian long–term care (LTC) facilities were approximately one in every three seniors, with one in every four being a chronic user of antipsychotic medications. Notably, in terms of cognitive

decline among the elderly 65 years and above who received residential care, there has been a steady rise in the statistics of elderly Canadians reported to have worsened cognitive ability as observed in the literature (CIHI, 2020; CIHI, 2019; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; WHO, 2021). However, despite the rising number of these fall–associated risk factors (dementia, use of psychotropic medication and cognitive decline among others) among Canadian elderly, the relationship between these predisposing risk factors and fall among the elderly receiving residential care in Canada has been reported to be minimally explored in recent years as , as observed in the literature (CIHI, 2016; Do et al., 2015; Dykeman, et al., 2018; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019;WHO, 2021; WRHA, 2018). From this premise, with the substantial body of evidence available, conducting a study that scrutinizes this relationship contextually is well–informed and crucial to better understanding the current trend and association between these predisposing factors and fall contextually among elderly Canadians in residential care. Ultimately, the study would contribute positively towards care modalities for the elderly Canadians in residential care when health care providers are guided by the study's findings and recommendation for a healthy community of the elderly in residential care across Canada and globally.

In this chapter, the research literature related to the problem of fall and implicated predisposing factors to fall, the gap in knowledge on fall and the risk factors contextually, rationale for study, research problem in terms of literature absence, the purpose of and

variables in the study and research questions. Additionally, the literature review on an appropriate theoretical foundation-SCT and conceptual framework, nature of study definition of terms including variables and confounders, assumptions, scope (internal validity and boundaries) and limitation, study's significance were summarily discussed and a transitional summary connecting the chapter to the second chapter.

Background

Common to most communities of the elderly are fall and fall–related injuries, especially unintentional fall. Unintentional fall is common among individual 65 years and above in various countries with a resultant consequential impact on their health, mobility, wellbeing, financial resources, social life and even dependence as reported in the literature (Do et al., 2015; Laberge & Crizzle, 2019). Foremost, an unintentional fall can be described as an unexpected, unplanned, and uncontrollable movement to the ground by an individual that maybe relatively preventable as described in the available body of literature (Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; WHO, 2021). Among the predisposing risk factors, I focused on cognitive decline, dementia, specific psychotropic groups of medication, and jurisdictions among other contributors to fall among individuals 65 years and above in Canada residential–care-based facilities, with residential–based continuing care facilities referred to as residential care homes, nursing homes or long–term care homes as observed in the literature (CIHI, 2019). Furthermore, a group of medications capable of affecting brain function, causing changes in mood, thoughts, perception, emotions, and behavior are commonly referred to as

psychotropic medication as reported in the literature (CIHI, 2016; Jennum et al., 2016) There are five major sub–groups (antidepressant, anti–anxiety, stimulant, antipsychotic s, and mood stabilizers) in this group. In this study, the psychotropic group of medication of specific interest are the antidepressant, hypnotics, anti–anxiety, and antipsychotic s. The examples of drug class codes used in Canada include: (a) –N05BA–benzodiazepine derivatives, (b) N06AB–selective serotonin reuptake inhibitors, (c) N05AH (diazepines, oxazepines, thiazepines and oxepines), and (d) N06AX (other antidepressants) as reported in the literature (CIHI, 2020; CIHI, 2016; DPIN, n.d; Jennum et al., 2016; National Center for Biotechnology Information, 2021). According to CIHI (2016) and WRHA (2018), the use of an antipsychotic s amongst seniors in a Canadian long–term care (LTC) facilities was approximately one in every three seniors, with one in every four being a chronic user of antipsychotic medications as of 2018. In addition, 86% of all unintentional fall injury–related hospitalizations for older adults were due to fall associated with use of one or more groups of psychotropic medication among others modifiable factors associated as reported in the literature (CIHI, 2020; CIHI, 2016; WR HA, 2018) Based on the available literature evidence, the use of more than one psychotropic drug heightens the risk of elderly individuals on these drugs to their concomitant side effects, including fall, while the use of four or more psychotropic medication at the least triples the risk of side–effects and adverse reactions linked to unintentional fall, which concurs with the literature (CIHI, 2016; WRHA, 2018) Nevertheless, in terms of available contextual data, there could be an overestimation or

underestimation on the impact of antipsychotic use amongst those 65 years and above in Canada as discussed in the literature CIHI (2016), Laberge and Crizzle (2019) WRHA (2018). Influential factors like psychotropic medication, cognitive decline, dementia, loss of balance and delayed or failure of postural adjustment have been speculated to be directly and or interrelated in their path to heighten fall risk among the elderly. In this regard, Gjorgjievski and Ristevski (2020) and Le Mouel et al. (2019) provided evidence on how elderly fallers' and non–fallers' normal aging physiological condition and or their postoperative conditions (secondary to their use of psychotropic and other medication used pre–, peri– and post–surgery) could decrease their physiologic reserve and or capacity to adjust their posture, in anticipation of externally imposed perturbations, which could impact their balance recovery action, leading either to regained balance or a fall occurrence. Another study that contributed to the literature on the relationship between fall and psychotropic medication was Laberge and Crizzle (2019). Laberge and Crizzle reported on how a combination of and singular use of alcohol and psychotropic medications (including benzodiazepines, antipsychotic s, lithium, anti–epileptics, memantine, antidepressants, and anti–hypertensive medications) increases fall risk among the elderly (Laberge & Crizzle, 2019). Similarly, in Canada, Do et al. (2015) reported that between 2005 and 2013, self–reported fall–related injuries by gender and age revealed a higher number of seniors sustaining injuries associated with fall with a concomitant rise in their use of health care facilities for fall–related injuries over the past decade. Interestingly, Dykeman, et al.'s (2018) study on fall highlighted the community

services fall prevention practices inadequacies in terms of health care providers education, organizational polices coupled with individuals' roles (perception and knowledge of fall–related risk factor) in their own fall prevention. In the same vein, Huynh et al. (2020) revealed that although some facilities like nursing homes use of bedrails in reducing fall prevention may be equivocal based on a few fall risk factors common to certain individuals however, understanding more of contributory risk factors and the use of bedrails through more studies maybe more informative and directional. WRHA (2018) reported on the current personal, economic, and healthcare system burden and role of place and income on fall among older adults in Canada, Manitoba, and Winnipeg, as well as the role of place and income in fall injury. The study revealed that 86% of all unintentional injury–related hospitalizations for older adults were due to fall and psychotropic medication use amongst other modifiable factors associated with a higher risk of experiencing another fall as seen in the literature (WRHA, 2018). Thus, with the substantial body of evidence available, it is important to understand the association between these predisposing factors and fall contextually among elderly Canadians in Residential care.

Problem Statement

Fall among the elderly remains a concern in any community of the elderly, whether in residential care (inclusive of long–term care home, nursing home and all care facilities catering to the elderly). Those affected are likely to sustain an internal or external injury to one or more tissues, organs, and systems in their bodies. Presently,

Canada is an aging population of the elderly that continues to increase rapidly in number, with a corresponding increase in illnesses, drug and medication use, cases of isolation, orthopedic surgical procedures and other factors associated with increased risk of fall amongst the elderly (Do et al., 2015; Laberge & Crizzle, 2019; Le Mouel et al., 2019; Parachute, 2018). In this study, I focused on elderly Canadians in residential care because there is a documented rise in the number of residential care facilities for elderly Canadians, those with a diagnosis of dementia, the elderly with worsening cognitive function, and national budget spending on psychotropic medication amongst this age group (CIHI, 2020; CIHI, 2019). Moreover, there is a literature gap in the Canadian context on associative study between these variables as seen in the literature (CIHI, 2016; Gjorgjievski & Ristevski, 2020; Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Therefore, the elderly, especially those with dementia, declining cognitive function, and those on different groups of medications, are at higher risk of fall compared to other age –groups and this is a major health concern.

Purpose of Study

The purpose of this quantitative study was to examine the association between cognition, neurocognitive disorder (dementia), psychotropic medication, and fall occurrence amongst the elderly who receive care from residential–based continuing care facilities using binary logistic regression analysis. Another purpose of the study is to know the percentage of the elderly who experienced fall and are on the specified psychotropic medication compared to those who did not are on this group of medication

in residential care in Canada. This purpose resonates with Laberge and Crizzle (2019) and Le Mouel et al.'s (2019) discussion on the need for further stu**dies** with regards to these predictors and outcome**.** Specifically, **t**he purpose of this quantitative study was to explore the association between cognitive levels, dementia, four groups of psychotropic medication (antipsychotic, anti–anxiety, antidepressant, and hypnotics) and fall amongst elderly Canadians 65+ using bivariate and multiple logistic regression analysis while controlling for age, gender, jurisdiction and indigeneity.

Research Questions and Hypotheses

Research Question 1 (RQ1): What is the association between cognitive decline and fall while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential care?

Null Hypothesis ($H_0$1): There is no association between cognitive decline and fall, while controlling for total age, gender, and First Nations among Canadians 65+ population receiving residential care.

Alternative Hypothesis (H_a1): There is an association between cognitive decline and fall, while controlling for age, gender, and First Nations among Canadians 65+ population in Residential care.

Research Question 2 (RQ2): What is the association between dementia and fall, while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential care?

Null Hypothesis ($H_0$2): There is no association between dementia and fall while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential care?

Alternative Hypothesis (H_a2): There is an association between dementia and fall, while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential care?

Research Question 3 (RQ3): What is the association between benzodiazepines, selective serotonin reuptake inhibitors (SSRI), diazepines, oxazepines, thiazepines and oxepines and other antidepressants and fall, while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential care?

Null Hypothesis ($H_0$3):There is no association between benzodiazepines, SSRIs, diazepines, oxazepines, thiazepines and oxepines and other antidepressants and fall, while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential Care.

Alternative Hypothesis (H_a3): There is an association between benzodiazepines, SSRIs, diazepines, oxazepines, thiazepines and oxepines and other antidepressants and diagnosis of fall, while controlling for age, gender, and First Nations among Canadians 65+ population receiving residential care.

Research Question 4 (RQ 4): To what extent do cognitive decline, dementia, jurisdiction, benzodiazepine derivatives, SSRIs, diazepines, oxazepines, thiazepines and

oxepines and other antidepressants predict of fall among Canadians 65+ population receiving residential care while controlling for age, gender, and First Nations?

Null Hypothesis ($H_0$4): There is no association between cognitive decline, dementia, jurisdiction, benzodiazepine derivatives, SSRIs, diazepines, oxazepines, thiazepines and oxepines and other antidepressants and fall, among Canadians 65+ population receiving residential care while controlling for age, gender, and First Nations.

Alternative Hypothesis (H_a4): There is an association between cognitive decline, dementia, jurisdiction, benzodiazepine derivatives, SSRIs, diazepines, oxazepines, thiazepines and oxepines and other antidepressants and fall among Canadians 65+ population receiving residential care while controlling for age, gender, and First Nations.

The Relevance of Study

The significance of this study is that I investigated the magnitude of the relationship between psychotropic group of medication and fall that would help inform better practice and medication guidelines in the delivery of care to the elderly Canadians in residential care in line with Laberge and Crizzle (2019) discussion. Moreover, based on Huynh et al. (2020), Laberge and Crizzle (2019) and Le Mouel et al. (2019) perspectives the recommendation from this study could influence current clinical guidelines and be used to reduce unintentional fall in this at–risk age group The economic benefit of this study lies in its ability to reduce Canadian spending's on hospitalization resulting from fall and fall–related morbidities and mortalities based on the study potential findings and recommendation. Additionally, the study could also pave

a path for future studies and contribute to the body of knowledge on fall amongst elderly Canadians in residential care and the elderly generally in line with Do et al. (2015), Huynh et al. (2020), Laberge and Crizzle (2019), Le Mouel et al. (2019) and WRHA (2018). Lastly, this study may result in increased awareness of health organizations and caregivers in their provision of care for the at–risk elderly being treated with the implicated psychotropic group of medication in agreement with CIHI (2016) and Laberge and Crizzle (2019) report.

In terms of potential positive social change, this study may be used by clinicians in their use of psychotropic medication and contribute to the reduction in fall diagnosis among the elderly receiving residential care in Canada. Specifically, through this study, I will be able to make recommendations regarding medication management modalities for the elderly in residential care and generally, thereby decreasing fall occurrences amongst our 65+ year old clients.

Gap in Literature

In terms of literature gap, Laberge and Crizzle (2019) reported the absence of a research study that detects an association or causal relationship between psychotropic medications and fall in the literature. In addition, CIHI (2016) reported on the absence of current literature that examined a statistical inferential relationship between these psychotropic groups of medication and fall amongst the Canadian elderly.

Justification of Research Problem

This study is crucial to understanding and filling the literature gap on the association between dementia, cognitive decline, the specified psychotropic groups of medications and fall in this population. Moreover, this study's capacity to uncover the extent to which these predictors are predisposing to or protective against fall among those in residential care contextually is pivotal to best fall prevention practices.

Theoretical and Conceptual Framework

I used social cognitive theory (SCT) as the framework for this study. Bandura developed SCT in the mid–1970s. In the 1940s, Palsdottir discussed social learning and imitation theory, which is the origin of SCT as seen in Glanz et al. (2015) and Middleton, et al. (2019). In line with the literature the SCT concepts of reciprocal determinism, behavioral capability, observation learning, and reinforcements were useful for explaining behavioral factors, social and environmental interactions, and cognitive elements in the relationship of fall amongst the elderly Canadians in residential care (CIHI, 2020; Do et al., 2015; Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle,2019; Middleton, et al., 2019; Raingruber, 2014). Furthermore, the logical connections between SCT and my study include its use in explaining how positive predictive associations are more likely to relate risk factor to a health problem in consonance with Cross et al. (2020), Do et al. (2015), Glanz et al., (2015), Middleton, et al. (2019), Oyibo et al. (2018), Petterson et al. (2021) and Raingruber (2014) reports. Additionally, the value of this theory to this study lies in its ability to link behavioral

influences of humans to health outcomes, even in the context of biological, physical, and non–physical environmental influences as explained in Glanz et al. (2015) and Raingruber (2014). I used the SCT to understand the possible chances of fall occurrence amongst the elderly and their declining cognitive function, behavioral influences factored in their use of psychotropic group of medication, and those with a neurocognitive disorder diagnosis in alignment with various assertions across the literature (Cross et al., 2020; Do et al., 2015; Glanz et al., 2015; Middleton, et al., 2019; Oyibo et al., 2018; Petterson et al., 2021; Raingruber, 2014). Moreover, the behavioral influence of clinicians as evidenced in the prescribed psychotropic medications used by these elderly ones, the resident elderly cognitive element as reflected in declining cognitive function and dementia diagnosis, and their social interactions (as seen on the jurisdiction, residential care and first–nation indigeneity) were applicable to the SCT constructs used in explaining the relationship between the predictors and fall (a history of fall) using the bivariate–multiple logistics regression data analysis in alignment with recommendations across the literature (Cross et al., 2020; Do et al., 2015;Glanz et al., 2015; Middleton, et al., 2019; Petterson et al., 2021; Raingruber, 2014;Wagner, 2020).

Nature of Study

To address the research questions in this quantitative study, a secondary data analysis was conducted. The study adopted a multi–variate logistic regression analysis of secondary data inferential design.

Definitions of Variables

The dependent variables identified and used from CIHI dataset is the categorical variable fall. The independent variables identified and used from the dataset are (a) cognitive performance levels (b) dementia diagnosis and (c) psychotropic medication (benzodiazepine derivatives, selective serotonin reuptake inhibitors, diazepines, oxazepines, thiazepines and oxepines and other antidepressants). The controlling factor variables identified in the dataset is gender (CIHI, 2019).

Limitations

A potential challenge for this study is that the dataset to be used was collected by a different individual/organization therefore, the data used are under the conditions of the original data collection methods and validity of Canadian Institute for Health Information (CIHI, 2020; Grimes & Schulz, 2002; Jemal et al., 2008; WHO, 2012). However, the standard instrumentation, data collection process (criteria and transparency) and tool and ethical principles governing CIHI data collection, use, storage, and disposal are measures taken by this organization to curb collection and confounding biases (CIHI, 2020; Grimes & Schulz, 2002; WHO, 2012).Additionally, in line with some weaknesses associated with secondary data use reported in the literature, this database may have some missing information which will be addressed as discussed in the data preparation aspect of this proposal (CIHI, 2020; Grimes & Schulz, 2002; Jemal et al.2008; WHO, 2012). These and other measures discussed in this proposal will help address these limitations and strengthen the internal, external and construct validity of this study.

Significance

This study is significant in that it would provide a scientific understanding on the magnitude of the relationship between psychotropic group of medication and fall that would help inform better guidelines in caring for the elderly and curbing unintentional fall (Laberge & Crizzle, 2019). Moreover, the recommendation from this study could influence current clinical guidelines thus, assisting in the reduction of fall in this at–risk age group (Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). The economic benefit of this study is in its ability to reduce Canadian spending on hospitalization resulting from fall when the study findings and recommendation reflects likewise (Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Lastly, the study could also pave a path for future studies and contribute to the body of knowledge on fall amongst elderly Canadians (Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). The potential positive social change of this study is that it would guide clinicians' practice in their use of psychotropic medication and contribute to a reduction in the number of fall among the elderly receiving residential care (community and Long–Term Care) in Canada. Specifically, the study finding would help me as a Public Health Practitioner to make recommendations regarding medication management modalities for the elderly in my organization, thereby decreasing fall occurrences amongst our 65+ year old clients.

Summary

Overall, the contextual predisposing risk factors to fall already discussed inclusive of declining cognition, dementia, environment and prescribed psychotropic group of medication are the reality of a significant proportion the elderly in residential care in Canada over the years (CIHI, 2020; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; WHO, 2021). However, the rising numbers of the implicated predisposing health conditions, evolvement of psychotropic drugs availability over the years, clinicians' prescription guidelines and environment influences and interaction among those in residential care have been documented to be associated with increasing incidence of fall as seen in the literature (Crowe & Stranks, 2018; Do et al., 2015; Ferreira et al., 2020; Hansen et al., 2021; NCBI, 2021; Olfson et al., 2015; Stafford et al., 2021; Soriano, 2013). Moreover, the limited studies on these risk–factors in recent times contextually forms a rational to conduct a study that seeks to understand the current association between the implicated predisposing factors and fall in the context of the overarching available data from the various Jurisdictions in Canada.

Chapter 2: Literature Review

Introduction

Globally, unintentional fall occurrence is a common denominator across various age groups as reported in the literature (Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; WHO, 2021). Various reports on the rising figures of unintentional fall among the elderly cuts across different countries, including Canada. However, despite this trend and the consequential impact it poses to various sectors of the country, in recent times, there has been a limited exploration of the variables of interest contextually, thus, the need for this study (CIHI, 2019; CIHI, 2016). The purpose of this quantitative study was to explore the statistical relationship between psychotropic medication ((a) benzodiazepine derivatives; (b) selective serotonin reuptake inhibitors; (c) diazepines, oxazepines, thiazepines and oxepines; and (d) other antidepressants), neurocognitive disorder, cognition, and fall among the Canadian elderly 65+ years in residential care. I used bivariate–multivariate logistic regression analysis while controlling for the age, gender, jurisdiction and indigeneity.et al.

Foremost, in terms of definition, an unforeseen, unintended, and uncontrollable movement of the body or any part of the body to the ground that is relatively preventable can be described as unintentional fall (Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; WHO, 2021). Across the literature, a plethora of predisposing risk factors to and sequelae of unintentional fall has been reported. The complexity of these risk factors interwoven relationship in compounding the consequential impact of

unintentional fall, the multilevel adverse effects of fall on the various levels of the socio–ecological model (individual, family and friends, community, organizations and society), and the rising economic burden of funding unintentional fall related hospitalizations and residential care cost are some of the disadvantages of unintentional fall that were reported in the literature (Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; CIHI, 2021; Davidson et al., 2018; Srivastav et al. ,2020). Additionally, the operational practice guidelines, clinical recommendation, existing policies coupled with various research studies makes unintentional fall and the implicated factors an area of research interest for further exploration is reported across the literature (Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; CIHI, 2021; Davidson et al., 2018; Srivastav et al. ,2020).

In this chapter, I will discuss how I found the evidence that I used in this study and the theoretical framework of SCT. Next, the exigency to search for and understand the various paradigms, assertions, scholarly findings, and contributions to fall and the implicated predisposing factors in body of evidence available in the literature across credible databases was appropriate in this study.

Literature Search Strategy

A range of scientific databases were used for this literature review. The searched databases include the online repository of information or library of Canadian Institute for Health Information database (2018–2022), Canadian Institutes of Health Research database (2018–2022),PUBMED (2018–2022),Government of Canada Archival (2018–

2022), Walden Library (2018–2022), PROQUEST (2018–2022), JSTOR (2018–2022), Cochrane Library (2018– 2021), MEDLINE (2018– 2021), Embase (2018–2021), PsycINFO (2018 –2021), Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus (EBSCOhost) (2018 –2021), International Geriatrics Association (ProQuest) (2018 –2021), Canadian Journal of Public Health (2018 –2021), Canadian Journal of Addiction (2018 –2021) and Canadian Journal on Aging (2018 –2021).

Their various search engines of the above listed databases were utilized through specific tools like the Boolean tool, the advanced search, various filters, and other helpful peculiar tools for searching the respective databases. The specific key words searched in these databases included: *unintentional fall, psychotropic group of medication, Canadian seniors, dementia,* and *fall risk.* The 5–year impact factor was put into consideration. For PubMed search, using the key words, and year filter, from 2018 –2022 a total of 43 articles were reviewed for the key variables,15 was reviewed for the theoretical foundation and 15 were reviewed for current practice guidelines on psychotropic medication and fall risk assessment tools. Secondly, from CIHI's, using the keywords and filtering quick stats files from 2018 to 2022, statistical databases and literature articles were reviewed. In MEDLINE, the key words in this study were used as search terms in combination with the sensitivity– and precision-maximizing version of the Cochrane Highly Sensitive Search Strategy for identifying Journals.

Theoretical Foundation–Social Cognitive Theory

Among other theories mentioned in Glanz et al. (2015), the discussion on SCT provides the implicated concepts that elucidate on predisposing risk factors and associated health behaviors connected to health problems and predictable health outcomes. Foremost according to Middleton, et al. (2019), the SCT is a psychology–based theory that explains how different persons within social systems create and follow different human processes, inclusive of knowledge and information acquisition and adoption. It was first developed in the mid–1970s by Bandura. However, the theory roots can be traced as far back to the 1940s, in Palsdottir's discussion on social learning and imitation theory (Glanz, et al., 2015; Middleton, et al., 2019). Notably, Bandura (2001) expository report on the concepts of the SCT highlighted the key focus of the theory on human interactions with the social systems, environmental influences, self–regulation, collective social responsibilities, and their interconnection to gain control and achieve individualized and national outcomes. The SCT has gained popularity in its wide use across multiple disciplines ranging from social sciences to public health.

The SCT is like the social learning and imitation theory in the sense that at some point both theories display some form of observation either through cognitive–thoughts or modelling (Glanz et al., 2015; Middleton, et al., 2019). However, while the earlier takes into consideration the determinants of learning–cognitive element (like thoughts and feelings) that the social learning and imitation theory may have not emphasized, the latter explains the processes of learning through individuals' ability to observe, imitate

and model the behaviors of others (Glanz et al., 2015; Middleton, et al., 2019). Furthermore, the SCT framework interprets the connection between humans, their behaviors, environment, and social interactions. However, critics of the theory are of the position that although the theory assumes that environmental dynamics result in individual changes, this is not always the case. Additionally, critics are of the view that the SCT does not take cognizance of physiological, emotional, or motivational predisposition that play a role in human behaviors, lacks clarity on the extent to which changes in these factors and interactions may influence each other and may be challenging to effect as it may be too wide.

Several researchers have used the SCT in explaining the behavioral, social, and cognitive elements factored into public health issues and diseases. In Oyibo et al. (2018), the social cognitive theory was adopted as a theoretical framework to explain the determinants of the possible outcome of bodyweight exercise behavior. In this study the SCT model was able to show that self–efficacy and social support were the strongest determinants of bodyweight exercise behavior, followed by outcome expectation (Oyibo et al., 2018).

Furthermore, in another study, Cross et al. (2020) used the SCT to evaluate the effectiveness of interventions designed to improve medication-taking ability and/or medication adherence in older community-dwelling adults prescribed multiple long-term medications. While the intervention design effectiveness was the health provider behaviors, non–adherence and adherence to medication were the older community-

dwelling adults' behaviors. The study showed that the SCT construct of clinician's behaviors in their intervention design and prescription plan contribute to medication adherence and overall intervention effectiveness (Cross et al., 2020). In Petterson et al. (2021) the SCT was used to explore self–determination among community–dwelling older adults who through behavioral change support utilized a self–managed digital fall prevention exercise program. The study was able to establish that the Safe Step Program assisted in the stabilization of new exercise routines for participants, in addition to the three major basic human psychological needs, with autonomy and competence being expressed as central in this context (Petterson et al., 2021). In Brooks et al. (2019), the SCT was used to understand the manner and extent to which sleep–related beliefs and/or behavior of individuals who are alcohol dependent were associated with sleep quality before and after discharge from a clinical research facility. The model construct of self–efficacy was useful in confirming that inpatient on alcohol rehabilitation treatment displayed higher self–efficacy for sleep with better sleep quality at specified times in Brooks et al. (2019). Additionally, in Wang et al. (2018), the SCT principles demonstrated that safety promotion intervention contributes to a reduction of home safety problems among low–income families with toddlers while enhancing a safe practices and home environment. Lastly for the purpose of this study, Borhaninejad et al. (2017) adoption of the SCT was to assess self–care behaviors as an effective means of managing chronic conditions like diabetes is exemplary to this theory usefulness in addressing the behavioral influence necessary to curb diabetes. The theory was used to confirm that

self–care as a behavioral factor contributes to the proper management of elderly diabetics. Therefore, educational interventions that emphasize and reinforce patients' self–care behavior were important to elderly patients' diabetics care as discussed in Borhaninejad et al. (2017).

The relevance of this theory and its distinct concepts lies in its ability to connect an individual behavior to other humans, physical and non–physical environmental influences, and associations. Therefore, this theory is important to this dissertation because it offers a theoretical and conceptual framework that helps in understanding and interpreting the likelihood of fall occurrence amongst the elderly on psychotropic group of medication in this context (Middleton, et al., 2019). Additionally, the importance of this theory to this dissertation lies in its distinct concepts of self-efficacy, reciprocal determinism, behavioral capability, observation learning expectation and reinforcements. These concepts are factorial to explaining and interpreting interwoven relationship between the biological and behavioral (cognitive decline, dementia, psychotropic groups of medication), environmental factor (Canada) and fall amongst the elderly Canadians in residential care as discussed across the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019; WHO, 2021).

Conceptual Framework

Common to the various sampled studies that utilized the SCT in this context is their emphasis on the SCT constructs. The constructs include of reciprocal determinism, behavioral capability, self–efficacy observational learning, reinforcements, and expectations as

reported in the literature (Borhaninejad et al., 2017; Brooks et al., 2019; Cross et al., 2020; Oyibo et al., 2018; Petterson et al., 2021; Wang et al., 2018).

Unique to the SCT is its six concepts that specify the relationships, individuals' abilities, responses and anticipated behaviors and corresponding outcomes that are influential to health outcomes. These concepts are reciprocal determinism, behavioral capability, self–efficacy, observational learning, reinforcements, and expectations as described in the literature (Borhaninejad et al., 2017; Brooks et al., 2019; Cross et al..2020; Oyibo et al., 2018; Petterson et al., 2021; Wang et al., 2018; Wadell & Read, 2013).

First among the SCT concepts is reciprocal determinism. This concept is about the relationship between individuals' experiences, their social and external environment, and behaviors and how they reciprocate each other in non–static ways as reported in the literature (Glanz et al., 2015; Wadell & Read, 2013.) In Smith's (2021) report, this SCT concept illustrated how drug addiction could result from the dynamic relationships between individual's personal characteristics, their social environment, and drug–centric behaviors.

The second concept is the behavioral capability. According to Glanz et al. (2015) and Sittig et al. (2020), the behavioral capability concept centers of individuals ability to carry out a particular behavior due to their ability of knowing and how to do the task. In Guntsviller et al. (2017) this concept was used as a conceptual framework to explain how behavioral confidence and literacy capability are necessary for low–income, Spanish–speaking adults to enact appropriate health behaviors. This is one among many studies in the literature that used this SCT concept as a foundational work to their research.

The third concept is the observational learning, which emphasizes how people reproduce actions they observed and witnessed from others' behaviors, sometimes referred to as modelling of behaviors as seen in the available body of evidence (Glanz et al., 2015; Kazemi et al., 2020; Troha et al., 2020). For example, in Kazemi et al. (2020), it was discovered that through observational learning the level of physical activity among women preparing for pregnancy may be improved.

The fourth concept is the reinforcement. This concept expounds on the chances of individuals carrying on or cutting off a behavior because of internal (self–initiated) or external (environmental or social) influences. Notably, this and the reciprocal determinism concepts exhibit similarities in how they connect behavior and environment as seen in Glanz et al. (2015) and Taniguchi et al. (2018). For example, this concept was used to show that letting patients know their smoking cessation score was positively helpful in reinforcing their resolve to cease smoking in Taniguchi et al. (2018).

The fifth SCT concept is expectations, which Glanz et al. (2015) and Rivera et al. (2018) explained how consequential people's behavior can be, health outcomes are expected from people's actions prior to engagement in such actions. These expected outcomes based on previous experience could act as a deterrent to or motivation to such actions. In Rivera et al. (2018) the expectation that training graduate public health students to educate communities about health issues was a creative and sustainable means to reach underserved population was proven true as the trained students effectively delivered cancer education to such local communities. This is one among many studies in

the literature that used this SCT expectation concept as a foundational theory for their research. The sixth SCT concept is the self–efficacy. This concept associate's individual's confidence to their respective ability to successfully perform a behavior and environmental influencer in line with the literature (Glanz et al., 2015; Rivera et al., 2018). Various public health studies have utilized this concept to buttress how individuals' confidence and ability contributed to performing a health behavior that prevents poor health outcomes in consonance with Brooks et al. (2019) and Rivera et al. (2018). Overall, the SCT conceptual paradigms on individuals, behavioral, and environmental influences that are implicated as predisposing risk factors to fall in this context will be discussed shortly with emphasis on two major concepts–Reciprocal determinism and self–efficacy that relate to this study but have been minimally explored in regards to the Canadian elderly, fall , cognition, neurocognitive disorder(dementia), use of psychotropic medication (a)benzodiazepine derivatives (b)selective serotonin reuptake inhibitors (c) diazepines, oxazepines, thiazepines and oxepines and (d) other antidepressants contextually.

The SCT concept of interest in this study are the reciprocal determinism and self–efficacy. Contributory to human behavior are interactions between their cognitive function and social factors: a concept of SCT known as reciprocal determinism described in Glanz et al. (2015) and Middleton, et al. (2019) report. The occurrence of such interactions amidst predisposing factors like environment(jurisdiction), neurocognitive disorder, cognitive state and behavioral factors that are influential to fall occurrence

among the elderly makes this concept important and key in this study as seen in the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019; WHO, 2021). For example, the use of psychotropic drugs by the elderly and their prescription by clinicians as behavioral social and factors that influence fall occurrence among the elderly is examined in this study as reported in the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019; WHO, 2021). This in turn determines the extent to which these behavioral factors are associated with fall.

Another concept of SCT to be assessed in this study is that of self–efficacy. Human behaviors are influenced by a couple of factors inclusive of their personal belief of achieving goals based on specific setting. Specifically, this concept explains cognitive mediation as an action path that allows, empowers changes and effectiveness in behaviors, actions, and skills whether in use or not, in line with the literature (Glanz et al., 2015; Middleton, et al., 2019). For example, applicably, this concept relates the declining cognitive state of the elderly as influential to a fall in this context in line with several reports across the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019). Furthermore, those elderly 65 years and above reported to have poor cognitive state, may be likely to experience a fall as they may not be able mediate the necessary cognitive stability and quick response in time necessary to stop a preventable fall in line with several reports across the literature (Cross et al., 2020; Glanz et al., 2015; Middleton, et al., 2019; Oyibo

et al.,2018; Petterson et al., 2021). Consequentially, this may be contributory to the frequency, severity, and impact of fall among the elderly 65 years and over in residential care in Canada.

Interestingly, these two SCT concepts by implication of the multifactorial nature of the predisposing fall–risks conditions in this study cuts across the different levels of the socioecological model in addressing the behavioral changes associated with a reduction in fall in line with several reports across the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019). Overall, the SCT constructs (reciprocal determinism and self–efficacy) practicability and applicability in fall reduction and promotion of behavior that favors unintentional fall reduction will be tested and used to explain the contextual variables in this study as reported in the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019). An in–depth literature review discussion on this study's variables will be the next focus of discussion in this study.

Literature Review Related to Key Variables

Epidemiology of Fall Related Injuries among the Elderly (Abroad, Canada and United States

Among the elderly, globally, the health topic–fall has remained the "Elephant in the room" discussion across health facilities and institutions. First, unintentional fall are described as fall that are spontaneous, unexpected, unplanned, and uncontrollable movement with gravity to the ground by an individual that maybe relatively preventable in line with several reports across the literature (Gulati et al., 2012; Healthy people.gov,

2019; Laberge & Crizzle, 2019; WHO, 2021). Based on CIHI (2016) report, fall can be categorized based on the environmental and physical situations under which they occurred. These include out of or through building or structure fall, fall on/from Ladder or Scaffolding, fall on/from stairs and steps, fall from one level to another, fall during transfer of patient, fall in the bathroom, collision with/ pushed by another person, slipping, tripping, and stumbling and lastly due to other/unspecified fall as seen in the literature (Cameron et al., 2018; CIHI, 2016; Public Health Ontario, 2020). From a 2016 report, the incidence of fall at the provincial level (in Ontario, Canada) showed the distribution pattern among these types of fall, with the elderly more in number (CIHI, 2016; Public Health Ontario, 2020). These figures provide a general overview on fall, the need to focus on the age group most affected (the elderly) and the importance of an in–depth literature review on fall and the contextual predisposing factor in this study. Fall association with injuries, makes it a pivot of discussions. When fall are associated with injuries, they are termed fall–related injuries. Based on the popularly accepted classification seen in National Center for Health Statistics, (NCHS) ICD9–CM (2005), fall–related injuries in the community, home care and long–term care are generally characterized by ICD–9–CM diagnoses for the related injured body part. On the other hand, according to NCHS, ICD9–CM (2005), acute care setting incident reports categorizes fall injuries under the ANA–NDNQI fall–related injuries categories which are: (a) None: patient did not sustain an injury secondary to the fall, (b) Minor: patient sustained fall–related injuries that require a simple intervention, (c) Moderate: patient

sustained fall–related injuries that require sutures or splints, (d) Major: patient sustained fall–related injuries that require surgery, casting, further examination (e.g., for a neurological injury), (e) Deaths: Patient sustained fall–related injuries that resulted in death.

According to the World Health Organization, globally, approximately 28–35% of people aged of 65 and over fall each year (2–4times) increasing to 32–42% for those over 70 years of age. Based on available data, some countries report higher figures than others (WHO, 2014). From other countries, according to Cameron et al. (2018) in a one–year prospective study conducted in Germany on 528 nursing homes, 75% of fall occurred in the rooms or bathroom of residents, 41% occurred while residents were being transferred and 36% when walking, gender–wise the rate of fall was higher in males (2.8 fall per person year) compared to female (1.49 fall per person year), more common in persons requiring moderate levels of care residents. Interestingly, most times, these incidents reporting are usually underestimated in standard reporting as reported in Cameron et al. (2018). Generally, the elderly residents of nursing homes encounter more frequent fall than others living in community. It is estimated that 30–50% of long–term care residents experience fall annually with 40% of them as reoccurring as reported in WHO (2014). However, these figures vary from country to country, coupled with the rising number of fall among the elderly. In the United States, a study conducted in Maryland reported that among individuals 55 years and above in 12 nursing home, an approximate of 30% experience a fall in four months, 97% of these fall did not end up in a hospital and 72%

of these residents were on psychotropic medication in line with the literature report (Galich et al., 2019). However, in Zulu et al.'s (2020) report on the United State elderly 65 years and above in a nursing home, an estimate of one in every seven fallers being hospitalized had a hip fracture. Contextually, in Canada,1 in 7 elderly persons experience unintentional fall yearly in line with the literature reports (Do et al., 2015; Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Across the literature it is reported that Canadian's seniors above 65 years and above are at risk of fall compared to the other age–groups and this present a major concern in an aging population like Canada in line with the literature reports (Do et al., 2015; Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Currently, an estimate of 1 in 6 Canadians is an elderly and the literature reports a steady rise in this age group, coupled with a rise in age–related illnesses, medication use, isolation, inadequate and difficult to access personal care support, orthopedic surgical procedures and other factors associated with increased risk of fall amongst this age group in line with the literature report (Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Of specific interest in this study are the elderly 65 years and above residing in the 7 Jurisdictions (provinces and territories) in Canada as reported in the literature (CIHI, 2019). Between 2018–2019, the Continuing Care Reporting System quality indicators (CCRS QIs) of CIHI reported safety as a quality indicator (with Has fallen as a quality indicator name) among the elderly 65years and above Canadians who received residential care (CIHI, 2019). Based on CIHI's CCRS report, 23.0% of elderly Canadians in the 90^{th} percentile and 8.0% in the 10^{th} percentile

for has fallen, while in 2019–2020, 23.2% of elderly Canadians in the 90th percentile and 7.3 % were in the 10th percentile for has fallen (CIHI, 2019). This is evidential to a 0.2% increase among those in the 90th percentile and a 0.7% decrease among those in the 10th percentile compared to the previous year. These higher occurrences in this groups are quite consistent with the literature.

In terms of mortality at the national level, for older Canadians, in–hospital mortality for a fall injury admission (8%) is common for older Canadian adults in line with report across the literature (WRHA, 2018). Moreover, fall deaths nearly double in frequency with each five–year increase in age and are more common among males in line with report across the literature (WRHA, 2018). On a provincial level, in Ontario, deaths related to fall were responsible for approximately 70% of unintentional injury deaths (Ontario Ministry of Health and Long–Term Care, 2020; Public Health Ontario, 2020). A year average of 92.4 per 100,000 deaths was reported amongst the elderly (65+) in Ontario, with a yearly average of 1647.8 deaths as reported in the literature (Ontario Ministry of Health and Long–Term Care, 2020). At the health system level, nationally, as of 2016 report, 81% of injury hospitalizations were due to fall, of which 37% were males, 63% were females, 15.9% were the elderly with dementia,7.4% were the elderly without dementia as reported in the literature (CIHI, 2016; Public Health Ontario, 2020). In terms of individual socioeconomic status, it was estimated that 58.5 per 1,000 of Canadians seniors in the lowest income group experienced fall compared to 47.5 per 1,000 in the highest income group, especially amongst those with dementia on antipsychotic

medication as reported in the literature (CIHI, 2016; Public Health Ontario, 2020). This multilevel impact of fall on Canadian elderlies, the health and economic systems, its trend observed among the lower income class and various Canadian provinces buttresses the need to consider the crucial and contextual implicated modifiable, environmental, behavioral, and biological risk factors.

Public Health Impact of Fall Among the Elderly

The adverse impact of fall among the elderly can be understood from the socioecological model levels. From the intrapersonal level, when the elderly fall, the head is the part of the body most imparted, resulting in Traumatic Brain Injury (TBI) which is reportedly the commonest form of injury in the elderly population. The cascade of fallouts resulting from fall is not limited to TBI. The pathological course of Alzheimer is reported to be common among the elderly with a history of repeated TBI secondary to fall, which could lead to a deterioration in executive functions (Hoffe & Holahan, 2019). Another unfavorable outcome of fall on an individual is fractured bone(s). Fall increases the elderly risk of having a fracture and its associated sequelae like pain, mobility issues, prolonged stay in hospital bed, post–surgical complications, aggravation of existing chronic conditions, deaths, and even recurrent fall (outside the comfort of one's home) as reported in the literature (Cameron et al., 2018; Cross et al., 2020; Petterson et al., 2021). Moreover, fall could result in injuries and damage to various body organs like the skin, external and internal organs, multiple systems, chronic ulcers, permanent disability, loss of income and short and long–term unemployment as reported in the literature (Cameron

et al., 2018; Cross et al., 2020; Crowe & Stranks, 2018; Do et al., 2015; Petterson et al., 2021). Additionally, after one or multiple fall, some elderly persons fears and psychological concerns about falling could pose a significant threat to their personal autonomy and movement consequentially resulting in little to no confidence in ambulatory activities, self–imposed activity restriction and post–traumatic stress disorder among others as reported in the literature (Cameron et al., 2018; Ferreira et al., 2020; Hansen et al., 2021; Olfson et al..2015; Soriano, 2013; Stafford et al., 2021; WHO, 2016).

Furthermore, based on the socioecological model levels, from the interpersonal level, most of the Canadian elderly have family members and relatives that are responsible in one or more ways for their upkeep, welfare, and safety. In the unfortunate event of an elderly encountering a fall comes the accompanying yet uncomfortable demands to cater to the health needs primary and secondary to the fall incidence. Explaining this in economic terms, critical to families are their cost of being caregivers to an elderly family member that has fall–related injuries. According to CIHI (2019), although family caregivers may be a culturally appropriate and morally justified in terms of caring for the elderly with fall–related injuries however, an estimated lost earning of CAD$65,000 annually is reported to among family caregivers affected. Furthermore, fall–related fatal injuries may incapacitate an elderly to a vegetative state or may even result in death. Thus, causing bereavement to families, friends, and communities, which

may negatively psychologically impact those related to the deceased as reported in the literature (Madden et al., 2019).

Additionally, from the community and organizational levels, the multilevel impact of fall can also be observed in communities of the elderly and various hospitals across Canada. Notably data collected suggests that fall–related visits to the hospital were more common from long–term care seniors with dementia who had a higher proportion of hospital visits related to fall compared to those without dementia, regardless of the jurisdiction and the lowest income group were more affected than those in the highest income group in line with the literature (CIHI, 2016; Public Health Ontario, 2020). CIHI (2016) and Public Health Ontario (2020) reported that hospitalizations due to fall related injuries were 81%, with 37% of those hospitalizations as males and 63% as females especially, as 15.9% among these hospitalizations were seniors with a diagnosis of dementia and 7.4 % had no diagnosis of dementia.

Another impact of fall on health facilities could be described in economic terms. Cost of medications and health–care–provider consultations in treatment and rehabilitation care for fall–related injury among the elderly 65 years and older is averaged to be CAD $9000 according to the literature (CIHI, 2019; WHO,2014). Among different cost items, hospital inpatient services cost is the most expensive (50%) while the long–term homes cost comes next (9.4% to 41%). In Canada, these costs are projected to increase to CAD$ by 2040.Globally, these costs are projected to increase to CAD$ 440

billion by year 2040, although it could vary from one country to another in line with the literature (CIHI, 2016; CIHI, 2020; WHO, 2020).

Notably, the adverse impact of fall at the society level is reflected in health policies and increasing monetary expenditures at the federal level primarily due to fall related complications. Majority of elderly Canadians who have needed or had a knee–replacement and or hip arthroplasty surgery (expensive surgical procedure) were reported to have had a fall prior to the fracture that necessitated such surgery elderly (CIHI, 2016; CIHI, 2020). These expensive knee–replacement and or Hip Arthroplasty surgery(is) are paid for by the Canadian Government as reported across the literature (CIHI, 2016; CIHI, 2020; Crowe & Stranks, 2018; Do et al., 2015; Soriano, 2013; Olfson et al., 2015; Ferreira et al., 2020; Hansen et al., 2021; Stafford et al., 2021).

Fall Prevention Interventions among the Elderly

For this study current fall prevention interventions among the elderly takes into context the existing psychotropic medication prescription guidelines, fall risk assessment tools used among this age group, medical error prevention efforts and surveillance– and systems–based interventions approach.

Generally, and contextually, the prescription, availability, and use of psychotropic medication among the elderly are and could be controlled by certain factors, which are primarily (a)prescription Guidelines (b)pharma care and (c)deprescribing Guidelines.

In terms of prescription guidelines**,** based on Canadian physicians' prescription guidelines, physicians can prescribe multiple medications for a patient. For patients with

multiple health conditions (common to the elderly), prescriptions of different drugs to address specific condition could result in 5 or more drugs being taken by a patient– a situation called polypharmacy as described across the literature (Molnar & Frank, 2019; Todd, Adam, et al., 2018). Reportedly, an estimate of 25 to 40% of the elderly 65 and above years' experience polypharmacy however, a considerate proportion of these medication are inappropriate, a situation regarded as "inappropriate polypharmacy" as explained across the literature (Molnar & Frank, 2019; Todd, Adam, et al., 2018). Notably, these drugs possess mild to severe side/adverse effects, which may possibly result in drug interactions possibly, resulting in a sequela of reactions that may be subclinical and or clinical overtime as reported across the literature (Molnar & Frank, 2019; Todd, Adam, et al., 2018). These reactions could eventually culminate in the pathological process that leads to fall. Therefore, contributory to the availability of psychotropic medications are existing prescription guidelines and prescribed over–the–counter drugs accessible by patients as reported in Molnar and Frank (2019) and Todd, Adam, et al. (2018). On the other hand, according to Canadian Journal of Addiction Medicine, the access to certain prescription drugs (usually through a regarded as prescription fraud) could facilitate drug and substance abuse hence, the need to cut down and restrict their availability as seen in Vaz and Crockford (2017). This could act as check on the prescription of some group of psychotropic medication like Benzos and SSRIs. Moreover, other measures to cut down on inappropriate polypharmacy are gradually gaining weight.

Secondly, in Canada, pharmacare operates with the major rationale of increasing Canadian's access to prescription drugs and out–of–pocket drugs thus, reducing cost–related non–adherence as reported in Health Canada (2019). Notably, there is the confidential rebates agreement between Canada and certain drug manufacturers to allow certain drugs much more available than the regular prescription as reported in Health Canada (2019). Psychotropic medications in this group may be more available. However, with this comes an incremental rise in the general dug consumption, generally among Canadians. It is estimated that a 1 percent reduction in out–of– pocket drug costs is proportional to an increase of 0.1% and 0.2 % total drug consumption as reported in Health Canada (2019). This premise makes a case for the increased availability and use of psychotropic medications generally, inclusive of the elderly.

Thirdly, deprescribing guidelines in Canada has been a step forward in curtailing the use of multiple unnecessary medication. When it comes to the use of drugs among the elderly, the popular saying *"the more, the merrier"* may not hold especially, as this tends to be the opposite in this case. Downsizing of polypharmacy and eliminating inappropriate polypharmacy among elderly Canadians, inclusive of those in residential care has been an ongoing measure to reduce this age–group ingestion of unnecessary medication in recent years as reported across the literature (Molnar & Frank, 2019; Deprescribing.org, 2021; Todd, Adam, et al., 2018). To optimize medication, minimize medication interactions, reduce aggravated side–effects, diminish adverse drug events (ADEs) risks resulting from inappropriate polypharmacy, while improving health

outcomes among the elderly with a range of morbidities, a set of guidelines known as deprescribing guidelines has been established as reported across the literature (Molnar & Frank, 2019; Deprescribing.org, 2021; Todd, Adam, et al., 2018). The recommended deprescribing guidelines operational in Ontario (largest Canadian province) lay emphasis on four key areas–crucial to maximization of drugs and minimization of ADEs as reported across the literature (Molnar & Frank, 2019; Deprescribing.org, 2021; Todd, Adam, et al., 2018). The guidelines are all residents in LTC homes and their families/caregivers participation in a shared decision–making regarding the establishment and monitoring of medication use(in the context of effectiveness, safety and non–drug alternatives), health care providers observation of signs and symptoms and changes associated with medications adjustment(clue for deprescribing), prescribers (in health care settings) documentation of specific medications use, goals and timeline and lastly, all members of health care team participation in deprescribing conversations as reported across the literature (Molnar & Frank, 2019; Deprescribing.org, 2021; Todd, Adam, et al., 2018). Notably, while prescription may allow access to multiple drugs (inclusive of psychotropic drugs) at time as the situation demand (and based on the Clinicians discretion), on the other hand, deprescribing of drugs curbs access to multiple drugs at a time that may not be necessary.

Another practice of fall prevention among the elderly is the use of fall assessment risk factors. Across the literature, a plethora of fall risk assessment tool exists. Some examples of Fall Risk Assessment (FRAT) tools include the Morse Fall Scale, SPLATT,

STRATIFY, Schmid Fall Risk Assessment and STEADI among others as reported across the literature (BCGuidelines.ca, 2020; Frieson et al., 2018; Phelan et al., 2016). The multipurpose of these tools are to predict the fall risks of users, inform caregivers of their patients fall risk, assist in tailoring of patients and users care in line with the tools assessment result and over all reduce the occurrence and burden of fall and its adverse outcomes. Some examples of fall risk assessment tools are discussed below. First, the UK NHS based Fall Risk Assessment tool (for sub–acute and residential care) is a four–item risk screening tool divided into three sections that assesses the risk status, with a risk factor checklist and an action plan as seen in the literature (BCGuidelines.ca, 2020; Frieson et al., 2018; Phelan et al., 2016). To use this tool effectively, an understanding of and clarity on the tool rationale, interpretation and application is required. In addition to this FRAT tool the NHS recommends the inclusion of a cognitive test called the Hodkinson Abbreviated Mental Test Score (ABTS) FRAT. This tool assesses the cognitive function of the patient. The second tool is the Center for Disease Control (CDC) fall prevention tool called STEADI "Stopping Elderly Accidents, Deaths & Injuries." This tool is a set of comprehensive materials that uses algorithm to systematically assess for modifiable fall risk factors and address fall risk among users, provide clues for including fall risk management into patient's clinical care as seen in the literature (Frieson et al., 2018; Phelan et al., 2016). Unlike some other fall risk evaluation tool, STEADI uniquely categorizes medication associated with fall into three. Notably, this assessment tool classifies psychotropics (anxiolytics/sedative–

hypnotics, antipsychotic s, antidepressants, anticonvulsants, and narcotic pain medications) among medication with a higher risk score based on a combination of effect to hamper cognitive function, increase sedation, decrease reaction times, and distort balance as explained in Frieson et al. (2018) and Phelan et al. (2016). Another is the SPLATT tool. This is one of the fall–risk assessment tools used in Canada. It assesses five areas namely: Symptoms immediately prior to the fall, previous fall history, location of fall, activity at time of fall, time of fall and trauma or injury resulting from the fall as explained in BCGuidelines.ca (2020). The SPLATT tool categorizes fall risk into three, with the third category as having the highest. Notably, this tool does not reflect medications associated with fall–risk or polypharmacy as explained in BCGuidelines.ca (2020). Another fall risk assessment designed by Europeans expert group for the elderly is the STOPPFall (Screening Tool of Older Persons Prescriptions in older adults with high fall risk) tool as explained Seppala et al. (2021). This tool takes into context 12 classes of drugs, inclusive of those implicated in this study, assists clinicians to manage FRIDs, conduct Fall–risk assessment and the cases considered for withdrawal or stepwise withdrawal, and those for monitoring after deprescribing as seen in Seppala et al. (2021). Unlike majority of the other fall risk assessment tool, the peculiarity of STOPPFall lies in its capacity to help in identifying culprit fall–risk associated medication and corresponding deprescribing and management modalities. For this study and contextually, the tools discussed above are the popularly used ones however, there are still a few tools used in fall assessment reported in the literature. Notably, majority of the

self–administered fall risk assessment tools do not reflect medications associated with fall–risk or polypharmacy as reported across the literature (BCGuidelines.ca, 2020; Frieson et al., 2018; Phelan et al., 2016). Interestingly, although there is no fall–risk assessment tool documented to be perfect however, a fall risk assessment tool should encompass and reflect associated fall–risk factors available in the literature and reportedly commonly among fallers. Some of the criteria for selecting a fall risk assessment tool include prospective validation in greater than one percent of the population, tools sensitivity and specificity analytic capacity, internal and external validity and generalizability, interrater reliability, and transparency simple calculation of score as reported across the literature (Frieson et al., 2018; Phelan et al., 2016). In Canada a combination of frailty assessment tools(The Hendrick II Fall Risk Model, Timed Get Up and Go Test, Berg Functional Balance Scale, Fall Efficacy Scale, 4 Stage Balance Test, 30 Second Chair Stand, Tinetti Performance Oriented Mobility Assessment (POMA), Fall Risk Assessment Tool (FRAT), Activities–specific Balance Confidence (ABC) Scale, Dynamic Gait Index, Six–Minute Walk Test, Morse Fall Scale and St. Thomas Risk Assessment Tool (STRATIFY)) are used to assess for fall risk however, none of these tools clearly specifies psychotropic medication rather most times it is left to the discretion and clinical judgement of the clinician despite substantial information to the contrary as reported across the literature (Agency for Healthcare Research and Quality, 2017; BCGuidelines.ca, 2020). Addressing the gaps and shortcomings of fall

risk assessment tools maybe contributory to the better care management of at–risk of fall elderly.

Another fall prevention intervention among the elderly is the medical error prevention efforts. According to Rodziewicz, et al. (2021) medical error prevention should span knowledge and proactive identification of medical possible medical errors, accountability of health experts, organizations, and systems in addressing them, and comprehensive federal and state laws to address them. Medical errors that could result in the elderly fall include (a)active Error (b) adverse event latent error (due to faulty system, designs, equipment installation or organizational structure errors that go unnoticed for a long time with no ill effect.)(c) medical error(preventable errors from technology, surgical, diagnostic, medication, devices, missed diagnosis, malpractice, the act of omission or commission that lead to unintended consequences and deliberate overhead decrease of health facilities nursing staff) (d) negligence (e negligent adverse events(f) near miss (g)never event, (h)noxious episode and (i) sentinel event among others. Some measures to address medical error that have successfully address these errors over the years include the establishment of and compliance with the Joint Commission Patient Safety goals in institutions as seen in Rodziewicz, et al. (2021). For fall prevention, these goals revolve around (a)correct identification of patient in at least two ways (b) identification of patient safety dangers and risks patient safety dangers and risks patient safety dangers and risks(c) enhanced communication of medical and investigation report promptly to patient (d) prevention of ulcers, monitoring of equipment

(like catheter changes, and central line precautions and post–op management in order to prevent fall (e) prevent surgery–related mistakes (f) correctly used alarm devices (g) adequate, safe and correct use medications by correct and double–checking labeling and handover of patient list of medication to the next care provider as situation demands (h) High sanitary protocols and monitoring of patients on specific drugs associated with fall and its predisposing health condition as described in Rodziewicz,et al. (2021). Additionally, another way to prevent medical errors that could result in fall is institutions, health facilities, health care workers, caregivers, patients and family members awareness of and compliance with federal and state laws(which covers areas like Provider Opioid Knowledge, Deficit Controlled Substance Act, Misuse of Controlled Substances, FDA–Approved Indication and Non–FDA Approved Indications among others) that guide their manufacture and distribution of medication and medical devices as reported across the literature (Preuss et al., 2021;Rodziewicz,et al., 2021).

Lastly on fall prevention intervention among the elderly is the surveillance and system–based intervention. Surveillance– and systems–based approach is another interventional line towed to curb fall occurrence among the elderly. According to Hyndman (2018), an integrative and wholistic approach to fall prevention that cuts across multiple systems would help in achieving significant progress in fall reduction among the elderly. Some examples of such multisystem approach are discussed as follows.

(a)the US–based PACE (Program of All–Inclusive Care for the Elderly) program which offers regular care from an interdisciplinary team, and it is targeted at the elderly

age–group who are at the highest risk of fall. Over the years since its inception, PACE has contributed to the success of health outcomes among program enrollees and caregivers. However, this program is funded majorly through the US–Medicare, Medicaid, and other insurers parties, making it not applicable to individuals not enrolled in this health insurance scheme and those who may have this insurance, but their premium does not extend to PACE. Nevertheless, operating a similar integrative model in other countries maybe all–encompassing and beneficial to majority of the population under a Universal Health Care insurance scheme.

(b)the New Zealand Primary Care Strategy. Under this strategy an integrated meso–level level of primary care that involves organizations like the Independent Practitioner Associations and Primary Health Organizations provides health services at a subsidized rate to individuals, families, and communities as reported across the literature (Cumming, 2011; Hyndman, 2018). Remarkable improvements in service provision and key performance indicators were reported as some of the gains from this strategy as reported across the literature (Cumming, 2011; Hyndman, 2018).

(c) Program of Research to Maintain Services for Autonomy (PRISMA). This integrated service delivery model was first used in the Canadian province of Quebec as reported across the literature (Hyndman, 2018; MacAdam, 2015). PRISMA was established for the elderly persons with the purpose of addressing the lapses in their care continuity, entry point, case management and individualized service and care plan as explained in Hyndman (2018) and MacAdam (2015). Reportedly, this strategy

successfully addressed the lapses and yielded results ranging from substantial reductions in (a) the functional decline of the elderly,(b) unmet need,(c) emergency room visits to a significant rise in the elderly client satisfaction with care Hyndman (2018) and MacAdam (2015).Other system–based fall prevention intervention strategy reported in the literature include but are not limited to the Esther Network(in Southern Sweden for the elderly), the Public Bodies Act (in Scotland) and the Norrtaelje model(in Sweden) as reported across the literature (Back & Calltorp, 2015;Davies, 2012; Hyndman, 2018; Scottish Intercollegiate Guidelines Network, 2011).

Modifiable Risk Factors Associated with Fall Prevention

Predisposing risk factors to fall could be classified into modifiable and non–modifiable. Additionally, according to WHO risk factors can be categorized are behavioral, environmental, biological, and socioeconomic (WHO, 2014). Modifiable risk factors may include but are not limited to cognitive decline, use of psychotropic medication, cognitive decline, dementia, and socioeconomic status among others while the non–modifiable risk factors may include age, history of fall and ethnicity, among others. Based on WHO classification, factors associated with fall could be classified as behavioral, cognitive decline and dementia as biological and Jurisdiction as socioeconomic as reported across the literature (Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; WHO, 2021; WHO, 2014). Additionally, a plethora of Cochrane reviews reported that in most elderly care facilities, relatively modifiable risk factors like fall history, cognitive impairment, mobility aid use, wandering, use of

sedatives, antipsychotic s, antidepressants, and total number of medications used, degenerative diseases, moderate level of disability, wandering, and dizziness are associated with a higher fall risk as reported across the literature (Cameron et al., 2018).This study is inclined towards a couple of the modifiable predisposing risk factors (primarily, to a large extent they are preventable) and ethnicity (first nations and non–first nations) to have a sociodemographic understanding contextually in Canada. These factors are discussed below. For this discussion, foremost to be discussed among the risk factors associated with fall prevention is cognitive decline.

Cognitive Decline

Cognition in advanced age is an important factor that should be taken into context in conversations around fall occurrences. cognitive decline, which could be physiological or pathological are reported in higher numbers among individual 55 years and above. Church et al. (2020) explained how the frailty of the elderly declines even in the absence of any pathology. Based on the Clinical Frailty Scale (CFS) that assesses certain areas including comorbidity, function, and cognition with a score range of 1(very fit) to 9 (terminally ill), the elderly usually ranges between 5 and 9 even in the absence of any disease, predisposing them to age–related cognitive decline as explained in Church et al. (2020). Consistent with the literature, a decline in brain function which directly and negatively impact the motor cognitive interface, implicating the attention, gait speed and balance functions could result in fall occurrence as reported across the literature (Hunter et al., 2020; Hunter et al., 2019; Montero–Odasso et al., 2019). In Canada, between

2018–2019, the Continuing Care Reporting System quality indicators (CCRS QIs) reported cognitive function as a quality indicator (with worsened cognitive ability as a quality name) among the elderly 65years and above who received residential care. Based on the CCRS report, 22.8% of elderly Canadians were in the 90th percentile and 4.2% were in the 10th percentile for worsened cognitive ability (Canadian Institute for Health Information, 2019). Comparatively, 17.1% of elderly Canadians were in the 90th percentile and 0.7% were in the 10th percentile for improved cognitive ability as seen in CIHI (2019) report. Thus, implicating higher occurrence of cognitive decline in this age which is quite consistent with the literature. Despite the rising figures of cognitive decline and fall, the relationship between cognitive decline and fall among the elderly receiving Residential care in Canada has been minimally explored. Therefore, the need to conduct a recent study that assesses this relationship contextually is prerogative to understanding this health problem. This leads the literature review to the second predictor variable.

Dementia

The second risk factor to be discussed is Dementia. Commonly referred to as ‘neurocognitive’ disorder among clinicians is usually described partly as a function of advanced age, in which certain portions (frontal, temporal and or parietal cerebral cortex) of the brain are impacted, losing their physiologic functions, resulting in the loss of neurologic and cognitive functions group as reported across the literature (Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Exemplary to this is Gilles et al. (2019) study on the elderly neurocognitive state that contributed to their higher

predisposition to fall comparatively to other diseases. Notably, the subcortical part of the brain, largely responsible for motion, learning, emotion, and consciousness has been linked to neurodevelopment and the pathological susceptibility and sequelae of neurocognitive disorders as reported across the literature (Hunter, 2019; Satizabal CL et al., 2019). There are different forms of Neurocognitive disorders. According to the ICD–10 classification, dementia could coexist with other diseases or occur as an organic disorder. The main types of dementia include Dementia in Alzheimer's disease, which could be of early, late, mixed(atypical) and unspecified. Another type of dementia is the vascular dementia, which could be of acute(rapid) onset, gradual onset, sub–cortical and mixed cortical and subcortical vascular dementia as reported across the literature (Arvanitakis et al.,2019; Church et al., 2020; Duong,2017; Hunter,2020; Hunter, 2019). Other forms of dementia include other vascular dementia, unspecified vascular dementia, dementia in Pick's diseases, dementia in Creutzfeldt–Jakob disease, dementia in Huntington's diseases, dementia in Parkinson's disease, dementia in human immunodeficiency virus (HIV) disease, dementia in other cerebral and somatic condition and generally unspecified dementia as reported across the literature (Arvanitakis et al., 2019; Church et al., 2020; Duong, 2017; Hunter, 2020; Hunter, 2019). Common among the elderly are vascular dementia and dementia in Alzheimer. Provincially, cognitive decline among the elderly Canadians especially, in Ontario, 16% of seniors living with dementia experienced fall as reported across the literature (CIHI, 2016; Public Health Ontario, 2020). More than half of these elderly ones with Alzheimer disease and other

dementia–related illnesses experienced behavioral and psychological symptoms, including delusions, aggression and agitation which increases their risk of falling as reported across the literature (CIHI, 2016; Public Health Ontario, 2020). Putting the rising figures of neurocognitive disorder, fall incidence, already discussed risk factors and this subject minimal exploration among the elderly receiving Residential care in Canada to context, it is rational to conduct a recent study that assesses this relationship and their potential impact the various risk factors positively. In addition to dementia and already discussed cognitive decline, the third predictor variable to be reviewed is the use of psychotropic medications among the elderly. is the use of Psychotropic Medications.

Psychotropic Drugs and Their Use Among the Elderly

According to existing body of literature, implicated among the predisposing factors of fall among the elderly are certain group of psychotropic medication. A brief history of psychotropic medication uses dates way back to the middle of the 20th Century when the use of this group of medication for mental health cases was instrumental to curbing the number of hospitalization primary to severe mental conditions as reported across the literature (Fisher et al., 2019; Jennum et al., 2016; Miller & Keane, 2003). Foremost, describing psychotropic medication, certain group of medications capable of affecting the brain function, causing changes in the mood, thoughts, perception, emotions, and behavior are commonly referred to as Psychotropic medication as reported across the literature (Fisher et al., 2019; Jennum et al., 2016; Miller & Keane, 2003). There are five major sub–groups (antidepressant, anti–anxiety, anti–panic agents,

stimulants, antipsychotic s, opioid, hallucinogens, and mood stabilizers) under this group. In this study, the groups of psychotropic medication of specific interest are antipsychotic, antianxiety, antidepressant and hypnotics. Four commonly used class examples from these groups to be discussed in detail in this literature review is the drug class codes – N05BA (benzodiazepine derivatives), N06AB (selective serotonin reuptake inhibitors), N06AB (diazepines, oxazepines, thiazepines and oxepines) and N06AX (other antidepressants) as reported across the literature (CIHI, 2021). Although, there are certain prescription restrictions guidelines on use of psychotropic medication however, these group of medication are of therapeutic benefit to certain medical condition therefore, providing a reason and excuse for their constant use and prescription by Clinicians and fraudulently acquired by some users at some point.

In Canada, between 2018–2019, the Continuing Care Reporting System quality indicators (CCRS QIs) reported safety as a quality indicator (with Taken antipsychotic s without a diagnosis of psychosis as a quality name) among the elderly 65years and above who received residential care as reported across the literature (CIHI, 2019). Based on the CCRS report, 34.2% of elderly Canadians in the 90^{th} percentile and 8.8% in the 10^{th} percentile had taken antipsychotic s without a diagnosis of psychosis between 2018–2019 as seen in CIHI's (2019) report. Comparatively, between 2019–2020, 34.5 % of elderly Canadians in the 90^{th} percentile and 8.4%were in the 10^{th} percentile had taken antipsychotic s without a diagnosis of psychosis as seen in CIHI (2020). Additionally, from 2019–2020, the number of the elderly in residential care who received anxiolytic

and antidepressant from four jurisdiction (Newfound land, Yukon, Alberta, and British Columbia) totaled 8,096 and 23,610 respectively as documented in CIHI's (2020) report. On the contrast, the number of the elderly in residential care who received anxiolytic(anti–anxiety) and antidepressant from four jurisdiction in 2018–2019 were 6949 and 29224 respectively as seen in CIHI (2019) report. Comparatively, there was a decline in the use of antidepressant however, there was a rise in the use of anxiolytics from the observed figures. Therefore, implicating an increase in the use of anxiolytics and indiscriminate use of psychotropic group of medication without a medically appropriate reason in this age group contextually during this period, which is quite consistent with the literature.

Notable, on the negative, these medications are associated with side effects especially, among the elderly. Based on the analogy that with a wider usage follows a higher risk and numbers of associated adverse and side effects associated with this class of medication, more elderly 65 years and above are predisposed to psychotropic medication–related fall as reported across the literature (Fisher et al., 2019; Jennum et al., 2016; Miller & Keane, 2003). For example, notably in Canada's most populous province, those with mild–moderate cognitive impairment and severe cognitive impairment who used antipsychotic s (increasing their risk of falling) were 51.5% and 37.9% respectively, while those with mild to moderate and severe aggression who used antipsychotic s (which heighten their fight and fall risk) were 36.7% and 22.5 % respectively as reported across the literature (CIHI, 2016; Public Health Ontario, 2020). Additionally, resonating

with the literature, according to Watt et al. (2020), the use of antipsychotic s among the elderly with Alzheimer disease increased their odd of having a fracture compared to those using anticonvulsants. Moreover, the death odds among the elderly on antipsychotic with neurocognitive disorder (dementia) is comparatively higher to those on antidepressant. If these reports point towards one direction, it is a path of unilateral effort that lay emphasis on increased research and close monitoring of psychotropic medication association with fall as reported across the literature (Do et al., 2015; Soriano, 2013). Another contributor to psychotropic medication related fall may be non-adherence (deviations from the agreed upon treatment and includes underutilization, over-utilization, and incorrect use of medication) to prescribed medication, which could be unintentional or intentional as well as seen in Cross et, al (2020). Each of the subgroup of psychotropic medication will be discussed concisely in this discuss.

Foremost, the anti–anxiety drugs, commonly referred to as the "anxiolytics" are the first class of psychotropic medication of interest in this study. Specifically, the benzodiazepine s class, popularly called *"Benzos"* will be the focus, based on the premise of this class being the most used, either as anxiolytics or hypnotics. Pharmacologically, the benzodiazepine s mechanism of action is explained in terms of their action on specific receptors in the brain, called gamma aminobutyric acid–A (GABA–A) receptors as reported across the literature (Crowe & Stranks, 2018; Olfson et al., 2015). Based on the Anatomical Therapeutic Chemical Drug Classification, they are regarded as the N05BA class code. According to the Drug Program Information Network

(DPIN), (n, d) there are about 56 generic drug products in this subgroup. The most popular and used ones are N05BA01: diazepam, N05BA02 : chlordiazepoxide, N05BA03 : medazepam, N05BA04 : oxazepam, N05BA05 : potassium clorazepate, N05BA06 : lorazepam, N05BA07 : adinazolam, N05BA08 : bromazepam, N05BA09 : clobazam, N05BA10 : ketazolam, N05BA11 : prazepam, N05BA12 : alprazolam, N05BA13 : halazepam, N05BA14 : pinazepam, N05BA15 : camazepam, N05BA16 : nordazepam, N05BA17 : fludiazepam,N05BA18 : ethyl loflazepate, N05BA19 : etizolam, N05BA21 : clotiazepam, N05BA22 : cloxazolam, N05BA23 : tofisopam, N05BA56 : lorazepam amongst others as reported across the literature (DPIN, n.d). In Canada, between 2018 and 2019, the number of the elderly 65 and above who were beneficiaries of benzodiazepine s were 627,113 as seen in CIHI's (2019) report). The benzodiazepines could be short or long acting. Their differences are based on their half–lives (the period for the blood concentration of a substance to decrease by half) variability lives as reported across the literature (Crowe & Stranks, 2018; Olfson et al., 2015). While the commonly used anxiolytics (for example diazepam) have longer half–lives, the hypnotics (for example, temazepam) have shorter half–lives as reported across the literature (Crowe & Stranks, 2018; Olfson et al., 2015). Users of these medications can develop higher tolerance (the need to increase doses to achieve the same therapeutic effect), a higher risk of physical and psychological dependence, with the possibility of developing withdrawal symptoms after a four–week period of use thus, precautionary prescription and monitoring of patients' usage is recommended as reported across the literature (Crowe &

Stranks, 2018; Do et al., 2015; McEwan et al., 2018; Olfson et al., 2015; Soriano, 2013). Notably, some long–acting benzodiazepines (usually chlordiazepoxide) are used in the management of alcohol withdrawal in primary care as reported across the literature (Crowe & Stranks, 2018; Olfson et al., 2015). Additionally, benzodiazepines are commonly reported to be misused for solely recreational purpose or in combination with opiates or stimulants by street users as reported in the literature (Crowe & Stranks, 2018; Olfson et al., 2015). These various scenarios under which this class of drugs are used increase their availability and use, even among the elderly and their risk of fall.

Secondly, the next psychotropic medication of interest this study is the commonly used class of antidepressant called selective serotonin reuptake inhibitors. These are group of drugs pharmacologically described as drugs whose mechanism of action is through a selective inhibition of serotonin reuptake by receptors (Marken & Munro, 2000). Based on the Anatomical Therapeutic Chemical Drug Classification, they are regarded as the N06AB class code (MCHP Metadata Repository – Drug Program Information Network, DPIN, n.d). According to the Drug Program Information Network (DPIN), there are about 86 generic drug products in this category. Based on NICE recommendation, the newer SSRI drugs (e.g., fluoxetine, citalopram, and sertraline) should normally be the first line of therapy based on their overdose safety range and better tolerability comparatively as reported in McEwan et al. (2018). In Canada, between 2018 and 2019, the number of the elderly 65 and above who were beneficiaries of SSRIs were 639,557, at an economic cost of $82,629.97 with an estimated rate of use of 10.7%

as seen in CIHI's (2019) report. In terms of the pharmacological basis of action, common to all SSRI are their ability to selectively inhibit serotonin receptors from binding serotonin as reported in Marken and Munro (2000). However, SSRIs are different from one another in their chemical composition and clinical usefulness in the context of their dose effectiveness, pharmacokinetics, and metabolism (Marken & Munro, 2000). Some and popular examples of SSRI include fluoxetine, fluvoxamine, sertraline, paroxetine, and citalopram. SSRIs secondary effect on the body could result in weight loss (increasing frailty) anxiety, agitation, sedation, panic disorder and polypharmacy. These side–effects have been reported to be associated with higher incidence of fall as reported across the literature (Do et al., 2015; Marken & Munro, 2000; Soriano, 2013). Moreover, the non–predictability of an individual likelihood of exhibiting these side–effects increase the need and cursory call for clinicians and care providers approach to prescription and monitoring of the elderly medication and care modality as reported across the literature (Do et al., 2015; Marken & Munro, 2000; Soriano, 2013). Moreover, the absence of literature that shows recent studies on this class of medication and fall contextually, coupled with the figures of the elderly Canadians in residential care. on this class of medication experiencing the discussed side–effects, it is imperative to add this class of drug to the psychotropic medication to be studied in this dissertation study.

The third group of psychotropic medication are the antipsychotics. For this dissertation a class example commonly used and to be discussed in detail are the diazepines, oxazepines, thiazepines and oxepines. Based on the Anatomical Therapeutic

Chemical Drug Classification, they are regarded as the N05AH class code. Going by the numbers, in Canada, between 2018 and 2019, the number of the elderly 65 and above who were beneficiaries of diazepines, oxazepines, thiazepines and oxepines were 214,129, at an economic cost of $41,446.94 and an estimated rate of use of 3.6% as seen in CIHI (2019) report. According to the Drug Program Information Network (DPIN), there are six generic drug products in this subgroup. They include N05AH01: loxapine, N05AH02: clozapine, N05AH03: olanzapine, N05AH04: quetiapine, N05AH05: asenapine and N05AH06: clotiapine according to DPIN (n, d) report. From a provincial lens and specific drugs example, in Ontario, chronic use of risperidone was 10.9% in the age–group of 65–74%, quetiapine was 13.7%, a different antipsychotic was 12.6% and all antipsychotic use was 32.9%, making Ontario the province with highest usage of this specified drugs as reported across the literature (CIHI, 2016; Public Health Ontario, 2020). Although the pharmacology of the N05AH class of drug act has not been established however, various literature has reported on this class of drug action potentiated by their antagonizing effect on the dopamine and serotonin receptors which results in marked cortical inhibition as reported across the literature (Harrison, et al., 2021; National Center for Biotechnology Information, 2021). Some of these drugs (for example, loxapine succinate) directly or indirectly inhibit spontaneous motor activity, which may be advantageous to fall prevention under certain circumstance or speed up fall occurrence under certain conditions as reported across the literature (Ferreira et al., 2020 Harrison, et al., 2021; NCBI, 2021). While some others (for example clozapine,

risperidone, olanzapine) may improve cognition, affect, tardive dyskinesia based on their actions (through their antagonist effect on serotonin (5–HT) 2A and D2 receptors) on the frontal cortex and mesolimbic pathway (Ferreira et al., 2020 Harrison, et al., 2021; NCBI, 2021). Based on these drugs mechanism of action on the brain, dosages, brand, efficacy, and other related factors they have been associated with adverse effects like orthostatic hypotension, restlessness, sleepiness, weight gain, and suicidal ideations, which all have the potential to precipitate and or contribute to fall occurrence in a user especially the elderly (Ferreira et al., 2020 Harrison, et al., 2021; National Center for Biotechnology Information, 2021). Based on the absence of literature evidence on recent studies, the possible side effects of this drug class, increasing figures of Canadian elderly in residential care and those using this class of medication, conducting a study on the relationship between this class of drug and fall contextually to inform and guide clinicians and practice–based evidence is justified.

The fourth group of psychotropic medication to be included in this study are regarded as “other antidepressants” although with some of this class examples having an overlap with antianxiety, antidepressant, antipsychotic and even hypnotic function and uses. Based on the Anatomical Therapeutic Chemical Drug Classification, these level 5 subgroup of Psychoanaleptics are regarded as the N06AX class code. According to the Drug Program Information Network (DPIN), there are about 26 generic drugs in this subgroup namely: N06AX01–oxitriptan, N06AX02–tryptophan, N06AX03–mianserin, N06AX04–nomifensine, N06AX05–trazodone, N06AX06–nefazodone, N06AX07–

minaprine, N06AX08– bifemelane, N06AX09–viloxazine, N06AX10–oxaflozane, N06AX11–mirtazapine, N06AX12–bupropion, N06AX13–medifoxamine, N06AX14–tianeptine, N06AX15–pivagabine, N06AX16–venlafaxine, N06AX17–milnacipran, N06AX18– reboxetine, N06AX19–gepirone, N06AX21–duloxetine, N06AX22–agomelatine, N06AX23–desvenlafaxine, N06AX24–vilazodone, N06AX25– hyperici herba and N06AX26–vortioxetine as reported across the literature (Ferreira et al., 2020 Harrison, et al., 2021; NCBI, 2021). In Canada, according to Canadian Institute for Health Information (2020), the number of the elderly 65 and above who were beneficiaries of this class of drug were 679,396 in number at an economic cost of $102,719.28 and an estimated rate of use was 11.4 % as reported across the literature (CIHI, 2020; Public Health Ontario, 2020). In terms of mechanism of action, the drugs in N06AX class code have different pharmacologic mode of action. The classification does not reflect the exact mode of action of the various drug examples in it especially as some act as agonist of melatonin receptors, others antagonist of serotonin–2C (5–HT2C) receptors and some block dopamine uptake among other mode of actions associated with the different drugs in this class as reported across the literature (Ferreira et al., 2020; Hansen et al., 2021; NCBI, 2021; Stafford et al., 2021). as reported across the literature 2020; Hansen et al., 2021; NCBI, 2021; Stafford et al., 2021). Like the other drugs already discussed in this study, the absence of literature evidence on recent studies, the possible side effects of this drug class, increasing figures of Canadian elderly in residential care and those using this class of medication, conducting a study on the

relationship between this class of drug and the other classes already discussed and fall contextually is justified.

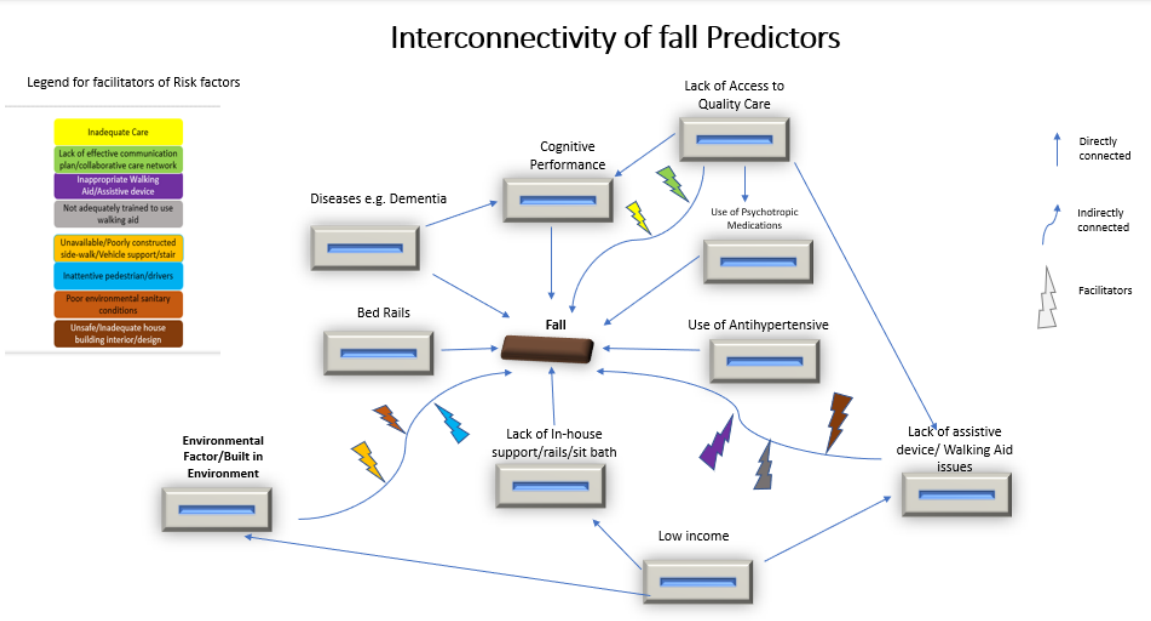
Undoubtedly, these groups of medication provide therapeutic benefit to certain patients hence, their existence, continuous prescription by physicians and use by patients, constant production by pharmaceutical industry and circulation in market and ultimately, availability to individuals over time, inclusive of the elderly as reported across the literature (Crowe & Stranks, 2018; Do et al., 2015; Soriano, 2013; Olfson et al., 2015; Ferreira et al., 2020; Hansen et al., 2021; NCBI, 2021; Stafford et al., 2021). However, the evolvement of these drugs availability over the years, constant review of clinicians' prescription guidelines and advice by regulatory bodies and the higher rates of these prescriptions among certain population and environment is reportedly linked to the increasing incidence of fall occurrence among user especially, the elderly. Despite the rising figures of these specific group of psychotropic medication and fall, the relationship between psychotropic medication and fall among the elderly receiving Residential care in Canada has been minimally explored contextually in the recent five to 10 years contextually. Therefore, conducting this study is paramount and positional to understanding the current association between the implicated predisposing factors and fall in the context of the overarching available data from the various Jurisdictions in Canada.

Complex Interconnectivity of Fall Predictors

In terms of the interrelationship between these contextual predictors, commonly observed among related risk factors/ behavioral lifestyle implicated in fall occurrence is a meshwork–like connection that reflect the interconnectivity of these factors one to another, these factors to the implicated disease(s) or health condition(s) and vice versa as reported across the literature (Crowe & Stranks, 2018; Do et al., 2015; Soriano, 2013; Olfson et al., 2015;Ferreira et al., 2020; Hansen et al., 2021; NCBI, 2021; Stafford et al., 2021). The contextual predisposing factors to fall discussed in this study may act multilaterally (more than one way) to cause other conditions that may lead to fall or unilaterally (one way) to result in fall as seen in WHO's (2016) report.

Figure 1

Interconnectivity of Fall Predictors



This complex connection as observed in figure 1 explains why a study on fall that scrutinizes multifactorial predisposing conditions, multilevel impact, multisystemic implication and multidirectional influences in its approach, as seen in this study is logical and rational in line with the literature (Crowe & Stranks, 2018; Do et al., 2015; Soriano, 2013; Olfson et al., 2015; Ferreira et al., 2020; Hansen et al., 2021; NCBI., 2021; Stafford et al., 2021). Moreover, the adoption of a study method, pertinent dataset and research design that has been proven successful in past studies in this regard and that provides substantial prove of evidence are essential to conducting this study.

Previous Research Conducted with Secondary Data Analysis

Adopted in this study is the Quantitative Methodology–Secondary Data Analysis using the Bivariate and Multiple logistic Regression design. Several studies have utilized the Quantitative Methodology–Secondary Data Analysis and the Multiple Logistic Regression (MLR) in public health studies to examine behavioural patterns relationship to health conditions as documented in the literature (Anuradha, et al., 2019; Pathak, et al., 2020). These studies provided substantiated model–based results that associated behavioural risk factors to diseases thereby, adding credibility and validity to the research–based recommendation, evidence–based public health practice and diseases prevention. Notably, these studies provided directional clue to this dissertation adoption of the secondary data analysis using MLR especially, in the methodology and design capacity to use existing data set in conducting a research and providing evidence–based recommendation for practice, showcase multiple of variables and their highest probability

of occurrence based on their unique probability as observed in their unique group, the design capacity to scrutinize a model of relationship between multiple variables, the statistically significant relationships, the unadjusted odds ratio (UOR) and adjusted OR (AOR) of occurrences among variables in alignment with the literature (Park et al., 2020;Wagner, 2020; Warner, 2013). Foremost, in Mat et al. (2018) a secondary subgroup analysis from an original randomized controlled trial was utilized to evaluate the effect of a personalized home–based exercise program to improve postural balance, fear of falling, and fall risk in older fallers with knee OA and gait and balance problems. In a second study, Anderson et al. (2019) utilized secondary data from PATH–IN study participants to investigate the proportion of participants at high risk for falling in the Physical Therapy vs. Internet–based Exercise Training for Patients with Osteoarthritis. The study revealed that the frequency with which balance training by improving postural control was used as an intervention in the Physical Therapy Home–based balance and strength exercises was beneficial to elderly fallers with Osteoarthritis and gait and balance conditions however, the fall recurrence pattern had nothing to show. A third study that utilized secondary data analysis is Griffin et al. (2020). In this study secondary data collected from a randomised controlled trial was analyzed to examine the impact of a dedicated team of health and social care professionals on the care of older adults in the Emergency Department (Griffin et al., 2020). From the secondary data analysed, it was observed that malnutrition had an association with a longer stay in the Emergency Department, functional decline, poorer quality of life, increased risk of hospital

admissions and a greater likelihood of admission to a nursing home at 30 days (Griffin et al., 2020). In a fourth study, Sibley et al. (2021) utilized secondary data from hundred and sixty–nine studies to analyze and examine the comparative effectiveness of fall prevention exercise approaches. From this secondary analysis it was established that this exercise combination reduction of the amount fall was signification compared to other combination.

In Watson et al. (2019) secondary data from two previous studies was analysed to investigate and confirm that Senior Fall Investigative Methodology (SFIM) approach, Hospital policies, reduced supervision, disease processes, the environment, and patients transferring without assistance dominated the reasons for increased risk of fall. Additionally in Put et al. (2013) secondary data from a prospective pilot study that recruited the elderly 65 years and older with a recent cancer diagnosis was analysed to examine the relationship between health and functioning and those who had a fall. Notably and to the contrary, the sociodemographic data and health characteristics including the frailty markers were not associated with a fall (Put et al., 2013). Lastly on past studies that utilized secondary data analysis is Boucher et al. (2019). This study used secondary data to establish that that is an association between burden of care and caregiver characteristics, relationship characteristics and caregiver's perception of social support resources (Boucher et al., 2019). Strikingly, one of the past studies discussed above that utilized secondary data could not confirm any association between specific variables and health outcomes and stated the need for further studies. Nevertheless,

majority of these past studies established that and reflected how various behavioural influences, environmental factors and individuals among the elderly contribute to health outcomes. In other words, using a quantitative secondary data analysis in this dissertation study is grounded on literature evidence and has proven to be effective in analyzing behavioural, individual, and environmental influences that are determinants of health outcomes. Thus, the adoption of a quantitative secondary data scrutiny in this study is logical, scientific, pragmatic, and contextually appropriate, given the predisposing factors of interest to fall in this age category, available body of literature on these factors and statistical data.

Summary and Transition

Prevention of diseases in public health does not occur in isolation rather, it occurs in the context of a handful of factors ranging from behavioral (individuals, communities, and society), environmental, systemic, cultural to prevalent practices. Prevention of fall especially, unintentional fall among the elderly is a vast ground that has gained substantial research as evidenced by the available body of literature in this regard. Narrowing it down to this study, unintentional fall has garnered a spectrum of scientific scrutiny ranging from its causes, associated predisposing conditions, complications of fall and the global and various countries burden of fall, related expenditures to existing practice guidelines (Cameron et al., 2018; Cross et al., 2020; Petterson et al., 2021; Molnar & Frank,2019; Deprescribing.org, 2021; Todd, Adam, et al.,2018). From a literature review lens, factorial to fall are behavioral, social, environmental, physical,

pathological, and psychotropic medication players that may singlehandedly and or in combination have significant impact on the elderly and certain brain portions associated with fall. However, despite the rising figures of neurocognitive disorders, cognitive decline, and the already discussed specified group of psychotropic medication and fall in this age group, the relationship between these variables and fall among the elderly receiving residential care in Canada has been minimally explored contextually in the recent five to 10 years contextually as documented in the literature (Cameron et al., 2018; Cross et al., 2020; Petterson et al., 2021; Molnar & Frank,2019; Deprescribing.org , 2021; Todd, Adam, et al.,2018;Huynh et al., 2020; Laberge & Crizzle, 2019; Le Mouel et al., 2019). Therefore, conducting this study is paramount and positional to understanding the current association between the implicated predisposing factors and fall in the context of the overarching available data from the various Jurisdictions in Canada. These succinct literature review provides the available and current body of evidence contextually in Canada on fall and associated factor. From this premise, since the available literature suggest the need to conduct further studies that could elaborately test for associations between fall and neurocognitive disorders, cognitive decline, and the specified group of psychotropic medication among this category of the elderly, using a study design that is appropriate may be carefully considered based on a multidimensional proposition. Therefore, a quantitative study of secondary data was adopted to ascertain the relationships between cognitive decline, neurocognitive disorders, the already discussed

group of psychotropic medication and fall among the elderly Canadians 65 years and above who are in residential care.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study is to examine the association between cognitive decline, dementia, the use of psychotropic medication and fall occurrence amongst the elderly who receive care from residential–based continuing care facilities using bivariate–multivariate logistic regression analysis in line with Laberge and Crizzle (2019) report. Another purpose of the study is to know the proportion of the elderly on the specified psychotropic medication who experienced more fall compared to those who did not in residential care in Canada as suggested in the literature (Laberge & Crizzle, 2019; Le Mouel et al., 2019).

Overall, this dissertation study was aimed at examining the association between cognitive decline, dementia, psychotropic medication– hypnotic, antidepressant, antianxiety and antipsychotic (classes–N05BA (benzodiazepine derivatives), N06AB (selective serotonin reuptake inhibitors), N06AB (diazepines, oxazepines, thiazepines and oxepines), N06AX (other antidepressants) and fall among elderly Canadians 65+ using bivariate and multivariate logistic regression analysis while controlling for gender. In tandem with this purpose, this chapter will consider the rationale for the adoption and appropriation of the bivariate–multiple regression design for the examination of the relationship among variables, the population of interest, the sampling and sampling

procedures and the procedures for recruitment. Other subjects discussed in this chapter are the data collection process and participants associated with the main study, permission protocol to gain access to dataset, reputability, and justification of Canadian Institute for Health Information dataset used. Additionally, the basis (literature sources) for which the dataset was collected, study's reliability, validity, and sufficiency of constructs in answering the research questions were discussed in this chapter. Importantly, this chapter will expatiate on this study's operationalization of selected variables, data analysis plan, threats to validity and ethical consideration in secondary data use and summary of multiple logistic regression design and secondary quantitative data analysis contextually among elderly Canadians in residential care. Research Design and Rationale

In this secondary data quantitative analysis, the independent variables are (a) cognitive performance, meaning that the cognitive performance of the elderly could be intact, mild/moderate or severe (b) dementia which means that the elderly has a current diagnosis of dementia (now known as neurocognitive disorder) (c) four broad categories of psychotropic medication namely: hypnotics, antidepressants, antianxiety and antipsychotics.. The dependent variable is fall, which means that the person has fallen at least once or more in the past 2 years, from 2018 to –2019. The controlling variable is gender.

Based on this study primary purpose to understand the association between cognitive performance, dementia, psychotropic medication (hypnotic, antidepressant,

antianxiety, and antipsychotic categories) and a fall while controlling for gender among Canadians 65+ population receiving residential care, adopting a multiple logistic regression analysis will be prioritized. Several studies across the literature have used one or more forms of regression analysis. There are different regression analyses in statistics. Peculiar to this study is a Bivariate Multiple Logistics Regression (MLR) design. Foremost, a MLR is a statistical analytic tool that explains the theory of multinomial probability amongst multiple (usually three or more) variables to predict that the probability is one and likely to occur instead of zero and not likely to occur as discussed in Wagner (2020) and Warner (2013). Several studies have utilized the MLR n public health to examine behavioral patterns relationship to health conditions as discussed in Anuradha, et al. (2019) and Pathak, et al. (2020).

Across the literature various public health studies have used the MLR design in examining behavioral inclinations, health professional practices and predisposing conditions factorial to certain public health issues/diseases. Foremost, in Park et al. (2020) the MLR provided a model–based results with substantial evidence to conclude that a few the risk factors were implicated in increasing the occurrence of TB, thereby increasing the study internal validity and usefulness to public health practice and TB prevention. In a different study, Anuradha, et al. (2019) used the multiple regression analysis in explaining the predictability of cancer risk among patients with a behavioral lifestyle of tobacco smoking who had head and neck cancer. In a third study, Hsu et al. (2021) was able to check and confirm that depression symptoms, the number of chronic

diseases, self–rated health, and arthritis were significantly associated with a poor sleep quality, and that the 2–min step test was associated with longer sleep latency among middle–aged and elderly participants from a rehabilitation clinic or health examination department using a Multiple logistic regression analysis.

In a fourth study, Zhao, et al. (2019), multiple logistic regression analyses were used to examine and confirm that hypertension or depression/anxiety increased risk for fall, males were more likely to experience a fall than females. On the other hand, older adults with hearing impairment or balance problems limiting activities were also more likely to fall among homebound community–dwelling older adults.

In another study, Wang et al. (2018), Chi–squared tests and multivariate logistic regression analyses were used to examine and confirm that total cost and self–treatment times were positively associated with insurance utilization and costs respectively among junior high education and senior high education participants, with a lower probability of using insurance. On the other hand, seriously sick participants who had a primary school education and those with enterprise occupations had higher cost (Wang et al., 2018).

In Tsai, et al. (2020) a multivariate logistic regression analyses were used to examine and confirm that there was an association between several sociodemographic and biological factors, including female sex, difficulty in performing one basic ADL, difficulty in performing two or more instrumental ADLs, unclear vision, comorbidities, urinary incontinence, and depressive symptoms. These predictors were significantly associated with fall in Tsai et al.’s (2020) study.

In a similar study, Chen, et al. (2021) established that Fear of Falling (FOF) and experiences of falling during the previous month or the previous year were both significantly associated with a FOF among the elderly aged 65 years and older in the United States using a multiple logistic regression analysis. Nicklett, et al. (2017) utilized a multivariable logistic regression design to confirm that drugs prescribed with special caution (atypical antipsychotics, non–benzodiazepine hypnotics and magnesium oxide) were significantly associated with less fall occurrence among hospitalized older people in Japan.

Observably, across the various studies already discussed is the use of MLR to test for associations between predisposing conditions and or behavioral factors and health or diseases. From this body of evidence, the MLR provides substantiated model–based results that associate behavioral risk factors to diseases, thereby adding credibility and validity to the research–based recommendation, influencing evidence–based public health practice and diseases prevention as documented in the literature (Anuradha, et al., 2019; Chen, et al., 2021; Nicklett, et al., 2017; Pathak, et al., 2020; Yong, et al.,2020). Notably, these studies provide directional clue to this dissertation adoption of the MLR especially, in the design capacity to showcase multiple variables (dependent variable(s), two or more independent variable(s)) and their highest probability of occurrence. This is based on their unique probability as observed in their unique group, the design capacity to scrutinize a model of relationship between multiple variables, the statistically significant

relationships, and the odds ratio of occurrences among variables as documented in the literature (Park et al., 2020; Wagner, 2020; Warner, 2013).

Thus, the adoption of a quantitative (MLR) scrutiny in this study was logical, scientific, evidence-based, and contextually appropriate, given the predisposing factors of interest to fall in this age category, available body of literature on these factors and statistical data. Specifically, since this study sought to understand the association between cognitive decline, dementia, specific group of psychotropic medication– hypnotic, antidepressant, antianxiety and antipsychotic (categories examples: benzodiazepines, SSRIs, diazepines, oxazepines, thiazepines and oxepines and other antidepressants) and fall, while controlling for gender among Canadians 65+ population receiving residential care, a quantitative study that inferentially examined the association between the implicated variables was of interest.

Methodology

Usually, in a secondary data analysis study, the researcher filters, selects or combines the variables of interest from the existing quantitative data set in order the achieve the research interest. This form of data was retrieved from a governmental health agency, applicably in this dissertation is Canadian Institute for Health Information (CIHI, 2019). Retrieved from CIHI databases were information on residential care facilities, the elderly in residential care, various medication, statistics on various diseases and their prevalence in various Canadian provinces, descriptive statistics of the dataset socio–demographics, economic and financial cost of health services and some

treatment/surgical procedures. These CIHI datasets provided information on diseases risks, community and general health need assessment and supported a review of literature in this study as required in line with reports across the literature (CIHI, 2021; WHO, 2012).

The advantages of using the quantitative methodology (in this case secondary data analysis) for research have been documented by different literature reports. Quantitative methodology in this study contributes to its usefulness, painting of an accurate, clear, and factual picture of the scenario thus, increasing the study's reliability as documented in the literature (Frankfort–Nachmias & Leon–Guerrero, 2018; Wagner, 2020; Warner,2013). Secondly due to the ease in understanding numerical data, the statistical process and analysis of results in MLR contextually is quite straightforward and time effective. Furthermore, this methodology provides a broad scope of data collection and analysis, while making it easier to minimize and eliminate biases that could have emanate from analyzing non–numerical data as seen in Warner (2013). Another advantage of secondary data is that they could be used in finding statistically significant relationship between fall and influential factors contextually as documented in the literature (Bartholomew et al., 2011; Bracht, 1999; Centers for Disease Control and Prevention, 2011; Jemal, 2008). On the other hand, this methodology is not completely devoid of flaws. Some of the databases may have missing, incomplete or delayed data or information from certain areas which may have been crucial to the analyses conducted on such data, thereby, constraining any analysis that implicates such state or locality if the rates have not been

adjusted as reported in the literature (CIHI, 2019; CIHI, 2020; Centers for Disease Control and Prevention(CDC), 2011; Jemal, 2008) Another limitation is that these databases estimates are based on the average experience of the general population and may over– or underestimate individual risk because of differences in exposure and/or genetic susceptibility as documented in the literature (Bartholomew et al., 2011; Bracht, 1999; Centers for Disease Control and Prevention, 2011; Jemal, 2008; New Mexico Department of Health., 2009;Pan American Health Organization/World Health Organization, 2009).

Despite the shortcomings of using secondary data, this dissertation will make use of existing dataset collected by Canadian Institute for Health Information. The primary purpose for collection of this dataset by CIHI was to understand the trend and pattern of health conditions in continuing care and hospital care facilities in Canada. Regarding this dissertation, using this secondary dataset would assist in answering the research questions and appreciating the existing data contextually to Canada (CIHI, 2019; CIHI, 2020) Furthermore, the secondary data in this context exists already in a manner that helps provide descriptive details of the dataset, captures the incidence and occurrence pattern of fall amongst these elderly clients in residential care facilities. Thus, provided useful information that assisted in the descriptive data analysis of this dissertation. Overall, the careful adoption of Canadian Institute for Health Information data on the variables in this study archived data contextually for statistical manipulation not only provided an objective and scientific way of finding meaningful relationship between the investigated

variables, it also added a perspective that is quite different from the qualitative perspective and overall added an explanatory statistics perspective to understanding the determinants contributory to the incidence of fall amongst these clients.

Population

The population of study are the Canadian elderly 65 years and above in residential care from 2018 to2019. According to Statistic Canada (2021) the elderly Canada 65 years and above are estimated to be 7,081,792 million people. However, those among this age group in residential care based on a 2019 fiscal year report all residents totaled 191,835 across seven Canadian provinces excluding the territories as reported in the literature (CIHI, 2020; CIHI, 2019).

In terms of gaining access to the dataset, it will be accessed from the Canadian Institute for Health Information. After an email inquiry from a CIHI senior data and information personnel, there will be no need to for a permission letter to gain access to the dataset as the dataset is always available to and accessible by the public in line with CIHI data reposition policy. In addition, upon approval from the Institutional Review Board (IRB) to conduct this study will the complete dataset be accessed from CIHI database.

In terms of reputability and justification of this data sources, the Canadian Institute for Health Information, CIHI, is Canadas leading health information and data organization. With over 5 decades of existence and a team of experts in health information and data management the organization Continuing Care Reporting System

(CCRS) is known for the collection and compilation of data from various health facilities across Canada and provision of such reliable and credible data to health researchers and the general public to understand the pattern, determinants, distribution of and deterrents to health conditions, services, policies, facilities and practice generally as reported in the literature (CIHI, 2020;CIHI, 2019).

Specifically, CIHI has a data collection transparency policy that informs the public of its data collection criteria, metrics, and eligibility. Moreover, CIHI is licensed by government of Canada to gather health–related data across health facilities in Canada in line with the PHIPPA as reported in the literature (CIHI, 2020; CIHI, 2019). For this study, CIHI has the comprehensive dataset with the details of the datapoint required for this study. Canadian Institute for Health Information operates with the tri–council policy statement (TCPS2) data collection guideline (CIHI, 2020; CIHI, 2019). CIHI specifications to the dataset implicated in this study include

(a) date and time of collection, which stated either the implicated facilities were boarded in the first(Q1) or second quarter(Q2) of a fiscal year

(b) types of facilities sampled, which stated either onboarded (new facilities) facilities, residential care and

(c) assessment expectations of facilities residents, which means that residents would have had a complete set of multiple assessment (which includes admission assessments, quarterly assessments, significant change assessments and full assessments) for a particular year

(d) client's assessment profile, which states that only information from each client's last assessment in a facility in the fiscal year was used to create resident clinical profile information and

(e) assessment instrumentation which specified the annual RAI–MDS 2.0 and interRAI Long–Term Care facilities assessment instruments (CIHI, 2020; CIHI, 2019).

Coupled with the CIHI data collection agreement policy, the TCPS2 ethical guideline governing the organizations data operations and the availability and accessibility of the datapoints implicated in this study in CIHI data reposition, using CIHI reposition as data source for this study is ethically and contextually justified.

The criteria for eligibility of residential care clients to be used in this study will be Canadian elderly 65 years and over who were residents of residential care between 2018 and 2021 coupled with the following original data collection criteria for the primary survey: Residential–based facilities data on the implicated elderly group from various Canadian provinces namely: Newfoundland and Labrador, Ontario, Manitoba (WRHA), Saskatchewan, Alberta, British Columbia, and Yukon. These group of elderly (based on CIHI (2019) report) were assessed with the RAI–MDS 2.0 assessment instrument from 2018–2019. Assessment was conducted within 14 days of admission to a facility, then quarterly during their stay or in the presence of a significant status change. Facilities for 2018–2019 included will be those with publicly funded/subsidized beds, some provinces, and territories (Newfoundland and Labrador, Ontario, Alberta, British Columbia, and Yukon) with full (all facilities and/or regional health authorities submitted data to CCRS)

coverage in their respective provinces/territories and others (Manitoba, Saskatchewan) had partial coverage (i.e., only certain facilities and/or regional health authorities submitted data to CCRS). The elderly assessed in two different facilities will be counted twice as they referred to as unique and counts were based on record rate.

In the context of exclusion criteria while selecting the population, the exclusion criteria as reported by CIHI (2021) and CIHI (2019) were automatically applied this study. These criteria are (a)The elderly without neurocognitive disorder, not using any psychotropic medication, no history of fall and limited life expectancy (3 months). (b)Those discharged to RACF living outside catchment area (c) The elderly in a facility in 2018–2020 may not have assessment records in CCRS. (d)The elderly who had less than 14 days of stay in the facility. (e) Those elderly admitted close to the end of the fiscal year, their initial assessment was not due until the first 14 days of 2019–2020. (f) They were discharged close to the beginning of the fiscal year and those the facility did not successfully submit the record to CIHI.

Data Analysis Plan

Data Cleaning

The software to be used for data analysis is the IBM SPSS version 27. In terms of data cleaning, the excel filters will be used to screen out the data points that are not necessary especially data points on age group 64 years and below, diabetics, those diagnosed with hypertension, other diagnosis not related to this dissertation, other medications not relevant to this dissertation, those in hospital and home care, those on

antihypertensives. According to CIHI (2020), the elderly Canada 65 years and above are estimated to be 8 million however, those among this age group in residential care are based on a 2020 and 2019 fiscal year report are 189,662 and 191,835 respectively. The software to be used for data analysis is the IBM SPSS version 27.

Access to the Database

The dataset used in this study will be accessed from the Canadian Institute for Health Information. After inquiry from CIHI senior data and information personnel, there will be no need to gain a permission letter to access the dataset based on the official letter response shown in the appendix (See Appendix). The letter emphasized that the dataset is available to and accessible by the public in line with CIHI data reposition policy.

Data Preparation

To address certain missing field of data, a range of measures will be used. First, the field will be deleted and entirely excluded where applicable and this will be reported in the data analysis result report. Secondly, the mean score for the implicated variable(s) may be used as the case may be. Also considered in data preparation is the presence of outliers. Outliers are regarded as discordant or abnormal figures that could distort statistical analysis result resulting in (1) higher error in variance and decrease in statistical power (2) reduction in normality for cases where non–random distribution of outliers exist (3) corruption of the relationship between predictor and outcome resulting in model bias. To curb for outliers in this dissertation, from the MLR model the Cook's distance for each observation will be conducted to check for outliers. In the presence of

outliers, the following will be done: (1) they will be removed (2) they will be replaced with mean or median values or (3) they will be kept in the model but reported during the regression model analysis. Additionally, using the multivariate logistic regression model, the robustness of the model will be tested using the 10–fold cross validation approach. In terms of recoding, categorical variables like gender will be dummy coded as 0=females and 1=males, 1.

Data Analysis

There are specific statistical tools and parametric measures to be used to analyze data. The choice of key parameters to interpret result is determined by various factors ranging from the study's purpose, the conceptual framework, the implicated variables, the research questions, and hypotheses to the research design model parametric and non–parametric tools as reported in the literature (Creswell & Creswell, 2018; Rudestam & Newton, 2015). From this premise results will be interpreted based on key parameter estimates from the MLR model like Chi–Square, odds ratios, adjusted R2, confidence intervals, statistical significance p–value etc.

Sample Size and Power Estimates

This study will use a large dataset from a population of 191,835 between 2018–2019 fiscal year elderly 65 years and above in residential care. Therefore, the study sample will not be determined as this dataset will provide sufficient sample size for the study (Faul et al., 2007). Additionally, in terms of power analysis, after the data set has been prepared and cleaned, a post hoc power analysis will be conducted using the

G*power software (Faul et al., 2007). In essence, the study sample will be all cases remaining after preparing and cleaning the data, which would still provide sufficient sample needed to conduct this study and validate this study as relevant as reported in the literature (CIHI, 2020; CIHI, 2019; Faul et al., 2007). For this study, a medium effect size of magnitude 0.3 at alpha, $\alpha = 0.05$ and Beta $\beta = 0.80$ will be the target (Faul et al., 2007).

Descriptive Statistical Analysis

There are a range of descriptive parameters to be analyzed in this dissertation. Foremost, the subsample analyses will be used in understanding the various impact of variables on different groups and categories while using some as baseline (Rudestam & Newton, 2015). Furthermore, the frequencies and measures of central tendency (which include frequency, count and percentages) to show sociodemographic distributions of key participant characteristics such as gender, number of residential cares, cognitive performance levels, dementia categories, psychotropic medication categories. The cross tabulations would provide the frequencies, percentages differences and contingency effect under the descriptive statistics (Rudestam & Newton, 2015). Additionally, the chi square descriptive analysis will be used to provide further information on the participants information by their subgroups (the various psychotropic medications categories), differences by age, race, gender, and the fall history as reported in the literature (Rudestam & Newton, 2015; Wagner, 2020; Warner, 2013). Some examples of mock tables that will be used to illustrate percentages, gender categories frequencies under the

dependent variables are shown below with the alphabets representing mock statistical values.

Case Processing Summary

	Cases Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Dependent variable	d	x%	k	s%	s	e%

Gender * Dependent variable Crosstabulation

Count

		Dependent variable		
		No	Yes	Total
Gender	Male	x	g	b
	Female	a	u	c
Total		k	j	n

Covariates

The covariate used in this study is gender. The rationale for inclusion of this variable is to compare (a) the influence of the male and female gender on fall occurrence and (b) how relationship between the predictor variables and fall vary across the gender categories. These reasons resonate with Creswell and Creswell (2018) and Rudestam and Newton (2015) discussion on covariates roles in a multiple logistic regression analysis.

Inferential Statistical Analysis

Useful to this dissertation are inferential parameters that align to the study's purpose, theoretical framework, variables and covariates, research questions and hypotheses and available secondary quantitative data. These parameters include chi–

square and the multiple logistic regression model. There are specified assumptions to using each of these parameters. It's very important to stick to and ensure that these assumptions are met in order to have proper interpretation of our models. Some of the steps to be taken to confirm that this dissertation meets these assumptions will be discussed below.

Assumption for Chi–Square

For chi–square, the steps to be taken to confirm that the assumptions for using chi–square are met will include (1) that the scores in each cell are independent of one another by observing the individual cell and ensuring that the score one cell has no effect on a score in another cell (2) to ensure that there are a minimum of five participants/occurrences/events in any given one cell as observed (3) ensuring that the dependent variable in the chi–square test is assumed to be a frequency or count, such as number of participants and not continuous variables unless they have been dichotomized through observation and inspection of the dataset for these criteria (Frankfort–Nahmias & Leon–Guerrero, 2018; Rudestam & Newton, 2015; Wagner, 2020; Wang et al., 2018; Warner, 2013).

Assumption for Multiple Logistics Regression Model

Secondly, for the multiple logistics regression model, the steps to be taken to confirm that the assumptions for using this model are met will include (1) to check for the binary nature of the response variable which will by counting and ensuring that the unit outcomes are two (2) to check for the linear relationship between the explanatory

variables and the logit of the response variable, which will be done by using a Box–Tidwell test (3) to check for the independence of observation by creating a plot of residuals against time (i.e. the order of the observations) and observe whether or not the pattern is random(i.e. in the absence of a random pattern the assumption is violated (4) to check for the sample size and ensure that it is large and this will be confirmed after the dataset has been prepared and cleaned based on observation (5) to ensure that there are no extreme outliers by observing the calculated Cook's distance for each observation. Confirmation of outliers and how to control them have been discussed in the data preparation of this dissertation (6) to ensure that no multicollinearity, by using the variance inflation factor (VIF), which measures the correlation and strength of correlation between the predictor variables in a regression model (Frankfort–Nahmias & Leon–Guerrero, 2018; Rudestam & Newton, 2015; Wagner, 2020; Wang et al., 2018; Warner, 2013).

Chi–square

A chi–square ($\chi 2$) statistic is a quantitative statistical inferential tool that measures the difference between the observed and expected frequencies among outcomes of a set of variables as described in Creswell and Creswell (2018) report. The chi–square test is used to analyze nominal or categorical data in the form of frequency counts. Additionally, the Chi square largely depends on the proportion of difference between actual and observed values, the degrees of freedom, and the samples size as reported in the literature (Creswell & Creswell, 2018; Frankfort–Nahmias & Leon–Guerrero, 2018;

Rudestam & Newton, 2015; Wagner, 2020; Wang et al., 2018; Warner, 2013). Usually, a chi–square goodness of fit test will be used to assist in checking whether a sample data matches a population. When the chi square test statistic is very small, it means that the observed data matches the expected data extremely well, which means the relationship is significant, and it exist whereas the opposite means there is no match and relationship between the observed and expected data as reported in the literature (Creswell & Creswell, 2018; Rudestam & Newton, 2015; Laureate, 2017b; Wagner, 2020; Wang et al., 2018; Warner, 2013). In Wang et al. (2018), the Crosstabulation Chi–squared tests and multivariate logistic regression analyses will be used to examine the difference in relationship among variables. To assess for the Chi–square in this study, the SPSS Crosstabulation function will be used. From the SPSS output table, the Chi–square value will be observed, reported, and interpreted adequately. In other words, at a p–value $<$ 0.05, the observed chi–square value from the SPSS output table will be interpreted as statistically significant as reported in the literature (Wagner, 2020; Wang et al., 2018; Warner, 2013). On the other hand, at p–value $>$ 0.05 the observed chi–square value from the SPSS output table will be interpreted as not–statistically significant as reported in the literature (Creswell & Creswell, 2018; Rudestam & Newton, 2015; Laureate, 2017b; Wagner, 2020; Wang et al., 2018; Warner, 2013).

Multiple Logistic Regression–Parameters

A key MLR parameter of interest is the Odds Ratios. The odds ratio is a comparison between the odds of a specific outcome or event across two different groups

or conditions., quite like a probability. Overall, the odds ratio offers a rich prediction uniqueness that makes it useful in epidemiological calculations (Wagner, 2020; Warner, 2013). Various studies utilized the odds ratio for interpretation of the prediction of the odds of a specific group outcome to another in health care as documented in the literature (Chen, et al., 2021; Nicklett, et al., 2017; Laureate, 2017b; Wagner, 2020; Warner, 2013). The advantage of using an odds ratio to a probability is that unlike the conditional probability which does not exceed one, an odd ratio upper limit is infinity as explained in Wagner (2020) and Warner (2013) reports. However, an odd ratio still has a fixed lower limit of 0; values of an odd ratio do not tend to be normally distributed, and values of the odds ratio do not tend to be linearly related to scores on quantitative predictor variables as reported in Wagner (2020) and Warner (2013). An odd ratio has no fixed upper limit. However, an odd ratio still has a fixed lower limit of zero as described in Wagner (2020) and Warner (2013) reports. Moreover, the values of an odds ratio are not usually normally distributed and neither do these values possess the tendency to be linearly explainable by scores on quantitative predictor variables as reported in Wagner, (2020) and Warner (2013). One way to control for this weakness of the odds ratio is to use the natural logarithm. In terms of interpretation contextually, applicable to this study, the log odds (OR) will be used and interpreted in units of log odds for comparing one category to another with a focus on the exponent value interpreted as either a negative beta exponent (the odds ratio is below 1.0) or as positive (the odds ratio is above 1.0), 1.0 being all things are equal as documented in Wagner (2020) and Warner (2013) reports. For

predictor variables with two or more categories, one of the categories will be used as baseline comparatively. Therefore, variable with log odds greater than 1 will be interpreted as being more likely to occur than the alternative compared, while those with the log odds of exactly equal 1, the compared variable has equal chances of happening versus not happening, and log odds less than one will be interpreted as a lesser chance of happening than not happening as reported in the literature (Wagner, 2020; Warner, 2013).

Secondly is the confidence interval. The *Confidence Interval* provides a range of possible values that are the likely range of values for the true effect in the population for some unknown value based on results from the statistics of observed data as reported in the literature (Frankfort–Nachmias & Leon–Guerrero, 2018). Therefore, the higher the percentage of the CI the higher the accuracy and vice versa. Furthermore, the CI could be used for both parametric and nonparametric analyses and for different study designs as seen in Frankfort–Nachmias and Leon–Guerrero (2018). In terms of statistical parameter recommendation available across the literature, when conducting inferential statistical analysis like the multiple regression analysis in this case, to a large extent the CIs should follow point estimates and conventional hypothesis tests as explained in the literature (Laureate, 2017b; Wagner, 2020; Warner, 2013). Usually, the 95% CI is used as exemplified in various studies, thus the 95% CI will be used to analyze the data set in this study as explained in the literature (Chen, et al., 2021; Nicklett, et al., 2017).

Another parameter is the MLR effect size. An effect size explains the magnitude of the association between two variables as explained in the literature (Laureate, 2017b;

Wagner, 2020; Wang et al., 2018; Warner, 2013). Various authors have used the effect in explaining the relationship observed among predictor and outcome. For example, in Tsai, et al. (2020), the effect size of fall–related hospitalization rates revealed a 2% relative risk reduction only for those aged 65–74 years but deteriorated for those aged 75–84 among older people in Taiwan. One effect size parameter to be analyzed in this Multiple Logistic Regression study that uses the adjusted R^2. The adjusted R square is also known as Coefficient of Determination or Nagelkerke in this case as explained in the literature (Laureate, 2017b; Wagner, 2020; Wang et al., 2018; Warner, 2013). The adjusted R–squared is described as a modified version of R–squared that adjusts for the number of predictors in a multiple logistic regression model as explained in the literature (Laureate, 2017b; Wagner, 2020; Wang et al., 2018; Warner, 2013). It is calculated as: Adjusted R2 = 1 – ((1–R2) * (n–1)/ (n–k–1)) where R2 is the R2 of the model, n is the number of observations and k is the number of predictor variables as explained in the literature (Laureate, 2017b; Wagner, 2020; Wang et al., 2018; Warner, 2013). Moreover, when the adjusted R^2 indicates a high goodness of fit it means the model accounted for a high variance among the computed variables as explained in the literature (Laureate, 2017b; Wagner, 2020; Wang et al., 2018; Warner, 2013). Notably, the adjusted R–squared is positive, not negative (Laureate, 2017b; Wagner, 2020; Warner, 2013). Specific to this study, the Multiple Logistic Regression Models used the adjusted R^2 (with range from 0.1 – 0.3 = small effect; 0.3 – 0.5 = moderate effect > 0.5 = large difference) will be used as explained in the literature (Laureate, 2017b; Wagner, 2020; Warner, 2013).

In terms of specific research question data analysis plan, for each research question and hypothesis there would be a corresponding data analysis plan as discussed below.

RQ1: What is the association between cognitive decline and a fall while controlling for gender among Canadians 65+ population receiving residential Care

H_{O1}: There is no association between cognitive decline and fall, while controlling for gender among Canadians 65+ population receiving residential Care

H_{A1}: There is an association between cognitive decline and fall, while controlling for gender among Canadians 65+ population in residential care.

In terms of data analysis plan for the first question and its hypothesis the multiple logistic regression model will be used to test whether cognitive decline increases the likelihood of fall history while controlling for gender among Canadians 65+ population receiving residential care equaled zero or not. The cognitive decline variable will be used in other to check for its impact on the outcome variable when controlling for gender among Canadians 65+ population receiving residential care in consonance with literature report (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013). The Chi square ($\chi 2$) statistic is the major metric for the model predictability of the existence of an association between cognitive decline and a fall history when controlling for gender among Canadians 65+ population receiving residential care. The adjusted R^2, odds ratio, associated 95% CI and degree of freedom obtained from running the MLR model on SPSS would be combined to get the size estimates. The statistical significance for the

overall MLR will be tested with significance level at $p < 0.05$ in consonance with literature report (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013).

RQ 2: What is the association between dementia and fall, while controlling for gender among Canadians 65+ population receiving residential care?

H_O2: There is no association between dementia and fall while controlling for gender among Canadians 65+ population receiving residential care?

H_A2: There is an association between dementia and fall while controlling for gender among Canadians 65+ population receiving residential care?

In terms of data analysis plan for the second question and its hypothesis the multiple logistic regression model will be used to test whether dementia increasing the likelihood of fall history while controlling for gender among Canadians 65+ population receiving residential care equaled zero or not. The variable dementia will be used in other to check for its impact on the outcome variable (fall history) when controlling for gender among Canadians 65+ population receiving residential care. The Chi square ($\chi 2$) statistic is the major metric for the model predictability of the existence of an association between dementia and a fall history when controlling for gender among Canadians 65+ population receiving residential care. The adjusted R^2, Odds ratio, associated 95% CI and degree of freedom obtained from running the MLR model on SPSS were also combined to get the size estimates. The statistical significance for the overall MLR will be tested with a significance a level of $p < 0.05$ in line with the literature (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013).

RQ 3: What is the association between antipsychotic, antidepressants, antianxiety and hypnotics and fall history while controlling for gender among Canadians 65+ population receiving residential care?

H_O3: There is no association between antipsychotic, antidepressants, antianxiety and hypnotics and fall history, while controlling for gender among Canadians 65+ population receiving residential care.

H_A3: There is an association between antipsychotic, antidepressants, antianxiety and hypnotics and fall history, while controlling for gender among Canadians 65+ population receiving residential care.

In terms of data analysis, for the third question and its hypothesis the multiple logistic regression model will be used to test whether antipsychotic, antidepressants, antianxiety and hypnotics increasing the likelihood of fall while controlling for gender among Canadians 65+ population receiving residential care equaled zero or not (CIHI, 2021; Laureate, 2017b; Warner, 2013). The antipsychotic, antidepressants, antianxiety and hypnotics categories be used in other to check for their impact on the outcome variable when controlling for gender among Canadians 65+ population receiving residential care (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013). The Chi square ($\chi 2$) statistic is the major metric for the model predictability of the existence of an association between antipsychotic, antidepressants, antianxiety and hypnotics and fall when controlling for, gender among Canadians 65+ population receiving residential care. The adjusted R^2, Odds ratio, associated 95% CI and degree of freedom obtained from

running the MLR model on SPSS will be combined to get the size estimates. The statistical significance for the overall MLR will be tested with a significance level of $p < 0.05$ (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013).

RQ 4: To what extent do cognitive decline, dementia, antipsychotic, antidepressants, antianxiety and hypnotics predict a fall history among Canadians 65+ population receiving residential care while controlling for gender.

$H_0$4— There is no association between cognitive decline, dementia, antipsychotic, antidepressants, antianxiety and hypnotics and fall among Canadians 65+ population receiving residential care while controlling for gender.

H_A4— There is an association between cognitive decline, dementia, antipsychotic, antidepressants, antianxiety and hypnotics and fall among Canadians 65+ population receiving residential care while controlling for gender.

In terms of data analysis plan for the fifth question and its hypothesis, the crosstab chi–square and multiple logistic regression model will be used to test whether cognitive decline, dementia, antipsychotic, antianxiety, antidepressant and hypnotic are increasing the likelihood of fall history while controlling for gender among Canadians 65+ population receiving residential care equaled zero or not (CIHI, 2021; Laureate, 2017b; Warner, 2013). The independent variables–cognitive decline, dementia, antipsychotic, antianxiety, antidepressant and hypnotic will be used in other to check for their impact on the outcome variable (fall) when controlling for gender among Canadians 65+ population receiving residential care (CIHI, 2021; Laureate, 2017b; Wagner, 2020;

Warner, 2013). The Chi square ($\chi 2$) statistic is the major metric for the model predictability of the existence of an association between cognitive decline, dementia, antipsychotic, antianxiety, antidepressant and hypnotic and a fall history when controlling for gender among Canadians 65+ population receiving residential care. The adjusted R^2, odds ratio, associated 95% CI and degree of freedom obtained from running the MLR model on SPSS were also used for size estimates (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013). The statistical significance for the overall MLR will be tested with a significance level at $p < 0.05$ (CIHI, 2021; Laureate, 2017b; Wagner, 2020; Warner, 2013).

The IBM SPSS version 27 software will be used to compute the already discussed– chi–square ($\chi 2$), effect size, confidence interval, odds ratios, and subsample analyses parameters.

Threats to Validity

Secondary quantitative data analysis using the Bivariate–Multiple Logistic Regression analysis design has limitations like all other types of research (Swart et al., 2015; Garg et al., 2008). Contextually, these limitations could be threat to the internal, external, construct and or statistical conclusion validity of this study (Cooper et al., 2009). Discussed below are the various forms of validity challenges that this study has proactively addressed in line with Good Practice of Secondary Data Analysis (GPS) principles and guidelines (Swart et al., 2015).

The first form of validity to be considered in this study is the external validity. External validity explains the generalization of a study's result (Swart et al.,2015). This study dataset and sample for analysis is contextual to Canada's elderly in residential care and does not include dataset from other countries. Therefore, while the study results maybe generalizable to Canada population, it may not be generalizable to other countries thus threatening its external validity. However, the literature search and review that influenced this study's methodology and MLR design cuts across several scientifically credible online and electronic journals and databases globally and from Canada thereby, affording this study both a dual perspective–global and Canadian, and ultimately increasing its external validity (Swart et al.,2015; Wagner, 2020; Warner, 2013).

The second form of validity to be considered in this study is the internal validity. This validity encompasses the validity of associations deduced or interpreted from the results of this study. A secondary quantitative data analysis that uses the MLR may not be able to rectify the issues associated with the primary collection of data, participants and the biases that may be associated with the data collection and quantification process however, its adherence to principles generally regarded as Good Practice of Secondary Data Analysis (GPS) may assist in confronting internal validity challenges that may surround this methodology(Swart et al.,2015).Contextually, this study dataset are under the conditions of the original data collection methods and validity of Canadian Institute for Health Information therefore, increasing the internal validity (CIHI, 2020; Grimes & Schulz, 2002; Jemal et al.; WHO,2012). Additionally, internal threats such as (a)

inappropriate sampling, which could be a challenge of quantitative data analysis that may result in biased representation of the population of interest (b) the estimates and interpretation of associations failure to illustrates true association, probability issues and controlling factors may pose a limitation to the study. To curb these limitations, (a) an appropriate design–the Multiple Logistic Regression design was adopted (b) a universally accepted sampling method (G*Power software) was used to calculate the sample size and effect size (Faul et al., 2007). Moreover, due to foresightful and proactive identification of possible scenarios and instances where such internal validity issues could arise, a cursory approach to ensure that the secondary dataset selected for use had a standard, acceptable and credible instrumentation as evidenced on CIHI archival data collection policy study thereby, increasing the study's internal validity (CIHI, 2020; Grimes & Schulz, 2002; Jemal et al.; Swart et al.,2015; WHO,2012). Another method of decreasing threats to internal validity is the adoption of and ensuring that the standard MLR analyses report and test parameter measures interpretations were utilized in this dissertation (Wagner, 2020; Warner, 2013). Chapter 5 will further elaborate on key areas that addressed and curbed threat to internal validity threat in this dissertation work.

Another form of validity crucial to this dissertation study is the construct validity. This validity refers to consistency in definitions (Nugent, 2009). In this study, the criteria details used by CIHI for inclusion of residents in Canadian residential care were consistent across all aspect of the dataset and all Canadas jurisdiction (CIHI, 2019; CIHI, 2020; Nugent, 2009). For example, across Canada all residential care facilities

participants had their assessment conducted within 14 days of admission to a facility and quarterly during their stay or in the presence of a significant status change (CIHI, 2019; CIHI, 2020). Additionally, the study design effect size will be based on various standard measures of effect size ranging from chi square, adjusted $R^{2,}$ coefficients and unstandardized coefficients to log odd ratio (Wagner, 2020; Warner, 2013). Moreover, the classification of psychotropic medication, cognitive decline and dementia was consistent across the dataset however some jurisdiction report for 2019–2020 were missing and this was explicitly stated in the dataset (CIHI, 2019; CIHI, 2020). For the missing data from some jurisdictions, Chapter 4 will address this issue by discussing the specific jurisdiction data set available and the use of adjusted rates as applicable. Therefore, the threat to construct validity has been addressed.

Lastly, statistical conclusion validity was also taken to context in this dissertation studies. According to Cooper et al. (2009) statistical conclusion validity explains the application of appropriate statistical tests to a study. The credibility and reliability of the effect size and conclusions of secondary data analysis depends on the deployment of an appropriate design and adequate interpretation of analytic parameters and corresponding procedures (Swart et al.,2015). Therefore, to address the threat to statistical conclusion validity, the dataset and statistical test to be used contextually in this study was assessed prior to study commencement as being analytically appropriate for the study (Frankfort–Nachmias & Leon–Guerrero, 2018; Wagner, 2020; Warner, 2013). Moreover several studies and peer–reviewed journals with similar inclinations have utilized this design and

its combined measures of effect size, odds ratio and adjusted R^2 among others to test, confirm and or disconfirm association between predictors and health outcome in the literature (Anuradha, et al., 2019; Chen, et al., 2021;Nicklett, et al.,2017; Pathak, et al., 2020; Swart et al.,2015; Wagner, 2020; Warner, 2013; Yong, et al.,2020). With these measures taken into consideration threat to statistical conclusion validity in this dissertation has been reduced to minimum.

Ethical Procedures

The Institution Review Board approval will be required in order to proceed with this study. Additionally, for a secondary quantitative analysis, a dissertation study like this will expand the utilization of the dataset, afford a learning opportunity from the published dataset, heightens the benefits of the dataset, validate the dataset and other studies related to the dataset. Furthermore, the adoption of secondary archived data contextually for statistical manipulation will provide an objective and scientific way of finding any meaningful relationship between the investigated variables using existing data, while adding a perspective that is quite different from the primary data (CIHI, 2020; CIHI, 2019; Jemal,2008; U.S. Department of Health and Human Services, 2012). Furthermore, the resources and funds utilized in the collection, processing and storage of the dataset will be justified as the dataset is judiciously put into use to conduct research and inform practice. In tandem, for a quantitative secondary data analysis, face–to–face contact with research participants will not be possible therefore, there will be no identifiers to compromise confidentiality and anonymity and no need for participants

informed consent, especially, as these challenges were already addressed by the data experts and organization that published the dataset(CIHI, 2019;Jemal,2008; New Mexico Department of Health.,2009; U.S. Department of Health and Human Services, 2009; U.S. Department of Health and Human Services, 2012; World Health Organization, WHO, 2012). This study is not funded by any organization rather, it is an independent dissertation work therefore, there is no present or future associated conflicts of interest.

Summary

This chapter covers the description of this dissertation study, adopted methodology, study design, research, and hypotheses, and important nitty–gritty peculiar to a quantitative secondary data analysis that uses the MLR. As a secondary quantitative secondary data analysis that utilizes the MLR, this study used a dataset already in existence in CIHI database (CIHI, 2020; CIHI,2018). Furthermore, discussed in this chapter are this study's adherence to the 11 principle of the Good Practice in Secondary Data Analysis (GPS) guidelines (Swart et al.,2015). The variables, research design and rationale, sampling procedures, conditions and procedures for data collection, data analysis plan, statistical analysis parameters, research questions and hypotheses and their respective data analysis plan, possible threats to dissertation validity, measures to address validity issues and study's limitations and ethical confines of the study were addressed in this chapter. The next chapter (Chapter 4) will include results of the descriptive analysis, inferential analysis, and hypotheses tests.

Chapter 4: Results

Introduction

The priority of this study was to examine the association between, cognitive performance, dementia, four groups of psychotropic medications, and fall occurrence amongst elderly Canadians, especially those who receive care from residential–based continuing care facilities. The rising figures of Canadian elderly who are at risk of fall, experience fall, and suffer from the sequelae of its related complications have prompted the need to understand the negative effect and extent of impact multiple predictors of fall have on its occurrence. In line with Warner (2013) discussion, the evidence garnered from understanding the current and extent of relationship between these multiple predictors and a fall history helped in proffering evidence–based intervention, strategies and policies that will go a long way in the reduction of fall occurrence, related injuries, and complications. Therefore, tailored research questions to check the relationship between these multiple predictors (specific group of psychotropic medications cognitive function, neurocognitive disorder) and an outcome (fall) among the elderly 65 years and above in residential care in Canada were analyzed in this context. There were five research questions in the proposal however, the data analysis focused on four questions due to the datapoints available in the final dataset accessed.

The four research questions, their null and alternate hypotheses are stated below.

Research Question 1 (RQ1): What is the association between cognitive performance and fall while controlling for gender among Canadians 65+ population receiving residential care?

H_O1: There is no association between cognitive performance and fall while controlling for total gender among Canadians 65+ population receiving residential care.

H_A1: There is an association between cognitive performance and fall, while controlling for gender among Canadians 65+ population in residential care.

Research Question 2 (RQ2): What is the association between dementia and fall, while controlling for gender among Canadians 65+ population receiving residential care?

H_O2: There is no association between dementia and fall while controlling for gender among Canadians 65+ population receiving residential care?

H_A2: There is an association between dementia and fall while controlling for gender among Canadians 65+ population receiving residential care?

Research Question 3 (RQ3): What is the association between antipsychotic, antianxiety, antidepressants, hypnotics and fall while controlling for gender among Canadians 65+ population receiving residential care?

H_O3: There is no association between antipsychotic, antianxiety, antidepressants hypnotics and fall, while controlling for gender among Canadians 65+ population receiving residential care.

H_A3: There is an association between antipsychotic, antianxiety, antidepressants hypnotics and fall, while controlling for gender among Canadians 65+ population receiving residential care.

Research Question 4 (RQ 4): To what extent do cognitive decline, dementia, antipsychotic, antianxiety, antidepressants, hypnotics predict a fall among Canadians 65+ population receiving residential care while controlling for gender?

H_O4— There is no association between cognitive decline, dementia, antipsychotic, antianxiety, antidepressants, hypnotics and fall history, among Canadians 65+ population receiving residential care while controlling for gender.

H_A4— There is an association between cognitive decline, dementia, antipsychotic, antianxiety, antidepressants, hypnotics and fall among Canadians 65+ population receiving residential care while controlling for gender.

RQ1 related to adverse outcome and the association between cognitive performance levels and fall among Canadians 65+ population receiving residential care. RQ2 centered on negative impact and the association between dementia and fall among Canadians 65+ population receiving residential Care. RQ3 covered the fall–out and examined the association between the four categories (anti–anxiety, antipsychotic, hypnotics, and antidepressant) of psychotropic medication and fall among the Canadian elderly 65 years and above in residential care. RQ4 earlier stated in the proposal was forfeited due to dataset limitation. Therefore, the fifth question in the proposal became the fourth question in this analysis. The fourth question covered the negative impact and

association between the combination of the three predictors (cognitive decline, dementia, anti–anxiety, antipsychotic, hypnotics, and antidepressant) and fall among elderly Canadians 65+ in residential care. An outcome of fall is the major adverse effect of these predictors examined.

This chapter presents findings on the statistical relationships between (a) cognitive performance levels (b) dementia and (c) anti–anxiety, antipsychotic, hypnotics, and antidepressant groups of psychotropic medication and fall among 180,231(sample size) assessed elderly Canadians 65 years and above in residential care between 2018 and 2019.

Data Collection

My study proposal was approved by the Walden University IRB on 29th of December 2021. The dataset used in this study was collected between 2018 and 2019 by the residential care facilities and submitted to CIHI. For the fiscal year 2018–2019, data were collected from residential care facilities across seven Canadian provinces as reported in CIHI database (CIHI, 2019). All participants were involved in the national Inter RAI– Chai survey conducted to provide a basic descriptive data to guide practice. The criteria for eligibility of residential care clients used in this study are Canadian elderly 65 years and over who were in residential care between 2018 and 2019. Other criteria used were based on the original data collection criteria for the primary survey. These criteria included residential–based facilities data on the implicated elderly group from various Canadian provinces (Newfoundland and Labrador, Ontario, Manitoba

Saskatchewan, Alberta, British Columbia, and Yukon); group of elderly that were assessed with the RAI–MDS 2.0 assessment instrument from 2018–2019; assessment was conducted within 14 days of admission to a facility and then quarterly during their stay or in the presence of a significant status change and facilities for 2018–2019 included those with publicly funded/subsidized beds. Additionally, other criteria included are some provinces, and territories (Newfoundland and Labrador, Ontario, Alberta, British Columbia, and Yukon) with coverage in their respective provinces/territories and others (Manitoba, Saskatchewan) with partial coverage (i.e., only certain facilities and/or regional health authorities submitted data to CCRS) and the elderly assessed in two different facilities were counted twice as they were referred to as unique and counts were based on record rate.

For the exclusion criteria, as reported by CIHI (2019) are the elderly without neurocognitive disorder, not using any psychotropic medication, no history of fall and limited life expectancy (3 months); those discharged to RACF living outside catchment area; the elderly in a facility in 2018–2020 may not have assessment records in CCRS; the elderly who had less than 14 days of stay in the facility; those elderly admitted close to the end of the fiscal year, their initial assessment was not due until the first 14 days of 2018–2019; they were discharged close to the beginning of the fiscal year and those facilities with no data record submitted to CIHI.

For this study, the dependent variable was a dichotomous (categorical) variable which aligns with a multiple logistic regression design and a total of three independent

variables in line with Warner's (2013) report. The study design used for this study was a bi–variate multiple logistic regression analysis; however, only the data points on the gender covariate were included. The research questions and hypotheses were modified to reflect these changes. The others (age and indigeneity) were not included in the analysis as they were not accessible under certain ethical circumstance surrounding their release contextually, missing from the dataset due to the nature and time of data collection and omitted due to their undue influence on the model.

Dummy Coding of Dependent, Independent and Controlling Variable

The dependent variable (fall) was recoded. On SPSS the value labels box (on the variable view) was used. This dependent variable was measured at two levels: fall −No Fall and fall −Fall. Each level was assigned a unique number to identify the level; for the dependent variable 0= No Fall, 1 = Fall.

Using the (k–1) method, the dummy coding process used a particular level as the reference category. To transform/recode the various categorical variables, the levels were assigned a take on number with a baseline level noted for comparison.

Post Hoc Power Analysis

Post hoc power analysis was conducted for all research questions that had statistically significant results using G*Power analysis software. The steps taken to calculate the power for the research questions are Test Family the 'X^2–tests' and Goodness–of–fit test options selections; Contingency tables' for Statistical test; type of power analysis −Post Hoc: compute achieved power–given alpha, sample size and effect

size as the medium effect size of 0.3. The alpha error probability used was 0.144 while the sample size was 180231 (the participants assessed for the variables tested). The degree of freedom (DF) was obtained from the SPSS chi square output table for each implicated RQ with a statistically significant result to get the power. All relationships power results were reported. Overall, the power of the study was one 1(Power:1.00, Critical X^2=9.56932, Non–centrality parameter λ=16220.79).

Results

The dataset excel file was imported into SPSS and the MLR analysis was conducted for the four research questions in this study. The results reported are the output from run the dataset through SPSS MLR analysis. The results are reported in two major formats: descriptive statistical analysis and inferential statistical analysis. The descriptive statistical analysis results are reported for the dependent and independent variables, respectively. The inferential statistical analysis results are reported according to the four research questions in this study.

Sample Demographic

From Table 1 below it can be observed that a total of 180231 residents across 1,319 residential care facilities from seven provinces (Newfoundland and Labrador, Ontario, Alberta, British Columbia, Manitoba, Saskatchewan, and Yukon) across Canada were captured in the original dataset. Ontario had the highest number of facilities (626), followed by British Columbia (297) among others and the least number of residential care facilities (5) were found in Yukon. The number of residents accessed were 180,231

with a total number of 59,470 males (33.00%),119,334 females (66.21%) and 1427 clients (0.79%) had unspecified gender. Ontario had the largest number (104,158) of assessed number of residents, followed by British Columbia (34,512) among others and Yukon had the least number (241). Table 1 shows more province– and variable–specific figures regarding the dataset used in this dissertation.

Table 1

Demographics of The Final Dataset

Descriptive Statistics

	N	Percentages	Std. Deviation
Total Number of assessed residents	180231	100.00%	64219.228
Gender			
Females	119,334	66.21%	42767.992
Males	59,470	33.00%	20912.086
Residential care	1319		
Cognitive Performance			
Relatively intact	34349	19.16%	11926.513
Mild moderate	86775	48.52%	31495.190
Severe	59470	32.32%	20829.714
Dementia	111024	61.60%	39998.388
Use of Psychotropic Medication			
Anti–anxiety	47093	10.81%	6796.801
Antipsychotic	19478	26.13%	16629.983
Antidepressant	95771	53.13%	34897.460
Hypnotic	15602	8.66%	5065.776

History of Fall (the Main Outcome variable)			
No Fall	109555	60.79%	38246.486
Fall	70676	39.21%	26067.885

Descriptive Statistics for Patients Diagnosis/Characteristics

Dependent Variable (Fall) and Independent Variable 1 (Cognitive level)

Foremost, from Table 1 it can be observed that between 2018 and 2019 a total of 70676 (39.21%) residents out of those assessed (180231) had fallen while 109555 (60.79%) had not fallen. Furthermore, from Table 1, it can be observed that between 2018 and 2019, across seven Canadian provinces, 19.16% of the number of residents assessed elderly 65 years and above in residential care had a cognitive performance relatively intact level (CIHI, 2019; Laureate, 2017b; Warner, 2013). Secondly, approximately 48.52% of the assessed resident's elderly 65 years and above in residential care had a Cognitive Performance Mild/Moderate level. Thirdly, 32.32% elderly 65 years and above in residential care had a Cognitive Performance Severe level. In other words, more persons had Cognitive Performance Mild/Moderate level compared to Cognitive Performance Severe level. While Cognitive Performance Intact level came least.

Independent Variable 2 (Dementia)

From Table 1, it can be observed that between 2018 and 2019, across seven Canadian provinces, 61.60% elderly 65 years and above in residential care had dementia among the population of those assessed (CIHI, 2019; Laureate, 2017b; Warner, 2013).

Independent Variable 3 (antipsychotic, antianxiety, antidepressant and hypnotics)

From Table 1, between 2018 and 2019 across seven Canadian provinces, for the third IV (antipsychotic, antianxiety, antidepressant and hypnotics) their respective percentages are as follows: the antidepressant group had the highest percentage at 53.13%, followed by the antipsychotic group with a percentage of 26.13%. antianxiety group came third (10.81%) while hypnotic was fourth place (8.66%) in terms of their percentage values.

Since the variables in RQ1–RQ3 use the same variables in RQ4 their descriptive statistics remains the same. Therefore, the next parameters to be discussed are the inferential statistics.

Chi–Square Assumption Testing Result

The assumptions testing for chi–square ($\chi 2$) conducted confirmed that the number in each cell were independent of one another as observed from tables 6 to 21 in their individual cell and the score of each cell had no effect on the score in another cell, there was a minimum of five participants/occurrences/events in all given one cell as observed across tables 6 to 21 and the dependent variable in the chi–square test is a dichotomous variable as the number of participants were categorized into two groups (No Fall=0 Fall=1) observed in Tables 6 (CIHI, 2019;Frankfort–Nahmias & Leon–Guerrero, 2018; Rudestam & Newton, 2015; Wagner, 2020; Wang et al., 2018; Warner, 2013).

Cross–tabulations

The cross–tabulation tables– 2, 4 and 6 show the 2x2 cross tabulations (within each category) between the independent variables (Cognitive levels, Dementia, Medication), gender and fall. These cross–tabulations show the relationship between the outcome variable and predictor variable within the categories in each variable.

Table 2

Crosstabulation of Fall versus Cognitive Levels

Cognitive Levels * Fall Crosstabulation					
			Fall		
			No Fall	Fall	Total
cognitive levels	cognitive intact	% within cognitive levels	53.7%	46.3%	100.0%
		% within fall	16.9%$_a$	22.6%$_b$	19.2%
	Cognitive moderate	% within cognitive levels	63.3%	36.7%	100.0%
		% within fall	50.5%$_a$	45.5%$_b$	48.5%
	cognitive severe	% within cognitive levels	61.3%	38.7%	100.0%
		% within fall	32.6%$_a$	31.9%$_b$	32.3%
Total		% within cognitive levels	60.8%	39.2%	100.0%
		% within fall	100.0%	100.0%	100.0%

Note. Each subscript letter denotes a subset of Fall categories whose column proportions do not differ significantly from each other at the .05 level.

Table 3

Crosstabulation of Chi–Square Test for Fall vs Cognitive levels

Chi–Square Tests			
	Value	df	Significance
Pearson Chi–Square	960.433[a]	2	<.001
Likelihood Ratio	949.487	2	<.001

Linear–by–Linear Association	351.354	1	<.001
N of Valid Cases	180231		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13540.64.

From the results presented in tables 2 and 3, the elderly participants of the study with intact level of cognitive performance reported the highest proportion of history of fall (46.3%). The elderly participants of the study with severe level of decline in cognitive performance reported the second highest proportion of fall (38.7%) and the elderly participants of the study with moderate level of decline in cognitive performance reported the slowest proportion of fall (36.7%); The difference was statistically significant, with p–value <0.05.

Table 4

Crosstab of Fall versus Dementia

Dementia * Fall Crosstabulation					
			Fall		
			Fall	No Fall	Total
Dementia		% Within Dementia	29.2%	70.8%	100.0%
		% Within Fall	16.5%	62.0%	34.4%I think there
	No	% Within Dementia	99.3%	0.7%	100.0%
		% Within Fall	6.6%	0.1%	4.0%
	Yes	% Within Dementia	75.9%	24.1%	100.0%
		% Within Fall	76.9%	37.9%	61.6%
Total		% Within Dementia	60.8%	39.2%	100.0%
		% Within Fall	100.0%	100.0%	100.0%

Table 5

Crosstabulation Chi–Square Test for Dementia and Fall

Chi–Square Tests			
	Value	df	Significance
Pearson Chi–Square	2135.011[a]	1	.000
Continuity Correction[b]	2133.678	1	.000
Likelihood Ratio	3378.694	1	.000
Linear–by–Linear Association	2134.993	1	.000
N of Valid Cases	118312		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1654.82.

b. Computed only for a 2x2 table

From the results presented in table 4 the elderly participants of the study with no dementia reported very low proportion of history of fall (0.7%) and the elderly participants of the study with dementia reported higher proportion of fall (24.1%). These proportions had differences that were all statistically significant, with p–value <0.05 (table 5).

Table 6

Crosstabulation of Fall versus Medication

Medication Category * Fall Crosstabulation		
	Fall	Total

			No Fall	Fall	
Medication Category	Hypnotic	% within medication category	48.1%	51.9%	100.0%
		% within fall	21.1%	34.6%	26.5%
	antipsychotic	% within medication category	72.3%	27.7%	100.0%
		% within fall	13.1%	7.6%	10.9%
	anti–anxiety	% within medication category	60.6%	39.4%	100.0%
		% within fall	54.0%	53.5%	53.8%
	antidepressant	% within medication category	81.1%	18.9%	100.0%
		% within fall	11.8%	4.2%	8.8%
Total		% within medication category	60.4%	39.6%	100.0%
		% within fall	100.0%	100.0%	100.0%

Table 7

Crosstabulation Chi Square Statistics for Medication and Fall

Chi–Square Tests			
	Value	df	Sig.
Pearson Chi–Square	6919.760[a]	3	.000
Likelihood Ratio	7203.836	3	.000
Linear–by–Linear Association	3821.113	1	.000
N of Valid Cases	177944		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6185.51.

From the results presented in table 6 the elderly participants of the study who use hypnotic reported the highest proportion of history of fall (51.9%); while the elderly participants of the study who used anti–anxiety psychotropic medication reported the second highest proportion of fall (39.4%); the elderly participants who used anti–

psychotic psychotropic medication reported the third highest proportion of fall (27.7%) and the elderly participants of the study who used antidepressants reported the slowest proportion of fall (18.9%). These proportions were all statistically significant, with p–value <0.05 (table 7).

Table 8

Crosstabulation of Fall versus Gender

Gender * Fall Crosstabulation					
			Fall		
			No Fall	Fall	Total
Gender	Female	% Within Gender	83.7%	16.3%	100.0%
		% Within Fall	92.2%	27.6%	66.7%
	Male	% Within Gender	14.2%	85.8%	100.0%
		% Within Fall	7.8%	72.4%	33.3%
Total		% Within Gender	60.6%	39.4%	100.0%
		% Within Fall	100.0%	100.0%	100.0%

In this groups of subjects, only 16.3% of female subjects reported history of fall while 85.8% of male subjects reported history of fall. Male subjects were at more than 5 time of risk in reporting history of fall than female subjects. The result is statistically significant, with p–value of p<0.05. Based on the bivariate analyses results, all three main independent variables are statistically associated with the dependent variable –fall, without adjusting potential confounding effects of one another and gender. In the next section, the results of the multiple logistic regression were discussed.

Multiple Logistics Regression Model Assumption Testing Result

The assumptions testing for the multiple logistics regression model confirmed that the outcome variable (fall) was binary nature of the response variable and had two–unit

outcome as observed on steps 1 and 2 outcomes across tables 9–35; there exist a linear relationship between the explanatory variables and the logit of the response variable as observed on the Pearson's value in the various models from tables 14, 21, 29 to 32. The Box–Tidwell test earlier specified in the proposal was not used. These SPSS models from RQ1–RQ4 made use of Pearson's value in checking for linearity and the sample size was large enough after the dataset was prepared and cleaned as observed on table 1(N=180231); there were no extreme outliers that could compromise the integrity of models by observing the Bayesian Information Criteria values and there was no multicollinearity between each IVs and DV as evidenced by a small variance inflation value (VIF $\leq$ 4) on tables 14, 20 and 27. However, high score of multicollinearities (greater than 2) is observed when the relationship is between a combination of two or IVs and the DV as evidenced by large variance inflation value (VIF $\geq$ 5) on tables 15, 28 and 33. Therefore, the strength of relationship between each predictor variable and outcome variable in each RQ regression model is unbiased however, and as expected there is high level of multicollinearity when 2 or more independent variable are added to the model (Frankfort–Nahmias & Leon–Guerrero, 2018; Rudestam & Newton, 2015; Wagner, 2020; Wang et al., 2018; Warner, 2013). Assumptions findings specific to each RQ will be discussed in each RQ result analysis section, respectively.

Inferential Statistics Result Analysis

In order to answer each specific research, question the relationship between each independent variable, IV (predictor) and the dependent variable, DV (outcome)

pertaining to each research question (RQ) was computed on SPSS. The assumptions for chi–square and the multiple logistic regression model and the analysis results were reported. Each RQ, the corresponding SPSS output tabulated results, the result report and analysis are discussed below.

Research Question 1(RQ1), Results and Analysis

RQ1: What is the association between the three cognitive levels and fall while controlling for gender among Canadians 65+ population receiving residential care

H_O1: There is no association between cognitive level and fall, while controlling for gender among Canadians 65+ population receiving residential care

H_A1: There is an association between cognitive decline and fall, while controlling for gender among Canadians 65+ population in residential care.

Analysis of Result (RQ1)

Using the multiple logistic regression model, a regression analysis using the IBM SPSS was run on the dependent variable (fall– Dichotomous Variable) and the independent variables (three cognitive levels) with a sample size of 180231. From table 9 the predictability of 60.6% the first category of fall (No Fall=0) and 39.4% for the second category of fall (Fall=1) were observed. Additionally, from table 11 the independent variable –Cognitive Performance–Relatively intact, Cognitive Performance–Mild/moderate, and Cognitive Performance–Severe were found to all have log ratios that were statistically significant($p<0.05.df=1$) (Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Furthermore, from table 10 it can be observed that the log ratio

(likelihood) of cognitive levels predicting fall was statistically significant and at 37.9% high effect value ($p<0.0001$, Cox &Snell $R^2=0.379$).

Table 9

Classification Table (Step 0) for Cognitive Performance levels and Fall

Classification Table [a, b]

			Predicted		
			Fall		Percentage
	Observed		No Fall	Fall	Correct
Step 0	Fall	No Fall	108339	0	100.0
		Fall	70465	0	.0
	Overall Percentage				60.6

a. Constant is included in the model.

Table 10

Model Summary for Cognitive Performance levels and Fall

Model Summary

Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	154494.144[a]	.379	.514

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Notably, from table 11 below the odds ratio (OR) of the elderly 65+ in residential care having fall among the cognitive levels using cognitive performance relatively intact

level as baseline can be interpreted as follows: Cognitive performance mild/moderate levels had the odds ratio of increasing fall when gender was controlled for (OR =1.070, df=1, 95%CI (1.033–1.108), p<0.001). Likewise, sex(1=male) increased the Odds ratio of fall (OR =31.505, df=1, 95%CI (30.635–32.399), p<0.001). On the contrary, cognitive performance severe level decreased the odds ratio of fall by 10.2% (OR=0.898 df=1, 95%CI (0.865–0.932) p<0.001) compared to the cognitive–intact level baseline while cognitive moderate level still increased the odds ratio of fall by 70% (OR=1. 070 df=1, 95%CI (1.033–1.108) p<0.001). However, from table 12, using cognitive performance severe level as baseline, cognitive performance intact levels (OR=1.114, df=1, 95%CI (1.073–1.156), p<0.001) and cognitive performance mild/moderate (OR=1.192, df=1, 95%CI (1.158–1.228), p<0.001) levels increased the odds ratio of fall.

Table 11

Parameter estimate in the equation for Cognitive Performance levels and Fall (Using Cognitive Intact level as baseline 0)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Cognitive Levels Intact (0)			137.896	2	<.001			
	Cognitive Level Moderate (1)	.068	.018	14.489	1	<.001	1.070	1.033	1.108
	Cognitive Levels Severe (2)	–.108	.019	32.392	1	<.001	.898	.865	.932
	Sex (1)	3.450	.014	58407.007	1	.000	31.505	30.635	32.399

Constant	– .016	10463.672	1	.000	.194	1.640

a. Variable(s) entered on step 1: Cognitive Levels, Sex.

Table 12

Parameter estimate in the equation for Cognitive Performance levels and Fall (Using Cognitive Severe level as baseline)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	gender	3.450	.014	58407.007	1	.000	31.505	30.635	32.399
	cognitive levels			137.896	2	<.001			
	cognitive levels (1)	.108	.019	32.392	1	<.001	1.114	1.073	1.156
	cognitive levels (2)	.176	.015	137.875	1	<.001	1.192	1.158	1.228
	constant	–1.748	.013	18939.730	1	.000	.174		

a. Variable(s) entered on step 1: Gender, Cognitive Levels.

Assumption for chi square for Cognitive Performance levels and Fall Model.

In terms of chi–square assumptions, RQ1 results (Tables 9–12) showed that the model met all assumptions to run a chi–square: the values in each cell were independent of another as observed on Table 9. In addition, the outcome variable–fall was dichotomous as observed on table 9, and the cell counts values were greater than 5 in number for both the fall and cognitive performance levels variables as observed on tables 9 and 10Furthermore, the Pearson chi square(X^2) statistics (table 13) is observed to be statistically significant (x^2=960.433 df=2 p<0.001) which confirms a relationship worthy

of note among the variables (Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Furthermore, in terms of the robustness of this statistically significant relationship, the model summary (table 10) Nagelkerke R square value of 51.4% (Adjusted R^2 =0.514, $p<0.001$) observed for the relationship between fall and cognitive levels is robust with a high predictive value.

Table 13

Cross Tabulation Chi–Square Test for Fall vs Cognitive levels

Chi–Square Tests			
	Value	df	Significance
Pearson Chi–Square	960.433[a]	2	<.001
Likelihood Ratio	949.487	2	<.001
Linear–by–Linear Association	351.354	1	<.001
N of Valid Cases	180231		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13540.64.

Table 14

Variance Inflation Factor for Cognitive Performance levels and Fall Model

Co–efficients[a]		
	95.0% Confidence Interval for B	Collinearity Statistics
Model		

		Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.717	1.464		
	Cognitive Perf.Severe	.000	.000	1.000	1.000

a. Dependent Variable: Fall

Assumption for MLR Multicollinearity between Cognitive Performance levels and Fall Model. Notably, from table 14 it can be observed that there is no multicollinearity between cognitive performance severe level and fall (VIF=1, CI:95%) therefore the predictor variable (cognitive performance severe level) singlehandedly predicted the outcome variable(fall) adequately and there is no threat to the regression model in this context in line with the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, this model with a single predictor met the criteria for no multicollinearity between cognitive performance levels and fall model (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013).

Assumption for Linear Relationship between Cognitive Performance levels and Fall Model. In terms of linear relationship between cognitive performance levels and fall, from Table 15 below, the Pearson score can be seen to be 0.0001 (Pearson =0.0001, df=2) which means that there is no linearity, the predictor variables explained the outcome variable adequately and there is no threat to the regression model (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Thus, this assumption criteria were met in this model.

Table 15

Goodness of Fit between Cognitive Performance levels and Fall

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	.000	3	.000
Scaled Deviance	.000	3	
Pearson Chi–Square	.000	3	.000
Scaled Pearson Chi–Square	.000	3	
Log Likelihood[b]	.000		
Akaike's Information Criterion (AIC)	8.000		
Finite Sample Corrected AIC (AICC)	28.000		
Bayesian Information Criterion (BIC)	7.784		
Consistent AIC (CAIC)	11.784		

Dependent Variable: Fall

Model: (Intercept), Cognitive Perf. Relatively intact, Cognitive Perf. Mild/moderate, Cognitive Perf.Severe

a. Information criteria are in smaller–is–better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Assumption for No Outliers Relationship between Cognitive Performance levels and Fall Model. From table 15 above it can be observed that the Bayesian Information Criteria (BIC) is 7.784. This means that there are likely no outliers in the model between cognitive performance levels and fall as the BIC is not greater than 10 (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Thus, the assumption for no outlier's relationship between cognitive performance levels and fall model was met.

Post Hoc for RQ1

The post–hoc power analysis for RQ1 was conducted using the G*power software. The post hic power value for the MLR model for RQ1 was conducted using the G*power software. The post hoc power value for RQ1 (statistically significant result) using a sample size of 180,231, a medium magnitude effect size of 0.3, alpha error probability value of 0.05 and degree of freedom (DF) of 2 (as observed on table 6d) was computed to be one (1). In other words, the model and statistical relationship observed in RQ 1 results analysis are sufficiently powered.

Overall, from the result analysis and tables 9 −14, it can be observed that the three levels of cognitive performance (with the severe level, Moderate level, Intact level) were statistically significant predictors of fall. Overall, the model and the relationship between cognitive level and all is statistically significant among Canadians 65+ population receiving residential care from 2018—2019, which resonate with certain report across the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013).

Therefore, we reject the null hypothesis (H_O1) and fail to reject the alternate hypothesis (H_A1) that there is an association between Cognitive level and fall among Canadians 65+ population in Residential care from 2018−–2019.

Research Question 2(RQ2), Results and Analysis

RQ 2: What is the association between dementia and fall history, while controlling for gender among Canadians 65+ population receiving residential care.?

H_O2: There is no association between dementia and fall history while controlling for gender among Canadians 65+ population receiving residential care.?

H_A2: There is an association between dementia and fall history, while controlling for gender among Canadians 65+ population receiving residential care.?

Analysis of Result (RQ2)

Using the multiple logistic regression model, a regression analysis using the IBM SPSS was run on the dependent variable (fall−dichotomous variable) and the independent variables (dementia–neurocognitive disorder) with a sample size of 180, 231.From table 16 the predictability of 77.2% for the first category of fall (No Fall=0) and 22.8% for the second category of fall (Fall=1) were observed among those that had dementia. Furthermore, from table 17, using the dementia–unknown category as baseline, the odd ratio of the elderly 65+ in residential care with dementia (1) having a fall increased by 8% (OR=1.075, df=1, 95%CI(1.035–1.116), $p<0.001$), while the odds ratio of those without dementia (category–dementia(2)) having a fall decreased by 0.1%((OR =0.001, df=1, 95%CI(0.001–0.001), $p<0.001$).

Table 16

Classification Table (Step 0) for dementia and fall

Classification Table[a, b]					
			Predicted		
			Fall		Percentage
	Observed		0	1	Correct
Step 0	Fall	0	90232	0	100.0
		1	26684	0	.0
	Overall Percentage				77.2

a. Constant is included in the model.
b. The cut value is .500

Table 17

Variables in the equation (step 1) for dementia, and Fall (Using the unknown status category as baseline)

Variables in the Equation									
								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Gender	4.344	.023	35554.866	1	.000	77.034	73.633	80.592
	dementia			2846.782	2	.000			
	dementia (1)	.072	.019	14.376	1	<.001	1.075	1.035	1.116
	dementia (2)	–7.287	.139	2757.137	1	.000	.001	.001	.001
	constant	–1.635	.008	37297.479	1	.000	.195		

a. Variable(s) entered on step 1: Gender, Dementia.

From table 18 it can be observed that the log ratio (likelihood) of cognitive levels predicting fall was statistically significant and at 12.6% high effect value ($p<0.0001$, Cox

&Snell R^2=0.126). Importantly the assumption testing for the chi–square statistics cuts across the four research questions.

Table 18

Model Summary for dementia, and fall model

Model Summary			
Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	109892.096[a]	.126	.191

a. Estimation terminated at iteration number 8 because parameter estimates changed by less than .001.

Assumption for chi square on Dementia, Gender, and Fall Model. In terms of chi–square assumptions, RQ2 results (Tables 16–18) showed that the model met all the assumptions to run a chi–square: the values in each cell were independent of another as observed on Table 8, the outcome variable–fall was dichotomous as observed on table 5a, and the cell counts values were greater than 5 in number for both the fall and dementia variable as observed on table 5a and 5b.

Notably, the Pearson chi statistics for RQ2 (table 19) is observed to be statistically significant (x2=2135.011, df=1 p<0.001) a relationship worthy of note among the variables as reported in the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, based on the model summary (Table 18) log ratio (likelihood) of dementia predicting fall and the chi–square statistically significant (Table

19), the relationship between dementia and fall when controlling for gender(sex) is noteworthy. Other assumptions to run a MLR model tested in RQ2 are discussed in the next section.

Table 19

Crosstabulation Chi–Square Test for Dementia and Fall

Chi–Square Tests			
	Value	df	Significance
Pearson Chi–Square	2135.011[a]	1	.000
Continuity Correction[b]	2133.678	1	.000
Likelihood Ratio	3378.694	1	.000
Linear–by–Linear Association	2134.993	1	.000
N of Valid Cases	118312		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 1654.82.

b. Computed only for a 2x2 table

Assumption for MLR Absence Multicollinearity between Dementia, Gender, and Fall Model. Notably, from table 20 it can be observed that there is no multicollinearity between dementia and fall (VIF=1, CI:95%) therefore the predictor variable(dementia) explained the outcome variable(fall) adequately and there is no threat to the regression model in this context in line with various assertions across the literature

(CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, the absence of multicollinearity means that this assumption was met for this model.

Table 20

Coefficients and Variance Inflation Factor for dementia and fall model

Coefficients[a]					
		95.0% Confidence Interval for B		Collinearity Statistics	
Model		Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.726	1.450		
	Dementia	.000	.000	1.000	1.000

a. Dependent Variable: Fall

Assumption for Linear Relationship between Dementia, Gender, and Fall Model. In terms of linearity between dementia, gender, and fall, from Table 21 below, the Pearson score is observed to be 0.0001 (Pearson =0.0001, df=0) which means that there is no linearity, the predictor variables explained the outcome variable adequately and there is no threat to the regression model (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, the linear relationship assumption to run this model exist.

Table 21

Good of Fit Relationship between dementia, and fall

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	.000	0	.
Scaled Deviance	.000	0	
Pearson Chi–Square	.000	0	.
Scaled Pearson Chi–Square	.000	0	
Log Likelihood[b]	.000		
Akaike's Information Criterion (AIC)	14.000		
Finite Sample Corrected AIC (AICC)	.		
Bayesian Information Criterion (BIC)	13.621		
Consistent AIC (CAIC)	20.621		

Dependent Variable: Fall

Model: (Intercept), Sex, Dementia

a. Information criteria are in smaller–is–better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Assumption for No Outliers Relationship between Dementia, Gender, and Fall Model*.* From table 21 it can be observed that the Bayesian Information Criteria (BIC) value is 13.621**.** This means that there are likely outliers in the model between dementia, gender and fall as the BIC value is larger than 10 in line with Wagner (2020) and Warner (2013) discussions. Thus, the assumption for no outliers in the Dementia, Gender and Fall Model may have been compromised.

Post Hoc for Dementia, Gender, and Fall

The post–hoc power analysis for RQ2 was conducted using the G*power software. The post hic power value for the MLR model for RQ2 was conducted using the G*power software. The post hoc power value for RQ2 using a sample size was 180231, a medium magnitude effect size of 0.3, alpha error probability value of 0.05 and degree of freedom (DF) of 1 (as observed on table 18) was computed to be one (1). In other words, the model and statistical relationship observed in RQ2 results are sufficiently powered.

Therefore, from the result analysis, it can be observed that fall increases with dementia at a highly predictive value in this context. Overall, the model and the relationship between dementia and fall is statistically significant among Canadians 65+ population receiving residential care. from 2018–2019. Therefore, we reject the null hypothesis (H_{O2}) and fail to reject the alternate hypothesis (H_{A2}) that there is an association between dementia (neurocognitive disorder) and fall among Canadians 65+ population in Residential care from 2018–2019.

Research Question 3(RQ3), Results and Analysis

RQ 3: What is the association between antianxiety, antipsychotic, antidepressants, hypnotics and fall, history while controlling for gender among Canadians 65+ population receiving residential Care?

H_O3: There is no association between antianxiety, antipsychotic, antidepressants, hypnotics and fall history, while controlling for gender among Canadians 65+ population receiving residential care.

H_A3: There is an association between antianxiety, antipsychotic, antidepressants, hypnotics and fall history, while controlling for gender among Canadians 65+ population receiving residential care.

Analysis of Result (RQ3)

Using the multiple logistic regression model, a regression analysis using the IBM SPSS was run on the dependent variable (fall– dichotomous variable) and the independent variables (four groups of psychotropic medication– antidepressant antianxiety antipsychotic and hypnotic). The group of psychotropic medication were available in these names on the final dataset unlike the pharmacological naming in the proposal, with a sample size of 180, 231. It should be mentioned that the dataset used in this study made use of the broader psychotropic umbrella names which covers the specific names earlier mentioned. In terms of analysis for this research question result, foremost from table 22 the predictability of dementia for fall are 60.2% (no fall=0) and 39.8% (fall=1) respectively when gender is controlled for.

Table 22

Classification Table for Psychotropic Medications and fall

Classification Table[a, b]

			Predicted		
			Fall		Percentage
	Observed		No Fall	Fall	Correct
Step 0	Fall	No Fall	106181	0	100.0
		Fall	70336	0	.0
	Overall Percentage				60.2

a. Constant is included in the model.

b. The cut value is .500

Notably from table 23 below, using the medication hypnotics category as baseline, it is observed antipsychotic, antidepressant and antianxiety medication had statistically significant odd ratios. Specifically, the odds ratio for fall in this sample increased by 1.571 times (OR =2.571, df=1, p<0.001, 95%CI (2.427–2.724)) among those on antipsychotic , increased by 48.6% (OR =1.486 df=1, p<0.001, 95%CI (1.390–1.588)) among those on antidepressant and increased by 228% (OR =3.284 df=1, p<0.001, 95%CI (3.109–3.470)) among those on antianxiety medication. respectively. However, from table 24 when antipsychotic category was used as a baseline the odd ratio decreased by 43% for antidepressant (OR =0.578 df=1, p<0.001, 95%CI (0.550–0.607)), decreased by 62% for hypnotic (OR =0.389 df=1, p<0.001, 95%CI (0.367–0.412)) and

increased by 28% for antianxiety (OR =1.277 df=1, p<0.001, 95%CI (1.238–1.318))

categories respectively.

Table 23

Parameter estimates for Psychotropic Medications and fall model (Using Hypnotic as Baseline)

Variables in the Equation

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	gender	3.462	.015	54452.089	1	.000	31.866	30.953	32.806
	hypnotics			2635.556	3	.000			
	antipsychotic	.944	.029	1029.206	1	<.001	2.571	2.427	2.724
	antidepressant	.396	.034	135.110	1	<.001	1.486	1.390	1.588
	anti–anxiety	1.189	.028	1805.884	1	.000	3.284	3.109	3.470
	Constant	–2.590	.027	9090.209	1	.000	.075		

a. Variable(s) entered on step 1: Gender, Medication Category.

Table 24

Parameter estimates for Psychotropic Medications and fall model (Using antipsychotic s as Baseline)

Variables in the Equation

							95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	gender	3.462	.015	54452.089	1	.000	31.866	30.953	32.806
	antipsychotic			2635.556	3	.000			
	antidepressant	–.549	.025	477.094	1	<.001	.578	.550	.607
	anti–anxiety	.245	.016	230.814	1	<.001	1.277	1.238	1.318
	hypnotics	–.944	.029	1029.206	1	<.001	.389	.367	.412
	Constant	–1.645	.015	12317.074	1	.000	.193		

a. Variable(s) entered on step 1: Gender, Medication Category.

Assumption for chi–square Psychotropic Medication and Fall Model

In terms of chi–square assumptions, RQ3 results (Tables 22 & 23) showed that the model met all the criteria to run a chi–square: the values in each cell were independent of another as observed on Table 22, the outcome variable–fall was dichotomous as observed on table 8a, and the cell counts values were greater than 5 in number for both the fall and the psychotropic medication as observed on table 22 and 23.

Importantly, the Pearson's chi statistics (table 25) is observed to be statistically significant (X^2=6919.760[a], df=3 p<0.0001) which confirms a relationship worthy of note among the variables. The robustness of the significant relationship can be observed from the log ratio (likelihood) (table 26) of the four medication categories predicting fall was statistically significant and at 38.9% high effect value (p<0.0001, Cox &Snell R^2=0.389)

when gender is controlled for. This confirms the model predictability of statistically significant results in this context in line with the literature report (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013).

Table 25

Crosstabulation Chi Square Statistics for Medication and Fall

Chi–Square Tests			
	Value	df	Sig.
Pearson Chi–Square	6919.760[a]	3	.000
Likelihood Ratio	7203.836	3	.000
Linear–by–Linear Association	3821.113	1	.000
N of Valid Cases	177944		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6185.51.

Table 26

Model Summary for Psychotropic Medications and fall

Model Summary			
Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	150497.628[a]	.389	.526

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Assumption for MLR Multicollinearity between Psychotropic Medication and Fall Model. Notably, from table 27 it can be observed that there is no multicollinearity between antianxiety group of medication and fall (VIF=1, CI:95%) therefore the predictor variable (antianxiety group of medication) singlehandedly predicted the outcome variable(fall) adequately and there is no threat to the regression model in this context as discussed across several reports (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). However, from table 8f it is observed that when two or more (antidepressant, antianxiety, antipsychotic and hypnotics) specified groups of psychotropic medications (IV1s) are combined in one model, the VIF is large (greater than 2), indicating the presence of collinearity which may be interpreted as combined predictors pose a threat to the MLR model. Therefore, with combined predictors the assumption may have been compromised in this model as the presence of multicollinearity indicates such.

Table 27

Coefficient and Variance Inflation Factor for antianxiety medication and fall

	Coefficients[a]	
Model	95.0% Confidence Interval for B	Collinearity Statistics

		Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.706	1.462		
	antianxiety	.000	.000	1.000	1.000

a. Dependent Variable: Fall

Table 28

Coefficient and Variance Inflation Factor for Psychotropic group of Medications and fall

Coefficients[a]					
		95.0% Confidence Interval for B		Collinearity Statistics	
Model		Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.879	1.434		
	antipsychotic	.000	.001	.001	1097.408
	antianxiety	–.002	.001	.001	1464.770
	Hypnotic	.000	.000	.055	18.162

a. Dependent Variable: Fall

Assumption for Linear Relationship between Psychotropic Medication and Fall Model. In terms of linearity between psychotropic medication and fall, from Table 29 below the Pearson score can be seen to 0.0001 (Pearson =0.0001, df=2) which means that there is no linearity, the predictor variables explained the outcome variable

adequately and there is no threat to the regression model in line with literature report (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, the Linear Relationship assumption was met in this model.

Table 29

Goodness of Fit for Psychotropic Medications and Fall

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	.000	2	.000
Scaled Deviance	.000	2	
Pearson Chi–Square	.000	2	.000
Scaled Pearson Chi–Square	.000	2	
Log Likelihood[b]	.000		
Akaike's Information Criterion (AIC)	10.000		
Finite Sample Corrected AIC (AICC)	70.000		
Bayesian Information Criterion (BIC)	9.730		
Consistent AIC (CAIC)	14.730		

Dependent Variable: Fall

Model: (Intercept), antipsychotic, antianxiety, antidepressaant, Hypnotic

a. Information criteria are in smaller–is–better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Assumption for Outliers Relationship between Psychotropic Medication and Fall Model. From table 28 it can be observed that the Bayesian Information Criteria (BIC) value to be 9.730. This means that there are no outliers in the model as the BIC was lesser than 10. This means that for this model on psychotropic medication and Fall, there was no outlier relationship that would have compromised the model. Therefore, this assumption was met in this model.

Post Hoc for Psychotropic Medication and Fall Model

The post–hoc power analysis for RQ3 was conducted using the G*power software. The post hoc power value for RQ3 using a sample size was 180231, a medium magnitude effect size of 0.3, alpha error probability value of 0.05 and degree of freedom (DF) of 3 (as observed on table 25) was computed to be one (1). In other words, the model and statistical relationship observed in RQ3 results are sufficiently powered.

Overall, from the result analysis, it can be observed that the relationship between antidepressant antianxiety antipsychotic, hypnotic and fall was significantly significant in this context. Strikingly, the odds ratio for fall was increased among those on antipsychotic, antidepressant, antianxiety category of medications respectively when hypnotics category was used as baseline. Overall, the model and the relationship between antidepressant, antianxiety, antipsychotic, and hypnotic and fall is statistically significant among Canadians 65+ population receiving residential care from 2018–2019. Therefore,

we reject the null hypothesis (H_O3) and fail to reject the alternate hypothesis (H_A^3) that there is an association between antidepressant, antianxiety, antipsychotic, and hypnotic (four group of psychotropic medication) and fall among Canadians 65+ population in Residential care from 2018–2019.

Research Question 4(RQ4) Results and Analysis

RQ 4: To what extent do cognitive decline, dementia, antidepressaant, antianxiety, antipsychotic, and hypnotic predict of fall among Canadians 65+ population receiving residential care while controlling for gender.

H_O4— There is no association between cognitive decline, dementia, antidepressaant antianxiety, antipsychotic, hypnotic and fall among Canadians 65+ population receiving residential care while controlling for gender.

H_A4— There is an association between cognitive decline, dementia, antidepressaant. antianxiety, antipsychotic, hypnotic and fall among Canadians 65+ population receiving residential care while controlling for gender.

Analysis of Result (RQ4)

Using the Multiple Logistic Regression model, a regression analysis using the IBM SPSS was run on the dependent variable (fall– Dichotomous Variable) and the independent variables (cognitive levels, dementia, antidepressant, antianxiety antipsychotic, and hypnotic). Foremost, from table 30 it is observed that the odd ratios were all statistically significant ($p<0.001$, CI:95%) for the relationships between the cognitive moderate and severe levels using cognitive intact level as baseline; dementia–

yes and –no categories using the dementia–unknown status category as baseline and antidepressant, antianxiety and Hypnotics medications categories using antipsychotic category as baseline and fall when gender was controlled for using male gender as baseline.

Table 30

Parameter estimates for the three cognitive levels, dementia, the four groups of psychotropic medications and fall model (using cognitive level intact, dementia unknown status, antipsychotic medication category and male gender as baselines for the independent variables respectively)

Variables in the Equation

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Cognitive Levels			139.022	2	<.001			
	Cognitive Levels (1)	.274	.023	138.899	1	<.001	1.315	1.257	1.376
	Cognitive Levels (2)	.227	.025	85.421	1	<.001	1.255	1.196	1.317
	Medication Category			4082.866	3	.000			
	Medication Category (1)	–.938	.031	930.624	1	<.001	.391	.368	.416
	Medication Category (2)	.359	.019	366.651	1	<.001	1.433	1.381	1.486
	Medication Category (3)	–1.424	.037	1518.443	1	.000	.241	.224	.259
	Gender (1)	–4.678	.026	32906.593	1	.000	.009	.009	.010

Dementia			1825.831	2	.000			
Dementia (1)	–8.547	.202	1797.119	1	.000	.000	.000	.000
Dementia (2)	.096	.020	24.163	1	<.001	1.101	1.060	1.144
Constant	2.711	.028	9715.218	1	.000	15.043		

a. Variable(s) entered on step 1: Cognitive Levels, Medication Category, Gender, Dementia.

Specifically for variable–specific odd ratios from table 30, foremost, it can be observed that the odds ratio of fall increased by 31.5% among those in the cognitive–moderate level category (OR =1.315, df=1, p<0.001, 95%CI(1.257–1.376)) and 25.5% among those in the cognitive–severe level category (OR =1.255, df=1, p<0.001, 95%CI(1.196–1.317)) when cognitive–intact category was used as baseline. Secondly, using the dementia–unknown status as baseline it can be observed that the odds ratio of fall decreased by 0.001% among those without dementia (dementia–no category) (OR =0.0001, df=1, p<0.001, 95%CI (0.0001–0.0001) which is explainable by the few numbers of those in this category compared to the baseline. However, the odds ratio increased by 10.1% among those in the dementia–Yes category (OR=1.101, df=1, p<0.001, 95%CI (1.060–1.144)) compared to the baseline.

Thirdly, among the psychotropic medication variable on table 9a, it can be observed that the odds ratio of fall decreased by 60.9% among those in the antidepressant category (OR =0.391, df=1, p<0.001, 95%CI (0.368–0.416)) and by 76% among those in hypnotics category, (OR =0.241, df=1, p<0.001, 95%CI (0.224–0.259)) respectively when the antipsychotic category was used as baseline. However, the odds ratio of fall

increased by 43.3% among those in the antianxiety category (OR =1.433 df=1, p<0.001, 95%CI (1.381–1.486)) when the antipsychotic category was used as baseline.

Additionally, it was observed that odds ratio for fall decreased by 0.9% among the female gender (OR =0.009, df=1, p<0.001, 95%CI (0.009–0.010)) when the male gender was used as baseline among the elderly 65years and above in residential care. Furthermore, from 31, it can be observed that the log ratio (likelihood) of cognitive levels, dementia, antidepressant, antianxiety, antipsychotic, and hypnotic predicting fall when all combined in a single model is 21.9% (p>0.05, Cox &Snell R^2=0.219).

Table 31

Sample table showing the Model Summary for RQ4

Model Summary			
Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	95816.315[a]	.219	.331

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Assumption for Chi square for Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall Model. In terms of chi–square assumptions, RQ4 results (tables 30–32) showed that the model met all the assumption to run a chi–square: the values in each cell were independent of another as observed on table 30, the outcome variable–fall was dichotomous as observed on table 30, and the

cell counts values were greater than 5 in number for both psychotropic medication, dementia, cognitive performance levels, gender (IVs) and fall(DV) variable as observed on tables 30 and 31.

Strikingly, when the crosstabulation function was used to run a chi–square statistics for the model combining all the variables, it yielded the same statistically significant chi–square statistics as observed in Tables 13, 19 and 25 ($p<0.05$, CI:95%). Based on the MLR model summary the magnitude of the statistically significant relationship can be observed from table 32 to be 21.9% (Cox&Snell $R^2=0.219$, $p>0.05$) for the relationship between cognitive levels, Dementia, antidepressant, antianxiety antipsychotic, and hypnotic and fall when gender(sex) is controlled for.

Table 32

Model Summary for RQ4

Model Summary			
Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	95816.315[a]	.219	.331

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Assumption for MLR Multicollinearity between Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall Model.

In terms of multicollinearity, from tables 33 and 34 below, it is observed that when all cognitive levels are combined in one model, the VIF is large (greater than 2), indicating the presence of multicollinearity which may be interpreted as combined predictors pose a threat to the MLR model and unreliable to interpret. Thus, it can be said that the assumption for no multicollinearity between variables may have been compromised in this model that combined the three major independent variables and gender and outcome variable (fall).

Table 33

Coefficient and Variance Inflation Factors for Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and fall

Coefficients[a]					
		95.0% Confidence Interval for B		Collinearity Statistics	
Model		Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.879	1.434		
	Cognitive Perf.	–.001	.000	.001	868.411
	Relatively intact				
	antipsychotic	.000	.001	.001	1097.408
	antianxiety	–.002	.001	.001	1464.770
	Hypnotic	.000	.000	.055	18.162
	Total Male 65 +	.000	.000	.000	2296.775

a. Dependent Variable: Fall

Table 34

Excluded Variables and Variance Inflation Factors Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and fall

Excluded Variables[a]				
			Collinearity Statistics	
Model		Beta In	VIF	Minimum Tolerance
1	Cognitive Perf. Mild/moderate	3.145[b]	8024.632	6.569E–5
	Cognitive Perf.Severe	–52.654[b]	1288003.976	7.764E–7
	Dementia	3.713[b]	6323.825	9.462E–5
	antidepressaant	–513.692[b]	13308046.942	3.115E–8
	Total Female65 +	.[b]	.	.000

a. Dependent Variable: Fall

b. Predictors in the Model: (Constant), Total Male 65 +, Hypnotic, Cognitive Perf. Relatively intact, antipsychotic, antianxiety

Assumption for Linear Relationship between Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall Model. In terms of linearity, from table 35 the Pearson score can be seen to 0.0001 (Pearson =0.0001, df=0) which means that there is no multicollinearity, the predictor variables explained the outcome variable adequately and there is no threat to the regression model in alignment

with the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, the assumption for linear relationship between psychotropic medication, dementia, cognitive performance levels, gender, and fall model was met in this model.

Table 35

Goodness of fit between Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall

Goodness of Fit[a]			
	Value	df	Value/df
Deviance	.000	0	.
Scaled Deviance	.000	0	
Pearson Chi–Square	.000	0	.
Scaled Pearson Chi–Square	.000	0	
Log Likelihood[b]	.000		
Akaike's Information Criterion (AIC)	14.000		
Finite Sample Corrected AIC (AICC)	.		
Bayesian Information Criterion (BIC)	13.621		

Consistent AIC (CAIC)	20.621

Dependent Variable: Fall

Model: (Intercept), Cognitive Perf. Relatively intact, Cognitive Perf. Mild/moderate, Cognitive Perf.Severe, Dementia, antipsychotic, antianxiety, antidepressant, Hypnotic, Total Female 65 +, Total Male 65 +

a. Information criteria are in smaller–is–better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Assumption for Outliers Relationship between Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall Model. From table 35 it can be observed that the Bayesian Information Criteria (BIC) value is 13.621. This means that there are likely outliers in the model between the combination of all independent variables Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall a BIC larger than 10 indicates more outliers and a weaker model of predictability. Thus, the assumptions for no outliers in this specific model may have been compromised.

Post Hoc for Psychotropic Medication, Dementia, Cognitive Performance levels, Gender, and Fall Model

The post–hoc power analysis for RQ4 was conducted using the G*power software. The post hic power value for the MLR model for RQ4 was conducted using the G*power software. The post hoc power value for RQ4 (not statistically significant result) using a sample size of 180231, a medium magnitude effect size of 0.3, alpha error probability value of 0.05 and degree of freedom (DF) of 1(as observed on table 9e) was

computed to be one (1), In other words, the model and statistically insignificant relationship observed in RQ4 results analysis are sufficiently powered.

In summary, from tables 30 and 35 it is observed that the model used in testing the relationship between the combined independent variables (cognitive levels, dementia and antidepressant, antianxiety antipsychotic, hypnotic) in this study predicting fall was statistically significant among Canadians 65+ population receiving residential care. from 2018–2019. Therefore, we reject the null hypothesis (H_{O4}) and fail to reject the alternate hypothesis that there is a statistically significant relationship between all independent variables (cognitive levels, dementia, antidepressant, antianxiety antipsychotic, hypnotic) combined and fall when controlling for gender among Canadians 65+ population receiving residential care.

Summary

Summarily, from an overview perspective on the four research questions result analysis, it can be observed that foremost, the model and the relationship between the three cognitive levels and fall is statistically significant among Canadians 65+ population receiving residential care from 2018–2019 as speculated in some literature report (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Thus, we reject the null hypothesis and fail to reject the alternate hypothesis that there is an association between Cognitive level and fall among Canadians 65+ population in Residential care from 2018–2019. Notably, in terms of the odd ratios (Table 7) of increasing or decreasing fall across the three cognitive levels, using cognitive performance severe level as baseline, cognitive

performance Intact and Cognitive Performance Mild/moderate levels increased the odds ratio of fall. Therefore, these two levels are predictors of fall.

Secondly, from RQ2 result analysis, the model and the relationship between dementia and fall is statistically significant among Canadians 65+ population receiving residential care. from 2018–2019. Furthermore, across tables 16– 21 it is observed that the model, and all metrics used in testing the relationship between dementia (neurocognitive disorder) level and fall were statistically significant among Canadians 65+ population receiving residential care. from 2018–2019 which resonates with the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Therefore, the null hypothesis (H_O1) was rejected, and we failed to reject the alternate hypothesis (H_A1) that there is an association between dementia and fall among Canadians 65+ population in Residential care from 2018–2019. In terms of the odd ratio for the second question, the odd ratio of fall increased among those with dementia (dementia–1 category) and decreased among those without dementia (dementia–2 category) when those with unknown dementia status was used as baseline. Thus, those with dementia were not protected against a fall.

Thirdly from RQ3 result analysis, the predictability value, chi square metric, Adjusted R^2 and log ratio were pointers to the statistically significant relationship between antidepressant antianxiety antipsychotic, hypnotic and fall among Canadians 65+ population receiving residential care. from 2018–2019 (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). Thus, the null hypothesis (H_{O2}) was

rejected, and we failed to reject the alternate hypothesis (H_A2) that there is an association between antidepressant, antianxiety antipsychotic and Hypnotic and fall among Canadians 65+ population receiving residential care. Noteworthy were the odds ratios for fall (which was increased) among those on antipsychotic, antidepressant, and antianxiety category of medications respectively when Hypnotics category was used as baseline (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013).

Lastly for the fourth research question (RQ4) there is a statistically significant relationship between cognitive levels, dementia hypnotic, antidepressant, antipsychotic, antianxiety groups of medication combined and fall. Therefore, we rejected the null hypothesis and failed to reject the alternate hypothesis that there is an association between cognitive levels, dementia hypnotic, antidepressant, antipsychotic, antianxiety groups of medication combined and fall among Canadians 65+ population receiving residential care from 2018 to 2019 in agreement with several discus across the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). For all variables combined in the fourth model, foremost, it can be observed that the odds ratio of fall increased among those in the cognitive–moderate level category and cognitive–severe level category when cognitive–intact category was used as baseline. Additionally, the odds ratio increased among those in the dementia–yes category compared to the dementia–unknown status baseline, while the odds ratio of fall decreased among those without dementia. Furthermore, among the psychotropic medication variable, the odds ratio for fall decreased among those in the antidepressant and hypnotics category

respectively and increased among those in the antianxiety category when antipsychotic category was used as baseline.

In summary, it can be concluded that the multiple logistic regression model was statistically significant for RQ1, RQ2, RQ3 and RQ4. These results are in line with the purpose of this study, the positionality of the SCT key concepts (reciprocal determinism and self–efficacy) applicable in this study, various assertions, and reports in the available body of literature on the importance of conducting an inferential study like this contextually. Conclusively, in line with these findings, chapter five discussions and recommendations will be grounded on these analyses results and context–specific application.

Chapter 5

Introduction

The purpose of this study was to examine the association between cognitive performance levels, dementia, four groups of psychotropic medication and fall occurrence amongst elderly Canadians, especially those who receive care from residential–based continuing care facilities. There is a high and increasing number of Canadian elderlies who are at risk of fall, experience it, the consequences of fall– related complications and the need to understand the extent of impact multiple predictors of fall have on its occurrence was emergent in this study.

An understanding of the current and extent of relationship between these multiple predictors and fall would drive evidence–based intervention, strategies and policies that are potentially beneficial to curbing fall occurrence, minimizing related injuries, and the cascade of multisystemic implications associated with fall occurrence as seen in the literature (CIHI, 2021; Laureate Education, 2017b; Warner, 2013). The results and analyses on the relationship between cognitive function, neurocognitive disorder–dementia, specific group of psychotropic medications and an outcome (fall) among the elderly 65 years and above in residential care in Canada yielded results that are specific to contextual application in care practice guidelines. From Chapter 4 results, for RQ1 result the three levels of cognitive performance had a statistically significant relationship with fall however, the severe cognitive performance level has a negative predictive OR unlike the other two levels. Thus, the alternate hypothesis (H_A1) that there is an

association between the three levels of cognitive performance and fall among Canadians 65+ population in residential care from 2018–2019 was not. In terms of the odd ratios of increasing or decreasing fall across the three cognitive levels, using cognitive performance severe level as baseline, cognitive performance intact and cognitive performance mild/moderate levels increased the odd ratio of fall while cognitive performance severe level decreased the odd ratio when cognitive intact level was used as baseline. In addition, from RQ2 result, dementia had a statistically significant relationship with fall among Canadians 65+ population receiving residential care from 2018 through –2019 as shown by the statistically significant MLR model. Thus, there was a failure to reject the alternate hypothesis (H_A2) that there is an association between dementia and fall among Canadians 65+ population in residential care from 2018–2019. Additionally, the odd ratio of fall increased among those with dementia (dementia–1 category) and decreased among those without dementia (dementia–2 category) when those with unknown dementia status was used as baseline. Thus, those without dementia are protected against a fall. Thirdly, the result of RQ3 showed that antidepressant, antianxiety, antipsychotic, hypnotic also had statistically significant relationship with fall and were also singlehandedly highly predictive of fall among Canadians 65+ population receiving residential care. from 2018 to –2019. Therefore, there was a failure to reject the alternate hypothesis (H_A3) that there is an association between antidepressant antianxiety antipsychotic and hypnotic and fall among Canadians 65+ population receiving residential care. Worthy of note, based on the result that showed increased odds ratios for

fall among those on antipsychotic, antidepressant, and antianxiety category of medications when hypnotics category was used as baseline, the categories of the elderly in these three categories are not protected against fall.

Lastly and notably, a combination of all independent variables in RQ4 yielded statistically significant relationship with fall result, like the other three RQs result. Thus, there was a rejection of the null hypothesis (H_O4) that there is no association between cognitive levels, dementia hypnotic, antidepressant, antipsychotic , antianxiety groups of medication and fall among Canadians 65+ population receiving residential care from 2018 to 2019.In terms of odds ratio for the fourth model, it can be observed that the odds ratio of fall increased among those in the cognitive–moderate level category and cognitive–severe level category when cognitive–intact category was used as baseline. Additionally, the odds ratio increased among those in the dementia–yes category compared to the dementia–unknown status baseline, while the odds ratio of fall decreased among those without dementia. Furthermore, among the psychotropic medication variable, the odds ratio for fall decreased among those in the antidepressant and hypnotics category respectively and increased among those in the antianxiety category when antipsychotic category was used as baseline.

A summary of the result indicated that among Canadians 65+ population receiving residential care. between 2018 to –2019, there existed a statistically significant relationship between cognitive levels and fall in the context of gender. Additionally, the study findings revealed a statistically significant relationship between dementia and fall.

Worthy of note is statistically significant relationship between antidepressant, antianxiety, antipsychotic, hypnotic and fall observed in the study findings. Furthermore, the independent variables all single–handedly and in combination yielded statistically significant in predicting fall with robust models, respectively. Therefore, these respective predictor–variables are predictive fall thus, consequential to care and practice guidelines in this population.

Interpretations of the Findings

Research Question 1 (RQ1)

The three levels of cognitive performance combined had a statistically significant relationship with fall. Notably while cognitive performance intact and moderate levels had predictive odds ratios for fall, cognitive performance severe level decreased the odds ratio of fall among Canadians 65+ population in Residential care from 2018 to –2019. Notably, their predictive abilities also varied among the three levels especially, as the odds ratio were increased for cognitive performance moderate and cognitive performance intact. These findings resonate with Gjorgjievski and Ristevski's (2020) and Le Mouel et al.'s (2019) studies on how elderly fallers and non–fallers normal aging physiological condition inclusive of cognition may predispose them to fall. However, the explanation to the cognitive performance severe level negative predictive value for fall resonates with several literature reports (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019; WHO, 2021) on the progress made through fall prevention practices targeted at severely demented clients. Although,

other variables such as coexisting neurological diseases that may have impacted the cognitive levels of the elderly in this study were not controlled for in this model. Nevertheless, this dissertation study findings established that two levels of cognitive performance are factorial to fall occurrence among this age group and should also be taken into consideration in this age group when fall prevention modalities are developed and utilized.

Research Question 2(RQ2)

Dementia had a statistically significant relationship with fall among Canadians 65+ receiving residential care. from 2018 to –2019 as shown by the robust statistically significant MLR model. Moreover, the odds ratio showed that those with dementia had increased odds ratio for fall and which should be taken into priority. This finding resonates with the assertions that the elderly with neurocognitive disorder have a higher predisposition to fall when compared to other diseases, and that dementia has a high predictive ability for fall in line with several literature report (CIHI, 2016; Gilles et al., 2019; Public Health Ontario, 2020).

Research Question 3 (RQ3)

Antidepressant, antianxiety, antipsychotics, and hypnotics had a statistically significant relationship with fall among Canadians 65+ receiving residential care from 2018 to –2019. Specifically, the odds ratios for fall (which was increased) among those on antipsychotic, antidepressant, and antianxiety category of medications respectively when hypnotics category was used as baseline was also observed. This can be interpreted

that these categories of psychotropic medications combined are predictors of fall among this population of individuals. This study findings resonates with WRHA (2018) report on the use of multiple psychotropic drug (four or more) ability to heightens the risk of elderly individuals to their side effects like fall especially, as this dissertation findings revealed that the risk of fall exists with the combined use of multiple psychotropic medications with positive odd ratios. Interestingly, the four groups combined have a predictability range of 95 to– 100.6% for fall when an elderly individual is on them. Therefore, from the literature, since 25 to 40% of the elderly 65 years and above experience polypharmacy which may be inclusive of psychotropic groups of medication, based on this study's result, it could be interpreted that minimizing the use of psychotropic medication from four to two of the groups in this study reduces the chances of fall by approximately 47–50% with respect to these group. This finding and interpretation also resonates with Vaz and Crockford (2017) report on the need to curtail access to certain prescription drugs which contributes consequentially to substance abuse and inappropriate polypharmacy.

Notably, in terms of the contextual dataset analyzed for this study that spanned 2018–2018, contrary to speculation of a possible overestimation of the impact of antipsychotic use amongst those 65 years and above in Canada, this study rather confirms the speculations of underestimation. This dissertation findings revealed that antidepressant, antianxiety, antipsychotic, and hypnotics use were in high numbers and

robustly significantly associated with fall thus, debunking the overestimated impact of psychotropic medication

Research Question 4 (RQ4)

Overall, although the result from the fourth model –that combined a total of eight levels of the three major independent variables in the test for their association with fall was statistically significant. For all variables combined in the fourth model, it can be observed that the odds ratio of fall increased among those in the cognitive–moderate level category and cognitive–severe level category when cognitive–Intact category was used as baseline. Additionally, the odds ratio increased among those in the dementia–yes category compared to the dementia–unknown status baseline, while the odds ratio of fall decreased among those without dementia. Moreover, among the psychotropic medication variable, the odds ratio for fall decreased among those in the antidepressant and hypnotics category respectively and increased among. This result resonates with this dissertation results finding of that of Laberge and Crizzle (2019) reported that a combination of and singular use of alcohol and psychotropic medications (like benzodiazepines, anti–psychotics, lithium, anti–epileptics, memantine, antidepressants, and anti–hypertensive medications) increases fall risk among the elderly, this dissertation study results findings confirmed that single–handedly, mild, moderate and severe cognitive performance level, dementia, antidepressants, hypnotics, antipsychotic and anti–anxiety group of psychotropic medications are highly predictive of fall under robust multiple logistic regression.

The findings from this study resonate with Dykeman, et al. (2018) position on the need to review and update inadequate fall prevention practices that do not reflect the contextual predictors examined in this study. Moreover, since the descriptive and logistic regression model result in this dissertation uncovers the high figures and predictability of the scrutinized variables for fall it is evidence–based to consider these predictors in conversations and health practices related to fall prevention. Worthy of note is this dissertation alignment with and capitalization upon Laberge and Crizzle (2019) findings on an increase in fall related injuries among elderly Canadians and the need to conduct further inferential study in the Canadian context with current figures is one of the major highlights of this study. Laberge and Crizzle (2019) and Canadian Institute for Health Information, CIHI (2016) emphasized the need for a research study that tests for an association or causal relationship between psychotropic medications and fall. This dissertation MLR design used to examine the relationship between psychotropic medications and fall aligns with Laberge and Crizzle (2019) and CIHI (2016) recommendations.

Importantly, these results confirm Do et al. (2015) speculation on the prevalence and a heightened rise in risk factors for fall especially, as this dissertation results findings revealed that between 2018 and 2019 there was a prevalence of these predictive risk factors of fall among Canadian 65 years and above in residential care. Moreover, the dissertation findings also revealed that the percentage of those affected by these highly

predictive factors for fall was quite significant enough to yield robust statistically significant results between these predisposing factors and fall.

Findings in Context of Social Cognitive Theory

In the context of the theoretical framework foundational to this dissertation-SCT, the statistically significant and predictive odd ratios found between the predictors and fall is relatable to this framework posit of how human behavior and practices, human environment and biological factors are linked and highly predictive of health outcomes, in consonance with several speculations across the literature (CIHI, 2019 ; Glanz et al., 2015; Laberge & Crizzle, 2019; Middleton, et al., 2019; Raingruber, 2014). Notably, two key SCT concepts–reciprocal determinism and self–efficacy applied in this dissertation were also in consonance with the study results.

Reciprocal Determinism

This concept elucidates on the contribution of human behavioral lifestyle/practices interactions that relates cognitive function and social factors to health outcome in a reciprocal manner (Glanz et al., 2015; Middleton, et al., 2019). The noteworthy statistically significant relationships between the predictor variables and outcome unequivocally recognizes the magnitude of their interaction with the elderly 65years and above to cause fall. Thus, the concept of reciprocal determinism is illustrated and observed in the cognitive performance levels, neurocognitive disorder(dementia), use of psychotropic drugs by the elderly (clinicians' prescription) as behavioral and social factors that influence fall occurrence among the elderly. The gradual increase observed in

the relationship between the three cognitive performance levels and fall as seen in the first model results exemplifies how health outcomes (stronger associations with fall) are influenced and reciprocated by human behavior (degree of cognitive performance level severity). This study has confirmed this concept to be valid especially as this population could be affected to one or more of these predictors and the fall outcome in alignment with literature report (CIHI, 2019; Glanz et al., 2015).

Self–efficacy

Another concept of SCT that was be assessed in this study is self–efficacy. This concept that borders on how human behavioral influencers like cognition/personal belief could contribute towards attaining health outcomes in specific setting was displayed in research question 2 results. This study result showed that those participants who had dementia but with lower frequency of fall may have had better master and control over their neurocognitive functions. Thus, there was not statistically significant associated with this category of fall. Whereas those participants who also had dementia but in the higher frequency of fall category may have had lesser control and mastery over their balance and movement which was observed in the statistically significant associations between this category of fall and dementia. In other words, this result confirms how the concept of self–efficacy (humans' ability to control or master their behaviors or functions could yield favorable health outcomes) could also contribute to health outcomes especially, in cases where measures to minimize their fall occurrences among individuals with severe cognitive performance has seen some progress as speculated and reported by

various authors(Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019; Laberge & Crizzle, 2019; Middleton, et al., 2019). Therefore, this result has confirmed that a category of the elderly 65 years and above with fewer fall and negative odd ratio may have had better mastery of their physiological function, coupled with effective existing fall preventive strategies in place for them.

Limitations of the Study

There were a couple of limitation observed in this study ranging from external, internal, construct to statistical conclusion validity issues. Discussed below are the limitations observed in this study.

External Validity

Although a global literature review was conducted for this dissertation, the dataset set used for analysis captured data from seven out of thirteen Canadian provinces from 2018–2019. In addition, the proposal planned to use dataset from 2018–2019 and 2019–2020 however, that of 2019–2020 was not utilized as data points for more provinces were not yet submitted, thus they were missing and could cause an interference with the result as observed in CIHI (2019) and CIHI (2020). Therefore, while the study results maybe generalizable to Canada population, it may not be generalizable to other countries thus threatening its external validity.

Internal Validity

Achieving a high degree of trustworthiness, reliability and internal validity was the at the core of this study. As such it was ensured that the sample size after data

cleaning was adequate (180231) the estimates and interpretation of associations yielded trustworthy association and probability results as observed in chapter 4 results, standard instrumentation adopted in the primary data collection, sampling technique and appropriate study design were used. In addition, various standard measures of effect size ranging from chi square, adjusted $R^{2,}$ coefficients and unstandardized coefficients to log odd ratio were appropriately and adequately reported in chapter 4 in alignment with Wagner (2020) and Warner (2013) recommendation. However, in terms of internal validity some limitations were observed especially, as the dataset used did not capture any specific information on indigeneity, race or ethnicity that was proposed as one of the confounding variables. This limitation occurred due to the ethical boundaries involved in accessing such data. In addition, due to the measurement of the various age–groups datapoint and the undue influence they may have on the models they were eventually omitted as controlling factor.

Construct Validity

Construct validity was ensured in the definition of terms and their consistency used in this study with regards to the dependent and independent variables. Fall, dementia, cognitive performance levels and the psychotropic groups of medication considered in this study maintained their appropriate definition and these terms were consistently used in the study. However, due to the nature of the dataset the specific examples of psychotropic medication(include (1)N05BA–benzodiazepine derivatives, (2) N06AB–selective serotonin reuptake inhibitors, (3) N05AH (diazepines, oxazepines,

thiazepines and oxepines) and (4) N06AX(other antidepressants) in the context of this nomenclature was not utilized rather the broader group of psychotropic medication names(anti–anxiety, antipsychotic , hypnotics, and antidepressant groups of psychotropic medication) were used as captured in the accessed dataset.

Statistical Conclusions Validity

The validity of the statistical conclusions drawn from this study are considered credible and reliable as an appropriate design– multiple logistic regression was used. Moreover, from chapter 4 it is observed that adequate reporting of all measurements, test assumptions, test metrics, statistical relationships and their inferences, effect size and appropriate tables was done. Additionally, precise interpretation of analytic parameters and corresponding procedures was conducted in this chapter as both statistically and not–statistically relationships and other important results were reported and interpreted in the context of this dissertation topic in line with Swart et al.'s (2015) discussion. Nevertheless, the statistical conclusion validity of this study is based on and limited to the used datapoints in the original database, the design and the results reported.

Recommendations Based on Study's Strengths and Limitations

In the context of this dissertation study strengths and limitations, specific recommendations for further research are discussed below. Foremost, from RQ1 results, all cognitive performance levels combined were statistically significant in the prediction of fall especially, with the moderate level and intact level positive predictive odds ratio and the negative predictive odds ratio of the severe level. Thus, this predictive association

between the levels of cognitive performance and fall among Canadians 65+ population in Residential care from 2018–2019 was one strength of this study, which resonated with several report across the literature (CIHI, 2019; Laureate Education, 2017d; Wagner, 2020; Warner, 2013). However, due to the study's limitation of not controlling for extraneous variables such as coexisting neurological and cognitive diseases among these clients that may have impacted the high predictability of the three cognitive levels in this model. Therefore, it is recommended that future research consider the inclusion and influence of race or indigeneity and age–groups datapoints in their analysis. Although a Multiple Logistic Regression design was used in this dissertation, it is recommended that future research use other inferential association–testing and meta–analysis designs to explore more on the relationship between these predictor, extraneous factors, and fall. It is also recommended that future studies consider models and other designs that can control for extraneous factors that could have significant impact on the association and model. Additionally, from RQ2 results that showed a robust statistically significant relationship between dementia and fall, this study was able to establish that dementia is highly predictive of fall however, the stages and types of dementia were not specified in this study. Therefore, future studies that could elaborate more on how the stages and types of dementia predict fall are recommended.

Thirdly, from the result of research question 3 analysis that showed a statistically significant relationship between the four groups of psychotropic medication and fall among the elderly in residential across the specified Canadian provinces emerges one of

this study noteworthy strengths in proving that the implicated groups of psychotropic medication were highly predictive of fall. However, it is important to conduct further research on the association between specific psychotropic drug class codes and fall. The rationale behind this recommendation is that while this study used the broader group of psychotropic medication (antidepressant, antianxiety, antipsychotic and hypnotics), future studies could test for association between specific psychotropic medication class codes and fall. Moreover, future studies that specifically examines the association between polypharmacy, prescription of psychotropic medication, over the counter use of medication and fall may also be considered.

Furthermore, although the fourth model never demonstrated a significant relationship between all predictor variables combined and fall however, from the results interpretation, the predictors single–handed ability to predict fall, it is crucial to consider them all (mild, moderate and severe cognitive performance level, dementia, antidepressants, hypnotics, antipsychotic and anti–anxiety group of psychotropic medications) as impactful singlehandedly and when combined in their positive and negative abilities to predict fall. Importantly, for future studies, it is recommended that a combination of datasets with similar datapoints across different countries be combined to increase the generalizability of the study's result

Implications

Positive Social Change : A Multi–level Perspective

Fall occurrence and its consequential impact ripples across the various societal levels. First, this study's result has the potential to inform, create more awareness, reinforce necessary facts, and assist individual on possible preventive measures that can be taken against these crucial risk factors (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019). Moreover, when individuals gain the knowledge on how cognitive level, dementia and these specific group of psychotropic medication have the high potential to lead to a fall, they are better informed to take part in their own care plan and collaborate with care provider in achieving best outcomes and an overall decline in their fall occurrence. This could save individuals the personal and economic demands of catering to the complications arising from fall.

Secondly, when family members get acquainted with the findings and information conveyed by this study, they could proactively act on them in ensuring that those affected by these contextual predictors take measures to cut down on unnecessary polypharmacy of psychotropic drugs, apply more precautionary lifestyle and care modalities against fall for families with members affected by cognitive impairment, dementia, and other health condition capable of increasing fall risk factors (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019). In addition, at the family level, when family members are increasingly aware of these high predictors of fall discussed in this study, they are more likely to perform better in caring for an elderly or any family member who is affected by

such. Thus, decreasing the economic cost of hiring an in–house caregiver, minimizing the chances of fall and the financial burden of surgical and post–surgical care on family members.

At the organizational level, the potential multidimensional impact of this study findings are (a) the development of more comprehensive fall risk assessment tools (b) better clinical guidelines and collaborative care plan(c) proactive anti–fall practices; informed and guided clinicians practice in their use of psychotropic medication (d) a reduction in fall occurrence among the elderly receiving residential care (community and Long–Term Care) in Canada (d)increased research on predictors of fall (e) training of staff on proactive measures to mitigate fall in care facilities, hospitals, health centers and organizations generally, which aligns with several speculations and discussion across the literature (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019).

At the societal level, this study has the potential to influence societal awareness on predictors of fall and their underestimation; improve policies on fall prevention across all governmental and non–governmental health care institutions; increase funding that caters to fall prevention research among the elderly; policies on better built–in environment; technologies for improved proactive fall prevention and management among others and decrease government spending on fall –related injuries and surgeries among others in line with several literature report (Glanz et al., 2015; Gulati et al., 2012; Healthy people.gov, 2019).

Methodological and Theoretical Implication

The methodological implication of this study is that quantitative analysis of secondary data is crucial for scientific studies as it is a cost–effective, evidence–based, and time–effective research method, capable of yielding reliable findings that could guide practice, real–life decision–making, contribute to the available literature evidence and provide basis for future research as discussed in Glanz et al. (2015). In line with this, future research could still avail this methodology to scrutinize behavioral influences on health outcomes using existing data. In terms of theoretical implication, social cognitive theory has effectively demonstrated that through reciprocal determinism and self–efficacy behavioral, cognitive, and social factors could influence health outcomes. Thus, it is recommended that other concepts of SCT and other behavioral theories in Public Health be adopted in the exploration of health predictors influences and impact on health outcomes.

Recommendations for Practice

Based on this study result to reveal notable predictive relationship between predictors (mild, moderate and severe cognitive performance level, dementia, antidepressants, hypnotics, antipsychotic and anti–anxiety group of psychotropic medications) and outcome(fall) and the sustained high number of fall incidents among elderly Canadians even in more recent years(2018–2021) as observed in CIHI (2020) and CIHI (2021) reports, it is important to understand that more proactive effort to address fall occurrence is still required. Therefore, this study’s practice recommendations are

based on a multisystemic perspective with an electronic digital inclination and current practice guidelines that encompasses the contextual predictors and other predisposing factors to fall reported across the literature (Gulati et al., 2012; Healthy people.gov, 2019).

In terms of practice recommendation, proactive measures to curb predictors of fall among elderly Canadians should take into consideration a multisystemic safety program that is based on a government policy; spans the three–tier of governance; involves a team of multidisciplinary health and non–health experts, health facilities, health educators and promoters, paramedics, law enforcement, Substitute Decision–Maker(SDM) and the elderly(client) family members; has a digital and an on–site platform and technology–based communication network capable for flagging off the elderly with the fall risk. The recommendation should also consider the elderly with an imminent danger or threat in a timely manner; enhanced fall predictors and fall occurrence surveillance capacity and directly in collaboration with local health agency and community organizations that serve the elderly as discussed in Agency for Healthcare Research and Quality (2017) and Hyndman (2018). This type of multisystemic program is jeered towards a national fall prevention strategy.

Additionally, it is crucial that current practice guidelines review and modify their measures and modalities to mitigate fall in the context of the highly predictive predisposing factors scrutinized in this study. From this premise, the need to consider a Fall Risk Assessment Tool (FRAT) in the light of these predictors is crucial especially, as

some existing FRAT reviewed in the literature omitted some of these highly predictive variables which when included would enable a thorough assessment of the highly predictive risk factors in line several literature report (Frieson et al., 2018; Phelan et al., 2016; Seppala et al., 2021). Therefore, based on the result interpretation of the independent variables (mild and moderate cognitive performance levels, dementia, anti–anxiety, antidepressants, hypnotics and antipsychotic psychotropic medications) that were predictive of fall, it is important to have a comprehensive FRAT tool that considers these risk factor in line with several discussions across the literature (Crowe & Stranks, 2018; Do et al., 2015; Soriano, 2013; Olfson et al., 2015; Ferreira et al., 2020; Hansen et al., 2021; Stafford et al., 2021). Moreover, it is recommended that successful existing fall prevention practices are upheld and an update and modification to the existing FRAT tool be done. A suggested FRAT tool that is modifiable to every client peculiar condition is shown in figure 2 below.

Figure 2

A Modifiable Comprehensive Fall Risk Assessment Tool

Modifiable Comprehensive Fall Risk Assessment Tool		
Name of Caregiver: *Date and Time of Assessment*:		
Predisposing Risk Factors	**Levels**	**Score**
Cognition	Mild	1
	Moderate	1
	Severe	1
Neurocognitive Disorder	Dementia	2
Medications	Antidepressant	1
	Antianxiety	2
	Antipsychotic	1

Associated Contextual Risk Factors

	Names/Levels	**Score**
History of fall	< once in 3 months	1
	once in 3 months	2
	> once in 3 months	3
Associated Health conditions that affect balance (Complete as per patient, 1 score per level)		
*Other medications with fall side–*effect *(Complete as per patient, 1 score per level)*		
Routine activities that affect balance (Complete as per patient, 1 score per level)		
Unfavorable home/housing condition (Complete as per patient, 1 score per level)		

Access to regular home help and health services *(Complete as per patient, 1 score per level)*	No access	
	Rare access	
	Irregular access	
Total Score:		
Score Legend: *Low–Moderate risk = 1, Severe risk = 2 – 5, Extremely Severe risk = 6 and above*		
Assessor's Plan		
Initial Plan		
Ongoing Plan		
Long–Term Plan		

Furthermore, in terms of clinical practice, practice guidelines should entail regular review and assessment of client fall risk; regular and collaborative review of deprescribing guidelines by health care providers and organization; consistent and on–demand collaborative review of the elderly medication; maximizing fewer medications to achieve the same actions required from multiple drugs and regular and up–to–date fall prevention strategies training for all health workers and allied professionals in alignment with several reports across the literature (Molnar & Frank, 2019; Deprescribing.org, 2021; Todd, Adam, et al., 2018).

Conclusion

This study has demonstrated the facts that fall occurrences and predictors are potential silent killers which have to an extent been largely dismissed as been overestimated. Strikingly, facts and figures have shown that an elderly Canadian in residential care fall at least one in three months. Therefore, based on these unabating statistics reported across the literature, the scanty or absence of current studies that highlight and uncover the seemingly incremental rise and impact of fall predictors, the economic burden and financial cost of post–fall related complications and other environmental, organic and societal influences contributory toward these poor health outcomes, this dissertation study was propelled and tailored towards curbing this silent yet very consequential poor health outcome.

This study addressing the literature gap of current quantitative and inferential study on these highly predictive risk factors of fall and fall outcome has successfully provided a current perspective to this topic contextually. It is exigent to understand that this study has brought to limelight the current role of mild, moderate, and severe cognitive performance levels, dementia, antidepressants, hypnotics, antipsychotic, and anti–anxiety group of psychotropic medications play on fall outcomes among the elderly in residential care. Thus, this study multilevel, multisystemic and multidimensional perspectives to fall predictors and recommendations at a time like this has driven further the conversations on the “what,” “whys,” “where we are,” “who” and “how” of fall. Conclusively, addressing the underestimated yet dire predictors and impact of fall among

the Canadian elderly in residential care and by virtue of extension, all elderly in Canada and globally should take into context the magnitude of current scientific evidence and as such remains a call to one and all.

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Appendix: Permission to Use CIHIs Dat

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Sent: July 20, 2021 10:09 AM

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Great thanks

[redacted]

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