Fall Risk Factors in Long-Term Care Facilities in Ontario

by

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Abstract

This research was the first large study in Ontario seeking to assess the fall risk factors of long-term care (LTC) residents. Ontario-wide LTC data were provided by the Canadian Institute of Health Information for the period April 2019 through March 2020. Guided by a positivist philosophical orientation, this thesis consolidated existing fall risk factor research using a literature review; developed a concept analysis on the relationship between homeostasis and falls in older adults; and conducted a cross-sectional, retrospective research study on falls in Ontario's LTC facilities. The main research question was: What are the factors associated with falls among residents living in Ontario's LTC facilities? Results showed a significant relationship between variables such as age, sex, diuretic use, visual impairment, dependency in activities of daily living, and cognitive and physical impairments with falls within the previous 30 days. Research results will contribute to the development of more effective falls prevention strategies.

Keywords: secondary data analysis, fall risk factor, long term care, nursing home, concept analysis

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Introduction

Falls can have emotional, psychological and physical consequences for older adults and their families. The Public Health Agency of Canada cites falls as "the leading cause of injury-related hospitalizations among Canadian seniors" (Public Health Agency of Canada, 2014, para 1). Many older adults admit to a fear of falling, which often limits their choice of activities as they withdraw from previously enjoyed activities (Trijillo et al., 2014). The goal of this thesis was to review the current state of knowledge related to falls and to identify fall risk factors in older adults residing in Ontario's long-term care (LTC) facilities.

Organization of the Thesis

This thesis consists of two articles followed by a discussion. The first article examined the concept of homeostasis as it pertained to falls in older adults. The purpose of this article was to conceptually explore the meaning of homeostasis and hypothesize the relationship between homeostasis and falls. In the context of this thesis, this article was a method to operationalize homeostasis and identify its connection to the variables used in the research analysis. The operationalization of the concept of homeostasis has the potential to help researchers better understand how changes in homeostasis influence risk of falls.

The second article presents a study of risk factors for falls in residents in LTC facilities. The purpose of this article was to provide a secondary data analysis on fall risk factors in LTC facilities. The intent was to predict the likelihood of falls in the presence of certain variables. The research question that guided this retrospective, cross-sectional study was: What are the risk factors for falls among residents in Ontario's LTC facilities and what are the regional similarities or differences in fall risk factors for residents of Ontario's LTC facilities?

Significance of the Problem

Falls are a significant financial burden to the Canadian government, costing more than $2 billion a year to the health care system (Accreditation Canada, 2014). About one-third of all older adults in the community experience a fall annually (National Institute for Health and Care Excellence, 2013) and the majority of these falls result in fractures (Public Health Agency of Canada, 2014). The long-term outcome of falls in older adults is increased morbidity (Botwinicka et al., 2016; Kron et al., 2003) and mortality (Public Health Agency of Canada, 2014).

As the Canadian population ages, more older adults seek residence in LTC facilities. Older adults in LTC facilities experience more falls and increased morbidity post-falls (Botwinicka et al., 2016) as well as higher rates of hip fractures than their counterparts in the community (Thorpe et al., 2017). It could be that there are more falls in LTC settings as a result of the changes to admission criteria initiated in 2010 where residents are now more likely to be frail with advanced age and decreased mobility (Ontario Long-Term Care Association, 2019a).

The purpose of this thesis is to better understand regional characteristics that may be related to falls in residents who are living in Ontario's LTC settings. The findings from this work may lead to modifications to existing falls assessment instruments and fall prevention strategies to include regional characteristics. The results of this research could inform education modules related to fall risks that might be used by nurses, care aides, older adults and family members.

Literature Review

Falls in Residents of Ontario's Long-Term Care Facilities

The aim of this narrative review was to explore characteristics associated with falls in LTC facilities in Ontario. This literature review served three purposes: 1) to review the research

on fall risk factors for residents living in Ontario LTC facilities; 2) to explore regional differences in community-based and LTC facility–based falls, such as seasonal variations and urban/rural patterns; and 3) to highlight the literature gap that this research study sought to fill.

The Cumulative Index to Nursing and Allied Health Literature (CINAHL), ProQuest Nursing and Allied Health Source, AgeLine and Google Scholar databases were searched. Since the study was solely concerned with residents in Ontario's LTC facilities, effort was made to identify previous research focused on this population. Where information was scarce, a wider search was conducted to include national and international articles on older adults in LTC settings and, at times, other populations (i.e., older adults living in the community). The search terms used to identify articles were: fall risk factors; falls in older adult AND long term care OR nursing homes; falls AND long term care; falls AND Ontario; fall risk factors AND nursing homes OR long term care OR residential care OR residential aged care; accidental falls; accidental falls AND Canada. In addition, references from identified articles were searched for other relevant articles.

The literature search process was extensive. No date limitation was specified when Canadian studies were searched but parameters of 2000–2020 were applied when searching globally because of the large number of articles retrieved. Over 50,000 studies were retrieved based on the search and articles were eliminated based on the following exclusion criteria: non-LTC populations, homogenous LTC populations (i.e., studies that only included LTC residents with dementia) and studies using videography as a method.

The literature search retrieved 16 studies that reported risk factors for falls in LTC settings globally. Studies showed that history of falls, medications, chronic illnesses, cognitive disturbances, physical impairment and increased age are risk factors for falls (Krueger et al.,

2001; Izumi et al., 2002; Kallin et al., 2002; Kron et al., 2003; Kerse et al., 2004; Fonad et al., 2008; Lee et al., 2008; Damián et al., 2013; dos Reis & de Jesus, 2015; Sousa et al., 2016; Dhargave & Sendhilkumar, 2016; Macri et al., 2017; Neto et al., 2017; Cameron et al., 2018; Zhang et al., 2019; Castaldo et al., 2020). Some studies identified some seasonal and climate influences on fall incidence within the general population (Morency et al., 2012; Bélanger-Bonneau et al., 2002; Stevens et al., 2007; Lantos, 2019). Icy/slippery surfaces (Morency et al., 2012; Bélanger-Bonneau et al., 2002), an increase in fall fatalities in December (Stevens et al., 2007) and an increase in fall fatalities in states with colder climates (Lantos, 2019) were all identified as seasonal fall factors. A few studies briefly discussed urban versus rural significance in LTC falls (Thorpe et al., 2017; Towne et al., 2017; Zhang et al., 2019). No studies were found comparing falls in LTC residents living in geographically diverse settings.

The following section chronologically reviews Canadian and global articles on fall risk factors in LTC facilities.

Identified Fall Risk Factors in Long-Term Care

Krueger et al. (2001) conducted a prospective case-control study to identify risk factors for falls and injuries in residents of a Canadian LTC facility. Over a year (July 1996 through June 1997), they followed 335 residents from St. Joseph's Villa in Dundas, Ontario (Hamilton-Wentworth Region). Data were extracted from residents' charts, and 27 variables were collected for analyses, including background and demographic factors, medical diagnoses, fall risk as assessed by facility nurses and fall incidents. Results showed that 52.8% of residents suffered a fall and 65% of those that fell had multiple falls. The authors found 10 of the 27 variables to be statistically significantly associated with falls, with the most important risk factors being a history of falls (within the past three months) ($p = .00$), level of care (living in a secured unit)

(p = .00), length of stay equal to or greater than two years (p = .00), potential for injuring others (exhibiting aggressive behaviour) (p = .00), and having illnesses, diseases or behaviours that were associated with falls (i.e., arthritis) (p = .02). They also found that the single most important factor associated with injury during a fall was altered mental state (i.e., confusion, poor judgment, restlessness), with these residents being 2.51 times more likely to suffer an injury than residents without altered mental states.

In Japan, Izumi et al. (2002) conducted a prospective study using 10 facilities. Three of those facilities were nursing homes (n=207) and, for the purposes of this review, only the results collected from the nursing home residents are discussed. Common fall risk variables (history of falls, altered mentation and limited mobility) were isolated from a review of fall risk assessment scales and used in a scale to identify common risk factors for falls in different settings. Participants were followed for up to three months. Results for the nursing homes showed a 12.5% incidence of falls and the final model showed only history of falls (p = .01) and the interaction between history of falls and assistance for elimination (p = .00) as significant factors for falls.

Kallin et al. (2002) studied 83 residents living in one residential care facility in Sweden to determine predisposing and precipitating factors for falls using a prospective, cross-sectional study. Participants were first given a baseline assessment by a physician, physiotherapists and a nurse, and then followed for a year. Variables that were collected included incidences of falls, injuries from falls, medication use, diseases and illnesses, and ability to perform activities of daily living (ADLs). Results showed an incidence rate of 2.29 falls per resident annually and 53.8% of residents who fell sustained injuries. Using a logistic regression analysis, variables positively associated with falling were the use of antidepressants (p = .02), impaired vision

(p = .04) and needing assistance with stairs (p = .02). Acute illnesses/diseases and drug side effects were associated with 28% and 8.6% of the falls, respectively. The authors concluded that falls should initially be seen as an effect of drugs or a symptom of disease.

In their prospective, observational study, Kron et al. (2003) looked at annual accidental fall risk factors at 472 LTC residents in Germany. The authors also looked for differences between single and recurrent fallers. Data were collected from the organizational charts and reports. Demographic, mobility, health and medication variables were statistically tested for significance using statistical software. Results showed that 247 residents had 980 falls. Overall, 21 variables showed strong associations with risk of falls, with the statistically significant variables being short-term memory loss (p = .05), transfer assistance (p = .00), urinary incontinence (p = .00), positive fall history (p = .00) and use of trunk restraints (p = .00). Depressive symptoms (p = .05), transfer assistance (p = .00), urinary incontinence (p = .01), and positive fall history (p = .00) were significant for recurrent fallers. Findings revealed that moderately dependent residents were more at risk of falls than independent or severely dependent residents.

Kerse et al. (2004) conducted a prospective cohort study in New Zealand to find rates and associated risk factors for falls and injuries. The study included 606 residents of residential care facilities who were monitored for falls and fall-related injuries for 18 months. Demographic information and health status variables were collected from facilities' medical notes and questionnaires. Facility-specific variables such as staffing ratios, routine fall prevention practices and sedation ratios were also collected. The data were analyzed using descriptive statistics which found an incidence of 2.75 falls per resident annually. Using multivariate analysis, variables found to be associated with increased falls were: having greater mobility, Parkinson's disease,

and having a fall or fall-related injury in the past year. P-values were not reported in this study. Interestingly, digoxin use and having a higher self-care score (more independence in self-care activities) were associated with a lower incidence of falls. Facility-specific variables were not found to be associated with falls.

In a Swedish study spanning four years (2000–2003), Fonad et al. (2008) sought to identify fall risk factors in five nursing homes. A total of 2,343 incidents from 2,651 residents were examined in an aggregate fashion. Staff nurses provided information on residents' fall risk assessments, falls, fractures, use of medications and restraints. Results found a positive association between fall risk and use of antidepressants ($p = .00$) and fractures ($p = .00$). There was a positive association between falls and the use of sleeping pills containing benzodiazepines ($p = .01$). Findings also showed a negative association between fall risk and wheelchair use ($p = .00$), safety belts ($p = .00$) and bed rails ($p = .00$), meaning the fall risk decreased with the use of a wheelchair, safety belt or bed rails. The authors note that this equipment may be viewed as protective measures.

Lee et al. (2008) conducted a cross-sectional study with 1,710 non-bedridden residents in Hong Kong nursing homes to identify fall risk factors and the effect of restraints on falls. Data on residents were gathered from residents, staff and residents' records using the Resident Assessment Instrument-Minimum Dataset (RAI-MDS) 2.0. The collected variables spanned the 22 sections of the assessment instruments, including demographic information, disease diagnoses, activity pursuits and psychological well-being. Results showed a positive association between falls in the past 180 days and visual impairment ($p = .00$), dementia ($p = .02$), number of medications ($p = .02$), use of psychotropic medications ($p = .00$) and increased age ($p = .01$). The

authors found that women were less likely to fall than men (p = .01). Restraints were used in 68% of the study population and had a borderline association with fewer falls (p = .05).

In Spain, Damián et al. (2013) sought to identify the frequency of falls and associated fall factors in residents 65 years and older residing in LTC institutions. Stratified cluster sampling from 47 facilities was used to select study participants (n=733 residents) residing in the facilities for more than 30 days. Questionnaires were used to collect information such as falls, sociodemographic variables, functional status, cognitive status, diseases/conditions and polypharmacy. Results showed that variables positively associated with falls were the number of diseases (strongest association), urinary incontinence, use of antidepressants, arrhythmias and polypharmacy. P-values were not reported for these findings.

Dos Reis and de Jesus (2015) conducted a cohort study in Brazil to determine the incidence and characteristics of falls using fall risk factors identified from the North American Nursing Diagnosis Association-I manual. Two hundred and seventy-one participants 60 years and older were followed for a period of six months. Cognitively intact participants were interviewed and, in cases of cognitively impaired participants, caregivers and medical records were accessed. The Mini Mental State Examination (cognitive evaluation), the Index of Independence in Activities of Daily Living and the Tinetti Balance Assessment Tool were used to assess participants. Results showed a mean age of 79 years and a fall incidence of 41%. The study found that having a history of a fall within the past six months (p = .03), stroke (p = .05), more than five chronic diseases (p = .00), a foot problem (p = .00) and the ability to ambulate (p = .02) were all significantly associated with having a fall. The study also found that the nursing diagnosis manual demonstrated high validity in detecting residents at risk of falling using the five significant conditions.

Another Brazilian study conducted by Sousa et al. (2016) looked for factors associated with risk of falls in 61 residents of two LTC institutions for more than three months. Data was collected through an examination of residents' medical records and the Downton Fall Risk Index. Results showed a mean age of 73.5 years and a positive association between fall risk and female sex ($p = .01$), age ($p = .00$), length of institutionalization ($p = .03$), the occurrence of adverse events ($p = .00$), use of medication ($p = .04$), number of drugs ($p = .04$), use of auxiliary equipment ($p = .02$), walking safely ($p = .04$) and history of falls in the last 12 months ($p = .00$).

In India, Dhargave et al. (2016) conducted a cross-sectional study in four geriatric homes. They looked at a sample of 163 residents over 60 years of age who were able to mobilize independently (with or without assistive devices). The authors administered a questionnaire collecting information on key variables, such as history of falls, sociodemographic data, medical conditions, mobility status, medication use and fear of falling. A physical assessment was also conducted by a physiotherapist using the Long-Term Care Fall Risk Assessment Form, the Mini Mental State Examination, the Berg Balance Scale and the Dynamic Gait Index. Based on their tests results, participants were divided into high-risk and low-risk groups for falling. Variables with strong associations with falls within the high-risk groups were history of falls ($p = .00$), poor vision ($p = .00$), multiple medication use ($p = .02$), chronic diseases ($p = .00$), use of walking aids ($p = .04$), imbalance and vertigo ($p = .00$). Females had a greater risk of falling than males ($p = .00$).

In their population-based, matched, retrospective cohort study set in Ontario, Canada, Macri et al. (2017) hypothesized that there was a positive relationship between antidepressant changes and risk of falls. They sought to determine whether the initiation of different classes of antidepressants was associated with falls or fall injuries in Ontario LTC facilities from 2008

through 2014. The study sample included all Ontario LTC residents over 66 years of age who were newly prescribed one antidepressant compared to those without antidepressant prescriptions. Data were obtained from the Institute for Clinical Evaluative Sciences' health database. The authors looked at variables such as age, sex, falls, injuries, ADL scores, history of psychiatric conditions, fall-associated medical conditions, number and types of prescribed medications, and health service utilization (i.e., emergency room visits). Findings showed that irrespective of antidepressant class, there was a statistically significant increased risk for falls (~ two-fold; $p = .00$) and fall-related injuries in all participant subgroups regardless of participant variables (i.e., age, sex, history of falls and ADL impairment). They also found associations between antidepressant use and hip fracture ($p = .00$), and antidepressant use and having a fall resulting in emergency department visit or hospitalization ($p = .00$).

Neto et al. (2017) conducted a cross-sectional study based in Brazil to analyze fall prevalence and fall risk factors in older adults residing in LTC facilities. The study sample consisted of 45 residents aged 60 years or older without altered cognitive activity who resided in one of two LTC facilities. Data consisted of sociodemographic and health data, medication, a chart review and the Berg Balance Scale. The study found 66.7% prevalence of falls in the sample population. Limitation of movement ($p = .01$) was found to be statistically significant in positively influencing residents' falls while age and number of medications were not. The presence of previous diseases ($p = .05$) had borderline significance.

Cameron et al. (2018) sought to identify risk factors for falls in LTC facilities in Nova Scotia, Canada, using a cross-sectional study design. Secondary data analyses of 395 LTC residents evaluated the relationship between falls and cognition, diagnosis of dementia, falls/number of falls, drug count (polypharmacy), potentially inappropriate medications

(according to the Beers list), frailty, visual impairment, how the patient physically transfers and mobility. The sample was mostly female residents, with an average age of 85 years for all participants. The authors found that males had more falls than females (14.5% and 6.1%, respectively; $p = .02$); although when adjusted for frailty, sex became borderline significant ($p = .06$). Findings also showed that dementia ($p = .03$), use of selective serotonin reuptake inhibitors (a type of antidepressant; $p = .01$), visual impairment ($p = .02$) and potentially inappropriate medications ($p = .03$) were statistically significant for increasing fall risk. Interestingly, the use of benzodiazepines was associated with a reduced number of falls ($p = .01$). Frailty and polypharmacy were not found to be risk factors for falls.

In their cross-sectional study, Zhang et al. (2019) looked at epidemiological characteristics and factors associated with falls of residents in LTC facilities. The sample for this study was 218 participants, 60 years and older, residing in 13 randomly selected LTC facilities in Xiamen, China. Study participants were followed for one year. Results showed that 71% of participants who fell were females ($p = .00$) and 85% of the fallers resided in urban LTC settings ($p = .05$). Personal variables that were associated with increased falls were poor balance and gait, chronic medical conditions, decreased cognitive status, sensory loss, poor living environment, poor footwear and poor foot health (p-values were reported as $p < .01$ for all variables).

In a one-year longitudinal study in Italy, Castaldo et al. (2020) looked at residents of nursing homes to find risk factors for falls and to identify distinguishing characteristics of residents who fall. The authors used a convenience sample consisting of 409 residents from two nursing homes. Study data collected from clinical records and incidence reports included demographic, clinical, medication, and fall events. Specific variables to be tested were history of falls, mobility problems, comorbidity, cognitive function, psychotropic drugs, physical restraints

and type of unit (i.e., geriatric unit and specialized dementia unit). Results showed a 27% prevalence of falls, with more men than women falling (p = .03). In addition, a higher percentage of patients in the specialized dementia units fell and about one-third of all falls noted in the study involved an injury. Variables that were statistically significant for falls in a multivariate analysis were history of falls (p = .00), residing in a specialized dementia unit (p = .02) and having moderate to high autonomy in ADLs (p = .00). Psycholeptics (i.e., antipsychotics, anxiolytics and sedatives) were found to have positive borderline significance for falls (p = .05).

The following section chronologically reviews community-based literature on seasonal/climate effects on falls.

Seasonal/Climate Effects

The literature search revealed seasonal and climate variations in fall incidents. The search found studies that identified seasonal influences on outdoor falls in many populations, including LTC facilities, but no studies solely focused on outdoor falls at LTC facilities. Four community-based studies that highlight seasonal and/or climate influences on falls are reviewed below.

In their retrospective study, Stevens et al. (2007) looked for seasonal patterns of falls in older adults in the United States. The original data for fatal falls were obtained from the National Center for Health Statistics' annual mortality tapes from the Centers for Disease Control and Prevention and data for non-fatal falls were obtained from the National Electronic Injury Surveillance System All Injury Program. All data were for adults aged 65+ years and the study period was December 2001 through November 2002. The data were analyzed separately for men and women. Results showed no seasonal patterns for men or women for either fatal or non-fatal groups; however, results did show a higher annual fatal fall rate (9.1% higher) in colder climates

than in warmer climates. Higher death rates were noted in colder climates in winter, spring and autumn.

In their population-based study in Quebec, Canada, Morency et al. (2012) looked at all falls in Laval and on Montreal Island in December 2008 and January 2009 that required ambulance intervention. The data, which included falls from all populations, including LTC residents, was used to map the "distribution of winter outdoor falls, with particular reference to meteorological conditions" (p. 218). Urgences-santé Corporation ambulance service provided falls data such as descriptors of falls and geographic coordinates, while Environment Canada's website provided information on meteorological circumstances during each outdoor fall. Results showed that 29% (690 falls) of all recorded falls occurred outdoors and people that fell outdoors tended to be younger than those who fell indoors. Records from ambulance attendants associated 72% of outdoor falls with ice, snow and/or slipping. When looking at meteorological data, 47% of outdoor falls occurred during weather events favourable to the development of freezing rain and icy sidewalks (i.e., rain with a subsequent drop in temperature).

Morency et al. (2012) conducted a secondary analysis of data reporting outdoor falls of adults more than 55 years old living in Laval and on Montreal Island between 1997 and 1999. The results from this study showed that most falls occurred on public sidewalks and roadways, with the most cited cause being ice and snow. There were also peaks in falling during both summer and winter (January) seasons.

Lantos et al. (2019) conducted a study in Hungary on data from 1995 through 2014 focusing on seasonal variation of mortality. They analyzed data obtained from the Hungarian Central Statistical Office's nationwide population registry. Results showed that falls were the second highest external cause of death and that 86% of all deaths related to falls were in the 60+

age group. In addition, there was a significant overall peak in mortality rates from accidental falls in December (p = .00), and a peak in January for females only (p = .00).

Synthesis of Studies

The reviewed articles were conducted in various global settings within LTC facilities and in the community. Taken together, falls were associated with some similar variables in many of the studies (see Table 1 in the Results section of the Research Study chapter of this thesis for summary of risk factors for falls). The most common factors associated with residents who fell were needing assistance with ADLs, a history of falls, illnesses/diseases, the use of medications and cognitive impairment (Krueger et al., 2001; Izumi et al., 2002; Kallin et al., 2002; Kron et al., 2003; Kerse et al., 2004; Fonad et al., 2008; Lee et al., 2008; Damián et al., 2013; Dhargave et al., 2016; Sousa et al., 2016; Macri et al., 2017; Zhang et al., 2019; Neto et al., 2017; Castaldo et al., 2020; Cameron et al., 2018). Less common factors associated with falls were fear of falling (Dhargave et al., 2016), number of years residing in institutions (Krueger et al., 2001; Sousa et al., 2016), restraint usage (Kron et al., 2003) and environmental factors (Zhang et al., 2019).

In this section of the thesis, the reviewed studies were synthesized in common variable groupings such as ADLs and movement.

Activities of Daily Living and Movement. In studies where ADLs were associated with participants who fell, different levels of abilities in completing ADLs were found to influence fall risk (Kallin et al., 2002; Izumi et al., 2002; Kron et al., 2003; Kerse et al., 2004; Dhargave et al., 2016; Zhang et al., 2019, Neto et al., 2017; Castaldo et al., 2020). Kron et al. (2003) found a higher incidence of falls during transfers for moderately dependent residents than for non-dependent and heavily dependent residents. Other authors found that residents needing walking

aids (Sousa et al., 2016; Dhargave et al., 2016), having vertigo (Dhargave et al., 2016), having poor balance and gait (Zhang et al., 2019), and having limitations in movement (Neto et al., 2017) were at higher risk of falls. In contrast, other studies found that residents who did not require walking aids and had a moderate to high degree of autonomy (Kerse et al., 2004; Castaldo et al., 2020), residents who could ambulate (dos Reis & de Jesus, 2015) and residents with a normal, steady walking pattern (with or without aid) (Sousa et al., 2016) had an increased risk of falling. Izumi et al. (2002) found a positive interaction between needing assistance for elimination and having a history of falls.

History of Falls. A History of falls was strongly associated with subsequent falls (Krueger et al., 2001; Izumi et al., 2002; Kron et al., 2003; Kerse et al., 2004; Dhargave et al., 2016; Castaldo et al., 2020); however, different studies used different definitions for a history of falls. One study defined a history of falls as a fall within the past three months (Krueger et al., 2001), two studies defined it as a fall within the past 180 days (Kron et al., 2003; Castaldo et al., 2020), other studies classified it as a fall in the previous year (Kerse et al., 2004; Dhargave et al., 2016), while yet another study defined it as a fall within the past two years (Izumi et al., 2002). Regardless, the correlation between a history of falls and subsequent falls had strong statistical significance in many studies.

Medical Conditions. The association between diseases and chronic illnesses such as cognitive impairment, depression, vertigo, poor foot condition, dementia diabetes and heart conditions, and falls was statistically significant in some of the reviewed studies (Krueger et al., 2001; Kerse et al., 2004; Lee et al., 2008; dos Reis & de Jesus, 2015; Cameron et al., 2018; Kron et al., 2003; Dhargave et al., 2016; Zhang et al., 2019, Neto et al., 2017; Damián et al., 2013).

Medications. Different aspects of medication use were also statistically significant in the reviewed studies. Polypharmacy, using multiple medications, was positively associated with falls in four studies (Lee et al., 2008; Damián et al., 2013; Dhargave et al., 2016; Sousa et al., 2016). The use of antidepressants (Kallin et al., 2002; Fonad et al., 2008; Cameron et al., 2018; Damián et al., 2013) and specifically newly initiated antidepressants (Macri et al., 2017) were also positively associated with falls.

Restraints. The use of restraints is a controversial topic in LTC. In Ontario, the *Patient Restraints Minimization Act* (Government of Ontario, 2001) directs LTC homes to decrease the use of restraints to a last resort. Three studies found restraints to be associated with falls, although in contrasting ways (Kron et al., 2003; Fonad et al., 2008; Castaldo et al., 2020). Kron et al. (2003) found that the use of trunk restraints increased the likelihood of falls; Castaldo et al. (2020) found that residents in physical restraints, excluding bed rails, had fewer falls; and Fonad et al. (2008) found that residents that used safety belts and bed rails had less falls.

Sex. The results for this variable were contrary in the reviewed studies. LTC homes commonly have more female than male residents and this was certainly seen in the reviewed studies overall having more female than male participants. When the variable of sex was statistically analyzed relative to falls, three studies (Dhargave et al., 2016; Sousa et al., 2016; Zhang et al., 2019) found that females were more likely to fall, while two studies found that males were more likely to fall (Lee et al., 2008; Castaldo et al., 2020). Another study showed borderline significance for males having more falls after the data was adjusted for frailty (Cameron et al., 2018).

Season/Climate Effects. Four articles on seasonal and climate variations in fall incidents were found. They had non-LTC participants and were population-based, secondary data analyses

from different countries (Canada, Hungary and United States). The studies by Bélanger-Bonneau et al. (2002) and Morency et al (2012) were similar in concept but differed in that the population in the former study was more focused on older adults. Even with this narrowed focus, caution has to be taken in associating falls from icy outdoor conditions and generalizing these findings to LTC residents ambulating mostly indoors. Caution must also be taken in applying the similar studies' findings of greater falls during icy outdoor conditions to the LTC residents since neither study focused solely on this population.

Morency et al. (2012) disclosed that intentional falls (i.e., suicide, assault or fight) were excluded from their analyses. This same exclusion of intentional falls was not noted by Bélanger-Bonneau et al. (2002)'s earlier study. In addition, since both studies used records from ambulance services, only falls that resulted in injuries warranting transfer to a hospital were included. Outdoor falls without injuries or with minimal injuries were excluded. Morency et al. (2012) recognized this limitation, stating, "this study underestimates the total number of outdoor falls" (p. 221) and Bélanger-Bonneau et al. (2002) noted that the data presented made up just "the tip of the iceberg" (p. 39) on falls. Public Health Agency of Canada (2014) data, which shows that between 2003 and 2010 the second most common activity preceding a fall was walking on snow or icy surfaces, supports the results from Morency et al. (2012) and Bélanger-Bonneau et al. (2002).

Like these two studies, where data were only recorded if injuries sustained were severe enough to warrant a trip to the hospital, Lantos et al. (2019) collected non-fatal data from emergency department records. In other words, only falls that resulted in injuries treated in an emergency department were included, again underestimating the number of non-fatal falls since many falls do not require a visit to the emergency department. With the exclusion of these other

falls, it is possible that other seasonal or climatic patterns were missed. Better methods are needed to capture non-injurious falls for a more robust analysis.

Stevens et al. (2007) found that fall fatality rates were higher in colder climates than warmer climates. This result is interesting, especially since they found no seasonal fall patterns. The authors posit that there may be something about living in a colder climate that puts individuals at a higher risk of fall fatalities, for example, being lower in vitamin D. Unfortunately, the authors were unable to assess for similar climate patterns in the non-fatal fall data due to the sampling methodology used for the dataset. The question of whether the climate influence persists in non-fatal fall data will have to be answered by future research.

Urban/Rural Factors. Two reviewed studies conducted in urban Canadian locations (Laval and Montreal Island) found that freezing rain and icy sidewalks (Morency et al., 2012) and ice and snow (Bélanger-Bonneau et al., 2002) were factors in the increased number of falls in the winter. In addition, Morency et al. (2012) found that most outdoor falls occurred in central neighbourhoods and commercial streets, which are mainly found in urban centres. This finding is corroborated by Lai et al. (2011)'s finding that hot spots for falls were found in urban areas in locations such as wet markets, where the ground is slippery because of water use for food products, and at junctions (intersections) where there is rushing/pushing due to busyness. It can also be inferred that rushing/pushing would not be a common cause for falls in rural areas since busy intersections are few and far between in such locales.

Some studies showed that location in an urban region and the size of population centres had a significant impact on falls. In their study in 13 LTC facilities in China, Zhang et al. (2019) found that the majority of fallers resided in urban locations (85.5%; $p = .05$). In their analysis of incidences of hip fractures in all LTC homes in Saskatchewan, Thorpe et al. (2017) found that

the size of the population centres where the LTC facilities were situated mattered more than their rural or urban designations. Overall, hip fracture rates were lower in medium-large population centres than in small urban and rural population centres. Examining hip fracture rates is important because Nyberg et al. (1996) reported that 95% of hip fractures sustained by older adults were caused by falls and could be used as a marker for falls when interpreting studies. In contrast, Towne et al. (2017) did not find any significant predictive associations between urban/rural areas and falls. Johnson et al. (2016) noted that more research is needed to identify any fall risk factors in residents living in rural versus urban locations.

Johnson et al. (2016)'s study of the experiences of rural fallers in Saskatchewan found that there was a lack of health care resources in rural communities. This suggested that rural dwellers may have more difficulty accessing health care services and benefits. For instance, individuals in need of LTC have increased frailty (Centre for Studies in Aging and Health, 2010) and care needs that are harder to meet in rural communities (Keating & Eales, 2012). Johnson et al. (2016) argued that limited access to services can cause older individuals to stay in their homes longer than is safe, therefore increasing fall risk.

In addition, Chan et al. (2012) found an association between dwellings in disrepair and a higher risk of falls among older adults. Nearly half of Ontario's LTC homes were built in the 1970s and are now in need of internal and external upgrades (Ontario Long Term Care Association, 2016). More research is needed to ascertain if falls in urban or rural areas are influenced by the poor condition of some LTC facilities.

Critique of Studies

Overall, the state of knowledge in relation to risk factors for falls in older adults living in LTC settings is of average strength. Some of the factors contributing to the strength of this

knowledge are strong sampling techniques, such as using participants from multiple LTC sites and the consecutive sampling approach used in most studies. Some threats to the strength of knowledge are the lack of province-specific studies and a consistent definition for falls in all studies.

In general, the sampling techniques used in the included studies strengthened the state of knowledge. Sampling techniques are an important aspect to consider in evaluating the state of knowledge related to a topic area because inadequate samples might not produce study results that accurately reflect the chosen population (Polit & Beck, 2017). Most of the studies in this review employed a non-probability, consecutive sampling approach (Krueger et al., 2001; Kron et al., 2003; Dhargave et al., 2016) where all residents in the accessible population who met the inclusion criteria were selected, though one study was limited in its sampling approach because the authors analyzed secondary data (Cameron et al., 2018). According to Polit and Beck (2017), consecutive sampling is the best approach to use in a contained accessible population with rolling enrolment, such as LTC facilities. As a result, the risk of bias is reduced, which improves the data and further strengthens the produced knowledge.

Few researchers evaluated the adequacy of their sample size while most studies were multisite studies. Only two research groups, Zhang et al. (2019) and Neto et al. (2017), used sample calculations to estimate adequate sample sizes to ensure enough power for their studies. On the other hand, the state of knowledge was strengthened by the majority of studies including residents from multiple LTC facilities (Izumi et al., 2002; Kron et al, 2003; Kerse et al., 2004; Fonad et al., 2008; Zhang et al., 2019; Dhargave et al., 2016; Neto et al., 2017; Castaldo et al., 2020; Cameron et al., 2018). Though Krueger et al. (2001) only included residents from a single facility, their sample size was comparable to other studies who sampled residents from multiple

facilities. Overall, the sizable number of participants in most of the reviewed studies strengthens the reliability and validity of the state of knowledge because it increases the sample's heterogeneity.

While many of the studies had samples that were representative of the wider LTC population (Krueger et al., 2001; Fonad et al., 2008; Sousa et al., 2016; Macri et al., 2018; Kron et al., 2003; Zhang et al., 2019; Castaldo et al., 2020), others had questionable inclusions and exclusions. Two studies (Kallin et al., 2002; Kerse et al., 2004) combined residents from different types of residential facilities even though not all residents were nursing home residents according to Ontario standards of needing around the clock nursing care (Ontario Long-Term Care Association, n.d.). Some residents lived in senior living apartments with limited help from staff (Kallin et al., 2002) and some lived in hostels and rest homes (Kerse et al., 2004). Other studies excluded residents with specific characteristics, such as residents that were unable to mobilize, had severe medical conditions or were uncooperative (Dhargave et al., 2016); cognitively impaired residents (Neto et al., 2017); and terminally ill residents (Castaldo et al., 2020). The authors of these studies did not provide reasons for their exclusions, which are problematic since those populations represent a significant proportion of LTC residents. In 2015–2016, 87% of residents in LTC facilities were affected by some form of cognitive impairment and 69% by dementia (Canadian Institute for Health Information, n.d.). The generalizability of some studies was also in question because of the overrepresentation of residents with emergency ambulance calls (Cameron et al., 2018) and the exclusion of 300 residents in units under restructuring efforts (Castaldo et al., 2020). As a result, the overall strength of the evidence generated in these studies is limited in its validity (are they really

measuring what they purport to measure?) and its reliability (are the results representative of the general LTC population?).

While most of the researchers presented prevalence rates, they are not representative of the heterogeneous population of LTC residents. The prevalence of falls was wide ranging between the studies: Dhargave et al. (2016), 28.8%; Krueger et al. (2001), 52.8%; Izumi et al. (2002), 12.5%; Cameron et al. (2018), 98.7%; Kron et al. (2003), 52.3%; dos Reis & de Jesus (2015), 41%; Castaldo et al. (2020), 27%; Zhang et al. (2019), 31.7%; Neto et al. (2017), 66.7%. On closer examination, some confounding factors might be associated with the variation in these numbers. Cameron et al. (2018) had an overrepresentation of residents with emergency ambulance transfers, Dhargave et al. (2016) excluded residents who had severe medical conditions and were uncooperative, and Castaldo et al. (2020) excluded residents in restructuring units and those who were terminally ill. Consequently, prevalence rates that are not representative of the target population are expected for these homogeneous samples. Similarly, Neto et al. (2017) excluded residents with altered cognitive activity but their prevalence rate for falls remained high at 66.7%. It is clear that there are still undetermined factors influencing the prevalence of falls in LTC facilities worldwide to give such wide-ranging results. These factors may be unique to individual countries and caution should be used in generalizing results from one country to another. More research is needed to strengthen the state of knowledge regarding prevalence rates in LTC facilities.

Another factor is that the majority of the data in these studies was self-reported, creating a risk of reporting bias. In general, studies that rely on reported falls and fall factors can have issues with unreported/undocumented falls since these events are often not included in residents' charts if they went unreported by the resident or if they were undocumented by staff (Cameron

et al., 2018). In addition, frailty data, medication dosing indications and degree of visual impairment were lacking in Cameron et al. (2018)'s study sample, and some fall risk assessments were missing data values in Krueger et al. (2001)'s study. Likewise, Kron et al. (2003) noted that because of the difficulty in assessing residents with dementia for certain symptoms (i.e., visual problems or depressive symptoms), the study may have under-represented such variables, leading to an inaccurate evaluation of certain variables in the fall risk assessments. Taken together, missing and misreported data in these self-report databases weaken the strength of knowledge.

Each of the reviewed studies used data collection tools such as scales, questionnaires or assessment instruments but few addressed the validity and/or reliability of those instruments in the LTC environment. Lee et al. (2008) used the translated version of the RAI-MDS 2.0 and reviewed research on the tool's validity and reliability. Zhang et al. (2019), who used the Falls Risk for Older People-Community Setting Scale and revised it for the LTC population, acknowledged that its validity might have been compromised. Neto et al. (2017), who used the Berg Scale in assessing residents' balance, adapting it for use in Brazil, did not discuss any reliability or validity problems from this modification. In general, not reviewing a tool's validity and reliability may threaten the validity of the studies' evidence and negatively impact the state of knowledge. Caution should be used when interpreting evidence and attempting to draw knowledge from studies that used unverified tools.

The definition of a fall was not operationalized in some of the reviewed articles. Most studies used the World Health Organization's (2007) definition of a fall being an unintentional change in position causing someone to rest on the floor or a lower surface (Sousa et al., 2016; Dhargave et al., 2016; Castaldo et al., 2020) or a similar definition (Kallin et al., 2002; Kerse

et al., 2004; Fonad et al., 2008; dos Reis & de Jesus, 2015). However, three studies did not explicitly state their definition (Krueger et al., 2001; Damián et al., 2013; Cameron et al., 2018), which is a significant oversight since different operational definitions of a fall will lead to diverse research findings. The definition of a fall changes depending on who is defining it. For example, some may define a fall as a loss of balance, while others only count injurious falls (World Health Organization, 2007). Since many of the studies provided differing definitions of a fall, and three studies did not provide a definition at all, this inconsistency in variable operationalization possibly weakens the validity of the information.

The above critique outlined some limitations in the reviewed LTC studies. While these limitations of not consistently defining study variables, excluding some portions of the LTC population from certain studies, and having missing or unreported data threaten the body of knowledge in the area of fall risk factors in LTC, the studies' results are still useful when used with caution related to generalizability. The results are useful in pointing researchers in the general direction of common fall risk factors in LTC, but it is up to researchers to conduct studies in their particular country or region to determine which factors truly apply to their particular LTC population of interest. In conducting a study, particular attention should be paid to using strong sampling techniques appropriate for multisite sampling, explicitly evaluating the appropriateness of the chosen assessment tool(s) for the chosen population and consistently defining study variables.

Summary

The reviewed studies identified significant factors that increase the incidence of falls in older adults. Many of the studies were conducted using LTC residents with international sample populations and thus have great relevance for LTC residents. The factors associated with falls in

LTC facilities were number of institutional years, level of care, performance of ADLs, history of falls, age, diseases/conditions, cognitive impairment, sensory deficits, medication use, aggressive behaviours, environmental factors and a fear of falling. In contrast, the evidence was inconclusive on whether sex or the use of restraints were fall risk factors. Some highlighted limitations were sampling exclusion criteria limiting study generalizability, lack of a definition for falls, missing information in collected data, contradictory findings regarding influence of restraints and sex on fall risk, widely varying prevalence fall rates from different studies and limited examination of the reliability of the studies' assessment tools.

No research was found on identifying seasonal influences in the LTC population but some evidence was found on seasonal effects on falls in the general population. The presence of icy/slippery surfaces and an increase in fall fatalities in the month of December and in states with colder climates were all identified as seasonal influences on falls. These findings were useful to include in this literature review because they at least give a hint at possible seasonal factors that also may be influencing falls in the LTC population. More research is needed since, even though older adults in LTC facilities have decreased outdoor trips, outdoor falls account for a significant amount of all falls: Neto et al. (2017), 20%; Dhargave et al. (2016), 12.5%; and Li et al. (2006), 48%. It is important to understand what the conditions are when LTC residents fall outdoors or fall indoors during hotter or colder months so that targeted fall interventions can be developed.

Only one study cited urban versus rural differences in incidence of falls in the LTC population. By investigating and understanding risk factors in rural and urban environments, better education and preventative measures can be devised to combat the problem of LTC falls in these areas. This is particularly important in rural areas where limited health care resources are usually spread thin over a number of small rural towns.

Literature Gap

This literature review was conducted to seek a better understanding of fall risk factors, including regional, geographic and seasonal variables, associated with fall incidence. No studies were found that compared falls in LTC residents living in northern versus southern locations and only one study briefly addressed urban versus rural fall incidence. Also, there were no studies specifically looking for seasonal influences on falls in LTC.

Relevant articles were reviewed for regional and seasonal significance in falls in LTC facilities in Ontario. Only two relevant studies were found in Ontario (Krueger et al., 2001; Macri et al., 2017) and one Canadian study outside of Ontario (Cameron et al., 2018). Krueger et al.'s (2001) study is a similar Ontario-based study that was completed almost 20 years ago on a smaller scale in a single LTC facility in Dundas, Ontario. Since 2001, many changes have occurred in LTC that have affected nursing care, including an overall increase in LTC residents, an increase in residents' comorbidities and regulations impacting various aspects of care (Government of Ontario, n.d.; Ontario Long Term Care Association, 2019b). The inclusion of more participants in this thesis study makes for a more robust sample that enhances the generalizability of study results (Polit & Beck, 2017).

This thesis study, the first large study in Ontario that sought to analyze population-based data collected from all LTC facilities for fall risk factors, was conducted to address multiple gaps in the existing literature:

- Little research to identify fall risk factors in Ontario's LTC facilities. Many studies focused on the community-dwelling older adult population and, of the studies focused on LTC, some excluded significant portions of the LTC population or included residents that would not qualify for LTC facility placement in Ontario. This thesis

study focused solely on LTC residents in Ontario in order to illuminate fall risk factors specific to this population.

- No or inconsistent definition of falls. This thesis study provided a relevant definition of a fall that is consistently used by all LTC facilities in Ontario. In addition, other variables used in this study were operationalized.
- Small sample sizes or studies conducted in a small number of facilities. While participant numbers may have been adequate according to power calculations, including more participants enhances the generalizability of study results. This thesis study used data collected from all 623 LTC facilities in Ontario, and the number of participants (n=101,315) was well over the required number for a logistic regression analysis (n=50) (Laerd Statistics, 2017).
- No research on seasonal influences on falls in LTC. This thesis study assessed the data for this criterion by grouping the months into seasons (Winter: December–February; Spring: March–May; Summer: June–August; Autumn: September–November) and using the seasons as a variable for comparison in the statistical analysis.
- Little research on differences in falls in LTC between urban and rural regions. This thesis study assessed the data for this criterion by using the rural and urban variables that were provided by the Canadian Institute for Health Information. These variables were created using the Statistics Canada definitions for urban and rural populations.

Philosophical Orientation: Positivism

It is important to state the research study's underlying ontological and epistemological assumptions. Carter and Little (2007) argued that every researcher should declare his/her

epistemological foundation since this would undoubtedly influence the methodology and methods used. In this thesis study, the researcher draws on a positivist philosophical orientation. Positivism is a paradigm or philosophical worldview on the complexities of the world: concepts, phenomena and philosophical questions (Polit & Beck, 2017). Positivism has a realist ontology that assumes that reality exists and is observable through objective and scientific means (LeCompte & Schensul, 2010). Positivism is deterministic in the belief that phenomena are not chaotic but explainable through observation (Polit & Beck, 2017). Positivists believe that a phenomenon can be understood and even predicted by objectively studying its antecedent causes (Polit & Beck, 2017). Positivism also has an objectivist epistemology, assuming that knowledge can be verified (Polit & Beck, 2017), the researcher is separate from the observed phenomena while maintaining an objective focus (LeCompte & Schensul, 2010), and the researcher's values and beliefs do not influence the observation of phenomena (Polit & Beck, 2017; LeCompte & Schensul, 2010).

In this thesis study, positivism is threaded throughout the methodology and methods in many ways. Figure 1 identifies three major ontological/epistemological assumptions that are consistent with positivism. The first assumption is that reality exists and is measurable (LeCompte & Schensul, 2010). Tuli (2010) noted that positivists aim to discover the reality that is out there. In this thesis study, the reality of falls and fall risk factors in Ontario's LTC facilities was examined. Positivists also argue that using a quantitative method of data analysis allows for reality to be objectively measured (Tuli, 2010). This was illustrated in this study's methodology through its use of a cross-sectional design and quantitative methods of analysis. LeCompte and Schensul (2010) noted that a cross-sectional design closely aligns with positivist ideals through its use of standardized measures that make possible the generalization of research findings to

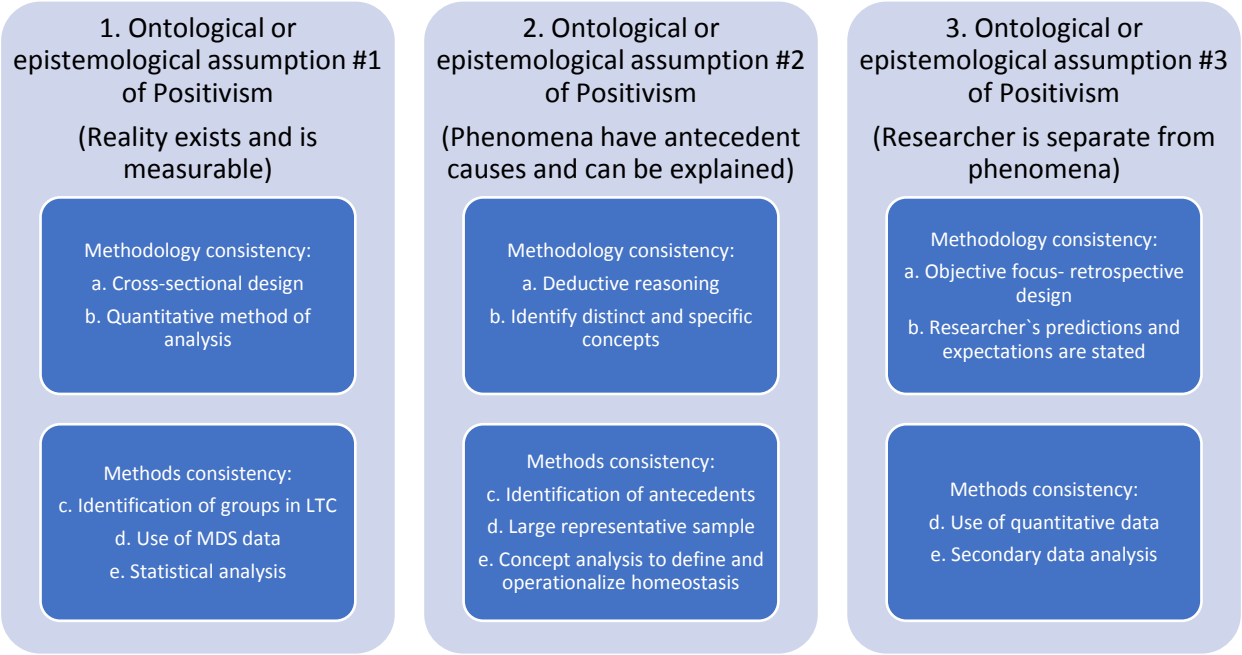
similar situation and settings This aim was achieved in the research study using the binomial logistic regression analysis from SPSS.

The second major positivist assumption found in this work is that phenomena can be explained by their antecedent causes (Polit & Beck, 2017). The phenomena being investigated in this study was fall risk. Methodologically, this second assumption was illustrated by using deductive reasoning to analyze the data to find antecedents to fall risk. The concept analysis article shows that an antecedent to falls is a lack of homeostasis. That analysis identified distinct and specific fall factors and explored how changes to homeostasis affected fall risk.

Another method consistent with the second assumption was using a large, representative sample of residents. The antecedent causes of fall risk are more reliably measured with a larger sample size because the larger the sample, the more likely that findings are applicable to the targeted population and are generalizable to similar groups (Polit & Beck, 2017). The large sample size thus increased the likelihood that the results were true explanations of the observed phenomenon. The study used data from 101,315 of residents from LTC facilities across Ontario. The sizable number of residents helped improve the strength of significant findings and increased the generalizability of study findings to all LTC facilities.

The third positivist assumption states that the researcher is separate from the phenomena (Polit & Beck, 2017; LeCompte & Schensul, 2010). Methodologically, separateness was achieved through the research study's retrospective design, which prevented the researcher from influencing the data. Secondary cross-sectional quantitative data analysis allowed the researcher to remain objective by having no contact with the study participants and or data, thereby enacting a value-free approach to the data management.

Figure 1: Application of Positivism in this Study



Sources: Polit & Beck (2017) and LeCompte & Schensul (2010)

In conclusion, positivism is the organizing paradigm that underlies this study. As summarized in Figure 1, there are three main positivist assumptions that are threaded through the study. These assumptions influenced the methodology and methods used and therefore had an effect on the study results. However, positivism seeks to minimize the footprint of the researcher on the study findings. In choosing this philosophical orientation, there may be less likelihood that I have misinterpreted or misled the data analysis or findings from that which the data was supporting.

Summary

This introduction included a review of the significance of the issue of falls in Ontario's LTC facilities, the literature concerning falls in LTC worldwide and the literature gaps that the authors hope to fill with this thesis. Significant factors that increase the incidence of falls in older adults residing in LTC facilities were identified in the research; factors such as number of

institutional years, level of care, performance of ADLs, history of falls, age, diseases/conditions, cognitive impairment, sensory deficits, medication use, aggressive behaviours, environmental factors and a fear of falling. The literature search also revealed the presence of seasonal and climate variations in fall incidents in the general population. However, there was little information regarding differences in fall patterns between urban/rural regions and no evidence of geographic location (north versus south) influence on falls.

The following two articles—a concept analysis and a research study—fill in the identified gaps in the literature. The findings of this thesis are potentially valuable for nurses in their practice of fall risk identification and fall prevention. The results yield current and relevant information on falls in Ontario's LTC facilities that will hopefully inform fall interventions and lead to a reduction in falls. Nurses (registered nurses, registered practical nurses and personal support workers) play an important role in falls management and they spend the most time with residents in LTC facilities. This research aims to support nurses in their care roles and maintain or improve residents' quality of life by avoiding falls and the consequences of falls.

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Concept Analysis: Changes to Homeostasis and the Risk of Falling

(Targeted for the Journal of Multidisciplinary Research at Trent)

Abstract

Annually, more than 30% of older adults experience a fall and most falls occur in the population aged 65 years and older. Research supports that factors leading to increased fall risk include the number of years institutionalized, performance of activities of daily living (ADLs), history of falls, age, diseases/conditions, cognitive impairment, sensory deficits, medication use, aggressive behaviours and environment. These factors destabilize older adults in long-term care (LTC) facilities and lead to falls. The term homeostasis is not present in nursing literature in relation to falls. The aim of this concept analysis was to operationalize the concept of homeostasis in relation to falls and examine how changes to this state can increase fall risk for older adults.

The Walker and Avant (2014) method was used to analyze the concept of homeostasis in relation to falls in older adults residing in LTC facilities. Different uses of the concept of homeostasis in relation to falls and its defining attributes, antecedents, consequences and empirical referents were explored. Factors related to fall risk were identified as antecedents of homeostasis and falls. Model, borderline, related, and contrary cases were also identified to further illustrate the relationship between homeostasis and the risk of falling. Finally, a concept map was used to visually illustrate the different components of homeostasis in relation to falls in older adults.

Keywords: concept analysis, falls, homeostasis, nursing, long-term care

According to the World Health Organization (2007), a fall is “inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects” (p. 1). Today, more than 30% of older adults experience a fall annually (Accreditation Canada, 2014), with most falls occurring in adults aged 60 years and older (Chang et al., 2015). With the number of Canadian older adults anticipated to rise in the coming years (Statistics Canada, 2019), the number of falls experienced by this population is also expected to rise. As of 2018, individuals 65 years of age and older constituted 17.2% of Canada’s population and were predicted to increase to approximately 29.5% by 2068 (Statistics Canada, 2019).

Falls are a significant financial burden to the Canadian government, costing more than $2 billion per year (Accreditation Canada, 2014; North East Local Health Integration Network, 2017). A fall has a significant impact on the morbidity (Kron et al., 2003; Public Health Agency of Canada, 2014) and mortality (Public Health Agency of Canada, 2014) of older adults. Post-fall injuries result in a loss of functioning and a lowered level of independence (World Health Organization, 2007). Examples of injuries from falls include hip fractures, traumatic brain injuries, upper limb injuries and post-fall syndrome (World Health Organization, 2007). Post-fall syndrome is a mental effect of falling revealed in confusion, depression and loss of autonomy (World Health Organization, 2007). The Public Health Agency of Canada (2014) also noted that fall-related deaths increased by 65% from 2003 to 2008.

There were two purposes of this paper:

1. to conduct a concept analysis to operationalize the concept of homeostasis in relation to falls in nursing; and

2. to examine changes to homeostasis that result in an increased risk of falls for older adults.

Falling is a physical act that can be described as a change in homeostasis. The purpose of this concept analysis was simply to determine the elements related to a change in homeostasis that are related to falls and the relationship among the elements (e.g., antecedents, attributes and consequences). It also provided a framework for operationalizing the elements of the concept for the purposes of research.

Concept Analysis

Concepts are abstract ideas of human behaviour and characteristics (Polit & Beck, 2017). One way to better understand the use of conceptual terms is to conduct a concept analysis. There are many different methods of conducting concept analyses but all methods have the same end goal of clarifying a concept's defining attributes so that it can be applied in specific disciplines and circumstances (Fitzpatrick & Wallace, 2006).

Nurses have been performing concept analyses since the early 1980s to operationalize concepts so that they can be precisely used in research. More specifically, these types of analyses sensitize nurses to the specialized use of nursing language in practice and research, reveal the basic underlying attributes of a concept, and facilitate choosing and/or building measurement instruments to accurately capture the attributes of a concept (Fitzpatrick & Wallace, 2006; Walker & Avant, 2014). Ultimately, the goals of concept analyses are to support research and impact nursing policy and practice. The model used in this article was provided by Walker and Avant (2014). The steps were to

1. select the concept;
2. determine the aims and purpose of the analysis;

3. identify all uses of the concept;
4. determine defining attributes;
5. identify a model case;
6. identify borderline, related and contrary cases;
7. identify antecedents and consequences; and
8. define empirical referents.

In this article, the order of steps for the model was changed, with the cases being identified last.

Select the Concept

Walker and Avant (2014) noted that the topic of a concept analysis should be an area of interest to the writer, with relevance to their clinical work. I am employed as a nurse in an LTC facility. Homeostasis is a biological, scientific term with a potentially significant application to research on falls and the work of nurses in preventing falls in LTC facilities. Rather than viewing reducing falls simply as eliminating fall risk factors, in relation to falls, homeostasis focuses on an individual's constant dance to maintain their balance even in the presence of fall risk factors.

Determine the Aims and Purpose of the Analysis

The purposes of this paper were to operationalize the concept of homeostasis in relation to falls in nursing, and to examine changes to homeostasis that result in an increased risk of falls for older adults. The ultimate goal of this study is to positively impact the lives of older adults by improving care and quality of life to minimize morbidity and mortality related to falls.

For this paper, I chose to conduct a concept analysis of homeostasis since, as per the requirements of Walker and Avant (2014), it is a concept that I find interesting and that is associated with my work, and it plays a critical role in pulling together many of the factors

identified in falls research. I hope that this work on homeostasis will help to better identify and investigate fall risk factors.

Identify all Uses of the Concept

Merriam-Webster Dictionary (n.d.) defines homeostasis as "a relatively stable state of equilibrium or a tendency toward such a state between the different but interdependent elements or groups of elements of an organism, population, or group." The origin of the word homeostasis comes from the Greek root words homeo (meaning similar) + stasis (meaning stable) = similar stable (Buckley, 2020). For the purposes of this literature review, the CINAHL, ProQuest Nursing and Allied Health, and Google Scholar databases were searched for common uses of the term homeostasis. Search keywords used were: homeostasis + falls, equilibrium + falls, balance + falls, falls in Canada, elderly + falls, falls + long-term care/nursing homes, and risk factors + fall. This search yielded over 50,000 results written in English and available electronically. For the purposes of this paper, articles from 2000 to 2020 were reviewed. The aims of this literature review were to gain a better understanding of the term homeostasis in relation to falls and to explore the state of falls and factors leading to falls in older adults.

The term homeostasis was first used in the discipline of biology by Cannon (1939) who defined it as "the coordinated physiological processes which maintain most of the steady states in the organism" (p. 25). These physiological processes are complex and involve different organs working cooperatively; stability is maintained by the organism using different methods to cancel disturbances to its equilibrium (Cannon, 1939). Miller and Keane (2003) defined homeostasis as "the tendency of biological systems to maintain relatively constant conditions in the internal environment while continuously interacting with and adjusting to changes originating within or outside the system" (para. 1). Modell et al. (2015) stated, homeostasis is "the maintenance of a

relatively stable environment by an organism in the face of changing external environment and varying internal activity" (p. 264). Homeostasis has also been applied in the social sciences to illustrate how an individual can maintain psychological balance in spite of opposing stresses (Rodolfo, 2000) and to explore the use of speed as a method of homeostatic control in driver training (Fuller, 2008).

A search of the term homeostasis in nursing literature revealed that the concept has not been formally analyzed with respect to falls and as such, is currently undefined in nursing practice. This may be because it is mainly viewed as a biological term, but I believe it has useful application in relation to falls. Overall, the most fitting definition of homeostasis in relation to falls in older adults is a combination of some aspects of the above definitions from other disciplines. For the purposes of this article, homeostasis in relation to falls was defined by the researchers as *the ability of the interdependent elements of the human body and its surrounding environment to cooperatively seek and maintain a condition of internal balance/equilibrium/stability in order to prevent falls and maintain health and functioning, regardless of any intrinsic or extrinsic factors/stresses that would tend to disturb the body's normal condition or function*.

Synonyms to homeostasis include equilibrium, balance, evenness, stability, equanimity, equipoise (Thesaurus, n.d.), steadiness, symmetry (Power Thesaurus, n.d.), absorption, adaptation and aerobic respiration (MacMillan Dictionary, n.d.). From this list, the four synonyms that are the most relevant to homeostasis in relation to falls are equilibrium, balance, stability and adaptation. It is important to note that while these terms are synonyms to homeostasis, homeostasis is not identified as a synonym for them (Merriam-Webster Dictionary, n.d.). This signifies that homeostasis is the most appropriate concept for falls because it

incorporates all the other concepts (i.e., balance, equilibrium, stability) (Biology, n.d.) and provides a deeper understanding of the phenomenon of falling. It is an overarching, broader concept that give a more comprehensive approach to the phenomenon than any of the other terms.

Determine Defining Attribute(s)

A defining attribute illustrates a defining characteristic of the concept and is obtained from different definitions proposed for the concept (Walker and Avant, 2014). Keywords pulled from the above definitions and synonyms to form the defining attributes of the concept homeostasis are cooperation, interdependent elements, equilibrium and balance. Each term on its own does not fully define homeostasis, but together the meaning of the concept as it pertains to the issue of falls in older adults is revealed.

Cannon (1939) indicated that homeostasis occurs with the cooperation of interdependent factors. For example, the leg bones do not move independent of the feet or the muscles. They require the feet to carry them and the muscles to provide the support and energy for movement. Furthermore, if the individual uses a walker, the body also uses it to maintain homeostasis in relation to falls. These interdependent elements must work together in cooperation to maintain equilibrium and balance while in motion. Thus, the defining attribute of homeostasis is the cooperation of interdependent elements working together to maintain balance and equilibrium.

Identify Antecedents

Walker and Avant (2014) stated that “antecedents are those events or incidents that must occur or be in place prior to the occurrence of the concept” (p. 173). In other words, what factors must be present to maintain homeostasis? In relation to falls in older adults, a search of the literature showed the concept homeostasis in relation to falls is applicable in describing varied

factors working together within and outside the body to maintain balance in the body. Variations in these factors cause changes in homeostasis and risk of falls. As a result, a brief overview of the main risk factors (the opposite of which are the antecedents to homeostasis) for falls was undertaken here as they are identified threats to the state of homeostasis in relation to falls. These risk factors were divided into intrinsic and extrinsic categories.

Intrinsic Factors. Many factors influence the incidence of falls. Intrinsic factors are patient-related (Damián et al., 2013) and originate from within the body (Merriam-Webster Dictionary, n.d.). Examples of intrinsic factors include functional impairment (Lee et al., 2008), history of falls, age, sensory defects, and cognitive impairment (Chang et. al, 2015).

History of Falls. In this analysis, a fall was defined as an unintentional change in position causing someone to rest on the floor or a lower surface (World Health Organization, 2007). In a seminal study, Tinetti (1987) identified that the most important factor in predicting future injurious falls was a recent previous fall. Later studies corroborated that the history of falls is a strong predictor of subsequent falls (Krueger et al., 2001; Izumi et al., 2002; Kron et al., 2003; Kerse et al., 2004; dos Reis & de Jesus, 2015; Dhargave et al., 2016; Sousa et al., 2016; Castaldo et al., 2020). Subsequent studies have identified additional factors that increase the risk of falls in older adults.

Increased Age. For the purposes of this analysis, older adults were considered 60 years of age or older (Krueger et al., 2001; Lee et al., 2008; Sousa et al., 2016; Dhargave et al., 2016; Neto et al., 2017; Zhang et al, 2019). Mackenzie and Byles (2018) found that older age and dementia were risk factors associated with falls involving a fracture of the neck of the femur. Various other researchers found similar results in that falls increased proportionately with age (Lee et al., 2008; Do et al., 2015; Sousa et al., 2016; Cruz et al., 2017).

Sensory Deficits. For the purposes of this thesis, sensory impairment was defined as a visual or hearing impairment (Kallin et al., 2002; Lee et al., 2008; Cameron et al., 2018; Dhargave et al., 2016; Sharif et al., 2018). Sensory impairments are positively associated with falls among older adults (Kallin et al., 2002; Lee et al., 2008; Cameron et al., 2018; Dhargave et al., 2016; Sharif et al., 2018). Visual impairments (Kallin et al., 2002; Lee et al., 2008; Dhargave et al., 2016; Cameron, et al., 2018), hearing impairments (Sharif et al., 2018) and sensory loss (Zhang et al., 2019) in older adults have also been associated with an increased risk of falls.

Illnesses/Diseases. An illness is a medical disease or condition that has been noted by a health care professional in an individual's circle of care (Krueger et al., 2001; Lee et al., 2008; Castaldo et al., 2020). Health conditions with significant associations with falls included hematology/oncology diagnosis, incontinence, cerebrovascular accident, arthritis, hypotension, diabetes, heart disease, generalized weakness, alcohol abuse, Parkinson's Disease, sleeplessness, seizure disorder (Krueger et al., 2001), dementia (Krueger et al., 2001; Lee et al., 2008; Cameron at al., 2018), depressive symptoms, urinary incontinence (Kron et al., 2003), chronic diseases/medical conditions (Damián et al., 2013; dos Reis & de Jesus, 2015; Dhargave et al., 2016; Zhang et al., 2019; Neto et al., 2017), osteoporosis, hypertension (Sharif et al., 2018) and poor pedal health (Zhang et al., 2019). Health conditions such as osteoporosis and low vitamin D levels also placed older adults at increased risk for bone fractures due to decreased bone density (Hall et al. 2010; Berridge, 2017; Lauer et al., 2019). Chang et al. (2015) found that 51% of older patients (65 years and older) fell due to factors such as diseases and weakness. Sharif et al. (2018) also found this to be true in their study on community-dwelling older adults, where 75% of respondents cited illness and balance problems as the cause of their falls.

Cognitive Impairment. In this concept analysis, cognitive impairment was defined as any cognitive decline noted by the individual, their caregiver(s) or their health care team (Krueger et al.; Zhang et al., 2019). Many studies found a positive correlation between falling and cognitive impairment (Cameron et al., 2018). In a southern Ontario LTC study, most of the LTC residents who fell and had fractures were females with cognitive impairments (McArthur et al., 2016). An Australian study found that having dementia (a condition characterized by cognitive deterioration) and older age were risk factors associated with having falls resulting in a fracture to the neck of the femur (Mackenzie & Byles, 2018). In studies conducted in LTC, specific aspects of cognitive impairment that had an influence on falls included alteration in mental state (Krueger et al., 2001), short-term memory loss (Kron et al., 2003) and decreased cognitive status (Zhang et al., 2019).

Ability to Perform Activities of Daily Living. Needing assistance with ADLs was found to be a factor that increased the risk of falls for residents in LTC facilities (Kallin et al., 2002; Izumi et al., 2002; Kron et al., 2003; Kerse et al., 2004; Dhargave et al., 2016; Zhang et al., 2019, Neto et al., 2017; Castaldo et al., 2020). Tasks requiring assistance such as using the stairs (Kallin et al., 2002), elimination (for those with a prior history of falls) (Izumi et al., 2002), transfers (Kron et al., 2003) and using walking aids (Sousa et al., 2016) were all associated with an increased risk of falls. However, some studies also found that having the ability to ambulate (dos Reis & de Jesus, 2015), greater mobility (Kerse et al., 2004) or higher autonomy in ADLs (Castaldo et al., 2020) increased the risk of falls.

Extrinsic Factors. Extrinsic factors originate from outside the body (Merriam-Webster Dictionary, n.d.) and can work together with intrinsic factors to increase an individual's risk of falls (Plaksin, 2014). They include medications (Cameron et al., 2018) and environmental issues

such as lighting, flooring (Chang et al., 2015) and outdoor environmental hazards like icy walkways (Bélanger-Bonneau et al., 2002; Morency et al., 2012).

Environmental. Environmental factors that were associated with increased falls varied in falls research. Some environmental factors that were associated with falls were unsafe living environments, inappropriate footwear and a residence in an urban location (Zhang et al., 2019). Neto et al. (2016) found that environmental adaptations aimed at reducing falls and injuries from falls were necessary in institutionalized settings. Beneficial environmental adaptations noted by Jiang et al. (2019) included ensuring areas were well-lit, and installing handrails in strategic locations such as corridors and elevators.

Seasonal factors such as adverse weather conditions and temperature have also been shown to influence the incidence of falls in older adults. Bélanger-Bonneau et al. (2002) found that ice and snow were the most cited cause of falls by the older population. They also found that falls peaked in the summer and winter seasons. Stevens et al. (2007) found that more fatalities resulted from falls in locations with colder climates than warmer climates. Bélanger-Bonneau et al.'s (2002) finding was corroborated by Morency et al. (2012) in their study that included participants from many populations, including residents of LTC. They found that 72% of outdoor falls were associated with weather conditions that cause ice, snow and/or slipping.

Medication Use. Research showed that psychotropic (Lee et al., 2008; Berry et al., 2016; Cox, 2016) and antidepressant medications (Cox et al., 2016) were linked to a significant increase in risk of falls in nursing home residents. Cox et al. (2016) found taking psychotropic drugs on a daily basis increased the incidence of falls three-fold. Berry et al. (2016) found the risk of falls increased with the initiation of a benzodiazepine and decreased with its cessation. Polypharmacy is the use of multiple drugs at the same time (World Health Organization, 2004).

This practice is generally used to treat identified comorbid conditions, which is common among older adults (Dhalwani et al., 2017). Polypharmacy should be monitored and, if possible, minimized since our ability to metabolize and absorb medications decreases with age (World Health Organization, 2007). Sharif et al. (2018) found that 10% of falls were caused by side effects of medications. A positive association was found between the number of medications taken daily and falls (Lee et al., 2008; Damián et al., 2013; Dhargave et al., 2016; Sousa et al., 2016). A significantly higher rate of falls was found among older adults who used multiple drugs for at least two years (Dhalwani et al., 2017). Certain medications, such as beta-blockers (Sharif et al., 2018), antidepressants and Potentially Inappropriate Medications according to the Beers List (Cameron et al., 2018) had a significant association with an increased incidence of falls.

Summary of Antecedents. As reviewed above, the factors that increase falls risk are intrinsic risk factors such as a history of falling, increasing age (older than age 60), cognitive impairment, certain illnesses/diseases, sensory impairment and assistance with ADLs. Extrinsic risk factors include use of multiple medications, fall-related medications and hazardous environmental risk factors (i.e., icy conditions, colder climates and tripping hazards). As Walker and Avant (2014) stated, “antecedents are those events or incidents that must occur or be in place prior to the occurrence of the concept” (p. 173). The opposite of the fall risk factors is what must occur for homeostasis to occur. Therefore, the antecedents to homeostasis are young age (less than 60 years old), lack of polypharmacy, cognitive or visual health, non-hazardous physical environment, no history of falls, independence with ADLs and the absence of medical conditions.

Conducting this concept analysis on homeostasis in relation to falls provided a different and unifying lens through which to view falls in older adults. Rather than viewing the reduction

of falls simply as the elimination of fall risk factors, homeostasis in relation to falls focuses on the individual's constant dance in maintaining balance even in the presence of fall risk factors. In other words, it focuses attention on the relationships between the different components of the concept. Clinically, this is at times illustrated in the acceptance that not all fall risk factors can be eliminated. Nurses should work together with older adults to identify what risk factors can be incorporated into the dance of homeostasis in relation to falls and what factors interrupt the dance. Nurses become support for or advocate in the resident's effort to maintain homeostasis. The concept of homeostasis in relation to falls was also analyzed to better understand how changes in homeostasis increase and decrease risk of falls. Operationalizing the concept can also help nurses choose personalized falls interventions for older adults based on person-centered interventions rather than generic ones.

Identify Consequences

Walker and Avant (2014) stated that "consequences are those events or incidents that occur as a result of the occurrence of the concept—in other words, the outcomes of the concept" (p. 173). As it pertains to falls in older adults, a direct consequence of maintaining homeostasis with relation to falls is a low risk of falls. On the other hand, changes in homeostasis caused by the identified intrinsic and extrinsic risk factors result in an increased risk of falls. This can be illustrated as a disruption in the cooperation of an individual's interdependent elements to maintain homeostasis. When this cooperation is disrupted in any way, it leads to imbalance and falls. In order to demonstrate the interdependency of elements, we explore eyesight. The body depends on the eyes for sight and the eyes depend on the body for their health. When eyesight is compromised, an individual is more likely to lose balance and fall (Kallin et al., 2002; Lee et al., 2008; Cameron et al., 2018; Dhargave et al., 2016; Sharif et al., 2018; Zhang et al., 2019) and the

consequence of the concept of homeostasis is changed by the disruption of an interrelated element's function. Nurses can join in this fight by individually assessing the strengths and weaknesses of residents or patients and providing interventions to prevent their weaknesses from overwhelming the balance of homeostasis (i.e., in this case, assessment by an optometrist to determine appropriate interventions).

Define Empirical Referents

According to Walker and Avant (2014), empirical referents are ways that the defining attributes of homeostasis can be measured. In this case, the identified defining attribute is the cooperation of interdependent elements working together to maintain balance and equilibrium. In a search of the literature, cooperation is measured as a function of a group activity involving a group of people (Merriam-Webster, n.d.; Jukema et al., 2021) but this does not apply to our concept in its prescribed context because the focus is on older adults and their internal systems.

Balance has been researched in nursing and rehabilitative therapy as an indicator of falls. Many clinical measures are available, including postural sway, functional reach, timed-chair stands, the Tinetti balance subscale and ten-foot walks (Thapa et al., 1996). While these measurements are used to assess an individual's balance in relation to falls risk, their validity in measuring homeostasis needs to be tested since they have not been shown to measure the other parts of the concept's attribute: the cooperation of interdependent elements. In other words, balance measures a person's ability to stay upright while homeostasis embodies the cooperation of different factors (i.e., body systems, caregiver support system) to maintain balance.

Identify Cases

Model Case. A concept analysis needs to provide examples or cases of the concept in use (Walker & Avant, 2014). The following model case demonstrates the defining attribute of homeostasis relating to falls in older adults.

Betty is an 80-year-old widow who recently moved to an LTC facility. She has Alzheimer's disease and suffers from urinary frequency. Her family visits her often and is very involved in her care. She is on multiple medications. She has a history of falls and has recently been complaining that her knees are buckling without warning. Her health care team is reviewing her therapies and medications to alleviate this complaint and decrease her risk of falls. She was always very well groomed and kept her home tidy, but with the advancement of Alzheimer's disease, she has become more unkempt and her room is cluttered. In response, she tries to be careful and take her time when walking with her walker. She cannot see well without her glasses and needs frequent reminders from the staff to wear them.

The above is an example of a model case to homeostasis in relation to falls. In this example, Betty is older than 60 and is experiencing polypharmacy, cognitive impairments and visual disabilities. She has a history of balance issues and her environment is cluttered. These intrinsic and extrinsic factors challenge her ability to maintain homeostasis with relation to falls, which puts her at an increased risk of falls. Betty is cooperating with her health care team and her family to restore homeostasis with relation to falls by decluttering her space, taking time while walking, decreasing the number of medications she is taking and consistently wearing her glasses. These changes should restore homeostasis and thus reduce her risk of falling.

This model case illustrates the defining attribute of homeostasis with relation to falls: the cooperation of interdependent elements working together to maintain homeostasis despite the

impact of intrinsic and extrinsic factors. These independent elements are the individual's different body systems and external support from others in the individual's environment.

Borderline Case. According to Walker and Avant (2014), "borderline cases are those examples or instances that contain most of the defining attributes of the concept being examined but not all of them" (p.170).

Sue is a 50-year-old active lady who lives at home. Her family often say she is sharper mentally than her children and rarely loses a game of chess. She is healthy and takes no medication other than calcium daily. Sue recently had a visit from her estranged sister which caused her some emotional angst. On her way to the dining room for supper, she tripped over a rug, lost her balance and fell. Sue was unable to get up and later found out she had fractured her right hip.

This is a borderline case since it contains parts of but not the whole defining attribute of the concept of homeostasis and falls. She is younger than 60 years old, is cognitively intact and has no problems with polypharmacy. She is normally able to coordinate her body with the interdependent elements working well. The missing part in this example is balance. Sue was absent-minded due to her heightened emotional state after her sister's visit and lost her balance on her way to the dining room. This case does not adequately illustrate all the components of homeostasis and is missing balance.

Related Case. Walker and Avant (2014) define a related case as "instances of concepts that are related to the concept being studied but that do not contain all the defining attributes" (p. 171).

Andy is a 30-year old male who has been involved in a motor vehicle accident. He has been unresponsive for two weeks with fitful and sudden movements that have caused him to

become unbalanced in his bed and fall. The nurses have implemented restraints to keep Andy balanced in his bed and this solution has worked well to decrease his risk of falls.

This related case highlights the related concept of balance, which is part of the defining attribute of the concept of homeostasis in relation to falls. Even though Andy is able to maintain balance on his bed with the help of restraints, this is not the same as maintaining homeostasis. This example illustrates how balance can be present without cooperation from the individual's interdependent elements (i.e., the working together of Andy's body parts in conjunction with support from his environment).

Contrary Case. According to Walker and Avant (2014), a contrary case is a clear example of what is "not the concept" (p. 172).

A 45-year-old male lives independently at home with his spouse and teenage children. He is very health conscious and exercises at least three times a week. He loves to play hockey and coaches his son's hockey team. He is proud of the fact that he is healthy, does not take medication and seeks to maintain his health through good nutrition. He considers it important to keep a home which is tidy and in good repair.

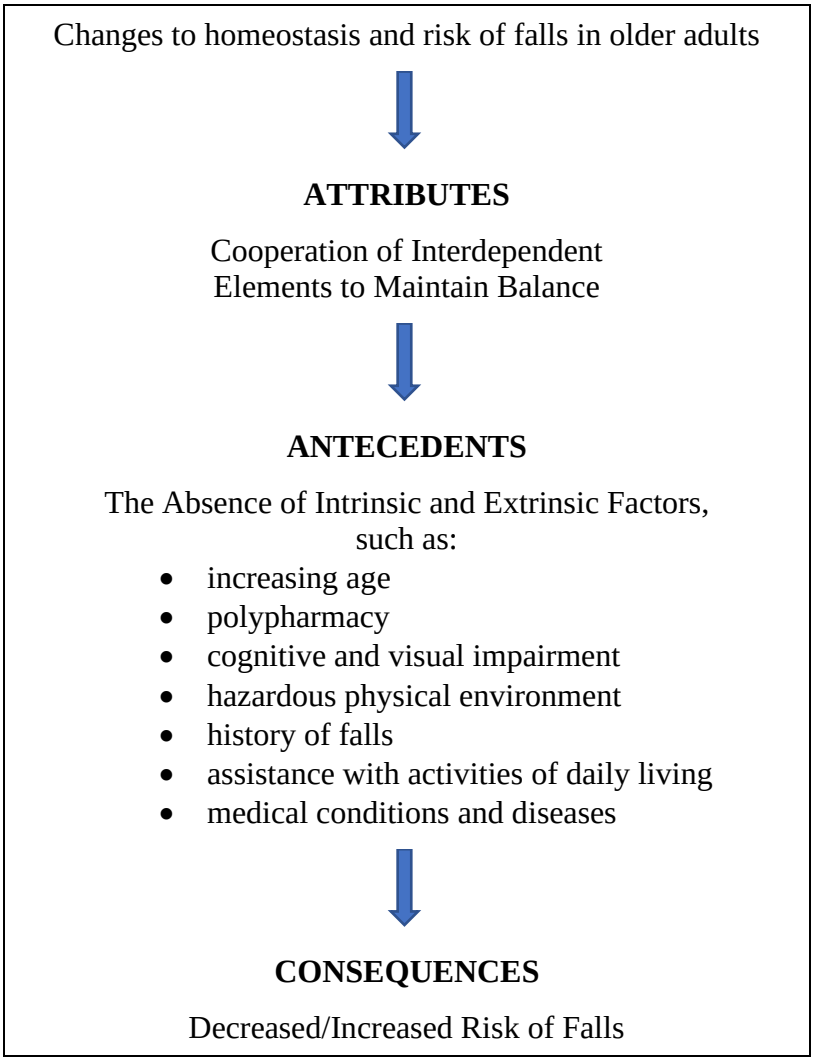
This is an example of a contrary case of homeostasis with relation to falls since the individual does not experience any of the identified intrinsic or extrinsic factors that are threats to the maintenance of homeostasis such as diseases, older age, hazardous physical environment and the use of medication.

Conclusion

Homeostasis in relation to falls in older adults is an important concept because operationalizing it helps researchers better understand how changes in homeostasis influence the risk of falls. For instance, the risk of falls increases when homeostasis is weakened by fall risk

factors such as an increase in the number of medications. Falls are complex and multifaceted and our conceptual framework for homeostasis in relation to falls gives a broader perspective of the issue and paves the way for future theoretical development. Using this conceptual lens, which encourages looking at older adults as people with interdependent parts working together to prevent falls, researchers can conduct studies that specifically address the key elements related to risk of falls. Individualized interventions can be implemented with the goal of helping an older adult regain homeostasis in relation to falls. In addition, nurses can use this conceptual lens to view older adults as being in a constant dance to maintain balance and prevent falls through the combined effort of their interdependent parts. These interdependent parts compensate for and resist the potentially detrimental effects of the intrinsic and extrinsic fall risk factors that disrupt homeostasis. Nurses are facilitators in helping older adults maintain homeostasis in relation to falls.

Figure 2: Homeostasis Concept Map



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Research Study: Falls in Long-Term Care in Ontario

(Targeted for Sage Open Nursing Journal)

Abstract

As the population ages and the average age of Canadians increases, there is greater demand for long-term care (LTC) facilities. A common issue in LTC facilities is falls. Identifying factors that put LTC residents at a greater risk for falls in Ontario is an important first step in developing strategies to mitigate fall risk. There is a gap in knowledge in this area, therefore this was a much-needed study. We investigated fall risk factors in residents in LTC facilities. It was the first population-based study in Ontario that sought to analyze population-based data collected from all LTC facilities for fall risk factors. The research questions guiding this retrospective, cross-sectional design were: *What are the factors that are associated with falls among residents living in Ontario's long-term care facilities? What are the regional similarities or differences in fall risk factors for residents of Ontario's long-term care facilities?* Guided by a positivist philosophical orientation, the researchers performed a secondary analysis on Ontario-wide LTC data provided by the Canadian Institute of Health Information for the period April 2019 through March 2020. Binomial logistic regression analysis was used to determine the significance of the relationship of selected variables to falls. Results showed a significant relationship between variables of age, sex, diuretic use, visual impairment, dependency in activities of daily living (ADLs), and cognitive and physical impairments with falls in the previous 30 days. Results will add to the body of knowledge on falls in residents of Ontario's LTC facilities and aid in the development of more effective fall prevention strategies for LTC residents in the province.

Introduction

Falls often have devastating consequences for older adults. Outcomes of falls can be traumatic for older adults ranging from physical injury, chronic pain, reduced cognition, loss of independence and death (Botwinicka et al., 2016; Kron et al., 2003; Public Health Agency of Canada, 2014). Given this, strategies to prevent falls are vitally important, especially for residents in LTC facilities who are at a high risk for falls and vulnerable to increased morbidity after a fall (Botwinicka et al., 2016).

In Ontario, Canada, registered nurses work in all areas of the health care system, including LTC. Nursing practice focuses on curative and preventative care for their clients and nurses have a critical role in reducing and preventing falls in LTC (Government of Ontario, n.d.). Nurses need comprehensive and recent evidence to inform their practice, as well as policy initiatives, to reduce the risk of falls in LTC settings.

Review of Literature: Falls in Long-Term Care

International research shows that there are various factors related to falls in LTC facilities. Existing literature supports that some of these factors are number of years living in LTC, level of care (i.e., secured unit or specialized dementia unit), ability to perform ADLs, history of falls, age, diseases/health conditions, cognitive impairment, sensory deficits, medication usage, aggressive behaviours, environmental factors, the use of restraints and a fear of falling (Krueger et al., 2001; Macri et al., 2017; Cameron et al., 2018; Kron et al., 2003; Dhargave & Sendhilkumar, 2016; Zhang, Zeng, et al., 2019; Neto et al., 2017; Castaldo et al., 2020). Evidence regarding whether sex is a fall risk factor is inconclusive (Dhargave et al., 2016; Zhang, Zeng, et al., 2019; Cameron et al., 2018).

Although existing research provided a summary of the state of knowledge about falls in LTC, only two studies were found that explored fall risk in LTC in Ontario (Krueger et al., 2001; Macri et al., 2017) and none analyzed the effect of northern/southern geographic locations on falls. In addition, there remains a gap in the literature related to seasonal variation in relation to falls within the LTC sector.

The primary purpose of this study was to analyse recent RAI-MDS data to identify the risk factors for falls in Ontario's LTC facilities.

Overview of Long-Term Care in Ontario, Canada

In Ontario, LTC facilities provide a home to people who need continuous nursing care, monitoring and/or assistance with ADLs (Ontario Long-Term Care Association, n.d.). The Ontario provincial government regulates care services in LTC facilities by way of the *Long-Term Care Homes Act*, 2007, and Regulation 79/10, 2010 (Government of Ontario, n.d.). The regulation establishes the standards of care necessary for an LTC facility to become licensed (Government of Ontario, n.d.) and states that LTC facilities are required to develop and implement programs in four domains: falls prevention and management; skin and wound care; continence care and bowel management; and pain management (Government of Ontario, n.d.).

Residents of LTC are assessed annually and quarterly using the Resident Assessment Instrument-Minimum Data Set (RAI-MDS) 2.0 (Government of Ontario, n.d.). Resident assessments are also completed whenever residents experience a significant change in health status (Government of Ontario, n.d.). The RAI-MDS was developed in the 1980s in the United States to provide a standard uniform assessment for LTC facilities (Poss et al., 2008) and modified by the Canadian Institute for Health Information for use in Canada in 2009. This instrument provides ongoing reliable and valid data on LTC residents (Hutchison et al., 2010;

Hawes et al., 1995). Data from the RAI-MDS are used by Health Quality Ontario to monitor and report on the quality of care in all health sectors of the province (Health Quality Ontario, n.d.).

Health Quality Ontario aims to decrease the incidence of falls in LTC. To this end, it monitors whether a resident has fallen within the previous 30 days and the previous 180 days (Health Quality Ontario, 2020). Health Quality Ontario set the provincial benchmark for the prevalence of falls at 9% for all LTC facilities during each reported 30-day period. However, the provincial average remains above this benchmark. In 2010/2011, the average for falls in LTC settings in Ontario was 13.9% and in 2019/2020 it was 16.5% (Health Quality Ontario, 2020). Clearly, more needs to be done to reach this benchmark. One way that this can be done is through a detailed examination of Ontario's falls data to determine the current fall risk factors specific to Ontario's LTC facilities and any regional factors that are unique to these facilities.

Philosophical Orientation: Positivism

The philosophical orientation of positivism guides this study. The three main positivist ontological and epistemological assumptions that are threaded throughout this study are: that reality exists and is measurable; phenomena have antecedent causes that can be explained; and the researcher is separate from the phenomena (Polit & Beck, 2017; LeCompte & Schensul, 2010).

Research Design

This was a population-based, retrospective, cross-sectional study (Polit & Beck, 2017). The dataset included RAI-MDS for all residents in 623 LTC facilities in Ontario between April 2019 and March 2020. Ethical approval for this research was obtained from Laurentian University's Research Ethics Board.

This study's research questions were as follows:

1. What are the risk factors for falls among residents in Ontario's LTC facilities?
2. What are the regional similarities or differences in fall risk factors for residents of Ontario's LTC facilities?

Research Variables

The RAI-MDS defines falls as "any unintentional change in position where the resident ends up on the floor, ground or other lower level" (Canadian Institute for Health Information, 2012, p. 162). It was important to have a clear definition for a fall since its definition differed among the studies reviewed and some studies failed to define a fall at all (Krueger et al., 2001; Cameron et al., 2018). The RAI-MDS indicator that served as the dependent variable was "a fall in the previous 30 days."

The literature review found scant studies on falls that were conducted in Ontario LTC settings. Further, geographical and seasonal variables were not assessed in previous studies on falls. The independent variables chosen for this thesis study were identified through similar studies from other jurisdictions (Krueger et al., 2001; Izumi et al., 2002; Kallin et al., 2002; Kron et al., 2003; Kerse et al., 2004; Fonad et al., 2008; Lee et al., 2008; Damián et al., 2013; dos Reis & de Jesus, 2015; Sousa et al., 2016; Dhargave & Sendhilkumar, 2016; Macri et al., 2017; Neto et al., 2017; Cameron et al., 2018; Zhang, Zeng, et al., 2019; Castaldo et al., 2020) and were augmented to include geographical (north/south; urban/rural) and seasonal variables. In terms of the geographic north/south variables, the Northeast and Northwest Local Health Integration Networks were categorized as "north" and all other Local Health Integration Networks in the province were categorized as "south." The urban/rural status of a facility was assigned by the Canadian Institute for Health Information using the definition for urban and rural areas from Statistics Canada (2011, para 2), "An urban area was defined as having a population of at least

1,000 and a density of 400 or more people per square kilometre. All territory outside an urban area was defined as rural area." Additional variables included demographic information (number of institutional years, age and gender), medication use, medical conditions (visual impairment, hearing impairment, cognitive impairment and illness/disease), level of ADL, resident behaviours (presence of aggressive behaviour), and regional/seasonal characteristics (facility geographic location and calendar season of fall) (see Appendix B for variable definitions).

Statistical Analysis

Variables in the analysis were continuous or dichotomous. RAI-MDS variables with more than two categories were combined to reflect either the presence of the item or not. Descriptive statistics were conducted to describe the sample. Because of the large number of variables, a Chi square analysis was performed to determine which variables were significantly associated with falls. Only significant variables were included in a binomial logistic regression analysis. Variables associated with less than 5% of the total sample were removed because of their effect on the model fit.

Results

The sample size was 101,315 residents representing N = 372,469 individual RAI-MDS assessments. There was an overall 21% fall rate. The mean age of residents was 83.6 years, 67% (n = 250,636) were female, 44% (n = 164,186) had dementia, 59% (n = 218,558) were taking at least one type of medication, 87% (n = 325,795) lived in an urban region, and 92% (n = 341,120) lived in southern Ontario. Refer to Table 1.

Table 1: Frequency Table (N=372,469)

Variable	**Frequency** ***f***	**Relative Frequency in Percentage** ***rf = (f/N)*100***
Female sex	250,636	67

Variable	Frequency *f*	Relative Frequency in Percentage *rf = (f/N)*100*
Urban location	325,795	87
Southern location	341,120	92
Eating assistance	317,882	85
Personal hygiene assistance	357,685	96
Dressing assistance	356,380	96
Toileting assistance	349,553	94
Assistance with mobility	335,022	90
Sensory impairment	32,485	9
Impaired range of motion:		
Neck	86,206	23
Arm	123,831	33
Foot	82,360	22
Leg	123,060	33
Bowel incontinence	112,131	30
Bladder incontinence	47,128	13
Aphasia	35,573	10
Cancer	13,166	4
Gastrointestinal disease	107,653	29
Diabetes mellitus	107,305	29
Arthritis	56,487	15
Osteoporosis	38,657	10
Urinary tract infection	18,476	5
Delirium	157,931	42
Dementia	208,283	56
Depression	125,120	34
Pain	103,288	28
Hypotension	2,505	1
Syncope	6,081	2
Hip fracture	19,561	5
Diuretic	95,299	26
Antipsychotic	96,748	26
Antidepressants	218,558	59
Hypnotic	12,988	3
Antianxiety	36,290	10
Analgesia	249,862	67

A logistic binomial regression analysis was conducted to determine the risk factors related to falling within the previous 30 days of the RAI-MDS assessment (Table 2). Listwise deletion of cases with missing data resulted in the inclusion of 109,871 (29.5%) cases in the

analysis. The number of cases were well over the requirement of the minimum number of cases (n = 15–50) required for the model's statistical accuracy in a regression analysis (Laerd Statistics, 2017). The model explained 19.2% (Nagelkerke R^2) of the variance in falls and correctly classified 80.1% of cases.

Many variables were significant for increased likelihood of falls, such as increasing age (p = .00), female sex (p = .00) and rural location (p = .00). Interestingly, the results also showed a significantly less likelihood of falls within the past 30 days if there had been a fall within the last 31–180 days (p = .00).

In the behaviours category, persistent verbal expressions of anger directed at self or others and a recent deterioration of behaviour symptoms (in the last 90 days) were both indicative of a likelihood to have fallen (p = .04 and p = .00, respectively). Inversely, there was significantly less likelihood of falls within the last 30 days if there were physically abusive (p = .00) and wandering behaviours (p = .00) present.

Many ADLs, balance and range of motion variables were significantly associated with a fall within the last 30 days. Needing assistance with eating (p = .00) or personal hygiene (p = .04) and having impaired balance while sitting (p = .00) were all significantly associated with an increased likelihood of falls. Impairment in neck, arm and foot range of motion also significantly increased the likelihood of a fall (p = .00). On the other hand, needing assistance with dressing (p = .02), toileting (p = .00) and locomotion/mobilizing within the unit (p = .00), and impaired balance while standing (p = .00) were all associated with a decreased likelihood of falls. A recent deterioration in ability to perform ADLs was related to significantly less likelihood of a fall within the last 30 days (p = .00). Impairment in leg range of motion was also significantly associated with decreasing the likelihood of a fall (p = .00).

Many medical conditions were analyzed for their likelihood of an increase in falls within the last 30 days. Of note, having bowel incontinence (p = .02), aphasia (p = .00), cancer (p = .03), gastrointestinal disease (p = .00), arthritis (p = .00), osteoporosis (p = .00), long-term memory impairment (p = .02), impaired decision-making status (p = .00) and visual impairment (p = .00) all significantly increased the likelihood of a fall. By contrast, having pain symptoms, bladder incontinence, a recent deterioration in urinary incontinence, impaired short-term memory or delirium translated to significantly less likelihood of a fall within the last 30 days (p = .00 for all of these variables).

Finally, an increasing number of medications and the use of diuretics significantly increased the likelihood of a fall (p = .00). Taking antipsychotics, antidepressants and hypnotics meant significantly less likelihood of a fall in the last 30 days (p = .00).

Table 2: Logistic Regression Predicting the Likelihood of a Fall within the Last 30 Days

						95% CI for EXP(B)	
Variable	**B**	**S.E.**	**Wald**	**Sig.**	**Exp(B)**	**LL**	**UL**
Demographics							
Number of years in institution	.000	.000	2.644	.104	1.000	1.000	1.000
Age	.005	.001	33.332	.000	1.005	1.003	1.007
Female sex	.247	.018	189.987	.000	1.280	1.236	1.326
Seasonal/Geography							
Spring	−.012	.020	.345	.557	.988	.951	1.028
Autumn	.001	.020	.003	.955	1.001	.963	1.041
Rural location	.069	.024	8.402	.004	1.071	1.022	1.122
Southern location	.002	.028	.004	.950	1.002	.949	1.058
History of Falls							
Fell in past 31–180 days	−.959	.016	3458.521	.000	.383	.371	.396
Behaviours							
Persistent anger (verbal expressions with self or others)	.043	.021	4.133	.042	1.044	1.002	1.088
Physical abuse to others	−.214	.030	51.623	.000	.808	.762	.856
Verbal abuse to others	−.003	.027	.014	.905	.997	.945	1.052
Wandering behaviour	−.452	.023	370.598	.000	.636	.608	.666
Disruptive behaviour	.005	.024	.036	.850	1.005	.958	1.053
Resists care	−.009	.021	.171	.679	.991	.952	1.032

Variable	B	S.E.	Wald	Sig.	Exp(B)	95% CI for EXP(B) LL	UL
Behaviour symptoms: recent deterioration	.071	.024	8.930	.003	1.073	1.025	1.125
Activities of Daily Living							
Assistance with dressing	−.193	.081	5.671	.017	.825	.704	.966
Eating assistance required	.167	.025	44.762	.000	1.182	1.126	1.242
Toileting assistance required	−.450	.059	57.770	.000	.638	.568	.716
Personal hygiene assistance required	.172	.081	4.449	.035	1.187	1.012	1.393
Locomotion on unit	−.284	.039	52.614	.000	.753	.697	.813
Locomotion off unit	−.079	.041	3.772	.052	.924	.853	1.001
ADL: recent deterioration	−.612	.024	630.746	.000	.542	.517	.569
Care needs: recent deterioration	−.333	.025	177.653	.000	.717	.683	.753
Balance							
Balance standing impaired	−.478	.036	173.661	.000	.620	.577	.666
Balance sitting impaired	.181	.019	91.150	.000	1.199	1.155	1.244
Range of Motion							
Neck: loss of range of motion	.070	.022	10.230	.001	1.073	1.028	1.120
Arm: loss of range of motion	.169	.020	69.044	.000	1.184	1.138	1.232
Leg: loss of range of motion	−.090	.021	17.434	.000	.914	.877	.954
Foot: loss of range of motion	.301	.026	135.977	.000	1.352	1.285	1.422
Incontinence							
Bowel incontinence	.048	.020	5.785	.016	1.050	1.009	1.092
Bladder incontinence	−.134	.027	24.413	.000	.875	.829	.922
Urinary continence: recent deterioration	−.196	.026	56.461	.000	.822	.781	.865
Medical Conditions							
Dementia	.010	.021	.225	.636	.990	.951	1.031
Arteriosclerotic heart disease	.030	.022	1.892	.169	1.031	.987	1.077
Aphasia	.115	.031	13.825	.000	1.122	1.056	1.192
Cancer	.058	.027	4.742	.029	1.060	1.006	1.116
Gastrointestinal disease	.056	.018	9.837	.002	1.058	1.021	1.096
Arthritis	.125	.017	53.887	.000	1.133	1.096	1.171
Osteoporosis	.084	.019	19.978	.000	1.087	1.048	1.128
Pain symptoms	−.485	.018	698.478	.000	.616	.594	.638
Conditions/diseases that make cognitive, ADL, behaviour patterns unstable	−.186	.018	110.699	.000	.830	.802	.859
Acute episode/flare up of recurrent or chronic problem	−.169	.021	62.333	.000	.844	.810	.881
Cognitive Impairment							
Short-term memory impairment	−.143	.030	22.824	.000	.867	.818	.919
Long-term memory impairment	.051	.022	5.443	.020	1.053	1.008	1.099
Delirium	−.121	.019	41.904	.000	.886	.854	.919

Variable	B	S.E.	Wald	Sig.	Exp(B)	95% CI for EXP(B) LL	UL
Decision-making cognitive skills impairment	.084	.034	6.231	.013	1.087	1.018	1.161
Sensory Impairment							
Hearing impairment	−.031	.018	3.024	.082	.970	.936	1.004
Vision impairment	.054	.017	9.700	.002	1.055	1.020	1.091
Medication Use							
Number of medications	.008	.002	15.815	.000	1.008	1.004	1.012
Analgesia	−.031	.020	2.498	.114	.969	.932	1.008
Antipsychotic	−.121	.019	39.199	.000	.886	.853	.920
Antianxiety	−.023	.027	.747	.388	.977	.926	1.030
Diuretic	.168	.020	72.961	.000	1.183	1.138	1.229
Antidepressant	−.123	.018	48.920	.000	.884	.854	.915
Hypnotic	−.131	.040	10.510	.001	.877	.810	.950

Discussion

Findings from this study offer insight into a range of factors that are associated with higher risk of falls for residents in LTC. The fall rate of 21% noted in this study is within the range found in international literature, which was 12.5% (Izumi et al., 2002) to 66.7% (Neto et al., 2017), but well above the provincial benchmark target of 9% (Health Quality Ontario, 2020). Although further studies need to confirm the findings and add to contextual data, this study provides a foundation to review nursing care related to fall prevention because the findings support that both non-modifiable and modifiable factors put residents at higher risk for falls.

Non-Modifiable Risk Factors

One non-modifiable factor that increased risk for falls in this study was increasing age ($p = .00$). Other studies uniformly found age to be a risk factor for falls, likely due to the changes that occur with increased age, such as loss of muscle and reduced sensory acuity (Sousa et al., 2016). Izumi et al. (2002) noted that “age is universally associated with a higher incidence of falls” (p. 146).

The results of this study indicated that being female increased the likelihood of a fall in the last 30 days (p = .00). In contrast, research findings were mixed as to whether sex is a risk factor for falls. Some studies found being male was a risk for falls (Lee et al., 2008; Castaldo et al., 2020; Cameron et al., 2018), while this and other studies found being female was a risk factor (Dhargave et al., 2016; Sousa et al., 2016; Zhang, Zeng, et al., 2019). The mixed findings suggest that attention should be paid equally to both men and women.

In this research study, residents in LTC facilities in rural locations were found to have increased likelihood of a fall in the past 30 days (p = .00). This finding is consistent with one study by Zhang, Ding, et al. (2019), who found that there were more falls among community-dwelling adults living in rural locations. However, our finding was contrary to a study by Zhang, Zeng et al. (2019), which found that the majority of fallers resided in urban locations (85.5%; p = .05). In a study conducted in Saskatchewan, Canada, Johnson et al. (2016) noted that a lack of health care resources in rural communities may have an impact on the likelihood of falls in rural areas.

In this research study, five conditions/diseases increased participants' likelihood of a fall within the past 30 days. It is possible that symptoms related to aphasia (p = .00), cancer (p = .03) and gastrointestinal disease (p = .00), which were all associated with increased likelihood of falls, put residents at an increased risk of falls. For example, residents with aphasia have difficultly comprehending, speaking and/or writing (Ontario Association of Speech-Language Pathologists and Audiologists, n.d.) and inability to communicate needs may lead to a fall. In addition, if aphasia was a result of a stroke, the resident may be at increased risk of falls as a result of impairments related to their stroke (Krueger et al. 2001).

Both arthritis (p = .00) and osteoporosis (p = .00) increased the likelihood of a fall, which is similar to the findings from research conducted by Krueger et al. (2001). In other studies, researchers did not explore individual conditions but grouped chronic/previous diseases together and found that this category was a fall risk factor (Damián et al., 2013; Dhargave et al., 2016; dos Reis & de Jesus, 2015, Neto et al., 2017; Zhang, Zeng, et al., 2019). Arthritis and osteoporosis are under-recognized risk factors for falls that need to be monitored and further investigated.

Most residents in the sample had cognitive impairment, which is not uncommon in LTC facilities; the Canadian Institute for Health Information (2018) found that 90% of all LTC residents had some degree of cognitive impairment. Specifically, in this study, 79% of participants had long-term memory issues, 79% had short-term memory issues and 88% had deterioration in their cognitive status within the past 30 days. Findings from the study showed that participants with long-term memory impairment (p = .02) and decision-making cognitive skills impairment (p = .01) were significantly more likely to have fallen in the last 30 days. On the other hand, having short-term memory impairment (p = .00) was associated with significantly less likelihood of a fall in the last 30 days. Since we know that procedural memory is an aspect of long-term memory that helps us to learn tasks involving multiple steps (Zimmermann, 2014), residents with long-term memory loss may be at a higher risk of falls when engaging in walking, talking and eating.

Our study evaluated elimination relative to fall risk. We found that residents who had bowel incontinence had increased likelihood of falls (p = .02), making bowel incontinence an under-recognized risk factor that needs to be monitored to improve the effectiveness of fall prevention strategies. The study also found that residents with urinary incontinence (p = .00) and

a recent deterioration in urinary continence (p = .00) had decreased likelihood of a fall within the last 30 days. This contrasts with other studies that identified urinary incontinence as a fall risk factor (Kron et al., 2003; Damián et al., 2013). In other work, Lee et al. (2011) showed an association between urinary incontinence and advanced dementia where residents may not be able to ambulate on their own and thus are less likely to fall.

This study found that any limitation in range of motion was significantly associated with falls. Take, for instance, range of motion in the neck, arm and foot. Participants with loss of range of motion in the neck (p = .00), arm (p = .00) and foot (p = .00) were significantly more likely to have fallen in the last 30 days, while participants with loss of range of motion in the leg were significantly less likely to have fallen in the last 30 days (p = .00). Literature associating limitations in range of motion of different body parts with falls is scant. Neto et al. (2017) found that a limitation to movement (no specific area of body was mentioned) was a significant, positive risk factor for falls. Limits in neck range of motion might affect an individual's ability to visually scan their environment and avoid falling hazards. Limits in foot range of motion can affect the ability of residents to safely and quickly react to threats to balance such as uneven flooring or tripping hazards (Chiacchiero et al, 2010).

In this study, residents needing assistance with ADLs such as eating (p = .00) and personal hygiene (p = .04) had increased likelihood of falling within the last 30 days. Tasks such as walking, talking and eating are based on procedural memory, which affects both non-mobile tasks, such as eating, and mobilization tasks like walking (Zimmermann, 2014). Since individuals with dementia, seen in most LTC residents, tend to overestimate their ability to perform ADLs (Mograbi et al., 2018), the gradual decrease in procedural memory in these residents may possibly increase their risk of falling.

In this study, residents with impaired sitting balance (p = .00) were significantly more likely to have fallen within the last 30 days, while in contrast, residents with impaired standing balance (p = .00) were significantly less likely to have fallen. This is contrary to studies that found imbalance and vertigo (Dhargave et al., 2016) and poor balance and gait (Zhang, Zeng, et al., 2019) to be risk factors for falls, though these studies did not indicate whether they tested for sitting imbalance. The performance of most ADLs require the ability to maintain balance while sitting, standing and transferring (Kallin, 2002). Poor balance while sitting is an under-recognized risk factor for falls that needs to be assessed.

A resident's level of independence (i.e., mobility and ADLs) seems to have an effect on the likelihood of falls. In terms of mobility, locomotion describes how the resident moves between locations on and off the unit (i.e., independent or with supervision/assistance). Residents needing assistance with on-unit locomotion (p = .00) and off-unit locomotion (p = .05) were less likely to fall within the last 30 days. Castaldo et al. (2020) had similar results, reporting that residents who were totally dependent on staff for locomotion were less likely to fall. This was confirmed in other studies, indicating that residents who need more hands-on staff assistance with locomotion are less likely to fall than residents with a greater ability to self-mobilize (dos Reis & de Jesus, 2015; Kerse et al., 2004; Castaldo et al., 2020).

Modifiable Risk Factors

Several conditions/diseases were noted to decrease residents' likelihood of a fall within the past 30 days, including delirium (p = .00); acute episode/flare up of a recurrent or chronic problem (p = .00); conditions/diseases that make a resident's cognitive, ADLs and behaviour patterns unstable (p = .00); and the presence of pain symptoms (p = .00). There were no data comparable to these findings in the research literature. There is potential for clinical intervention

to reduce symptoms and mitigate harm for each of these conditions. If delirium, a flare up, an acute condition or pain are recognized by care providers, resources can be put in place to address them which, in turn, may reduce the likelihood of a fall.

Data from this study showed a positive association between the number of medications taken by a resident and falls in the last 30 days (p = .00). This finding is similar to other studies (Lee et al., 2008; Damián et al., 2013; Dhargave et al., 2016; Sousa et al., 2016). Polypharmacy is common in LTC as older adults present with several medical conditions (Neto et al., 2017).

Park et al. (2015) argued that it is not only polypharmacy but also the type of medications taken by residents that increases their risk of falls. In their systematic review of studies, they found that using sedatives, hypnotics and antidepressants was particularly associated with increased risk of falls for adults over 60 years of age. The findings in our study showed that using antidepressants had an inverse relationship with falls (p = .00). The use of antidepressants in the older adults and their effect on fall risk has been well researched, with several studies agreeing that antidepressant use (Fonad et al., 2008; Kallin et al., 2002; Damián et al., 2013; Park et al., 2015), newly initiated antidepressants (Macri et al., 2017) and selective serotonin reuptake inhibitors (Cameron et al., 2018) were all directly associated with falls. In our study, it was unclear why using hypnotics (p = .00) and antipsychotics (p = .00) were associated with a decreased likelihood of falls. The negative impact of using these medications in other studies suggests that the findings of this study should be interpreted cautiously.

In this study, diuretics were the only drug category found to increase the likelihood of a fall occurring in the past 30 days (p = .00). Although McArthur et al. (2016) did not compare medication use to falls, they did find that most falls in LTC homes occur in residents' bedrooms and bathrooms. Berry et al. (2012) purported that residents on diuretics may attempt self-

transfers and ambulation without assistance in a rush to use the bathroom. Using these studies together provides some data to suggest that diuretics may be associated with falls in LTC settings. Further, using diuretics may increase risk of dehydration and hypotension, which increases fall risk (Berry et al., 2012; Hamrick et al., 2020), further explaining why diuretics might have been associated with falls in LTC in our study.

Participants with visual impairment (p = .00) had increased likelihood of a fall within the last 30 days. Various other researchers have found that poor vision is associated with increased risk of falls (Kallin et al., 2002; Lee et al., 2008; Dhargave et al., 2016; Cameron et al., 2018; Zhang, Zeng, et al., 2019). In this and other studies, visual impairment was a generic category with no differentiation between level and type of visual impairment and whether it was modifiable.

Some behavioural variables included in this study were associated with an increase in risk of falls while others were not. Participants with a recent deterioration in behaviour symptoms (p = .00) and persistent verbal anger (p = .04) were significantly more likely to have fallen in the last 30 days. This is in contrast to the findings of Kron et al. (2003) who also studied persistent anger among residents and did not find a significant association with falling. There are clinical strategies that can be implemented to reduce/mitigate a resident's behaviour, such as the Behavioural Support Ontario program (Behavioural Support Ontario, 2013).

Implications for Practice

Many variables assessed in this study that were associated with falls are modifiable in practice. Some practical recommendations for health care practitioners are to:

- implement harm reduction strategies for residents who display responsive behaviours in order to reduce agitation and fall risk,

- administer diuretics at least six hours before bedtime (Heart and Stroke Canada, n.d.) and in the morning medication pass,
- monitor residents with bowel incontinence, aphasia, cancer, gastrointestinal disease, arthritis, osteoporosis, long-term memory impairment, and an impaired decision-making status in fall risk assessment tools.

Implications for Research

Future research needs to be aimed at better understanding how to prevent falls by residents in LTC. For instance, the physiological changes that occur when taking diuretics are known to put residents at increased risk of falling (Berry et al., 2012; Hamrick et al., 2020), but clinical strategies, such as timing of dosing of medication, need to be better understood to prevent falls in this population. In addition, more research on the contexts of falls in LTC is needed to better determine the circumstances surrounding falls, such as times of falls, activity prior to falls, types of falls, whether falls occurred indoors or outdoors, and psychological influences (e.g., fear of falling). These additional details would aid in identifying any missed fall risk factors and in developing more targeted and effective fall prevention strategies.

Summary

This study's findings are robust and wide ranging. They serve to fill identified gaps in falls research in Ontario's LTC facilities by providing research on resident variables associated with high fall risk that was previously unknown. Some findings supported existing research and others were contradictory. Several significant fall risk variables that were identified in the literature were not significant in this study. This research also analyzed the influence of geographic and seasonal factors on falls in LTC.

Limitations and Strengths

Contextual and environmental variables could not be assessed using this data because data were limited to the information captured on RAI-MDS assessment forms. Though the process of collecting data using these forms is vulnerable to errors and reporting bias since it is completed by health care staff in each of the LTC facilities, the RAI-MDS tool is reliable and valid (Hutchison et al., 2010; Hawes et al., 1995). Another limitation involved the missing data (n=262,598 out of 372,469 cases) resulting in 29.5% (n=109,871) cases included in the logistic binomial regression analysis. However the large number of cases in the regression analysis ensured the accuracy of the regression model, the validity and the statistical power (Laerd Statistics, 2017; Polit & Beck, 2017). Finally, the participant group was a heterogeneous population living in LTC settings in Ontario, so generalizability to LTC settings in Ontario and Canada is strong.

Conclusions

This study used data provided by the Canadian Institute of Health Information that is collected quarterly and annually from Ontario's LTC residents by health care staff. Data from this study supported that many variables (age, sex, rural location of facility, history of falls, behaviours, ADLs, balance, range of motion, medical conditions, visual impairment, cognitive impairment, incontinence and medication use) increased or decreased the likelihood of a fall in LTC settings. This study also identified non-modifiable and modifiable risk factors that contribute to the likelihood of resident falls. Some modification suggestions were discussed. The results of this study are useful in guiding the efforts of health care providers in reducing falls in Ontario's LTC facilities.

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Discussion

This thesis accomplished three things. It consolidated research on relevant fall risk factors through a literature review. It analyzed and developed a concept for the relationship between homeostasis and falls in older adults. And it conducted and reported on the results of a cross-sectional, retrospective research study. Following a brief overview of the three accomplishments is a discussion of the implications of the study's research findings for nursing practice, health policy, education and future research.

Brief Review

The literature review revealed several risk factors for falls. An in depth review of 16 research articles that focused on falls in LTC facilities around the world, identified factors positively associated with falls such as number of institutional years, level of care, performance of activities of daily living (ADLs), history of falls, age, diseases/conditions, cognitive impairment, sensory deficits, medication use, aggressive behaviours, environmental factors and a fear of falling (Krueger et al., 2001; Izumi et al., 2002; Kallin et al., 2002; Kron et al., 2003; Kerse et al., 2004; Fonad et al., 2008; Lee et al., 2008; Damián et al., 2013; dos Reis & de Jesus, 2015; Sousa et al., 2016; Dhargave & Sendhilkumar, 2016; Macri et al., 2017; Neto et al., 2017; Cameron et al., 2018; Zhang et al., 2019; Castaldo et al., 2020). The literature also showed that seasonal and geographic trends could affect the risk of falls, such as the presence of icy/slippery surfaces (Morency et al., 2012; Bélanger-Bonneau et al., 2002), colder climates (Steven et al., 2007) and more fall fatalities in December (Lantos et al., 2019). The literature also showed a positive association between falls and living in an urban location (Zhang et al., 2019) and in medium-large population centres (Thorpe et al., 2017).

These identified fall risk factors were instrumental in the construction of a concept analysis on homeostasis and falls by showing that homeostasis was present when fall risk factors were absent. In other words, when fall risk factors were present, the likelihood of an individual falling was greatly increased, leading to a disruption in the individual's homeostasis. Homeostasis in relation to falls was defined by the authors as *the ability of the interdependent elements of the human body and its surrounding environment to cooperatively seek and maintain a condition of internal balance/equilibrium/stability in order to prevent falls and maintain health and functioning, regardless of any intrinsic or extrinsic factors/stresses that would tend to disturb the body's normal condition or function*. This definition illustrates that interdependent elements, such as the mind, will and physical body, seek to maintain healthy functioning despite the presence of stimuli that could precipitate a fall. In nursing practice, the concept of homeostasis contributes to falls prevention by giving nurses another avenue of illustrating how risk factors work to destabilize residents' attempts at maintaining balance. Nurses seek to help residents maintain homeostasis by preventing falls and managing fall risk factors.

Some gaps in the evidence were identified in the literature on falls. First, there were very few studies examining falls risk variables in Ontario LTC settings. It is important to generate provincial falls data because generalizing falls data from one country to another may not be appropriate since there are geographic-specific differences in access, finances and the roles of LTC facilities across jurisdictions that may affect risk profile (Kron et al., 2003). Second, since there is no universal definition of a fall, studies used different definitions, with some not providing one, which could have led to differing results and measurements across studies. Third, the influence of geographic and seasonal factors on falls has not been examined in LTC research,

yet there is some evidence that these factors influence falls in the general population and it is necessary to find out if this is also the case in the LTC population.

Implications for Nursing Practice

The findings from the literature review, concept analysis and research study have the potential to aid nursing practice in LTC. This section first describes the goal of nursing care in LTC, then gives a brief overview of fall assessment tools used in LTC and finally describes the clinical implications of this thesis work on nursing practice.

Nursing in Long-Term Care

The *Nursing Act* defines the scope of nursing as "the promotion of health and the assessment of, the provision of, care for, and the treatment of health conditions by supportive, preventive, therapeutic, palliative and rehabilitative means in order to attain or maintain optimal function" (Government of Ontario, 2017, chapter 32, section 3). In other words, nurses aim to help residents maintain and regain homeostasis in relation to falls through many avenues. Post-fall trauma, disruption and confusion destabilize older adults and decrease their likelihood of regaining homeostasis. Nurses facilitate the goal of maintaining homeostasis in relation to falls by supporting residents at risk of falling through fall prevention activities. They also provide supportive, therapeutic and rehabilitative treatment for those who have already suffered a fall.

As required by the Government of Ontario (n.d.), when residents are first admitted an LTC, a 24-hour admission care plan is completed. This care plan is used by the staff to direct resident care until a permanent nursing care plan is put in place, which must include input from all relevant departments (i.e., dietary, nursing and life enrichment). The nursing care plan is a very important part of fall prevention since it is a place where nurses can direct the efforts of health care personnel involved in providing care for that resident.

Fall Assessment Tools in Long-Term Care

Fall prevention programs often endorse a multidisciplinary and multifactorial approach for health workers to assess residents for risk of falls and to implement fall prevention strategies (Registered Nurses of Ontario, 2017; Australian Commission on Safety and Quality in Healthcare, 2009). The first step in a fall prevention program is to assess a resident's risk of falling using one of many available fall risk assessment tools. These tools contain questions designed to identify different fall risk factors. Welch et al. (2016) conducted a comprehensive review of studies on assessment tools and found that five tools were commonly referenced and had good predictive accuracy for falls in LTC: the Morse Fall Scale, the STRATIFY (St. Thomas Risk Assessment Tool), the Fall Risk Assessment Tool, the RAI-MDS and the Ontario modified STRATIFY. These five tools assess multiple fall risk factors at once and give a level of fall risk for the resident. There are other common assessment tools that focus on just one or two fall risk factors. For example, the Mini Mental Status Examination (Kurlowicz & Wallace, 1999) assesses for cognitive impairment and the Timed Up and Go Test (Podsiadlo & Richardson, 1991) assesses gait and balance. Although the RAI-MDS showed high predictive accuracy for falls, it requires 80 minutes and training to administer (Welch et al., 2016). Applicable fall prevention strategies are selected and implemented based on the results of these assessment tools.

Using fall risk assessments is critical to identifying early indicators of high fall risk for a resident and thus preventing falls (Fonad et al., 2008; Castaldo et al., 2020). The Registered Nurses Association of Ontario recommends nurses screen for fall risk at admission, annually and with a significant change in health status (Registered Nurses' Association of Ontario, 2017).

This thesis may add to developing more robust and accurate falls risk assessment tools by providing a more comprehensive list of fall risk variables. One important way that nurses can apply the findings of this thesis in the screening phase is by ensuring the variables that were found to increase the likelihood of falls are included in their fall risk assessments in order to quickly identify at-risk residents. For example, a nurse might assess that a new resident has impaired range of motion in her neck. Knowing this is a risk factor for a fall, they can highlight that the resident is at higher risk for falls in the care plan and refer the resident to the physiotherapist for further assessment and interventions. This thesis identified many variables as high risk for falls that are not included in the common fall risk assessment tools. For example, few fall assessment tools assess for age, sex, persistent verbal anger expressions, eating assistance, personal hygiene assistance, neck/arm range of motion impairment, aphasia, cancer or gastrointestinal disease. According to results from this study, these are all important variables in the assessment of falls risk. With more research, perhaps the findings of this thesis can be used to build a fall risk assessment tool that is quickly administered and that requires minimal training. This tool would be valuable to nurses' attempts to identify residents at high risk for falls.

The Nursing Role and Modifiable Fall Risk Factors

It is important to identify which fall risks are modifiable in order to implement interventions to addressing them and thus reduce falls. Categories such as medication use, some medical conditions, limitations in range of motion and ADLs can be modified to some degree.

The study found that the number of medications and the use of diuretics were both variables that increased residents' likelihood of falling. Nurses, nurse practitioners, physicians and pharmacists can review residents' medications to potentially reduce the number of medications and, if possible, eliminate or reduce doses of diuretics. Some organizations

recommend that physicians and pharmacists review residents' medications (Australian Commission on Safety and Quality in Healthcare, 2009) but it is important to include nurse practitioners, registered nurses and registered practical nurses in the discussion since they often have firsthand knowledge of how individual residents are responding to medications.

The research study showed that medical conditions such as bowel incontinence, aphasia, cancer, gastrointestinal disease, arthritis, osteoporosis, long-term memory impairment, impaired decision-making status and visual impairment significantly increased the likelihood of a fall. Each resident's primary health care team should work together to prevent development of any of these conditions and to reverse or mitigate their effects if the conditions are already present. For example, 70% or more of cases of visual impairment are reversible (Abdelhafiz & Austin, 2003; Harwood et al., 2001), so effort should be made to routinely assess residents' vision (Abdelhafiz & Austin, 2003) and to provide interventions such as cataract surgery as required (Harwood et al., 2001). The negative effects of visual impairments that cannot be reversed can be diminished by health care staff ensuring that residents are properly prescribed and wear their corrective devices (i.e., glasses). A policy recommendation regarding eye exams is made in the next section.

In the study, needing assistance with some ADLs and having limitations in range of motion increased the likelihood of falling. These impairments may be responsive to treatment efforts from physiotherapists or other support staff. Nurses should be prompt to refer residents to these services when required. For example, they can request a range of motion assessment on a physiotherapy referral form.

Many authors have noted that success in falls prevention requires a multifactorial approach (Izumi et al., 2003; dos Reis et al., 2015; Sousa et al., 2016). Implementing this

section's recommended interventions for modifiable fall risk factors is an example of a multifactorial approach. Other multifactorial suggestions for fall prevention are increasing supervision, improving communication with all staff regarding chosen fall prevention strategies and making use of the multidisciplinary support staff present in LTC facilities.

Implications for Health Policy

Policies that affect LTC facilities are integral to the health of residents. In Ontario, the provincial government regulates care services in LTC facilities through the *Long-Term Care Homes Act*, 2007 and Regulation 79/10, 2010 (Government of Ontario, 2019). It is mainly because of requirements in these legislations to develop and implement fall prevention and management programs that all LTC facilities in Ontario are keenly focused on reducing falls. Neto et al. (2017) noted that implementing public policies and securing financial support allow evidence-based strategies to be implemented to prevent falls in LTC. Policy is an essential conduit for financial support. In this section, the authors will identify changes to current policy regarding eye examinations, funding and staffing of LTC facilities that are guided by our findings.

This study found that visual impairment increased the odds of falling by 1.06 times. Currently residents in LTC facilities are not required to have routine eye examinations even though annual tests are covered by the Ontario government for adults over 65 years (Government of Ontario, 2021). A policy recommendation is for LTC facilities to ensure all residents receive routine eye examinations by either contracting an optometrist to come onsite to perform assessments or by facilitating residents' travel offsite to an optometrist of their choice.

The results of this study raise questions about whether increased staff awareness and increased supervision of residents with certain fall risk variables, such as having a history of falls

and having a diagnosis of dementia, decreased the likelihood of falls. Policy influences the financial support which influences the amount of staff available to supervise and care for residents. Staff in LTC do important work in helping to prevent falls (Registered Nurses' Association of Ontario, 2017); unfortunately, the shortage of nursing staff in LTC has been increasing (Ministry of Long-Term Care, 2020), which may hamper the level of staff supervision for fall prevention. Not only is there a need for an overall increase in nursing staff in LTC (Registered Nurses Association of Ontario, 2018), it has been difficult for homes to find staff to maintain their current staffing requirements. This has been painfully apparent during the COVID 19 pandemic (Perkel, 2021).

The findings of this study suggest that more staff hours per resident will lead to better outcomes for falls prevention. For example, more staffing may lead to better supervision of residents with bowel incontinence who were found to have increased likelihood of falling. Legislation requires LTC facilities to have adequate staffing and to provide for the needs of their residents (Government of Ontario, 2019); however, there are two significant issues in relation to the policy of adequate staffing: satisfactory staff-to-resident ratios, and hiring and retaining Personal Support Workers and Registered Nurses (Ministry of Long-Term Care, 2020). In fact, the Registered Nurses Association of Ontario (2018) called for minimum staffing ratios and increased funding to increase resident safety. The Ministry of Long-Term Care (2020) agreed, recommending that health care providers should be assigned a maximum number of residents. This is important since research has shown that increased registered nurse staffing is associated with decreased probability of resident hospitalization, decreased mortality and better employee outcomes (Dellefield et al., 2015).

Data from this study also suggest that location and funding may be important factors in falls prevention. For example, the study found that participants that live in rural areas, have visual impairment and have limitations in range of motion were more likely to fall. Rural areas may have less access to resources and allied professionals (Johnson et al., 2016). The Ontario Ministry of Long-Term Care (2020) recommended increased involvement of allied professionals (i.e., physiotherapists, occupational therapists, recreation therapists and social workers) since these services have been reported to decrease trips and falls and improve strength and mobility. LTC facilities could use more funding for fall prevention equipment, such as tab alarms, wander guards, non-skid socks, hip protectors and wheelchair tabletops. Funding could also be used for continued research to identify additional fall risk factors (such as contextual and environmental risks) and subsequent development of fall interventions.

Incorporating the results of this thesis work into resident care would benefit from a more holistic approach to falls prevention. Within an LTC facility, implementing policy that focuses on a holistic approach to care is beneficial for residents and staff (Ministry of Long-Term Care, 2020), including relational and emotional models of care such as the Gentle Persuasive Approach, P.I.E.C.E.S. and the Butterfly Model (Ministry of Long-Term Care, 2020). Facilities that embrace this approach have seen fewer falls and reduced staff turnover (Ministry of Long-Term Care, 2020).

Homeostasis is a unique approach to fall prevention that was introduced in this thesis and promotes viewing the resident as a whole person with interrelated parts. This valuable concept directs staff to identify areas in residents' lives that may support or diminish the maintenance of homeostasis. The findings of this thesis (i.e., the need for a decrease in the number of medications taken by residents and an increase in staff supervision of more mobile residents)

support the implementation of resident-centered policies using the concept of homeostasis in relation to falls to promote a holistic approach to reducing falls in Ontario's LTC facilities. For example, such a policy would focus on each resident, acknowledging their efforts to maintain homeostasis in relation to falls, and then look at ways that staff can help them in this goal (i.e., increased supervision and decreased meds).

Implications for Education

The findings of this study suggest that implementing evidence-based interventions yields results. For example, the authors hypothesize that the reason history of falls and dementia were not found to increase the likelihood of falls is because of staff education on these well-known fall risk factors. In a study looking at the effect of implementing evidence-based education and best practices in nursing homes, Teresi et al. (2013) found an annual fall reduction of up to 12 falls in an institution, which translated to up to $52,000 in savings. Neto (2017) went even further by saying that nurses should not only educate staff, but also older adults on the conditions that increase the risk in falls and use demonstrations to show how to avoid these conditions.

Educating nurses on the very real dangers of falls in older adults is a necessity. While falls disproportionately affect older adult residents of LTC facilities, they also affect older adults in every field of nursing. Nursing education is regulated by the College of Nurses of Ontario who take an active role in approving the province's Practical Nursing, Baccalaureate Nursing and Nurse Practitioner programs (College of Nurses of Ontario, 2018). Given the scarcity of Ontario-based LTC fall research, effort should be made by the College of Nurses of Ontario to encourage nursing schools to undertake and incorporate such research in their programs.

Nurses have a responsibility to integrate "research findings into professional service and practice" (College of Nurses of Ontario, 2018a, p. 8). The question is, how will they integrate if

they are not aware of the current research findings? This is where a dedication to continuing education comes in. Endeavouring to stay up-to-date with relevant, current research in the nursing field is a point that is endorsed by the College of Nurses of Ontario in their Knowledge Professional Standard (College of Nurses of Ontario, 2018a). This goal should be facilitated by organizations that employ nurses by providing and/or subsidizing upgrade courses, workshops/conferences and/or skills days. For example, the findings of this thesis are important, and nurses should be aware of them by reading nursing research (continuing education).

Nurses must also pass their knowledge of fall risk factors on to all staff directly involved in providing care for residents. As directors of care, registered nurses and registered practical nurses are all in supervisory roles in LTC, they are in a position to provide fall prevention teaching to personal support workers and the rest of a facility's support staff. Education can be accomplished through in-house training sessions and by having established routes to quickly communicate changes in policy, procedures and resident status (such as a change in a resident's fall status). Incorporating this thesis' findings into nursing care using the suggested education strategies could work to increase nurse and staff awareness of the current research on falls in LTC and improve the likelihood of integrating this knowledge into their practice. As a result, residents would benefit from getting the best possible evidence-based care.

Implications for Future Research

Research is important to the future of nursing and this study offers many exciting considerations for future research. The study adds to previous research on falls in LTC facilities and illustrates the changing face of falls in LTC. Findings such as having a history of falls decreasing the likelihood of having a fall and the diagnosis of dementia not being significant for

falls are contrary to previous falls research. These contrary findings illustrate changes in risk factors for falls in LTC that will not be reflected in the current literature.

For instance, this study found that a diagnosis of dementia in and of itself was not linked to falls, but the secondary effects of dementia (such as loss of procedural memory) can increase the likelihood of falls. Thus, grouping residents with dementia into a single category may be deceptive. There are many different types of dementia with different stages of neurodegeneration over time (Canadian Nurses Association, 2016). As a result, it might be important to conduct research that classifies residents according to their stage of dementia to effectively target fall prevention strategies.

Another finding showed that participants who needed assistance with personal hygiene were more likely to have fallen in the past 30 days. In the RAI-MDS data set, the variable "assistance for personal hygiene" is divided into five categories: independent, supervision, limited assistance, extensive assistance and total dependence (see Appendix C for the breakdown of all categories on the RAI-MDS form). For the purposes of this research, we combined all findings into two categories, independent (no help or oversight) and assistance required. Future research could further divide the requires assistance category into residents who require limited assistance, extensive assistance or are totally dependent in order to discern which group is at greatest risk of falling.

An additional area for future research is exploring layering or stacking variables in statistical analysis in order to discern the effect or interaction between variables. For example, our study found that having dementia did not increase a resident's likelihood of falling but having cognitive deficits and needing help with certain types of ADLs did increase the likelihood of a fall. What would we find if we statistically analyzed these three variables to determine how

they interact to influence risk of falls? This idea of interactions between variables is integral to the concept of homeostasis, which is based on interdependence. Homeostasis breaks down when variables work (often working together) to overwhelm the body's attempts to maintain balance. Lee et al. (2008) noted that physical impairment in and of itself is not necessarily linked to falls if it is adequately corrected by assistive aids (i.e., walker). It is the interaction of variables such as cognitive impairment and eye disease with physical impairment that increases a resident's likelihood of falling. Izumi et al. (2002) found an interaction between requiring assistance for elimination, having a history of falls and the likelihood of future falls. Kerse et al. (2004) called for more research into the interaction between behaviour, functional status and falls. In the same way, future research could assess layering different variables to see the effect of their interaction on residents' likelihood of falling. It would be interesting to analyze the effect on falls by layering dementia with assistance with ADLs because the results would be helpful in better understanding which combination of variables put residents at higher risk of falling.

Further investigation is needed into the causal roles of the fall risk variables identified in this study. As recommended by Kron et al. (2003), properly designed randomized controlled trials should be conducted to determine the causal effects of the fall risk factors on fall rates. For example, why was it that in our study residents who took diuretics or those with visual impairments had an increased likelihood of falling? Research to discover causal links is especially relevant for modifiable fall risk factors like medications where doses can be changed and alternate medications can be introduced to mitigate fall risk (Macri et al., 2017).

Damián et al. (2013) noted that since most falls do not result in physical injury, it is more important to focus on studying risk factors for injurious falls. This is important since the aim of falls research is to decrease falls and thus decrease resulting injuries. Although we did not

analyze residents with fall-related injuries to see if they have a different fall risk profile, other studies have done this with varying results (Krueger et al., 2001; Kerse et al., 2004; Do et al., 2015; Towne et al., 2017; Macri et al., 2017). It would be valuable to analyze recent Ontario LTC data on fall-related injuries, which was impossible for this study because the RAI-MDS form does not collect information on fall-related injuries.

Finally, our study did not find any seasonal effects on falls but this does not preclude the presence of other outdoor factors. Our study was also unable to assess risk factors for outdoor falls since our data did not distinguish between indoor and outdoor falls. O'Loughlin et al. (1994) showed that risk factors differ between indoor and outdoor falls. Therefore, future research should focus on identifying outdoor fall risk factors. While outdoor fall rates in LTC appear lower than in the community, possibly due to restrictions on outdoor movements, a substantial 12.4% of falls occurred outside LTC facilities (Dhargave et al., 2016). Lai et al. (2011) also pointed out that while some studies cite "environmental factors," they do not explicitly define this term. Therefore, it is difficult to know if the term is highlighting factors within (i.e., rugs) or outside the home (i.e., icy surfaces).

Conclusion

This thesis has explored the phenomenon of falls in LTC facilities in Ontario through the lens of homeostasis as a guiding concept. A research study was conducted to identify current risk factors for falls, including age, sex, location of facility (rural/urban), history of falls, behaviours, ADLs, balance, range of motion, medical conditions, visual impairment, cognitive impairment, incontinence and medication use. By filling evidence gaps in literature, I hope that this work will contribute to developing more effective fall management and prevention programs in LTC. The

suggested implications for the different areas of nursing should be used to further the main goal of helping residents maintain or regain homeostasis by reducing falls.

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Appendices

Appendix A: Ethics Certificate

APPROVAL FOR CONDUCTING RESEARCH INVOLVING HUMAN SUBJECTS

Research Ethics Board – Laurentian University

This letter confirms that the research project identified below has successfully passed the ethics review by the Laurentian University Research Ethics Board (REB). Your ethics approval date, other milestone dates, and any special conditions for your project are indicated below.

TYPE OF APPROVAL / New X / Modifications to project / Time extension	
Name of Principal Investigator and school/department	Abimbola Akomah, Nursing, supervisor, Roberta Heale, w. Lori Rietze, Robin Gorham
Title of Project	Falls and Fall Risk Factors in Long-Term Care Facilities in Ontario
REB file number	6017296
Date of original approval of project	May 22, 2019
Date of approval of project modifications or extension *(if applicable)*	
Final/Interim report due on: *(You may request an extension)*	Mau 22. 2020
Conditions placed on project	

During the course of your research, no deviations from, or changes to, the protocol, recruitment or consent forms may be initiated without prior written approval from the REB. If you wish to modify your research project, please refer to the Research Ethics website to complete the appropriate REB form.

All projects must submit a report to REB at least once per year. If involvement with human participants continues for longer than one year (e.g. you have not completed the objectives of the study and have not yet terminated contact with the participants, except for feedback of final results to participants), you must request an extension using the appropriate LU REB form. In all cases, please ensure that your research complies with Tri-Council Policy Statement (TCPS). Also please quote your REB file number on all future correspondence with the REB office.

Congratulations and best wishes in conducting your research.

Rosanna Langer, PHD, Chair, Laurentian University Research Ethics Board

Appendix B: Variable Definitions

Unless otherwise stated, variable definitions are from:

Canadian Institute for Health Information. (2012). Resident Assessment Instrument (RAI) RAI-MDS 2.0 User's Manual. (Canadian version).

Dataset from Apr 2019 – Mar 2020

Risk Factor Variables	**Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)**	**MDS Form Categories**
Number of Institutional Years	The date the resident was most recently admitted to your facility (p.45).	AB1 Admission date
Age	Provided in numeral form (e.g., 41).	age_assessment
Sex	Male or female or other.	aa2_sex_code
Falls	**Fall:** any unintentional change in position where the resident ends up on the floor, ground or other lower level (p. 162).	j4b_fell_in_past_31_180_days
Aggressive Behaviours	**E1d–Persistent anger with self or others:** both verbal statements and non-verbal expressions of anger observed in the last 30 days (p.90). **Wandering:** Locomotion with no discernible, rational purpose (p. 96). **E4–Behavioural symptoms:** the frequency and alterability of behavioural symptoms in the last seven days that cause distress to the resident, or are distressing or disruptive to facility residents or staff members (p. 96).	**Section E (Behavioural Symptoms):** e1d_persistent_anger e4aa_wandering_freq e4ba_verbal_abuse_freq e4ca_physical_abuse_freq e4da_disruptive_freq e4ea_resists_care_freq e5_change_in_behaviour_symptom

Risk Factor Variables	Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)	MDS Form Categories
	E5–Change in behaviour symptoms: refers to the status of any symptoms described in item E4 (p. 100).	
Activity of Daily Living	**ADL self-performance:** measures what the resident actually did (not what he or she might be capable of doing) within each ADL category over the last seven days according to the performance-based scale (p. 109).	**Section G (physical functioning and structural problems):** g1ea_locomot_on_unit_self g1fa_locomot_off_unit_self g1ga_dressing_self g1ha_eating_self g1ia_toilet_use_self g1ja_personal_hygiene_self
	G3–Balance: while standing (not walking) without an assistive device or assistance of a person; while sitting without using the back or arm of the chair for support (p. 125).	**G3 (Test for balance)** g3a_balance_while_standing g3b_balance_while_sitting
	G4–Functional limitation in range of motion: limitation in the capacity of a joint to move through its range that interferes with daily functioning (particularly with ADLs), or places the resident at risk. Range of motion can be assessed actively, with partial physical assistance (active assisted) or passively (p. 130).	**G4 (Functional limitation in range of motion)** g4aa_neck ROM g4ba_arm_range_of_motion g4ca_hand_range_of_motion g4da_leg_range_of_motion g4ea_foot_range_of_motion
	G9–Change in ADL function: changes occurring in the resident's	**G9 (Change in ADL function)** g9_change_adl_function

Risk Factor Variables	Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)	MDS Form Categories
	overall ADL self-performance, as compared to status of 90 days ago (or since last assessment if less than 90 days ago) (p. 139). **Q2–Overall self-sufficiency:** includes self-care performance and support, continence patterns, involvement patterns, use of treatments, etc.; monitors resident's overall progress at the facility over time (past 90 days) (p. 213).	**Section Q (Discharge potential and overall status):** q2_change_in_care_needs
Illnesses/Diseases	**H1a, b–Bladder and Bowel Continence:** Refers to control of urinary bladder function and/or bowel movement (p.141). **H4–Change in urinary continence:** changes in the resident's urinary continence status as compared to 90 days ago (or since last assessment if less than 90 days ago) (p.146). **I1–Diseases:** active diagnoses determined through patient, physician and nursing input that have a relationship to current ADL status, cognitive status,	**Section H (Continence in last 14 days):** **H1a (Bowel continence)** H1a_bowel_continence_self **H1b (Bladder continence)** h1b_bladder_continence_self **H4 (Change in urinary continence)** h4_change_urinary_continence **Section I (Disease Diagnoses):** **I1 (Diseases)** i1d_arterio_heart_disease i1l_arthritis i1o_osteoporosis i1r_alzheimers i1s_aphasia

Risk Factor Variables	Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)	MDS Form Categories
	behaviour status, medical treatment, nursing monitoring, or risk of death (p. 152). Conditions that have been resolved or no longer affect the resident's functioning or care plan are not included (p. 148).	i1rr_cancer i1ss_gastrointestinal_disease
	Pain: Any type of physical pain or discomfort in any part of the body. The pain experience is very subjective; pain is whatever the resident says it is (p. 158).	**Section J (Health Conditions): J2 (Pain symptoms)** j2a_pain_symptoms_freq
	J5–Stability of Conditions: to determine if the resident's disease or health conditions present over the last seven days are acute, unstable or deteriorating (p. 163).	**J5 (Stability of conditions)** j5a_condition_lead_to_instable j5b_experiencing_acute_episode
Cognitive Impairment	**B2–Memory:** the resident's functional capacity to remember both recent and long-past events (p. 71).	**Section B (Cognitive Patterns): B2 (memory)** b2a_short_term_memory_ok b2b_long_term_memory_ok
	B3–Memory recall: the resident's memory/recall performance within the environmental setting (p.73).	**B3 (memory/recall ability)**
	B3–Memory recall: the resident's actual performance in making	**B4 (cognitive skills for daily decision-making)** b4_cognitive_skills

Risk Factor Variables	Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)	MDS Form Categories
	everyday decisions about tasks or ADLs (p.74). **B5–Indicators of delirium:** behavioural signs that may indicate that delirium is present. A recent change (deterioration) in cognitive function is indicative of delirium (p. 76). **B6–Change in cognitive status:** changes in the resident's cognitive status, skills, or abilities as compared to his or her status of 90 days ago (or since last assessment if less than 90 days ago) (p. 78).	**B5 (Indicators of delirium- periodic disordered thinking/awareness)** b5a_easily_distracted b5b_periods_of_alt_percept b5c_episodes_of_disorg_speech b5d_periods_of_restlessness b5e_periods_of_lethargy b5f_mental_function_varies **B6 (Change in cognitive status)** b6_change_cognitive_status
Sensory Deficits	**C1–Hearing:** the resident's ability to hear (with environmental adjustments, if necessary) during the past seven-day period (p. 80). **D1–Vision:** the resident's visual abilities and limitations over the past seven days, assuming adequate lighting and assistance of visual appliances, if used (p. 87).	**Section C (Communication/Hearing):** **C1 (Hearing)** c1_hearing **Section D (Vision patterns):** **D1 (Vision)** d1_vision
Medication Use	**O1–Number of medications:** the number of different medications	**Section O (Medications):** **O1 (Number of medications)** o1_num_of_medications

Risk Factor Variables	Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)	MDS Form Categories
	(over the counter and prescription drugs) the resident has received in the past seven days (p. 188). **O2–New medications:** whether the resident is currently receiving medications that were initiated in the last 90 days (only includes given as needed meds and regularly administered meds) (p. 189). **O4–Days received the medication:** the number of days the resident received the medication in the last seven days (p. 190).	**O2 (New medications)** o2_new_medications **O4 (Days received the following medication)** o4a_days_antipsychotic o4b_days_antianxiety o4c_days_antidepressants o4d_days_hypnotic o4e_days_diuretic o4f_days_analgesic
Seasonal	**Season Categories:** the seasonal calendar was followed.	**Season Categories:** Winter- December to February Spring-March to May Summer- June to August Autumn- September to November
Geographic Regions	**Urban/Rural:** Urban/rural status of facility as a variable was assigned by the Canadian Institute for Health Information at the request of the researcher. Definition for Urban/rural areas as per Statistics Canada (2011, para 2): "An urban area was defined as having a population of at least	**Urban/Rural:** fac_urban_rural_code − The Rural/Urban variable was provided by CIHI. These variables were created using the Statistics Canada definitions for urban and rural populations (Statistics Canada, 2011). **North/South:** Variable developed with the NE and NW LHINS as 'north' and all others as south

Risk Factor Variables	Definitions as per RAI-MDS 2.0 User's Manual (Morris et al., 2012)	MDS Form Categories
	1,000 and a density of 400 or more people per square kilometre. All territory outside an urban area was defined as rural area."	
Restraints	**P4–Devices and restraints:** a physical restraint is any manual method, or a physical or mechanical device, material or equipment that is attached or adjacent to the resident's body, that the resident cannot remove easily, and that restricts a resident's freedom of movement or normal access to his or her body (p. 205).	Did not request for this MDS category from CIHI therefore unable to test for this risk factor.
Environmental	N/A	No variables on MDS therefore unable to test for this risk factor
Fear of Falling	N/A	No variables on MDS therefore unable to test for this risk factor
Level of Care- type of resident unit	N/A	No variables on MDS therefore unable to test for this risk factor

Appendix C: Resident Assessment Instrument-Minimum Data Set Form

1

Minimum Data Set (MDS) 2.0©
Canadian Version

FULL ASSESSMENT

**** Status in last 7 days, unless other time frame indicated.***

Addressograph

SECTION AA and A: IDENTIFICATION INFORMATION		
AA1	UNIQUE REGISTRATION IDENTIFIER	
A1	RESIDENT NAME	
A2	ROOM NUMBER	a. Unit; b. Room #
AA2	SEX	M. Male F. Female O. Other
A3	ASSESSMENT REFERENCE DATE	Year Month Day
AA3a	BIRTH DATE	Year Month Day
AA3b	ESTIMATED BIRTH DATE	Birth date is estimated 0. No 1. Yes
AA4	ABORIGINAL IDENTITY	Person identifies self as First Nations, Métis or Inuit 0. No 1. Yes a. First Nations b. Métis c. Inuit
A5	MARITAL STATUS	1. Never married 4. Separated 2. Married 5. Divorced 3. Widowed 9. Unknown
AA6	FACILITY NUMBER	Prov./Terr. Facility Number (See manual for province/territory codes)
AA5a	HEALTH CARD NUMBER	a. Enter the resident's health card number, or enter "0" if unknown or "1" if not applicable.
AA5b	PROVINCE/ TERRITORY OF ISSUE	b. Enter the Province/Territory code issuing health card number. (See CCRS manual for province/territory codes.)
A6a	HEALTH RECORD NUMBER	
A6b	HEALTH REGISTER NUMBER	

A7	RESPONSIBILITY FOR PAYMENT	*(Check all that apply in LAST 30 DAYS.)*	
		a. Provincial/territory government plan (for resident of province/territory)	a
		b. Other province/territory (resident of Canada)	b
		c. Federal government—Veterans Affairs Canada	c
		d. Federal government—First Nations and Inuit Health Branch (FNIHB)	d
		e. Federal government—other (RCMP, Canadian Forces, federal penitentiary inmate, refugee)	e
		f. Worker's compensation board (WCB/WSIB)	f
		g. Canadian resident, private insurance pay	g
		h. Canadian resident, public trustee pay	h
		i. Canadian resident, self pay	i
		j. Other country resident, self pay	j
		k. Responsibility for payment unknown/unavailable	k
AA8	REASON FOR ASSESSMENT	Primary reason for assessment 01. Admission assessment (before day 14) 02. Full annual assessment 03. Significant change in status assessment 04. Significant correction of prior full assessment	
A11	DECISION-MAKER FOR PERSONAL CARE AND PROPERTY	1. Person 2. Other a. Personal Care b. Property	
A12	ADVANCE DIRECTIVES	0. Not in Place 1. In Place a. Advance Directives for Not Resuscitating b. Advance Directives for Not Hospitalizing	

☐ = when box blank, must enter number or letter a = when letter in box, or when instructed to do so, check if condition applies

FA/MDS 2.0
February 2012

SECTION AB: DEMOGRAPHIC INFORMATION

AB1	ADMISSION DATE	Year ☐☐☐☐ Month ☐☐ Day ☐☐

SECTION B: COGNITIVE PATTERNS

B1	COMATOSE	*(Persistent vegetative state or no discernible consciousness)* 0. No 1. Yes (Skip to item G1)	
B2	MEMORY	*(Recall of what was learned or known)* a. Short-term memory OK—seems or appears to recall after 5 minutes 0. Memory OK 1. Memory problem b. Long-term memory OK—seems or appears to recall long past 0. Memory OK 1. Memory problem	
B3	MEMORY/ RECALL ABILITY	*(Check all that resident was normally able to recall during the LAST 7 DAYS.)*	
		a. Current season	a
		b. Location of own room	b
		c. Staff names/faces	c
		d. That he/she is in a facility	d
		e. *NONE OF ABOVE* are recalled	e
B4	COGNITIVE SKILLS FOR DAILY DECISION MAKING	*(Made decisions regarding tasks of daily life.)* 0. INDEPENDENT–decisions consistent and reasonable 1. MODIFIED INDEPENDENCE–some difficulty in new situations only 2. MODERATELY IMPAIRED—decisions poor; cues or supervision required 3. SEVERELY IMPAIRED—never/rarely made decisions	
B5	INDICATORS OF DELIRIUM-PERIODIC DISORDERED THINKING/ AWARENESS	*(Code for behaviour in LAST 7 DAYS.) Accurate assessment requires conversations with staff and family who have direct knowledge of resident's behaviour over this time.* 0. Behaviour not present 1. Behaviour present, not of recent onset 2. Behaviour present, over last 7 days appears different from resident's usual functioning (e.g. new onset or worsening)	
		a. EASILY DISTRACTED (e.g. difficulty paying attention, gets sidetracked)	
		b. PERIODS OF ALTERED PERCEPTION OR AWARENESS OF SURROUNDINGS (e.g. moves lips or talks to someone not present; believes he or she is somewhere else; confuses night and day)	
		c. EPISODES OF DISORGANIZED SPEECH (e.g. speech is incoherent, nonsensical, irrelevant, or rambling from subject to subject; loses train of thought)	
		d. PERIODS OF RESTLESSNESS (e.g. fidgeting or picking at skin, clothing, napkins, etc.; frequent position changes; repetitive physical movements or calling out)	
		e. PERIODS OF LETHARGY (e.g. sluggishness; staring into space; difficult to arouse; little bodily movement)	
		f. MENTAL FUNCTION VARIES OVER THE COURSE OF THE DAY (e.g. sometimes better, sometimes worse; behaviours sometimes present, sometimes not)	
B6	CHANGE IN COGNITIVE STATUS	Resident's cognitive status, skills or abilities have changed as compared to status of 90 DAYS AGO (or since last assessment if less than 90 days). 0. No change 1. Improved 2. Deteriorated	

SECTION C: COMMUNICATION/HEARING PATTERNS

C1	HEARING	*(With hearing appliance, if used)* 0. HEARS ADEQUATELY—normal talk, TV, phone 1. MINIMAL DIFFICULTY—when not in quiet setting 2. HEARS IN SPECIAL SITUATION ONLY—speaker has to adjust tonal quality and speak distinctly 3. HIGHLY IMPAIRED or absence of useful hearing	
C2	COMMUNICATION DEVICES/ TECHNIQUES	*(Check all that apply during LAST 7 DAYS.)*	
		a. Hearing aid, present and used regularly	a
		b. Hearing aid, present and not used regularly	b
		c. Other receptive communication techniques used (e.g. lip reading)	c
		d. *NONE OF ABOVE*	d
C3	MODES OF EXPRESSION	*(Check all used by resident to make needs known.)*	
		a. Speech	a
		b. Writing messages to express or clarify needs	b
		c. American sign language or Braille	c
		d. Signs or gestures or sounds	d
		e. Communication board	e
		f. Other	f
		g. *NONE OF ABOVE*	g
C4	MAKING SELF UNDERSTOOD	*(Expressing information content—however able)* 0. UNDERSTOOD 1. USUALLY UNDERSTOOD—difficulty finding words or finishing thoughts 2. SOMETIMES UNDERSTOOD—ability is limited to making concrete requests 3. RARELY OR NEVER UNDERSTOOD	
C5	SPEECH CLARITY	*(Code for speech in LAST 7 DAYS.)* 0. CLEAR SPEECH—distinct, intelligible words 1. UNCLEAR SPEECH—slurred, mumbled words 2. NO SPEECH—absence of spoken words	
C6	ABILITY TO UNDERSTAND OTHERS	*(Understanding verbal information content—however able)* 0. UNDERSTANDS 1. USUALLY UNDERSTANDS—may miss some part or intent of message 2. SOMETIMES UNDERSTANDS—responds adequately to simple, direct communication 3. RARELY OR NEVER UNDERSTANDS	
C7	CHANGE IN COMMUNICATION/ HEARING	Resident's ability to express, understand, or hear information has changed as compared to status of 90 DAYS AGO (or since last assessment if less than 90 days). 0. No Change 1. Improved 2. Deteriorated	

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SECTION F: PSYCHOSOCIAL WELL-BEING

F1	SENSE OF INITIATIVE/ INVOLVEMENT	a. At ease interacting with others	a
		b. At ease doing planned or structured activities	b
		c. At ease doing self-initiated activities	c
		d. Establishes own goals	d
		e. Pursues involvement in life of facility (e.g. makes and keeps friends; involved in group activities; responds positively to new activities; assists at religious services)	e
		f. Accepts invitations into most group activities	f
		g. *NONE OF ABOVE*	g
F2	UNSETTLED RELATIONSHIPS	a. Covert/open conflict with or repeated criticism of staff	a
		b. Unhappy with roommate	b
		c. Unhappy with residents other than roommate	c
		d. Openly expresses conflict/anger with family/friends	d
		e. Absence of personal contact with family or friends	e
		f. Recent loss of close family member or friend	f
		g. Does not adjust easily to change in routines	g
		h. *NONE OF ABOVE*	h
F3	PAST ROLES	a. Strong identification with past roles and life status 0. No 1. Yes 9. Unknown (admission only)	
		b. Expresses sadness, anger or empty feeling over lost roles or status 0. No 1. Yes 9. Unknown (admission only)	
		c. Resident perceives that daily life (customary routine, activities) is very different from prior pattern in the community 0. No 1. Yes 9. Unknown (admission only)	

SECTION G: PHYSICAL FUNCTIONING AND STRUCTURAL PROBLEMS

G1 **A. ADL SELF-PERFORMANCE** *(Code for resident's **PERFORMANCE OVER ALL SHIFTS** during LAST 7 DAYS, not including setup)*

0. **INDEPENDENT.** No help or oversight–OR–help/oversight provided only 1 or 2 times during last 7 days.
1. **SUPERVISION.** Oversight, encouragement or cueing provided 3 or more times during last 7 days–OR–Supervision plus physical assistance provided only 1 or 2 times during last 7 days.
2. **LIMITED ASSISTANCE.** Resident highly involved in activity; received physical help in guided maneuvering of limbs, or other non-weight-bearing assistance 3 or more times–OR–More help provided only 1 or 2 times during last 7 days.
3. **EXTENSIVE ASSISTANCE.** Although resident performed part of activity, over last 7-day period, help of the following type(s) was provided 3 or more times:
   - weight-bearing support
   - full staff performance during part (but not all) of last 7 days.
4. **TOTAL DEPENDENCE.** Full staff performance of activity during entire 7 days.
8. **ACTIVITY DID NOT OCCUR** during entire 7 days.

B. ADL SUPPORT PROVIDED *(Code for **MOST SUPPORT PROVIDED OVER ALL SHIFTS** during LAST 7 DAYS; code regardless of resident's self-performance classification.)*

0. No setup or physical help from staff
1. Setup help only
2. One-person physical assist
3. Two+ persons physical assist
8. ADL activity did not occur during entire 7 days

			A SELF-PERFORMANCE	B SUPPORT PROVIDED
G1a	BED MOBILITY	How resident moves to and from lying position, turns from side to side, and positions body while in bed		
G1b	TRANSFER	How resident moves between surfaces–to and from: bed, chair, wheelchair, standing position (EXCLUDE to and from bath and toilet)		
G1c	WALK IN ROOM	How resident walks between locations in own room		
G1d	WALK IN CORRIDOR	How resident walks in corridor on unit		
G1e	LOCOMOTION ON UNIT	How resident moves between locations in own room and adjacent corridor on same floor. If in wheelchair, self-sufficiency once in chair		
G1f	LOCOMOTION OFF UNIT	How resident moves to and returns from off-unit locations (e.g. areas set aside for dining, activities or treatments). If facility has only one floor, how resident moves to and from distant areas on the floor. If in wheelchair, self-sufficiency once in chair		
G1g	DRESSING	How resident puts on, fastens, and takes off all items of street clothing, including donning and removing prosthesis		
G1h	EATING	How resident eats and drinks (regardless of skill). Includes intake of nourishment by other means (e.g. tube feeding, total parenteral nutrition)		
G1i	TOILET USE	How resident uses the toilet room (or commode, bedpan, urinal); transfers on/off toilet, cleanses, changes pad, manages ostomy or catheter, adjusts clothes		
G1j	PERSONAL HYGIENE	How resident maintains personal hygiene, including combing hair; brushing teeth; shaving; applying makeup; washing and drying face, hands, and perineum (EXCLUDE baths and showers)		

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SECTION G: PHYSICAL FUNCTIONING AND STRUCTURAL PROBLEMS (cont'd)

			A (SELF-PERFORMANCE)	B (SUPPORT PROVIDED)
G2	BATHING	How resident takes full-body bath or shower, sponge bath, and transfers in and out of tub or shower (EXCLUDE washing of back and hair). *(Code for most dependent in self-performance and support.)* Bathing self-performance codes are: 0. Independent–No help provided 1. Supervision–Oversight help only 2. Physical help limited to transfer only 3. Physical help in part of bathing activity 4. Total dependence 8. Bathing did not occur during the entire 7 days (Bathing support codes are as defined in item G1aB, "support provided" above)		
G3	TEST FOR BALANCE	*(Code for ability during test in the LAST 7 DAYS.)* 0. Maintained position as required in test 1. Unsteady, but able to rebalance self without physical support 2. Partial physical support during test or doesn't follow directions 3. Not able to attempt test without physical help		
		a. Balance while standing		
		b. Balance while sitting–position, trunk control		
G4	FUNCTIONAL LIMITATION IN RANGE OF MOTION	*(Code for limitations during LAST 7 DAYS that interfered with daily functions or put resident at risk of injury.)* **A. RANGE OF MOTION**: 0. No limitation; 1. Limitation on 1 side; 2. Limitation on both sides **B. VOLUNTARY MOVEMENT**: 0. No loss; 1. Partial loss; 2. Full loss	A	B
		a. Neck		
		b. Arm—including shoulder or elbow		
		c. Hand—including wrist or fingers		
		d. Leg—including hip or knee		
		e. Foot—including ankle or toes		
		f. Other limitation or loss		
G5	MODES OF LOCOMOTION	*(Check all that apply during LAST 7 DAYS.)*		
		a. Cane, walker, or crutch	a	
		b. Wheeled self	b	
		c. Other person wheeled	c	
		d. Wheelchair primary mode of locomotion	d	
		e. *NONE OF ABOVE*	e	
G6	MODES OF TRANSFER	*(Check all that apply during LAST 7 DAYS.)*		
		a. Bedfast all or most of the time	a	
		b. Bed rails used for bed mobility or transfer	b	
		c. Lifted manually	c	
		d. Lifted mechanically	d	
		e. Transfer aid (e.g. slide board, trapeze, cane, walker, brace)	e	
		f. *NONE OF ABOVE*	f	
G7	TASK SEGMEN-TATION	Some or all of ADL activities were broken into sub-tasks during LAST 7 DAYS so that resident could perform them. 0. No 1. Yes		
G8	ADL FUNCTIONAL REHAB. POTENTIAL	*(Check all that apply during LAST 7 DAYS.)*		
		a. Resident believes self to be capable of increased independence in at least some ADLs	a	
		b. Direct care staff believe resident is capable of increased independence in at least some ADLs	b	
		c. Resident able to perform tasks/activity but is very slow	c	
		d. Difference in ADL self-performance or ADL support, comparing mornings to evenings	d	
		e. *NONE OF ABOVE*	e	
G9	CHANGE IN ADL FUNCTION	Resident's ADL Self-Performance status has changed as compared to status of 90 DAYS AGO (or since last assessment if less than 90 days). 0. No change 1. Improved 2. Deteriorated		

SECTION H: CONTINENCE IN LAST 14 DAYS

H1	CONTINENCE SELF-CONTROL CATEGORIES *(Code for performance over all shifts.)* 0. CONTINENT–Complete control 1. USUALLY CONTINENT–BLADDER, incontinent episodes once a week or less; BOWEL, less than weekly 2. OCCASIONALLY INCONTINENT– BLADDER, 2+ times a week but not daily; BOWEL, once a week 3. FREQUENTLY INCONTINENT–BLADDER, tended to be incontinent daily, but some control present (e.g. on day shift); BOWEL, 2 or 3 times a week 4. INCONTINENT–Had inadequate control. BLADDER, multiple daily episodes; BOWEL, all (or almost all) of the time		
H1a	BOWEL CONTINENCE	Control of bowel movement, with appliance or bowel continence programs, if used	
H1b	BLADDER CONTINENCE	Control of urinary bladder function (if dribbles, volume insufficient to soak through underpants), with appliances (e.g. foley) or continence programs, if used	
H2	BOWEL ELIMINATION PATTERN	*(Check all that apply in LAST 14 DAYS.)*	
		a. Bowel elimination pattern regular—at least 1 movement every 3 days	a
		b. Constipation	b
		c. Diarrhea	c
		d. Fecal impaction	d
		e. *NONE OF ABOVE*	e
H3	APPLIANCES AND PROGRAMS	*(Check all that apply in LAST 14 DAYS.)*	
		a. Any scheduled toileting plan	a
		b. Bladder retraining program	b
		c. External (condom) catheter	c
		d. Indwelling catheter	d
		e. Intermittent catheter	e
		f. Did not use toilet, commode, urinal	f
		g. Pads or briefs used	g
		h. Enemas, irrigation	h
		i. Ostomy present	i
		j. *NONE OF ABOVE*	j
H4	CHANGE IN URINARY CONTINENCE	Resident's urinary continence has changed as compared to status of 90 DAYS AGO (or since last assessment if less than 90 days). 0. No change 1. Improved 2. Deteriorated	

SECTION I: DISEASE DIAGNOSES

(Check only those diseases that have a relationship to current ADL status, cognitive status, mood and behaviour status, medical treatments, nurse monitoring, or risk of death. Do not list inactive diagnoses.)

I1	DISEASES	*(If none of I1a–I1uu apply, CHECK item I1vv)*	
		ENDOCRINE/METABOLIC/NUTRITIONAL	
		a. Diabetes mellitus	a
		b. Hyperthyroidism	b
		c. Hypothyroidism	c
		HEART/CIRCULATION	
		d. Arteriosclerotic heart disease (ASHD)	d
		e. Cardiac dysrhythmia	e
		f. Congestive heart failure	f
		g. Deep vein thrombosis	g
		h. Hypertension	h
		i. Hypotension	i
		j. Peripheral vascular disease	j
		k. Other cardiovascular disease	k
		MUSCULOSKELETAL	
		l. Arthritis	l
		m. Hip fracture	m
		n. Missing limb (e.g. amputation)	n
		o. Osteoporosis	o
		p. Pathological bone fracture	p
		NEUROLOGICAL	
		q. Amyotrophic lateral sclerosis (ALS)	q
		r. Alzheimer's disease	r
		s. Aphasia	s
		t. Cerebral palsy	t
		u. Cerebrovascular accident (stroke)	u
		v. Dementia other than Alzheimer's disease	v
		w. Hemiplegia/hemiparesis	w
		x. Huntington's chorea	x
		y. Multiple sclerosis	y
		z. Paraplegia	z
		aa. Parkinson's disease	aa
		bb. Quadriplegia	bb
		cc. Seizure disorder	cc
		dd. Transient ischemic attack (TIA)	dd
		ee. Traumatic brain injury	ee
		PSYCHIATRIC/MOOD	
		ff. Anxiety disorder	ff
		gg. Depression	gg
		hh. Bipolar Disorder	hh
		ii. Schizophrenia	ii
		PULMONARY	
		jj. Asthma	jj
		kk. Emphysema/ COPD	kk
		SENSORY	
		ll. Cataracts	ll
		mm. Diabetic retinopathy	mm
		nn. Glaucoma	nn
		oo. Macular degeneration	oo
		OTHER	
		pp. Allergies	pp
		qq. Anemia	qq
		rr. Cancer	rr
		ss. Gastrointestinal disease	ss
		tt. Liver disease	tt
		uu. Renal failure	uu
		vv. *NONE OF ABOVE*	vv
I2	INFECTIONS	*(If none of I2a-I2m apply, CHECK item I2n.)*	
		a. Antibiotic resistant infection (e.g. Methicillin resistant staph)	a
		b. Cellulitis	b
		c. Clostridium difficile	c
		d. Conjunctivitis	d
		e. HIV infection	e
		f. Pneumonia	f
		g. Respiratory infection	g
		h. Septicemia	h
		i. Sexually transmitted diseases	i
		j. Tuberculosis (active)	j
		k. Urinary tract infection in LAST 30 DAYS	k
		l. Viral hepatitis	l
		m. Wound infection	m
		n. *NONE OF ABOVE*	n
I3	OTHER CURRENT DIAGNOSIS AND ICD-10-CA CODES	a	
		b	
		c	
		d	
		e	
		f	

SECTION J: HEALTH CONDITIONS

J1	PROBLEM CONDITIONS	*(Check all problems present in LAST 7 DAYS UNLESS OTHER TIME FRAME IS INDICATED.)*	
		INDICATORS OF FLUID STATUS	
		a. Weight gain or loss of 1.5 or more kilograms in last 7 days (3 lbs.)	a
		b. Inability to lie flat due to shortness of breath	b
		c. Dehydrated; e.g. output exceeds intake	c
		d. Insufficient fluid; did NOT consume all or almost all liquids provided during LAST 3 DAYS	d
		OTHER	
		e. Delusions	e
		f. Dizziness/vertigo	f
		g. Edema	g
		h. Fever	h
		i. Hallucinations	i
		j. Internal bleeding	j
		k. Recurrent lung aspirations in LAST 90 DAYS	k
		l. Shortness of breath	l
		m. Syncope (fainting)	m
		n. Unsteady gait	n
		o. Vomiting	o
		p. *NONE OF ABOVE*	p
J2	PAIN SYMPTOMS	*(Code for the highest level of pain present in LAST 7 DAYS.)*	
		a. FREQUENCY with which resident complains or shows evidence of pain: 0. No pain *(Skip to J4)* 1. Pain less than daily 2. Pain daily	
		b. INTENSITY of pain: 1. Mild pain 2. Moderate pain 3. Times when pain is horrible or excruciating	
J3	PAIN SITE	*(Check all sites where pain was present in LAST 7 DAYS.)*	
		a. Back pain	a
		b. Bone pain	b
		c. Chest pain during usual activities	c
		d. Headache	d
		e. Hip pain	e
		f. Incisional pain	f
		g. Joint pain (other than hip)	g
		h. Soft tissue pain (e.g. lesion, muscle)	h
		i. Stomach pain	i
		j. Other site	j
J4	ACCIDENTS	*(CHECK all that apply.)*	
		a. Fell in PAST 30 DAYS	a
		b. Fell in PAST 31 to 180 DAYS	b
		c. Hip fracture in LAST 180 DAYS	c
		d. Other fracture in LAST 180 DAYS	d
		e. *NONE OF ABOVE*	e

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SECTION J: HEALTH CONDITIONS (cont'd)

J5	STABILITY OF CONDITIONS	*(Check all that apply.)*	
		a. Conditions or diseases make resident's cognitive, ADL, mood, or behaviour patterns unstable (fluctuating, precarious, or deteriorating)	a
		b. Resident experiencing an acute episode or a flare-up of a recurrent or chronic problem	b
		c. End-stage disease; 6 months or less to live	c
		d. *NONE OF ABOVE*	d

SECTION K: ORAL/NUTRITIONAL STATUS

K1	ORAL PROBLEMS	*(Check all that apply in LAST 7 DAYS.)*			
		a. Chewing problem	a	c. Mouth pain	c
		b. Swallowing problem	b	d. *NONE OF ABOVE*	d
K2	HEIGHT AND WEIGHT	a. *(Record height in centimetres)* a. HEIGHT (cm.)			
		b. *(Record weight in kilograms)* b. WEIGHT (kg.)			
		Base weight on most recent measure in LAST 30 DAYS; measure weight consistently in accord with standard facility practice (e.g. in AM after voiding, before meal, with shoes off, and in nightclothes).			
K3	WEIGHT CHANGE	**a. Weight loss**—5% or more in LAST 30 DAYS or 10% or more in LAST 180 DAYS.			
		0. No 1. Yes 9. Unknown (admission only)			
		b. Weight gain—5% or more in LAST 30 DAYS or 10% or more in LAST 180 DAYS			
		0. No 1. Yes 9. Unknown (admission only)			
K4	NUTRITIONAL PROBLEMS	*(Check all that apply in LAST 7 DAYS.)*			
		a. Complains about the taste of many foods			a
		b. Regular or repetitive complaints of hunger			b
		c. Leaves 25% or more of food uneaten at most meals			c
		d. *NONE OF ABOVE*			d
K5	NUTRITIONAL APPROACHES	*(Check all that apply in LAST 7 DAYS.)*			
		a. Parenteral/IV	a	f. Dietary supplement between meals	f
		b. Feeding tube	b		
		c. Mechanically altered diet	c	g. Plate guard, stabilized built-up utensil, etc.	g
		d. Syringe (oral feeding)	d	h. On a planned weight change program	h
		e. Therapeutic diet	e	i. *NONE OF ABOVE*	i
K6	PARENTERAL OR ENTERAL INTAKE	*(Skip to Section L if neither 5a nor 5b is checked.)*			
		a. Code the proportion of total calories the resident received through parenteral or tube feedings in the LAST 7 DAYS			
		0. None 2. 26% to 50% 4. 76% to 100%			
		1. 1% to 25% 3. 51% to 75%			
		b. Code the average fluid intake per day by IV or tube in the last 7 days			
		0. None 3. 1001 to 1500 cc/day			
		1. 1 to 500 cc/day 4. 1501 to 2000 cc/day			
		2. 501 to 1000 cc/day 5. 2001 or more cc/day			

SECTION L: ORAL/DENTAL STATUS

L1	ORAL STATUS AND DISEASE PREVENTION	*(Check all that apply in LAST 7 DAYS.)*	
		a. Debris (soft, easily removable substances) present in mouth prior to going to bed at night	a
		b. Has dentures and/or removable bridge	b
		c. Some or all natural teeth lost—does not have or does not use dentures (or partial plates)	c
		d. Broken, loose, or carious teeth	d
		e. Inflamed gums (gingiva); swollen or bleeding gums; oral abscesses, ulcers or rashes	e
		f. Daily cleaning of teeth or dentures, or daily mouth care—by resident or staff	f
		g. *NONE OF ABOVE*	g

SECTION M: SKIN CONDITION

M1	ULCERS (due to any cause)	*(Record the **number** of ulcers at each ulcer stage—regardless of cause. If none present at a stage, record "0" (zero). Code all that apply in LAST 7 DAYS. Code 9 for 9 or more.)* **Requires a full body exam.**	
		a. **Stage 1**–A persistent area of skin redness (without a break in the skin) that does not disappear when pressure is relieved	
		b. **Stage 2**–A partial thickness loss of skin layers that presents clinically as an abrasion, blister or shallow crater	
		c. **Stage 3**–A full thickness of skin is lost, exposing the subcutaneous tissues—presents as a deep crater with or without undermining adjacent tissue	
		d. **Stage 4**–A full thickness of skin and subcutaneous tissue is lost, exposing muscle or bone	
M2	TYPE OF ULCER	*(For each type of ulcer, code for the **highest stage** in LAST 7 DAYS using scale in item M1—i.e., 0 = none; stages 1, 2, 3, 4.)*	
		a. Pressure ulcer—any lesion caused by pressure resulting in damage of underlying tissue	
		b. Stasis ulcer—open lesion caused by poor circulation in the lower extremities	
M3	HISTORY OF RESOLVED/ CURED ULCERS	Resident has had a pressure ulcer that was resolved or cured in last 90 days.	
		0. No 1. Yes	
M4	OTHER SKIN PROBLEMS OR LESIONS PRESENT	*(Check all that apply during LAST 7 DAYS.)*	
		a. Abrasions, bruises	a
		b. Burns (second or third degree)	b
		c. Open lesions other than ulcers, rashes or cuts (e.g. cancer lesions)	c
		d. Rashes (e.g. intertrigo, eczema, drug/ heat rash, herpes)	d
		e. Skin desensitized to pain or pressure	e
		f. Skin tears or cuts (other than surgery)	f
		g. Surgical wounds	g
		h. *NONE OF ABOVE*	h
M5	SKIN TREATMENTS	*(Check all that apply during LAST 7 DAYS.)*	
		a. Pressure relieving device(s) for chair	a
		b. Pressure relieving device(s) for bed	b
		c. Turning or repositioning program	c
		d. Nutrition or hydration intervention to manage skin problems	d
		e. Ulcer care	e
		f. Surgical wound care	f
		g. Application of dressings (with or without topical medications) other than to feet	g
		h. Application of ointments or medications (except to feet)	h
		i. Other preventative or protective skin care (except to feet)	i
		j. *NONE OF ABOVE*	j
M6	FOOT PROBLEMS AND CARE	*(Check all that apply during LAST 7 DAYS.)*	
		a. Resident has one or more foot problems (e.g. corns, callouses, bunions, hammer toes, overlapping toes, pain, structural problems)	a
		b. Infection of the foot (e.g. cellulitis, purulent drainage)	b
		c. Open lesions on the foot	c
		d. Nails or callouses trimmed during LAST 90 DAYS	d
		e. Received preventative or protective foot care (e.g. used special shoes, inserts, pads, toe separators)	e
		f. Application of dressings (with or without topical meds)	f
		g. *NONE OF ABOVE*	g

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SECTION N: ACTIVITY PURSUIT PATTERNS

N1	TIME AWAKE	*(Check appropriate time periods over LAST 7 DAYS.)* Resident awake all or most of the time (i.e. naps no more than 1 hour per time period) in the:			
		a. Morning	a	c. Evening	c
		b. Afternoon	b	d. *NONE OF ABOVE*	d
	(If resident is comatose, skip to Section O.)				
N2	AVERAGE TIME INVOLVED IN ACTIVITIES	*(When awake and not getting treatment or ADL care)* 0. Most—more than 2/3 of time 1. Some—from 1/3 to 2/3 of time 2. Little—less than 1/3 of time 3. None			
N3	PREFERRED ACTIVITY SETTINGS	*(Check all settings in which activities are preferred.)*			
		a. Own room	a	d. Outside facility	d
		b. Day or activity room	b	e. *NONE OF ABOVE*	e
		c. Inside facility/off unit	c		
N4	GENERAL ACTIVITY PREFERENCES (adapted to resident's current abilities)	*(Check all PREFERENCES whether or not activity is currently available to resident.)*			
		a. Cards, other games	a	i. Watching TV	i
		b. Crafts or arts	b	j. Gardening or plants	j
		c. Exercise or sports	c	k. Talking or conversing	k
		d. Music	d	l. Helping others	l
		e. Reading, writing	e	m. *NONE OF ABOVE*	m
		f. Spiritual or religious activities	f		
		g. Trips or shopping	g		
		h. Walk/wheeling outdoors	h		
N5	PREFERS CHANGE IN DAILY ROUTINE	*(Code for resident preferences in daily routine.)* 0. No change 1. Slight change 2. Major change			
		a. Type of activities in which resident is currently involved			
		b. Extent of resident involvement in activities			

SECTION O: MEDICATIONS

O1	NUMBER OF MEDICATIONS	*(Record the NUMBER of different MEDICATIONS used in the LAST 7 DAYS. Enter "00" if none used.)*			
O2	NEW MEDICATIONS	Resident currently receiving medications that were initiated during the LAST 90 DAYS. 0. No 1. Yes 9. Unknown (admission only)			
O3	INJECTIONS	*(Record the NUMBER OF DAYS injections of any type were received during the LAST 7 DAYS. Enter "0" if none used.)*			
O4	DAYS RECEIVED THE FOLLOWING MEDICATION	*(Record the NUMBER OF DAYS during LAST 7 DAYS; enter "0" if not used. N.B. Enter "1" for long-acting medications used less than weekly.)*			
		a. Antipsychotic		d. Hypnotic	
		b. Antianxiety		e. Diuretic	
		c. Antidepressant		f. Analgesic	

SECTION P: SPECIAL TREATMENTS AND PROCEDURES

P1a	SPECIAL TREATMENTS, PROCEDURES AND PROGRAMS	***SPECIAL CARE**—(Check treatments or programs received in LAST 14 DAYS.)*			
		TREATMENTS		**PROGRAMS**	
		a. Chemotherapy	a	m. Alcohol or drug treatment program	m
		b. Renal Dialysis	b	n. Alzheimer's or dementia special care unit	n
		c. IV medication	c	o. Hospice care	o
		d. Intake/output	d	p. Pediatric Unit	p
		e. Monitoring acute medical condition	e	q. Respite care	q
		f. Ostomy care	f	r. Training in skills required to return to the community (e.g. taking medications, house-work, shopping, transportation, ADLs)	r
		g. Oxygen therapy	g		
		h. Radiation	h		
		i. Suctioning	i		
		j. Trach. Care	j		
		k. Transfusions	k		
		l. Ventilator or respirator	l	s. *NONE OF ABOVE*	s
P1b		***THERAPIES**—(Record the number of days and total minutes each of the following therapies was administered (for at least 15 minutes a day) in the LAST 7 DAYS. Enter "0" if none or less than 15 minutes daily.) Note: Count only post-admission therapies.* Box **A** = **# of days** administered for 15 minutes or more Box **B** = **total # of minutes** provided in last 7 days			
			A	B	
		a. Speech—language pathology, audiology service			
		b. Occupational therapy			
		c. Physical therapy			
		d. Respiratory therapy			
		e. Psychological therapy (by any licensed mental health professional)			
		f. Recreation therapy			
P2	INTERVENTION PROGRAMS FOR MOOD, BEHAVIOUR, COGNITIVE LOSS	*(Check all interventions or strategies used in the LAST 7 DAYS, no matter where received.)*			
		a. Special behaviour symptom evaluation program			a
		b. Evaluation by a licensed mental health specialist in LAST 90 DAYS			b
		c. Group therapy			c
		d. Resident-specific deliberate changes in the environment to address mood or behaviour patterns (e.g. providing bureau in which to rummage)			d
		e. Reorientation (e.g. cueing)			e
		f. *NONE OF ABOVE*			f
P3	NURSING REHABILI-TATION/ RESTORATIVE CARE	*(Record the NUMBER OF DAYS each of the following rehabilitation or restorative techniques or practices was provided to the resident for more than or equal to 15 minutes per day in the LAST 7 DAYS. Enter "0" if none or less than 15 minutes daily.)*			
		a. Range of motion (passive)			
		b. Range of motion (active)			
		c. Splint or brace assistance			
		Training and skill practice in:			
		d. Bed mobility			
		e. Transfer			
		f. Walking			
		g. Dressing or grooming			
		h. Eating or swallowing			
		i. Amputation or prosthesis care			
		j. Communication			
		k. Other			

☐ = when box blank, must enter number or letter a = when letter in box, or when instructed to do so, check if condition applies

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SECTION P: SPECIAL TREATMENTS AND PROCEDURES			
P4	DEVICES AND RESTRAINTS	*(Use the following codes for the LAST 7 DAYS:)* 0. Not used 1. Used less than daily 2. Used daily	
		a. Full bed rails on all open sides of bed	
		b. Other types of side rails used (e.g. half rail, 1 side)	
		c. Trunk restraint	
		d. Limb restraint	
		e. Chair prevents rising	
P5	HOSPITAL STAY(s)	*Record number of times resident was admitted to hospital in the LAST 90 DAYS [or since last assessment]. Enter "00" if no admission.*	
P6	EMERGENCY ROOM (ER) VISIT(s)	*Record number of times resident visited ER in the LAST 90 DAYS [or since last assessment if less than 90 days]. Enter "00" if no ER visits.*	
P7	PHYSICIAN VISITS	In the LAST 14 DAYS (or since admission, if less than 14 days in facility), how many days has the physician (or authorized assistant or practitioner) examined the resident? *(Enter "00" if none.)*	
P8	PHYSICIAN ORDERS	In the LAST 14 DAYS (or since admission, if less than 14 days in facility), on how many days has the physician (or authorized assistant or practitioner) changed the resident's orders? *Do not include order renewals without change.* *(Enter "00" if none.)*	
P9	ABNORMAL LAB VALUES	Has the resident had any abnormal lab values during the LAST 90 DAYS (or since admission)? 0. No 1. Yes	

SECTION Q: DISCHARGE POTENTIAL AND OVERALL STATUS			
Q1	DISCHARGE POTENTIAL	a. Resident expresses or indicates preference to return to the community. 0. No 1. Yes	
		b. Resident has a support person who is positive towards discharge. 0. No 1. Yes	
		c. Stay projected to be of a short duration—Discharge projected WITHIN 90 DAYS. *(Do not include expected discharge due to death.)* 0. No 2. Within 31–90 days 1. Within 30 days 3. Discharge status uncertain	
Q2	OVERALL CHANGE IN CARE NEEDS	Resident's overall level of self-sufficiency has changed significantly as compared to status of 90 DAYS AGO (or since last assessment if less than 90 days).	
		0. No change	
		1. Improved—receives fewer supports, needs less restrictive level of care	
		2. Deteriorated—receives more support	

SECTION R: ASSESSMENT INFORMATION			
R1	PARTICIPATION IN ASSESSMENT	a. Resident: 0. No 1. Yes	
		b. Family: 0. No 1. Yes 2. No family	
		c. Significant other: 0. No. 1. Yes 2. None	

☐ = when box blank, must enter number or letter a = when letter in box, or when instructed to do so, check if condition applies

Full Assessment Form Resident Name/ID:_____ 10

SECTION R: ASSESSMENT INFORMATION (cont'd)

SIGNATURES OF THOSE COMPLETING THE ASSESSMENT

Provider Type **Assessor ID #**

Signature of Assessment Coordinator (sign on above line)

R2b. Date Assessment Coordinator signed as complete

Year Month Day

Other Signatures	Title	Sections	Date	Provider Type	Assessor ID #

☐ = when box blank, must enter number or letter a = when letter in box, or when instructed to do so, check if condition applies

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Appendix D: List of Statistically Non-significant Variables

(not included in regression analysis)

Risk Factor Variables	MDS Form Categories
Activity of Daily Living	**Section G (physical functioning and structural problems): G1a-G1j** g1aa_bed mobility self g1ba_transfer self g1ca_walk_in_room_self g1da_walk_in_corridor_self **G3 (Test for balance)** g3a_balance_while_standing g3b_balance_while_sitting **G4 (Functional limitation in range of motion)** g4fa_other_ltd_range_of_motion **G5 (Modes of locomotion)** g5a_cane_walker g5b_wheeled_self g5c_other_person_wheeled g5d_wheelchair_primary_locomot **G8 (ADL functional rehab potential)** g5a_cane_walker g5b_wheeled_self g5c_other_person_wheeled g5d_wheelchair_primary_locomot g8a_res_more_independence g8b_staff_more_independence g8c_slow_performing_tasks g8d_am_pm_differ_adls
Incontinence	**H3 (Appliances and programs)** h3a_scheduled_toileting_plan h3b_bladder_retraining_program h3c_external_catheter h3d_indwelling_catheter h3e_intermittent_catheter h3f_did_not_use_toilet h3g_pads_briefs_used h3h_enemas_irrigation h3i_ostomy_present

Risk Factor Variables	**MDS Form Categories**
Behaviours	**Section E (Mood and Behaviour):** **E1-E3 (moods- depression, anxiety sad)** e1a_negative_statements e1b_repetitive_questions e1c_repetitive_verbalizations e1e_self_deprecation e1f_express_unrealistic_fear e1g_recurrent_statements e1h_repeat_health_complaints e1i_repeat_anxious_complaints e1j_unpleasant_mood_in_morning e1k_insomnia e1l_sad_facial_expression e1m_crying e1n_repeat_physical_movements e1o_withdrawal_from_activities e1p_reduced_social_interaction e2_mood_persistence e3_change_in_mood

Illnesses/Diseases	**Section I (Disease Diagnoses):** **I1 (Diseases)** i1a_diabetes_mellitus i1c_hypothyroidism i1e_cardiac_dysrhythmias i1f_congestive_heart_failure i1h_hypertension i1k_other_cardiovasc_disease i1u_cerebrovasc_accident i1v_dementia_not_alzheimers i1w_hemiplegia_hemiparesis i1ff_anxiety_disorder i1gg_depression i1jj_asthma i1kk_emphysema i1ll_cataracts i1mm_diabetic_retinopathy i1nn_glaucoma i1oo_macular_degeneration i1pp_allergies i1qq_anemia i1ss_gastrointestinal_disease i1b_hyperthyroidism i1g_deep_vein_thrombosis i1i_hypotension i1j_peripheral_vasc_disease i1m_hip_fract i1n_missing_limb i1p_pathological_bone_fract i1x_huntingtons_chorea i1y_multiple_sclerosis i1z_paraplegia i1aa_parkinsons_disease i1bb_quadriplegia i1cc_seizure_disorder i1dd_transient_ischemic_attack i1ee_traumatic_brain_injury i1t_cerebral_palsy i1q_amyotrophic_lat_sclerosis i1hh_manic_depressive i1ii_schizophrenia i1rr_cancer i1tt_liver_disease i1uu_renal_failure

Risk Factor Variables	MDS Form Categories
	I2 (Infections): i2k_urinary_tract_infection **Section J (Health Conditions):** j1f_dizziness j1m_syncope j1f_dizziness j1m_syncope j1n_unsteady_gait **J3 (Pain site)** j3a_back_pain j3b_bone_pain j3c_chest_pain j3d_headache j3e_hip_pain j3f_incisional_pain j3g_joint_pain_not_hip j3h_soft_tissue_pain j3i_stomach_pain j3j_other_pain **J4 (Accidents)** j4c_hip_fract_in_last_180_days j4d_other_fract **J5 (Stability of conditions)** j5c_end_stage_disease

Risk Factor Variables	**MDS Form Categories**
Cognitive Impairment	**Section B (Cognitive Patterns):** **B3 (memory/recall ability)** b3a_current_season b3b_location_of_own_room b3c_staff_names_faces b3d_aware_in_nursing_home b4_cognitive_skills **B5 (Indicators of delirium- periodic disordered thinking/awareness)** b5a_easily_distracted b5b_periods_of_alt_percept b5c_episodes_of_disorg_speech b5d_periods_of_restlessness b5e_periods_of_lethargy b5f_mental_function_varies
Sensory Deficits	**Section C (Communication/Hearing):** **C2 (Communication devices/techniques)** c2a_hearing_aid_used c2b_hearing_aid_not_used c2c_other_recept_comm_tech **C7 (Change in communication/hearing)** c7_change_in_communication (interested in comparing if improvement or deterioration in this category is significant for falls) **Section D (Vision patterns):** **D2 (Visual limitations/difficulties)** d2a_side_vision_problems d2b_sees_halos **D3 (Visual appliances)** d3_visual_appliances
Medication Use	**Section O (Medications):** o2_new_medications
Seasonal	**Season Categories:** Winter: December to February Summer: June to August
Geographic Regions	Urban North

Appendix E: Comparison of Findings to Existing Literature on Fall Risk Factors of Residents in Long-Term Care

Variable	Our Study (inverse/direct relationship)	Existing Literature (inverse/direct relationship)
Age	direct	direct (Krueger et al., 2001; Lee et al., 2008; Dhargave et al., 2016)
Female sex	direct	direct (Dhargave et al., 2016; Sousa et al., 2016; Zhang et al., 2019) inverse (Lee et al., 2008; Cameron et al., 2018; Castaldo et al., 2020)
Rural location	direct	direct (Zhang et al., 2019b)
History of falls	inverse	direct (Krueger et al., 2001; Izumi et al., 2002; Kron et al., 2003; Kerse et al., 2004; Dhargave et al., 2016; dos Reis & de Jesus, 2015; Sousa et al., 2016)
Persistent anger	direct	None
Physical abuse	inverse	direct (Krueger et al., 2001)
Wandering	inverse	None
Eating assistance	direct	inverse (Zhang et al., 2019)
Personal hygiene assistance	direct	direct (Zhang et al., 2019)
Dressing assistance	inverse	inverse (Zhang et al., 2019)
Toileting assistance	inverse	inverse (Zhang et al., 2019)
Assistance with locomotion on unit	inverse	inverse (Kerse et al., 2004)
Impaired sitting balance	direct	None
Impaired standing balance	inverse	direct (Dhargave et al., 2016; Zhang et al., 2019)
Impaired range of motion	direct	direct (Neto et al., 2017)

Bowel incontinence	direct	None (Krueger et al., 2001 did not identify what kind of incontinence)
Bladder incontinence	inverse	direct (Krueger et al., 2001; Kron et al., 2003; Damián et al., 2013)
Aphasia	direct	None
Cancer	direct	None
Gastrointestinal disease	direct	None
Arthritis	direct	direct (Krueger et al., 2001)
Osteoporosis	direct	None
Delirium	inverse	direct (Krueger et al., 2001; Cameron et al., 2018; Zhang et al., 2019)
Pain	inverse	None
Long-term memory impairment	direct	direct (Cameron et al., 2018; Zhang et al., 2019)
Short-term memory impairment	inverse	direct (Kron et al., 2003)
Impaired decision-making/cognitive skills	direct	direct (Cameron et al., 2018; Zhang et al., 2019)
Visual impairment	direct	direct (Kallin et al., 2002; Lee et al., 2008; Cameron et al., 2018; Dhargave et al., 2016; Zhang et al., 2019)
Number of medications	direct	direct (Lee et al., 2008; Damián et al., 2013; Dhargave et al., 2016; Sousa et al., 2016)
Diuretic	direct	direct (Cameron et al., 2018)
Antipsychotic	inverse	direct (Cameron et al., 2018)
Antidepressants	inverse	direct (Kallin et al., 2002; Damián et al., 2013; Part et al., 2015; Macri et al., 2017; Cameron et al., 2018)
Hypnotic	inverse	direct (Park et al., 2015)