

The association between access to medical care (physicians and nurse practitioners) and impact on resident outcomes: A retrospective cross-sectional analysis

by

Krittika Bali

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

Department of Medicine  
University of Alberta

© Krittika Bali, 2022

## Abstract

The nursing home population is vulnerable and medically complex, yet little is known about models of medical service provision and associated quality outcomes. The goal of this thesis project is to examine the association between physician and nurse practitioner accessibility and practice sensitive outcomes.

This project used data from the Translating Research in Elder Care (TREC) longitudinal study and the routinely collected Resident Assessment Instrument – Minimum Data Set version 2.0 (RAI-MDS 2.0) to test the association between the availability of physicians (MD) and nurse practitioners (NP) in nursing homes (NH) and clinically-relevant resident outcomes of antipsychotic medication (APM) use without indication of psychosis, physical restraint use, hospitalization and emergency department (ED) transfers, and polypharmacy. Eight models were created using logistic regression to test the association between the access measures of daily presence of MD or NP on unit and MDs being involved in care planning and each of the four resident outcomes.

The sample consisted of 10,888 residents across 320 units in 92 facilities. Staff from 277 (86%) units reported an MD or NP visited daily and 318 (99%) units reported that the MD or NP could be reached when needed. Following adjustment for multiple confounding variables, there were no associations between either measure of access and any of the resident outcomes. For example, the association between having an NP visit the unit on a typical weekday and APM use (OR= 1.18, 95% CI: 0.56-2.53), NP presence on a unit on a typical weekday and physical restraint use among residents (OR=2.08, 95% CI: 0.26-2.10) and MDs (OR=1.42, 95% CI: 0.54-

3.75) should be noted for having wide confidence intervals. Associations between having visits with either an MD or NP at the unit level and hospitalization and ED transfers (OR=1.17, 95% CI: 0.46-3.10) and polypharmacy and visits by either NP or MD (OR=1.37, 95% CI: 0.64-2.93) follow the same trend. There were wide 95% confidence intervals for all estimates of association.

Although no associations were identified between these medical care access measures and the selected resident outcomes, the wide confidence intervals demonstrate uncertainty on the point estimates. Additional research with more direct measures of access to medical care is still needed.

## Preface

This thesis is an original work by Krittika Bali.

## Dedication

*I would like to dedicate this thesis to my parents (Vinod and Sonia) who taught me the value of integrity, kindness, perseverance, faith, and resilience. Thank you for your unconditional support, grace, and guidance throughout this process and for always encouraging me to pursue my goals.*

## Acknowledgements

This thesis would not have been possible without the support of many people. I was privileged enough to acquire the supervision and mentorship of Dr. Andrea Gruneir and her unwavering support and guidance throughout this process. Thank you, Dr. Gruneir, for providing me with opportunities to engage in innovative research, collaborate and network with others in the field, and disseminate my research to scholars, organizations, and communities. I would also like to thank my supervisory committee for taking time out of their busy schedules and engaging with my work. Thank you Dr. Adrian Wagg for your commitment to my success, expertise, and insight as well as willingness to help and mentor, and thank you to Ruth Murphy for her invaluable insight as a citizen partner and giving my research a real world lens. I would also like to extend my gratitude to the staff and data analysts, Leo and Fangfang, at TREC for helping with me with statistics and for data unit manager, Joseph Akinlawon, for being so accommodating to all of my requests. Thank you to Barb Thompson for her excellent administrative support and looking out for me during my time as a graduate student.

Thank you to my friends and family for showing me their love and compassion by supporting me throughout this endeavor.

## Table of Contents

|                                                                                                       |             |
|-------------------------------------------------------------------------------------------------------|-------------|
| <b>Abstract .....</b>                                                                                 | <b>ii</b>   |
| <b>Preface.....</b>                                                                                   | <b>iv</b>   |
| <b>Dedication.....</b>                                                                                | <b>v</b>    |
| <b>Acknowledgements .....</b>                                                                         | <b>vi</b>   |
| <b>Table of Contents .....</b>                                                                        | <b>vii</b>  |
| <b>Table of Tables .....</b>                                                                          | <b>ix</b>   |
| <b>List of Abbreviations.....</b>                                                                     | <b>xi</b>   |
| <b>Background .....</b>                                                                               | <b>xii</b>  |
| <b>Thesis Overview .....</b>                                                                          | <b>xiii</b> |
| <b>1 Literature Review .....</b>                                                                      | <b>1</b>    |
| <b>1.1 Nursing Homes.....</b>                                                                         | <b>1</b>    |
| <b>1.2 The Nursing Home Population .....</b>                                                          | <b>2</b>    |
| <b>1.3 Medical Conditions.....</b>                                                                    | <b>3</b>    |
| 1.3.1 Frequency of Common Chronic Conditions .....                                                    | 3           |
| 1.3.2 Aging and Susceptibility to Infection.....                                                      | 4           |
| 1.3.3 Falls in the Nursing Home .....                                                                 | 6           |
| 1.3.4 Responsive Behaviors in Nursing Home Residents .....                                            | 8           |
| 1.3.5 Disability .....                                                                                | 9           |
| <b>1.4 Providers of Primary Care to Long Term Care Residents.....</b>                                 | <b>9</b>    |
| 1.4.1 Nursing Staff.....                                                                              | 9           |
| 1.4.2 Physicians and Nurse Practitioners .....                                                        | 10          |
| <b>2 Association between access to Medical care and Resident Outcomes .....</b>                       | <b>12</b>   |
| <b>2.1 Introduction .....</b>                                                                         | <b>12</b>   |
| 2.1.1 TREC Priority Setting.....                                                                      | 12          |
| <b>2.2 Data.....</b>                                                                                  | <b>14</b>   |
| 2.2.1 RAI-MDS 2.0 .....                                                                               | 14          |
| 2.2.2 TREC Survey.....                                                                                | 17          |
| <b>2.3 Methods .....</b>                                                                              | <b>18</b>   |
| 2.3.1 Study Design and Measures .....                                                                 | 18          |
| 2.3.2 Resident-level Characteristics RAI-MDS 2.0.....                                                 | 18          |
| 2.3.3 Facility-level Characteristics (TREC Survey).....                                               | 19          |
| 2.3.4 Unit-level Characteristics (TREC Survey) .....                                                  | 19          |
| 2.3.5 Medical Care Variables.....                                                                     | 19          |
| 2.3.5.1 Physician and NP availability on a typical weekday .....                                      | 20          |
| 2.3.5.2 How often are physicians involved in managing care planning .....                             | 21          |
| 2.3.5.3 Most of the time our staff is able to contact a physician when a resident has a problem ..... | 21          |
| 2.3.6 Outcome Variables .....                                                                         | 22          |
| 2.3.6.1 Antipsychotic medication use.....                                                             | 22          |
| 2.3.6.2 Physical restraint use .....                                                                  | 22          |

|                                                                            |           |
|----------------------------------------------------------------------------|-----------|
| 2.3.6.3 Hospitalization and ED transfers .....                             | 23        |
| 2.3.6.4 Polypharmacy .....                                                 | 24        |
| <b>2.5 Analysis.....</b>                                                   | <b>24</b> |
| 2.5.1 Cohort Description .....                                             | 24        |
| 2.5.2 Medical Care Access Description .....                                | 25        |
| 2.5.3 Association between Medical Care Access and Outcome Variables.....   | 25        |
| <b>2.6 Results .....</b>                                                   | <b>27</b> |
| 2.6.1 Resident, Facility and Unit Characteristics .....                    | 27        |
| 2.6.2 Medical Care Variables.....                                          | 28        |
| 2.6.3 Outcome Variables.....                                               | 29        |
| 2.6.4 Final Models .....                                                   | 30        |
| <b>2.7 Discussion .....</b>                                                | <b>31</b> |
| 2.7.1 Summary of Findings .....                                            | 31        |
| 2.7.2 Main Findings .....                                                  | 31        |
| 2.7.2.1 Medical Care Access .....                                          | 32        |
| 2.7.2.2 Outcome Variables .....                                            | 34        |
| 2.7.2.3 Association between Medical Care Access and Outcome Variables..... | 35        |
| 2.7.3 Limitations.....                                                     | 36        |
| 2.7.3.1 RAI-MDS 2.0 .....                                                  | 36        |
| 2.7.3.2 TREC Survey .....                                                  | 37        |
| <b>3 Conclusions and Future Direction .....</b>                            | <b>39</b> |
| <b>3.1 Conclusions .....</b>                                               | <b>39</b> |
| <b>3.2 Future direction .....</b>                                          | <b>39</b> |
| <b>Tables .....</b>                                                        | <b>41</b> |
| <b>References .....</b>                                                    | <b>63</b> |
| <b>Appendix.....</b>                                                       | <b>73</b> |



## Table of Tables

|                                                                                                  |           |
|--------------------------------------------------------------------------------------------------|-----------|
| <b>Table 1-1 Resident characteristics of 10,888 residents in the NH in wave 5. ....</b>          | <b>41</b> |
| <b>Table 1-2 Characteristics of Nursing Homes Included in Wave 5 of TREC Survey</b>              |           |
| <b>Collection. ....</b>                                                                          | <b>44</b> |
| <b>Table 1-3 Access to medical care at the facility level across Wave 5 (N=90).....</b>          | <b>45</b> |
| <b>Table 1-4 Characteristics of Nursing Home Units Included in Wave 5 of TREC Survey</b>         |           |
| <b>Collection. ....</b>                                                                          | <b>46</b> |
| <b>Table 1-5 Staff Responses Regarding Physician Access by Nursing Home Unit Type for</b>        |           |
| <b>Wave (N=320).....</b>                                                                         | <b>47</b> |
| <b>Table 1-6 Staff Responses Regarding NP Access for Nursing Homes in Wave 5</b>                 |           |
| <b>(N=320).....</b>                                                                              | <b>48</b> |
| <b>Table 1-7 Number and proportion of units that reported at least one resident who</b>          |           |
| <b>experienced each outcome during the TREC Wave 5 data collection period.....</b>               | <b>49</b> |
| <b>Table 1-8 Number and proportion of residents who experienced each outcome measure</b>         |           |
| <b>during the TREC Wave 5 data collection period (N=10,888).....</b>                             | <b>52</b> |
| <b>Table 1-9 Resident outcomes with respect to frequency of visits on a typical weekday by a</b> |           |
| <b>physician for Wave 5 (N=320).....</b>                                                         | <b>53</b> |
| <b>Table 1-10 Resident outcomes with respect to frequency of visits on a typical weekday by</b>  |           |
| <b>an NP for Wave 5 (N=320). ....</b>                                                            | <b>54</b> |
| <b>Table 2-1 Unadjusted and adjusted odds ratios for the association between units that</b>      |           |
| <b>reported that at least one physician or NP had routine visits with residents (UVAR086</b>     |           |
| <b>and UVAR097) on a typical weekday and antipsychotic use without indication of</b>             |           |
| <b>psychosis among residents in Wave 5. (N=2493).....</b>                                        | <b>56</b> |
| <b>Table 2-2 Unadjusted and adjusted odds ratios for the association between units that</b>      |           |
| <b>reported residents' physicians being actively involved in managing care planning</b>          |           |
| <b>(UVAR094) and use of antipsychotic medication without indication of psychosis</b>             |           |
| <b>among residents in Wave 5 (N=2,493).....</b>                                                  | <b>57</b> |
| <b>Table 2-3 Unadjusted and adjusted odds ratio of the association between units that</b>        |           |
| <b>reported at least one physician or NP having routine visits with residents (UVAR086</b>       |           |
| <b>and UVAR097) on a typical weekday and physical restraint use among residents in</b>           |           |
| <b>Wave 5. (N=6551).....</b>                                                                     | <b>57</b> |
| <b>Table 2-4 Unadjusted and adjusted odds ratios for the association between units that</b>      |           |
| <b>reported residents' physicians being actively involved in managing care planning</b>          |           |
| <b>(UVAR094) on unit and physical restraint use among residents belonging to Wave 5</b>          |           |
| <b>(N=6551).....</b>                                                                             | <b>58</b> |
| <b>Table 2-5 Unadjusted and adjusted odds ratios for the association between units that</b>      |           |
| <b>reported at least one physician or NP having routine visits with residents (UVAR086</b>       |           |
| <b>and UVAR097) on a typical weekday and hospitalization rates/ED transfer among</b>             |           |
| <b>residents belonging to Wave 5 (N=1567).....</b>                                               | <b>59</b> |
| <b>Table 2-6 Unadjusted and adjusted odds ratios for the association between units that</b>      |           |
| <b>reported residents' physicians being actively involved in managing care planning</b>          |           |
| <b>(UVAR094) and hospitalization rates/ED department visits among Wave 5 residents</b>           |           |
| <b>(N=1567).....</b>                                                                             | <b>60</b> |

|                                                                                                                                                                                                                                                       |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Table 2-7 Unadjusted and adjusted association between units that reported having at least one physician or NP having routine visits with residents on the unit (UVAR086 and UVAR097) and polypharmacy among residents in Wave 5. (N=5270).....</b> | <b>61</b> |
| <b>Table 2-8 Unadjusted and adjusted odds ratios of the association between units that reported residents' physicians being actively involved in managing care planning and polypharmacy issues among residents in Wave 5 (N=5270) .....</b>          | <b>62</b> |

## List of Abbreviations

|                                                                                                |                                                                                  |
|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <b>ADL</b> , Activities of Daily Living                                                        | <b>SPSS</b> , Statistical Package for the Social Science                         |
| <b>AL</b> , Assisted living                                                                    | <b>TREC</b> , Translating Research in Elder Care                                 |
| <b>AD</b> , Alzheimer’s disease                                                                | <b>ADRD</b> , Alzheimer’s disease related dementia                               |
| <b>AOR</b> , Adjusted odds ratio                                                               | <b>IQR</b> , Interquartile range                                                 |
| <b>APM</b> , Antipsychotic medication                                                          | <b>ED</b> , Emergency department                                                 |
| <b>CPS</b> , Cognitive performance scale                                                       | <b>LR</b> , Logistic regression                                                  |
| <b>CIHI</b> , Canadian Institute for Health Information                                        | <b>PA</b> , Physician assistant                                                  |
| <b>ADE</b> , Adverse drug event                                                                | <b>LPN</b> , licensed practical nurse                                            |
| <b>CHESS</b> , Changes in Health, End-Stage Disease and Signs and Symptoms of medical problems | <b>CI</b> , Confidence interval                                                  |
| <b>MMSE</b> , Mini Mental State Examination                                                    | <b>TSI</b> , Test for severe impairment                                          |
| <b>DRS</b> , Depression rating scale                                                           | <b>VOICES</b> , Voices of Individuals, family and friend Caregivers Educating uS |
| <b>LTC</b> , Long term care                                                                    | <b>OR</b> , Odds ratio                                                           |
| <b>NH</b> , Nursing home                                                                       | <b>NNHS</b> , National Nursing Home Survey                                       |
| <b>RAI-MDS 2.0</b> , Resident Assessment Instrument – Minimum Data Set version 2.0             | <b>MD</b> , Physician                                                            |
| <b>NP</b> , Nurse practitioner                                                                 | <b>H&amp;E</b> , Hospital and emergency department                               |

## Background

The first part of this thesis is a literature review describing the need to understand the importance of appropriate medical care provision in the NH. A literature review was conducted to determine suitable variables to target the access to medical care component which was narrowed down to two variables. I decided to further investigate the access to medical care piece by analyzing on a typical weekday, would at least one physician or nurse practitioner, or either professional have routine visits with residents. I was also interested in exploring the TREC Survey variable of MD involvement in care planning.

The second part of this thesis was a retrospective analysis using secondary data collected from Wave 5 (Sept 1, 2019 to March 10, 2020) of the TREC longitudinal study, which consisted of 10,888 residents. This part is structured as follows: design, analysis, and results. The statistical software program SPSS was used to perform a generalized mixed model analysis incorporating a binary logistic regression to test this association. Finally, eight models were created to test the association between the two medical care variables and each of the four outcome variables. The last part of this thesis provides general conclusions and directions for future research.

## Thesis Overview

This thesis is composed of three chapters. The first chapter serves to provide a background to the research question by providing a literature review, leading to the research questions for the subsequent study. Chapter 2 provides details on the data used, the study design, and the analysis. The first part of Chapter 2 lists the full results including descriptive characteristics of the residents, units, and nursing homes included in the study and the final model results. Chapter 3 includes general conclusions and directions for future research.

Question: What is the association between access to medical care and resident outcomes in Canadian nursing homes?

## 1 Literature Review

### 1.1 Nursing Homes

Nursing homes are major providers of care for older people and serve an important function in the Canadian health care system<sup>2</sup>. Nursing homes, also referred to as long term care homes, are complex care systems that provide housing and care for residents with significant medical or social care needs and where age related dementias are common. Approximately 80% of residents will die within the nursing home<sup>2</sup>. Lack of access to appropriate medical care and therapy is a pervasive problem in nursing homes which stems from a variety of challenges pertaining to healthcare professional availability and presence in the facility. Since provision of medical care can have an effect on the quality of care and life of NH residents, it is useful to develop a better understanding of the organizational structure within a nursing home and who is responsible for delivering appropriate care to residents<sup>24</sup>.

## 1.2 The Nursing Home Population

Nursing home residents are increasingly medically complex with multiple health conditions. Therefore, this population requires good health services access. Some common predictors for admission to the NH include older age, lack of social support and poor social connection, and health status. Maxwell et al. provide a closer look at research that explores the predictors of transfer from assisted living (AL) to the NH in the United States<sup>18</sup>. AL has also become an increasingly popular residential care option in Canadian provinces due to the functional independence and satisfaction it provides residents<sup>18</sup>, which has implications for the NH sector. In Alberta, potential predictors of NH placement at the resident-level included age, sex, length of stay, marital status, bladder or bowel incontinence, number of chronic diseases, placement on the cognitive performance scale (CPS), activities of daily living (ADL), poor social relationships, frequent bladder incontinence and control, and severe aggressive behaviors and health instability<sup>18</sup>.

Currently the average age for a NH resident in Canada is 85 years with the most common medical problems being bladder incontinence, dementia, and musculoskeletal diseases<sup>55</sup>. Women are more likely to need NH care than men with 79% of women and 58% of men needing some NH care before they die<sup>3</sup>. Furthermore, older women are more likely to suffer mobility and personal care dependency than older men<sup>3</sup>. Sherwood states that "someone is a long-term care person who has reached, either suddenly or gradually, a state of collapse or deterioration in human behavioral functioning which requires—for survival, slowing down the rate of deterioration, maintenance, or rehabilitation—the services of at least one other human being"<sup>3</sup>. However, there has been some disagreement over a definition of who is classified as a long-term

care person as those residents who live with cognitive impairment unaccompanied by functional dependence are often left out.

Nursing homes provide care to persons with complex medical needs which in turn require a multidisciplinary approach to care<sup>4</sup>. Studies have shown that predisposing factors such as demographics, social structure, and health beliefs influence an individual's ability to access health services<sup>5</sup>.

### 1.3 Medical Conditions

The following sections examine common chronic conditions seen among nursing home residents and how aging is associated with an increased susceptibility to infection and increased likelihood of transfer to acute care as well as exploring some predictors of nursing home care among older adults.

#### 1.3.1 Frequency of Common Chronic Conditions

Nursing home residents are a population with multiple medical diagnoses and complex care needs, rendering them a highly vulnerable patient population<sup>6,7</sup>. Certain medical conditions are more prevalent in nursing home settings than others. The three most prevalent conditions in this population are urinary incontinence, fecal incontinence, and responsive behaviors<sup>7</sup>. Data from the National Nursing Home Survey (NNHS) reported that the most common diagnoses among nursing home residents overall were hypertension (55%), dementia (51%), depression (35%), arthritis (33%), diabetes mellitus (24%), gastroesophageal reflux disease (GERD) (23%),



atherosclerosis (21%), congestive heart failure (CHF) (20%), cardiovascular disease (CVD) (20%), and anemia (19%)<sup>6</sup>.

There are significant sex differences between combinations of various comorbid conditions in the nursing home population that range from differences in social support, social capital, and biological differences. Diagnoses of vascular diseases (atherosclerosis, CVD, lipid disorders, peripheral vascular disease), coronary artery disease, hyperlipidemia, atrial fibrillation, COPD, diabetes mellitus, Parkinson's disease, renal failure and benign prostatic hyperplasia are more common in men<sup>6</sup>. Anemia, arthritis, CHF, dementia, depression, osteoporosis, thyroid disease, hypertension, hyperlipidemia, and arthritis are more prevalent in women<sup>8</sup>. Residents 65-74 and 75-84 years of age have a higher prevalence of diabetes and hyperlipidemia compared to residents over the age of 85<sup>8</sup>. Regardless of age, women have a higher incidence of inflammatory and immune-related disorders such as arthritis, thyroid disease, depression, and osteoporosis which is also reflected in the chronic medical conditions of nursing home residents<sup>8</sup>.

### 1.3.2 Aging and Susceptibility to Infection

Physiological changes, functional impairment, malnutrition, and the use of invasive devices such as indwelling catheters and nasogastric feeding tubes can give rise to alterations in body systems and influence the occurrence and severity of infections<sup>9</sup>. In terms of the respiratory system, there are marked declines in cough reflex, elastic tissue, and mucociliary transport which increases the likelihood of developing pneumonia and aspiration<sup>9</sup>. Skin also sees a decline in vascularity, elasticity, and subcutaneous tissue which manifests as delayed wound healing<sup>9</sup>. The gastrointestinal and urinary systems change with age with a decrease in gastric acidity, motility,

increase in perineal-vaginal colonization in women, increase in prostate size and lessened prostatic secretions in men as well as a decrease in urine osmolality<sup>9</sup>. This increase in gastric acidity increases the likelihood of infection after ingestion of a pathogen<sup>9</sup>.

Poor functional status of nursing home residents includes incontinence of bladder and bowel, immobility, and limitations in activities of daily living<sup>9</sup>. Residents who are confined to either a chair or bed are at a higher risk of developing pressure ulcers<sup>9</sup>. The presence of urinary and fecal incontinence can contribute to environmental contamination with harmful and often agent-resistant bacteria placing residents at a higher risk of developing infection<sup>9</sup>.

Prevalence studies have indicated that symptomatic urinary tract infections, respiratory tract infections, and skin infections are the most common infections in LTC residents<sup>9</sup>. Though incidence of upper respiratory tract infections is much lower than lower respiratory tract infections, 1.1 episodes are recorded per 100 resident months in nursing homes<sup>9</sup>. Lower respiratory tract infections such as bronchitis and pneumonia are much more prevalent in the nursing home population compared to the older community dwelling population<sup>9</sup>. There are several limitations around pneumonia diagnosis in nursing homes. Though presence of causative agents through blood cultures can be used to detect pneumonia, this method is used in fewer than 25% of cases<sup>9</sup>. Given the heavy reliance on sputum specimens to define the bacteriology, oropharyngeal colonization is difficult to differentiate from pulmonary infection<sup>9</sup>. Urinary tract infections are the most common infections in nursing homes<sup>9</sup>. Lastly, the prevalence of pressure wounds in nursing homes further reflects the quality of nursing care. Residents with impaired

mobility, sensory impairment, and incontinence are at a higher risk of developing pressure wounds and this is reflective of the quality of nursing home care<sup>9</sup>.

Various microorganisms with differing modes of transmission have been known to cause outbreaks in nursing homes<sup>9</sup>. Given an environment that is conducive to cross-contamination of organisms among residents through the environment or staff, outbreaks of various infections are commonly reported<sup>9</sup>. The recent COVID-19 pandemic has shown how easily infectious conditions can spread through NHs and how vulnerable residents are to severe outcomes.

### 1.3.3 Falls in the Nursing Home

Falls are common among nursing home residents and pose a risk for injury. Falls contribute to significant morbidity, immobility, and mortality among residents with the most commonly attributed causes being arthritis, drug side effects, alcohol intake, and visual problems<sup>10</sup>. Other common risk factors for falls include medication use, functional impairment, and comorbid medical diagnoses<sup>10</sup>. With more accurate reporting of falls available for institutions and given the frail nature of the residents, the mean incidence of falls of the nursing home population is three times higher than that of the community-dwelling older population<sup>10</sup>. Given the complexity of the aging resident population, falls may result in further disability. Serious injuries such as head trauma, soft tissue injuries, and severe lacerations result from 11% of falls whereas only 4% result in fractures<sup>10</sup>. For residents who experience recurrent falls, serious consequences to their quality of life include anxiety like symptoms along with feelings of helplessness<sup>10</sup>.

The causes of falls can be attributed to different reasons given the population being studied. Community-dwelling residents experience falls that are associated with the environment whereas nursing home residents are more likely to experience falls given their frailty and weakness, dizziness, and confusion caused by various disorders<sup>10</sup>.

According to a review of the epidemiology and causes of falls in the NH, 25% of falls were attributed to dizziness whereas 16% were attributed to environmental hazards<sup>10</sup>. Dizziness may be difficult to define as it can have many different causes ranging from vertigo to acute labyrinthitis<sup>10</sup>. Other possible explanations for dizziness could be depression, side effects of drugs, anxiety, and cardiovascular problems<sup>10</sup>. Cognitive impairment can further disproportionately increase the frequency of falls due to impaired judgment, visual-spatial perception, and the ability to orientate oneself<sup>10</sup>.

Nursing home residents are often diagnosed with more than one medical condition and are often taking multiple medications. Specifically, sedatives, psychotropic drugs, cardiac drugs, and nonsteroidal anti-inflammatory drugs increase the risk for falling in nursing homes<sup>10</sup>. However, there is a weak association between medical diagnoses and falls showing that those who had fallen were diagnosed with more medical conditions than those who had not fallen<sup>10</sup>.

Most falls are multifactorial in nature resulting from intrinsic risk factors, the resident's functional level, and environmental context<sup>10</sup>. With functional impairments and falls being interrelated, exercise and rehabilitation interventions focusing on improving strength and endurance are important. However, treatment focused on acute conditions such as stroke and hip

fracture is emphasized rather than improving strength and function of residents<sup>10</sup>. Active residents are typically at greater risk of falling because they are moving around.

The role of the clinician in the nursing home setting should assess and address modifiable factors which might contribute to falls including a medication review in order to stop medications likely to increase falls risk and prescribe medications that have short lasting effects and that are less likely to have sedative effects<sup>10</sup>. Some interventions to mitigate the risk of falls in the NH include medical intervention to reduce modifiable risk factors and prescribe appropriate interventions. Along with rehabilitation programs, walking and safe frequent physical activity is also recommended to improve strength and endurance<sup>10</sup>.

#### 1.3.4 Responsive Behaviors in Nursing Home Residents

Responsive behaviors are defined as verbal or physical actions that can be potentially disturbing to others. With a more person-centered approach in mind, these behaviors may be a better reflection of internal states rather than problem behaviors. These behaviors may be indicative of underlying pain, loneliness, or not wanting personal care<sup>17</sup>. Across nursing homes in Canada, responsive behaviors such as verbal abuse, resistance to care, physical abuse, and socially inappropriate behaviors were exhibited by 26% to 66% of residents<sup>17</sup>. Responsive behaviors are common, disruptive, and damaging to the resident and the nursing home and are often managed by medications that can have negative implications for residents' health and decrease their overall quality of life<sup>17</sup>.

### 1.3.5 Disability

Nursing home residents are often ill-equipped to engage in independent self-care which in turn contributes to self-care disability<sup>19</sup>. Self-care disability is defined as the dependence on others to conduct activities of daily living (ADL) and has been linked to a lower quality of life among residents<sup>19</sup>. There is a strong association between visual impairment and disability, coming in second to arthritis and rheumatism as a cause of disability among nursing home residents<sup>20</sup>. Visual impairment in turn has an impact on ADL functioning with residents requiring more care and assistance with walking, getting outside, and transferring in and out of bed<sup>20</sup>. Overall, functional and cognitive impairment is prevalent among nursing home residents<sup>19</sup>.

## 1.4 Providers of Primary Care to Long Term Care Residents

### 1.4.1 Nursing Staff

Nursing staff play an integral role in the quality of care of nursing home residents<sup>12</sup>. A study looking at the effects of nursing staffing patterns on quality of care outcomes hypothesized that full-time registered nurses (RN) have a positive impact on quality of care outcomes<sup>12</sup>. Since an RN staffing mix, which is defined as the proportion of RNs relative to other care staff, is associated with improved quality of care outcomes, it may be beneficial for NHs to employ more RNs<sup>12</sup>. In Canada, the professionally regulated nursing workforce is composed of RNs and licensed practical nurses (LPN)<sup>13</sup>. The major difference in educational background between RNs and LPNs is that RNs undertake a 4-year bachelor's degree in nursing whereas LPNs take a 2-year diploma course. As such, RNs have more of a managerial position within the nursing home whereas LPNs are closer to the point of care and more involved in providing direct clinical

care<sup>13</sup>. Employing RNs in the NH sector is also important since they are trained with problem solving skills and actively generating solutions which ultimately improves resident outcomes<sup>12</sup>.

A survey of 309 RNs and 448 LPNs from 91 NH across Western Canada compared demographic characteristics of nursing staff from Alberta, British Columbia, and Manitoba and found significant differences by age and role of LPN vs RN<sup>13</sup>. In terms of differences by age, LPNs were younger than RNs on average with 47.4% of LPNs being under the age of 40 compared to 25.9% of the RNs<sup>13</sup>. Younger RNs also reported feeling less competent in comparison to older RNs when health-related staff outcomes within the NH were studied<sup>13</sup>. RNs spent a significant portion of their time providing indirect care in the form of documenting and charting, whereas LPNs provided more medical provision to residents<sup>13</sup>. A greater RN presence in relation to point of care has shown to have lower rates of negative resident outcomes<sup>14</sup>.

#### 1.4.2 Physicians and Nurse Practitioners

Physicians are medically trained professionals that play a significant role in the diagnosis and therapeutic decision making for residents and are responsible for diagnosing and performing assessments within nursing homes<sup>15</sup>. General practitioners are often responsible for delivering medical care to residents of nursing homes but with an increase in the older population in the nursing home, the physician workload has increased tremendously and there is very little literature exploring physician involvement in the NH and even less literature reporting the impacts that may have on quality of care for residents<sup>23</sup>. Many fee for service compensation models lack incentive for physicians to provide nursing home care or travel between facilities and little is known of the implications it has for residents<sup>16</sup>. The limited research that does shine

light on physician presence in the NH reports that increased presence of an MD in a NH results in fewer hospitalizations even after controlling for resident demographics and diagnoses<sup>25</sup>. Physician presence in nursing homes can influence hospitalization rates, resident satisfaction, and functional status<sup>16</sup>.

Given the restrictions on physician availability, there has been an increase in the number of mid-level providers, medical professionals that are not physicians but who are licensed to diagnose and treat residents, to compensate for the lack of physicians by changing the skill mix<sup>54</sup>. NPs, the largest group of mid-level providers, are responsible for the delivery of care in various settings with an important role in NH settings. NPs are trained in physical examination, care planning, monitoring resident medical status, can prescribe within their scope of practice<sup>22</sup>. Where physician care is limited or unavailable, NPs are pivotal members of the multidisciplinary team delivering medical care to residents.

There is limited research on how medical staff models impact medical care delivery in the NH but due to the perceived lack of physician driven care, there has been an increase in NP and physician assistants (PA) involvement in care even though there is still a gap in our understanding of how their presence impacts residents' care. Additionally, there is a lack of data on a national level, surrounding how NPs and PAs work as part of the medical team and the implications that has for access to medical care for residents<sup>26</sup>.



## 2 Association between access to Medical care and Resident Outcomes

### 2.1 Introduction

This goal of this thesis was to explore the association between access to medical care defined by physician and NP availability and practice sensitive resident outcomes. The objective of this thesis project was to use data collected in the Translating Research in Elder Care (TREC) longitudinal study to test the association between the availability of physicians and nurse practitioners in nursing homes and clinically-relevant resident outcomes. TREC has been collecting data on NH facilities, units, and care staff for nearly 15 years and then linking it to the routinely collected Resident Assessment Instrument – Minimum Data Set version 2.0 (RAI-MDS 2.0) in Western Canadian provinces. This is a unique data source that includes in-depth staffing and setting variables not found elsewhere.

#### 2.1.1 TREC Priority Setting

One of TREC's core values is partnership with research end users, with hopes to improve quality of care provided to residents in nursing homes. As a commitment to providing integrated knowledge translation, the VOICES (Voices of Individuals, family and friend Caregivers Educating uS) committee was established. The committee is comprised of members from all over Canada with the collective goal of recognizing those with lived experience in enacting social change in this sector<sup>27</sup>. From October to December 2018, an online survey composed of various open ended questions on key aspects of available TREC data including staffing mix, unit, facility, and work environment data was administered widely to respondents<sup>27</sup>. Respondents

included friends and family of those currently living in a NH or those who had previously lived in a NH, NH managers, and administrators. From these respondent surveys, the study authors narrowed the list of identified research priorities down to a list of 10 priorities that were identified as being the most salient, with a strong emphasis on the non-clinical aspects of care in the NH<sup>27</sup>. The top 10 priorities included questions focusing on relationships between staffing (numbers, mix, and type) and resident outcomes, resident quality indicators, and quality improvement activities and resident and staff outcomes as areas for further research using secondary data available in TREC<sup>27</sup>.

In partnership with caregivers, patients, and clinicians in Alberta, the Alberta Health Services Seniors Health Strategic Clinical Network and the Alzheimer Society of Canada led priority setting partnerships with respect to dementia-related care and service and stigma, quality of life, and dementia care, respectively<sup>56</sup>. While results from both priority setting activities offer insight into broader areas for future research at the level of the community, they do not match with the priorities identified in the NH sector. As such, TREC's priority setting project offers an opportunity to explore and identify specific questions that can be addressed without the need of new data collection while also incorporating the perspectives of owner-operators and health system decision makers which has not been done in the past<sup>27</sup>. I was particularly driven to lead the priority identified as "is there an association between access to medical care (e.g physicians and nurse practitioners) and resident outcomes?" This was important to me as the NH population is such a medically vulnerable population, often with multiple complex conditions and there is a lot that is unknown about healthcare provision in this sector. The National Academies of Sciences, Engineering, and Math define access to medical care as "the timely use of personal

health services to achieve the best possible health outcomes<sup>28</sup>.” Since the nursing home resident population is especially vulnerable, this population is at a greater risk of poorer health outcomes and health disparities<sup>28</sup>. That said, this research priority will allow me to explore the availability of medical care in nursing homes via physicians and nurse practitioner presence and the impact on resident outcomes.

## 2.2 Data

TREC is a multi-level and longitudinal research program that seeks to improve the quality of care of nursing home residents and the quality of work-life of the people who work in them. The goal of this program is to identify modifiable organizational context characteristics in the NH and the impact of these characteristics on resident and staff outcomes. TREC is situated in 3 provinces: Alberta, Manitoba, and Saskatchewan in the first phase, with British Columbia replacing Saskatchewan in the second phase. For this research paper, the RAI-MDS 2.0 and TREC Survey data from wave 5 (Sept 1, 2019 to March 10, 2020) were used.

### 2.2.1 RAI-MDS 2.0

The Resident Assessment Instrument (RAI-MDS 2.0), initially developed in the United States but now used internationally, has made its way to Canada and is used for nursing home residents as an intervention that increases documentation of physical and mental health with triggers for further assessment when health problems are identified<sup>29,30,31</sup>. This system was put in place for measuring and evaluating nursing home care as it allows for a standardized assessment of resident outcomes<sup>32</sup>. Specifically, it consists of various tracking forms and modules that are completed on admission and subsequently at either quarterly intervals or when there is a

significant change in resident clinical condition. The latter is more common, with a shorter assessment carried out every 3 months<sup>33</sup>. Using more than 400 data items, the assessment collects information on cognition, health conditions, diagnoses, medications, and treatments<sup>34</sup>. Typically, designated RNs or LPNs are employed within the NH to complete the assessment using information on residents collected from direct care workers before submitting within specific time windows to appropriate agencies, including the Canadian Institute for Health Information (CIHI)<sup>33</sup>. The information collected in the RAI-MDS 2.0 is used in nursing home facilities to not only monitor and improve quality of care in these facilities, but to also capture the most important characteristics of nursing home residents. In these assessments, items range from simple yes or no response options to quite detailed and complex response items with up to 16 sub-items, each with up to three response options<sup>33</sup>. Items are derived with a specific intent in mind and from specific sources. Some common sources of information are from discussion with the resident and facility staff, facility administration records, care plans, and information from the attending physician<sup>34</sup>. Examples of items collected include but are not limited to identification, demographic information, cognitive patterns, psychosocial well-being, certain medications, health conditions, and disease diagnoses<sup>34</sup>. The RAI-MDS 2.0 is intended to serve at multiple levels; the individual resident by contributing to care planning, the facility level by contributing to quality improvement and tracking quality measures/indicators, and overall by enabling reporting on quality indicators and tracking over time. At the resident level, the RAI-MDS 2.0 contributes to care planning by establishing a course of action that helps the resident move towards a specific goal utilizing their own strengths<sup>34</sup>. The interdisciplinary use of this assessment helps facility staff to view nursing home residents as holistic beings for whom quality of life and care are significant and as such serves as a means to gather and analyze information<sup>34</sup>.

Since implementation of the RAI-MDS 2.0, there has been an increase in the attention that standardized collection and reporting enabled and the ability to target these issues for improvement in outcomes<sup>35,36</sup>.

Since the RAI-MDS 2.0 assessment is important in evidence based health management, the quality of the data used is important<sup>34</sup>. However, there are some limitations surrounding the validity and reliability of RAI-MDS 2.0 data, both of which are necessary in instilling confidence in a measurement system<sup>34</sup>. Validity is defined as the accuracy with which a tool measures what it is supposed to measure. Criterion, predictive, and convergent validity have all been identified as essential in instilling confidence in the RAI-MDS 2.0 assessment<sup>34</sup>. With respect to items measuring medical care in the nursing home, and resident autonomy and satisfaction, there seems to be weak validity<sup>33</sup>. Scales such as the ADL, CPS, and depression rating scale (DRS) captured within the RAI-MDS 2.0 are validated against the gold-standard measures which are further explained later in the chapter<sup>34</sup>. Reliability, on the other hand, is defined as the repeatability and measurement consistency of a tool and is quantitatively measured using the kappa statistic which is a measure of consistency between test results<sup>33,37</sup>. In order to establish confidence levels among users of the assessment, inter-rater studies are utilized to calculate levels of agreement<sup>34</sup>.

Quality indicators (QIs), derived from the RAI-MDS data, are selected based on expert consensus are used as proxy measures for quality of care<sup>32</sup>. Outcomes may be positive or negative ranging from falls and pressure ulcers to physical independence and improved

continence. That said, practice sensitive QIs provide both the greatest opportunity for improving resident function and slowing the trajectory of decline experienced by most residents<sup>32</sup>.

### 2.2.2 TREC Survey

The TREC Survey was used to gather provider (staff) level data. The survey is composed of a variety of survey instruments that measure organizational context, knowledge translation, individual factors believed to impact knowledge translation, and staff outcomes believed to be sensitive to both organizational context and knowledge translation<sup>31</sup>. The TREC Survey is particularly useful in that it allows for data collection from both regulated staff (physicians, registered nurses, managerial staff) as well as unregulated staff (care aides). The TREC Survey includes the Alberta Context Tool (ACT) which is designed to measure the organizational context in complex healthcare settings, and several other scales such as the self-reported knowledge translation, individual factors, belief suspension, and various measures of staff<sup>31</sup>.

## 2.3 Methods

### 2.3.1 Study Design and Measures

This retrospective cross-sectional study was a secondary analysis of data from the RAI-MDS 2.0 and the TREC Survey to test the association between reported access to physicians and nurse practitioners and resident outcomes with data from wave 5 collected from Sept 1, 2019 to March 10, 2020.

### 2.3.2 Resident-level Characteristics RAI-MDS 2.0

The resident sample is characterized by age, sex, marital status, medical conditions, and various outcome scales including the CPS (Cognitive Performance Scale), ADL short form, CHESS (Changes in Health, End-Stage Disease and Signs and Symptoms of medical problems), and the Pain Scale. The CPS describes the cognitive status of an individual and has been validated against the Mini-Mental State Examination (MMSE) as well as the Test for Severe Impairment (TSI)<sup>38</sup>. The scale assesses short and long term memory, memory recall and orientation items, identity of staff and ability of resident to make decisions surrounding one's own awareness and activities of daily living<sup>38</sup>. The scores on the CPS scale range from 0-6 with 0 indicating intact cognitive functioning and 6 indicating very severe impairment<sup>39</sup>. The CHESS outcome scale was put in place to detect frailty and health instability with the major goal in mind to identify residents at risk of serious decline<sup>39</sup>. Some RAI-MDS 2.0 assessment items captured within this scale include weight loss, end-stage disease, edema, shortness of breath, decline in ADL and decline in cognition<sup>39</sup>. The scores on this scale range from 0-5 with higher scores being indicative of greater medical complexity. Higher scores are associated with adverse outcomes

such as hospitalizations and poor self-rated health<sup>55</sup>. The ADL short form measures a resident's ADL status. The Pain scale, validated against the visual analogue scale, summarizes the presence and intensity of pain and is composed of 2 RAI-MDS 2.0 assessment items; frequency and intensity of pain. The Pain scale scores range from 0-3 with higher scores indicating a more severe pain experience<sup>55</sup>.

### 2.3.3 Facility-level Characteristics (TREC Survey)

Standardized data collection forms consist of variables describing facility size, ownership model, and location included. Facilities were either classified as public not for profit, private for profit, and voluntary not for profit. Data reflected the facility distribution over three provinces of Alberta, Manitoba, and British Columbia. Facilities were classified as either small (<80 beds), medium (80-120 beds), or large (>120 beds).

### 2.3.4 Unit-level Characteristics (TREC Survey)

Unit type and number of beds on unit were some important characteristics to explore when describing the NH units. Units were classified as either general LTC, dementia, secure mental health/psychiatric, and other. For number of beds, units were described as small (9-30 beds) medium (31-60 beds), or large (>61 beds).

### 2.3.5 Medical Care Variables

I chose specific medical care variables to examine and better understand how medical care is reported in the NH. In order to decide which medical care variables I wanted to incorporate into my final models, TREC Survey data on how often staff feel like they can contact physicians for resident's problems, care planning, and routine visits across Unit type for Wave 5 was



analyzed (Table 1-5). The variables of “on a typical weekday, was at least one physician visiting residents on this unit and “on a typical weekday, was at least one NP visiting residents on this unit” were chosen as being most salient to my question of interest. The other variable was “Generally, residents’ physicians are actively involved in managing care planning.” Upon performing descriptive statistics for the variable assessing the staff’s ability to contact a physician for resident’s routine needs, there was no variation in response options so this variable was not included as one of the final exposure variables to test further.

#### *2.3.5.1 Physician and NP availability on a typical weekday*

The first medical care exposure variable conceptually reflects the presence of a medical care provider on the nursing home unit, whether that be a physician or a nurse practitioner.

Operationally, this variable is identified in the TREC Survey as a combination of UVAR086 and UVAR097. UVAR097 is asked as “on a typical weekday, is at least one NP having routine visits with residents on this unit?” The response options for the variables include “Yes” or “No.”

UVAR086 is operationally defined as “on a typical weekday, is at least one MD having routine visits with residents on this unit?” The response options for that variable also consist of “Yes” or “No”. I decided to create 1 new variable with 4 response options that captured the two variables accordingly. If respondents had answered “Yes” to both variables, that response option was labelled as “Either Physician or NP.” If respondents had responded “Yes” to having NP visits but “No” to MD visits, then the option was labeled “NP Only.” If respondents had responded “Yes” to having MD visits but “No” to NP visits, then the option was labelled as “MD Only.” If respondents had answered “No” to both UVAR086 and UVAR097, then the option was stated as “Neither” in SPSS.

#### *2.3.5.2 How often are physicians involved in managing care planning*

I decided to include this variable to better understand medical care access in the NH with respect to a physician. In the TREC Survey, this is operationally defined as “Generally, the residents’ physicians are actively involved in managing care planning for residents on this unit” (UVAR094). The response options for UVAR094 include “Strongly agree”, “Agree”, “Disagree”, “Strongly disagree”, “Neither Agree or Disagree” and “Other”. I decided to combine the response options into two categories “Strongly agree or agree” and “Other” to create a dichotomous variable.

#### *2.3.5.3 Most of the time our staff is able to contact a physician when a resident has a problem*

Another medical care exposure variable of interest was UVAR093 in the TREC Unit survey. UVAR093 was conceptually defined as general medical provider availability and operationally defined as “Most of the time our staff is able to contact a physician when a resident has a problem” in the TREC Survey. The response options for UVAR093 include “Strongly agree”, “Agree”, “Disagree”, “Strongly disagree”, “Neither Agree or Disagree” and “Other”. Once again, I decided to combine the response options into two categories “Strongly agree or Agree” and “Other” to create a dichotomous variable. However, given no response variation, the decision was made in terms of not testing it any further.

### 2.3.6 Outcome Variables

The outcome variables of interest include antipsychotic medication use without any indication of psychosis, physical restraint use, hospitalization and emergency department transfers, and polypharmacy; all outcome measures were obtained from the RAI-MDS 2.0. By definition, an outcome refers to a final consequence such as recovery, survival, or restoration of function of the resident population in nursing homes<sup>21</sup>.

#### *2.3.6.1 Antipsychotic medication use*

Antipsychotic medications are frequently prescribed in order to manage the behavior of residents with negative side effects of delirium, tachycardia, decreased mobility, and cognitive impairment<sup>7</sup>. The issue at hand, however, is that antipsychotics may be inappropriately prescribed at times and/or warrant additional monitoring<sup>7</sup>. Therefore, I wish to look whether or not antipsychotics were administered (O4a) without indication of schizophrenia (I1ii), Huntington's disease (I1x), or hallucinations (J1i) in the week prior to assessment.

#### *2.3.6.2 Physical restraint use*

Physical restraints are mechanical devices that restrict freedom of movement and are usually discouraged unless ordered by a physician given that resident's symptoms warrant their use, with most people generally agreeing that the pros are miniscule in comparison to the serious harms associated with their use<sup>7</sup>. Although they have been used regularly in the past, their use has substantially decreased across nursing homes but continues to be an issue. The detrimental effects of physical restraints include psychiatric morbidity, pressure ulcers, responsive behavior,

mental health issues, and nosocomial infection<sup>7</sup>. The RAI items Pfc and Pfd indicate use of trunk, limb, and/or chair restraint used in the week prior to assessment were used for analysis.

#### *2.3.6.3 Hospitalization and ED transfers*

The frequency for transfers to acute care for common conditions like pneumonia places a significant burden on the healthcare system and is associated with substantial economic costs and a general reduction in quality of life, decline in functional status, and falls for residents<sup>22</sup>. Pneumonia, as well as other lower respiratory tract infections, are commonly seen among nursing home residents. However, due to a lack of on site care by nurse practitioners or physicians, residents are often hospitalized. A randomized control trial of nursing home residents aged 65 and over was conducted in Hamilton, Ontario to assess whether onsite treatment of pneumonia and other lower respiratory tract infections using a clinical pathway with diagnostic and monitoring guidance would be of merit<sup>22</sup>. Their results indicated that although there were no differences in mortality or quality of life among those in the “clinical pathway” group vs those in the usual care group, and the clinical pathway group had a mean of 0.79 hospital days with the usual care group having a mean of 1.74 hospital days. With this data, one can ascertain that treating residents on site with appropriate care with the clinical pathway can substantially reduce health care costs and hospitalizations<sup>22</sup>. Given this example of treatment for disease in the NH, I am interested in exploring how access to a healthcare professional can impact hospitalization and emergency department (H&E) transfer rates. Operationally, using the RAI-MDS 2.0, I want to know whether there was a hospital stay or ED visit in the last 90 days using the P5 RAI-MDS 2.0 item.

#### 2.3.6.4 Polypharmacy

Polypharmacy does not have a single definition as in some places is defined as the use of 5 or more medications whereas other places define it as more than 10. Either way, polypharmacy is associated with an increased likelihood of adverse drug reactions and drug-drug interactions. Thus, understanding prescriber habits and how often a medical care team is visiting and paying attention to medications and making active decisions about what people should stay on, start, modify, or stop is worth exploring. Therefore, the conceptual definition of this outcome is polypharmacy. Operationally, item O1 from the RAI, (number of medications)  $\geq 9$  indicating if more than 9 medications were used in the week prior to assessment was used here.

### 2.5 Analysis

#### 2.5.1 Cohort Description

In order to better understand the resident cohort, descriptive statistics were run using statistical software Statistical Package for the Social Sciences (SPSS v26, Amos v26) to describe the residents by demographics and medical diagnoses. Resident demographic and medical diagnoses were tabulated. Mean, median, and interquartile range (IQR) were calculated for continuous variables, including age. For categorical variables, frequency distributions of categories were obtained.

The facilities were characterized by owner-operator model, facility size, and province, and units were characterized by unit bed size and unit type.

### 2.5.2 Medical Care Access Description

From the TREC Survey variables on MD and NP presence in nursing homes, I created tables to better understand how medical care is delivered at the level of the unit, who is responsible for that delivery, and how that access varies by unit type.

### 2.5.3 Association between Medical Care Access and Outcome Variables

The relationship between medical care access variables and dichotomous resident outcomes was modelled using logistic regression and models were fit using a generalized estimating equation (GEE), allowing residents to be nested in units and units to be nested within facilities in the NH. The reasoning for performing a multilevel model was twofold. Firstly, one of the basic assumptions of most statistical tests is that all of the observations are independent of one another. Residents on the same unit, however, are more likely to be more similar to each other than compared to residents on another unit. Similarly, units within a facility are more similar to one another than units within a different facility, but also residents living within the same facility are more similar than residents living in a different facility. The model results are presented as odds ratios (ORs) and accompanying 95% confidence intervals (CI).

Logistic regression was used as the statistical model of choice as it is often used with dichotomous dependent variables like those used here. The odds ratio calculated from the logistic regression model is a measure of the association between each medical care exposure variable and each dichotomous outcome variable<sup>40</sup>. This number represents the odds that the outcome occurs given each of the medical care exposure variables compared to the odds of the outcome

occurring in the absence of that medical care exposure<sup>40</sup>. The 95% CI is also reported to estimate the precision of the OR<sup>40</sup>. Theoretically, a 95% CI indicates that if the same population were sampled countless times and CIs were calculated each time, the resulting intervals would contain the true population value in approximately 95% of the cases<sup>40</sup>.

It is important to take into account the effect of confounding variables. This is represented by adjusted ORs (AOR). The goal here is to see how the estimated associations change when specific variables are added into the model. Confounding variables are defined as those that can affect the association between the exposure and the outcome either causally or non causally<sup>41</sup>. The list of potential confounders was resident age, sex, owner-operator model, province, medical diagnoses, CPS, and ADL status, to list a few. Instead of looking to see if age, as an example, is associated with each outcome variable, I am more interested in understanding if any confounding variable is interfering with my ability to observe an association between the exposure and outcome variables. Quantitatively, my attention is focused on a 10 percent or greater change in the odds ratio between the exposure variable and outcome in order for a variable to be consider a confounder.

## 2.6 Results

### 2.6.1 Resident, Facility and Unit Characteristics

In the sample of 10,888 residents (Table 1-1) the mean age was 84.5 (SD=10.4), 67% of residents were female, 48.7% were widowed, and 62.5% had been diagnosed with Alzheimer's or some other form of dementia. Fifty-one percent had mild or moderate cognitive impairment, and 82.8% were defined as highly dependent, with an ADL score greater than four. The most common reported conditions were Alzheimer's or other dementia (62.5%), depression (30%), and diabetes (21.6%).

Facility characteristics are shown in table 1-2 with medical access at the facility level described in table 1-3, and unit characteristics in table 1-4. The mean (SD) number of LTC beds in facilities in wave 5 were 126(66) in a sample of 90 facilities. Large facilities made up the largest share with 40%. Twenty-two percent of facilities were public not for profit, 42.2% were private for profit, and 35.6% were voluntary not for profit (Table 1-2). Ninety percent of facilities in wave 5 (N=90) reported having a physician or a roster of physicians visit the residents, 55.6% of facilities reported family physicians visiting their own residents, and 15.6% reported having a NP (Table 1-3). Thirty-seven percent of facilities in the sample were located in Alberta, 17.8% in Manitoba, 44.4% in British Columbia (Table 1-3).

For Unit bed size in Wave 5 (N=320), 53.4% of units were classified as small, having anywhere from 9 to 30 beds, 45.9% as medium with 31-60 beds, and 0.6% large with more than 61 beds (Table 1-4). For unit type, 69.7% were general LTC units, 14.1% secure dementia, 3.1%



non-secure dementia, 0.9% secure mental health/psychiatric, and 12.2% classified as “other” (Table 1-4).

### 2.6.2 Medical Care Variables

The data I analyzed from TREC Survey on physician availability by unit type showed 91.5% of all general LTC units (N=223), 85.5% of dementia units (N=55) and 61.9% of all “other” units (N=42), reported at least one physician having routine visits with residents on the unit on a typical weekday (Table 1-5). Seventy percent of general LTC units, 69.1% of dementia units, and 73.8% of other units reported that residents’ physicians are actively involved in managing care planning (Table 1-5). On a typical weekend, 27.4% of all general LTC units (N=223), 18.2% of dementia units (N=55) and 11.9% of all “other” units reported at least one physician having routine visits with residents on the unit. With respect to the staff’s ability to contact a physician for residents’ routine needs, 100% of all general LTC units, 98.2% of dementia units and 100% of “other” units reported “yes.”

The same process of analysis was applied to gain a better understanding of NP access in the NH. Fifteen percent of units in wave 5 (N=320) reported at least one NP having routine visits with residents on a typical weekday (Table 1-6). With respect to NP being actively involved in care planning, 5.6% of units agreed, 10.3% strongly agreed, 2.2% neither agreed nor disagreed, 2.8% disagreed, 0.3% strongly disagreed, and 78.7% reported “N/A” (Table 1-6).

Of those units with NP visits on a typical weekday, 23.9% had residents with APM use, 55.2% had residents with physical restraint use, 11.9% had residents with H&E transfers, and 45.3% reported residents with polypharmacy (Table 1-10).

### 2.6.3 Outcome Variables

Fifteen percent of units reported antipsychotic medication usage with no indication of psychosis, 57.2% reported physical restraint use, 10.3% reported hospitalization and ED visits, and 34.7% reported polypharmacy (Table 1-7). Since my unit of analysis is that of the resident, I also created a table to describe each outcome at the resident level. At the resident level, 22.9% of residents were using antipsychotic medication with no indication of psychosis, 60.2% of residents had physical restraint use, 14.5% H&E transfers, and 48.4% polypharmacy (Table 1-8).

#### 2.6.4 Final Models

I created eight final models testing the association between each of the two medical care variables against each of the four outcome variables. The first model looked at the association between presence of MDs, NPs, either, or neither on a typical weekday and APM use. Results for unadjusted and adjusted estimates are provided: MD only: (OR 0.68 (0.50-0.90)), (AOR 0.80 (0.60-1.06)), NP only: (OR 1.23 (0.53-2.86)), AOR (1.18 (0.56-2.53)), either: (OR 0.83 (0.34-1.99)), (AOR 0.78 (0.36-1.73), relative to neither (Table 2-1). The second model looked at the unadjusted and adjusted odds ratios for the association between physician involvement in care planning and APM use: (OR (1.22 (1.11-1.35)), (AOR 0.92 (0.75-1.12)) (Table 2-2).

Adjusted and unadjusted results of the model testing the association between MD or NP presence on a typical weekday and physical restraint use among residents were: MD only: (1.65 (0.62-4.38)), (AOR 0.80 1.42(0.54-3.75)), NP only: (1.98(0.24-16.34)), AOR (2.08 (0.26-2.10)), either: (OR 0.33 (0.05-2.48)), (AOR 0.46 (0.06-3.43)), and neither (Table 2-3). Results of the model testing the association between physician involvement in care planning and restrain use were: (OR 1.21 (1.11-1.32)), (AOR 1.34 (0.67-2.67)) (Table 2-4).

Adjusted and unadjusted results of the model testing the association between MD or NP presence on a typical weekday and hospitalization and ED transfers were: MD only: (OR 0.88 (0.58-1.31)), (AOR 0.92 (0.63-1.36)), NP only: (OR 0.66 (0.25-1.73)), AOR (1.13(0.45-2.83)), either: (OR 1.45(0.55-3.83)), (AOR 1.17(.46-3.10)), and neither (Table 2-5). Results of the model testing the association between physician involvement in care planning and

hospitalization and ED visits among residents were: (OR 0.946(0.836-1.070)), (AOR 0.93 (0.74-1.18)) (Table 2-6)).

Lastly, adjusted and unadjusted results of the model testing the association between MD or NP presence on a typical weekday and polypharmacy were: MD only: (OR 1.251(0.855-1.830)), (AOR 0.989(0.739-1.324)), NP only: (OR 0.876(0.355-2.165)), AOR (0.791(0.381-1.641)), either: (OR 1.039(0.412-2.620)), (AOR 1.373(0.644-2.926)), and neither (Table 2-7). Results of the model testing the association between physician involvement in care planning and polypharmacy among residents were: (OR 1.160 (1.065-1.265)), (AOR 0.93 (0.77-1.12)) (Table 2-8).

## 2.7 Discussion

### 2.7.1 Summary of Findings

Residents in my sample were older, female, and frequently presented with at least a diagnosis of dementia and/or Alzheimer's disease as consistent with other studies.

Access to medical care as per physician and nurse practitioner availability on the unit and facility level shows that both professionals were available with little to no variation across different unit types. I did not find associations between the identified measures of medical care and each of the selected outcomes.

### 2.7.2 Main Findings

### *2.7.2.1 Medical Care Access*

TREC Survey data was used to assess physician presence in the nursing home. From table 1-5, it is evident that most units in wave 5 of data collection reported having access to a physician with respect to routine visits, obtaining medical orders as well as the number of physicians that come in to see residents. However, this data is quite different from the literature where most units and facilities report poor access to physicians<sup>45</sup>. Across the very limited research in physician access in nursing homes, most findings report little to no access by medical specialists and general practitioners<sup>45</sup>. A report of systematic reviews explored areas that received inadequate medical care in the NH by examining which diseases or impairments determine morbidity in the NH, what the standards for medical care are in this setting and the legal, economic, and ethical aspects to consider when analyzing specialist care in the NH<sup>45</sup>. They reported that the gaps in data do not allow for evidence-based recommendations on how modifications that could be made to the medical care system for residents of nursing homes<sup>45</sup>. The reason that my data may reflect a high level of physician access may be due to several limitations or simply the fact that the facilities where prior studies were done actually had worse access relative to where TREC's data was collected. For one, the TREC survey respondents may not have been in the optimal position to be aware of physician and NP presence. It is also possible that there is just good access to physicians in these provinces but there has been little data to date that helps us to see that. This will be explored further in the limitations section of this thesis.

Since the role of the NP in the nursing home has been identified in Canada fairly recently as of the 1970s, there is still some speculation around the role and scope of the NP in the nursing

home<sup>46</sup>. In most provinces, the NP work pattern involves collaborating with physicians, taking up leadership roles, as well as being the primary driver of communication between residents and their family members and care givers. In the literature, NPs are often defined as being easily accessible and available for families to answer questions and provide updates on resident's health status. My data reflect that although NPs are available on the unit, staff in the nursing home are not able to contact an NP for routine nursing needs across a majority of the units assessed using the TREC Survey. This difference may be attributed to the fact that the units that do have high NP availability are not participating in the TREC Survey or those who are responding to the survey are not directly involved in the process. I decided to include NPs in my measure of interest as they are able to prescribe, perform certain medical procedures, and order most diagnostics<sup>47</sup>. Given their educational credentials, they are often placed in leadership roles in facilities to supervise and oversee all nursing activity, coordinate care across settings, and take up a consultancy role for residents and their families. As such, residents (87%), physicians (90%), and families (85%) report a high level of satisfaction with the role of the NP from a study done in the USA<sup>48</sup>. Further, NP presence in a facility has shown to decrease hospital admission and ED transfers all the while improving resident access to quality medical care<sup>48</sup>. This is particularly interesting since my findings suggest the opposite. For example, the AOR, 95% CI is 1.13(0.45-2.83) for the association between seeing an NP on a typical weekday and H&E transfer. This estimate, along with others listed in table 2-6, display wide confidence intervals, indicating an unstable estimate. This may be the result of not having enough information in the TREC Survey surrounding NP access.

#### *2.7.2.2 Outcome Variables*

Since the nursing home cohort is comprised of vulnerable individuals with complex care needs who require close monitoring by medical care providers, this raises issues surrounding overprescribing and specifically overuse of antipsychotic medication with no indication of psychosis. Given the many other resident outcomes to choose from the RAI-MDS 2.0, I was interested in learning more about inappropriate prescribing and use of APM since it has been shown to be consistent with other measures of NH quality<sup>42</sup>. In the past, various initiatives have been implemented to bring about better practices in nursing homes. In particular, academic details has been given considerable attention in this area. Studies have shown the effectiveness of interactive methods to engage nursing staff and physicians to use non-pharmacological techniques and associated APM withdrawal<sup>43</sup>. This is important as prescriber habits affect APM rather than resident factors and facility characteristics, underscoring the importance of such educational initiatives.

Another salient issue that reflects the quality of medical care in NH is that of physical restraint use. Physical restraint use can contribute to negative health outcomes and decrease the overall mental and physical well-being of residents in the NH, but is also associated with the management of resident behavior. That said, I wanted to include this as one of the outcome variables to draw any findings associated with physical restraint use and access to a medical professional<sup>44</sup>. However, restraint use is a contested area since there are both pros and cons associated with their use and the decision to use also varies by staff. Nursing staff usually initiate requests for physical restraint use but both nurse and physicians differ in their reasoning for use with the same resident, and the practice is often unreported<sup>44</sup>. Further, physical restraints,

including bed rails, are often used to manage resident behaviors, decrease disruption to other residents and maintain therapies for easily agitated residents<sup>44</sup>. Also interesting to note is that no research has supported physical restraint use among fall prevention strategies.

Polypharmacy is a particularly important resident outcome that I felt was necessary to be studied further as it is a driver of emergency department transfers and sometimes even death of NH residents, if not monitored. Polypharmacy is another pervasive issue in the NH sector as it can lead to adverse drug-drug interactions, adverse drug events (ADE) and functional and cognitive impairment. Efforts to improve resident outcomes have involved progressive reduction in a stepwise manner of potentially inappropriate medications by deprescribing<sup>52</sup>.

#### *2.7.2.3 Association between Medical Care Access and Outcome Variables*

To test the association between access to care, eight models were created with both unadjusted and adjusted associations between the medical care exposure variables and each outcome variable. The analyses that adjusted for confounding variables were assessed separately to see how each confounder would potentially shift the odds ratio. No one confounder was responsible for causing a shift in the odds ratio.

The first model I created looked at the association between presence of physicians and NPs on a typical weekday on each unit. For the second model, I took a closer look at the data surrounding MD engagement in care planning. Compared to the reference categories, the adjusted odds ratios for the association between APM use and weekly visits by a MD and either



MD/NP was less than 1 whereas with NP only, was greater than 1, with wide CIs for each finding, suggesting there is unlikely to be an association. The same conclusion can be made for the other three outcome variables. These findings are interesting as the literature reports that having increased access to a medical professional, whether that be an MD or NP is associated with positive outcomes for NH residents. Instead of interpreting my data to fit the conflicting literature, it is important to be cognizant of the fact that organizational context plays a role in how medical care is provided to residents, which varies by facility and by province. That said, the questions that are asked in the TREC Survey may not be tapping into the issue of medical care access in the NH or perhaps some of the practice-sensitive resident outcomes reported in the literature are not as sensitive to the medical access variables used here. Also, since LPNs are often providing direct clinical care to residents including administering medication, their role in the provision of medical care should not be overlooked. This poses a limitation in my study as data surrounding access to LPN in a NH was not considered for my work.

### 2.7.3 Limitations

#### 2.7.3.1 RAI-MDS 2.0

As part of routine clinical care, the RAI-MDS 2.0 is a system that captures relevant information surrounding resident physical and mental health and functional status at admission, quarterly intervals, and following major health-related events<sup>49</sup>. The system consists of seven assessment models and forms. It is important to be mindful of the limitations of the quality indicators derived from the RAI-MDS 2.0 items. Further, it could also be that the outcomes are

simply not the right outcomes for understanding the medical care issues. At both the level of the assessor and the instrument, validity and reliability need attention. The reliability of this system can be called into question as there have been errors reported with respect to data entry and how some items are defined, such as pressure ulcer change. That said, my selected outcome measures do not represent a full range of the processes of care that may be important to the quality of care received by residents and may affect their outcomes.

#### *2.7.3.2 TREC Survey*

The TREC Survey is composed of a suite of instruments, designed to attain provider level data with the goal of ultimately achieving better resident, staff, and system outcomes. Along with capturing data surrounding organizational context and knowledge translation, the survey also includes various scales that tap into individual factors such as attitudes towards research use, job and career satisfaction, belief suspension, and problem solving ability<sup>49</sup>. However, there may be some concerns in how data are captured, what data are captured, and some insight into future directions. Selection bias with respect to who the survey was administered to in the NH can create room for error. Though the TREC Survey includes questions that are aimed at both regulated and unregulated staff, respondents who do not speak English as a first language may have more difficulty responding to questions. Results from the TREC survey of 1,381 care aides from 30 facilities across three Canadian prairie provinces found that over 50% of respondents did not speak English as a first language<sup>50</sup>.

When running my analyses using the TREC Survey data and modelling my final associations, I wanted to take into account the effect of potential confounders that may impact the initial association. I took into consideration variables such as resident age, sex, and province. However, this raises the question of whether other confounders that were not included in the RAI-MDS 2.0 assessment such as perceived language barriers or mobility issues that play a part in the association. Lastly, the wide CIs seen in my findings could be attributable to the relatively small sample size of NPs in the NH.

### 3 Conclusions and Future Direction

#### 3.1 Conclusions

Although no associations were identified between these medical care access measures and the selected resident outcomes, the wide confidence intervals demonstrate uncertainty on the point estimates. Additional research with more direct measures of access to medical care is still needed.

#### 3.2 Future direction

The older population is projected to increase in the upcoming years posing unique challenges to the organization of the care of older people. Exploring medical care provision in the NH sector with respect to the barriers to access will lead to better healthcare delivery for a vulnerable population. This can potentially be done by conducting observational studies and garnering more information on the quality of visits between physicians and residents rather than quantity of visits.

This can be done by engaging NH residents in qualitative interviews to grasp how residents perceive care in the NH. I would do this in a way in which culturally sensitive questions are asked and perhaps have the survey translated in a few languages to be as inclusive as possible in my approach. Further, the two variables available to me to account for the access to medical care in nursing homes were closely related to one another. It would be an informative next step to examine data for models which provide regular visits versus those which are responsive only.

Perhaps it may be wise to design a survey that asks questions relevant to resident perceptions of quality of care received in the NH as they are experts in their own lives. This may be achieved with prospective primary data gathering along with triangulation of results by data collection from a number of sources of complementary data.

## Tables

Table 1-1 Resident characteristics of 10,888 residents in the NH in wave 5.

| Variables                          | Total (N=10,888) n(%) |
|------------------------------------|-----------------------|
| <i>Demographic Characteristics</i> |                       |
| <b>Age assessment</b>              |                       |
| Age in years, mean(SD)             | 84.8 (10.4)           |
| <b>Age in years</b>                |                       |
| 20-29                              | 6 (0.1)               |
| 30-29                              | 23 (0.2)              |
| 40-49                              | 47 (0.5)              |
| 50-59                              | 175 (1.8)             |
| 60-69                              | 573 (5.7)             |
| 70-79                              | 1649 (16.5)           |
| 80-89                              | 3679 (36.9)           |
| 90 and over                        | 3829 (38.4)           |
| <b>Sex, n (%)</b>                  |                       |
| Female                             | 7195 (67.0)           |
| Male                               | 3692 (33.0)           |
| <b>Marital status</b>              |                       |
| Married                            | 2819 (25.9)           |
| Widowed                            | 5104 (46.9)           |
| Divorced                           | 1072 (9.8)            |
| Separated                          | 429 (3.9)             |

|                                                     |             |
|-----------------------------------------------------|-------------|
| Never Married                                       | 914 (8.4)   |
| Unknown                                             | 550 (5.1)   |
| <b>Activities of Daily Living Impairment, n (%)</b> |             |
| Independent (ADL_H<2)                               | 629 (5.7)   |
| Medium dependent (ADL_H 2-4)                        | 1064 (9.8)  |
| Highly dependent (ADL_H>4)                          | 9195 (84.5) |
| <b>CHESS Scale Score, n (%)</b>                     |             |
| 0                                                   | 5319 (48.9) |
| 1                                                   | 3387 (31.1) |
| 2                                                   | 1501 (13.8) |
| 3                                                   | 480 (4.4)   |
| 4+                                                  | 201 (1.8)   |
| <b>Pain Scale</b>                                   |             |
| No pain                                             | 8058 (74.0) |
| Less than daily pain                                | 2139 (19.6) |
| Daily pain but not severe                           | 605 (5.6)   |
| Severe daily pain                                   | 86 (0.8)    |
| <b>Cognitive Performance Scale (CPS)</b>            |             |
| Relatively intact cognition (CPS<2)                 | 2113 (19.4) |
| Mild/moderate impairment (CPS 2-3)                  | 6599 (60.6) |
| Severe Impairment (CPS>4)                           | 2176 (19.9) |

| <b>Medical Diagnoses, n (%)</b>       |             |
|---------------------------------------|-------------|
| Alzheimer's disease or other dementia | 6767 (62.5) |
| Congestive heart failure              | 1309 (12.1) |
| Cancer                                | 479 (4.4)   |
| Diabetes                              | 2404 (22.1) |
| Depression                            | 3419 (31.4) |
| Renal Failure                         | 895 (8.3)   |
| Stroke                                | 2127 (19.5) |



Table 1-2 Characteristics of Nursing Homes Included in Wave 5 of TREC Survey Collection.

|                                               | <b>Wave 5<br/>(N=90), N(%)</b> |
|-----------------------------------------------|--------------------------------|
| <b>Facility Owner operator model</b>          |                                |
| Public not for profit                         | 20(22.2)                       |
| Private for profit                            | 38(42.2)                       |
| Voluntary not for profit                      | 32(35.6)                       |
| <b>Facility Size</b>                          |                                |
| <i>Total number of LTC beds<br/>(mean,SD)</i> | 126(66)                        |
| Small (<80 beds)                              | 21(23.3)                       |
| Medium (80-120 beds)                          | 33(36.7)                       |
| Large (>120 beds)                             | 36(40.0)                       |
| <b>Province</b>                               |                                |
| Alberta                                       | 34(37.8)                       |
| Manitoba                                      | 16(17.8)                       |
| British Colombia                              | 40(44.4)                       |

Table 1-3 Access to medical care at the facility level across Wave 5 (N=90).

|                                                                                         | <b>Wave 5<br/>(N=90),<br/>N, %</b> |
|-----------------------------------------------------------------------------------------|------------------------------------|
| <b>We have a physician or roster of physicians who visit the residents</b><br>N(%), Yes | 81(90.0)                           |
| <b>Family physicians visit their own residents</b><br>N(%), Yes                         | 50(55.6)                           |
| <b>We have nurse practitioner(s)</b><br>N(%), Yes                                       | 14(15.6)                           |
| <b>None of the above</b>                                                                | 0(0.0)                             |

Table 1-4 Characteristics of Nursing Home Units Included in Wave 5 of TREC Survey Collection.

|                                      | <b>Wave 5<br/>(N=320), N(%)</b> |
|--------------------------------------|---------------------------------|
| <b>Unit Bed Size</b>                 |                                 |
| Small (9-30)                         | 171(53.4)                       |
| Medium (31-60)                       | 147(45.9)                       |
| Large (>61)                          | 2(0.6)                          |
| <b>Unit type</b>                     |                                 |
| General LTC                          | 223(69.7)                       |
| Secure Dementia                      | 45(14.1)                        |
| Non Secure Dementia                  | 10(3.1)                         |
| Secure mental health/psychiatric     | 3(0.9)                          |
| Non-secure mental health/psychiatric | 0(0.0)                          |
| Other                                | 39(12.2)                        |

Table 1-5 Staff Responses Regarding Physician Access by Nursing Home Unit Type for Wave 5 (N=320).

| Variable                                                                                                      | General LTC Unit<br>(N=223)<br>N(%) | Dementia Unit<br>(N=55)<br>N(%) | Other unit(s)<br>(N=42)<br>N(%) | All units<br>(N=320)<br>N(%) |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------|---------------------------------|------------------------------|
| <b>On a typical week, how many physicians would be in to see residents?</b>                                   |                                     |                                 |                                 |                              |
| 0                                                                                                             | 0(0.0)                              | 0(0.0)                          | 0(0.0)                          | 0(0.0)                       |
| 1-3                                                                                                           | 155(69.5)                           | 26(47.3)                        | 32(76.2)                        | 213(66.6)                    |
| 4-6                                                                                                           | 62(27.8)                            | 21(38.2)                        | 10(23.8)                        | 93(29.1)                     |
| 7-10                                                                                                          | 6(2.7)                              | 4(7.3)                          | 0(0.0)                          | 10(3.1)                      |
| >10                                                                                                           | 0(0.0)                              | 4(7.3)                          | 0(0.0)                          | 4(1.3)                       |
| <b>On a typical weekday would at least one physician have routine visits with residents on unit, yes</b>      |                                     |                                 |                                 |                              |
|                                                                                                               | 204(91.5)                           | 47(85.5)                        | 26(61.9)                        | 277(86.6)                    |
| <b>On a typical weekend, would at least one physician have routine visits with residents on the unit, yes</b> |                                     |                                 |                                 |                              |
|                                                                                                               | 61(27.4)                            | 10(18.2)                        | 5(11.9)                         | 76(23.8)                     |
| <b>How are medical orders usually obtained (not mutually exclusive categories),</b>                           |                                     |                                 |                                 |                              |
| In person                                                                                                     | 81(36.3)                            | 16(29.1)                        | 9(21.4)                         | 106(33.1)                    |
| By phone                                                                                                      | 83(37.2)                            | 20(36.4)                        | 5(11.9)                         | 108(33.8)                    |
| By fax                                                                                                        | 49(22.0)                            | 19(34.5)                        | 87(66.7)                        | 96(30.0)                     |
| By email                                                                                                      | 0(0.0)                              | 0(0.0)                          | 0(0.0)                          | 0(0.0)                       |

|                                                                                            |           |          |          |           |
|--------------------------------------------------------------------------------------------|-----------|----------|----------|-----------|
| By text                                                                                    | 7(3.1)    | 0(0.0)   | 0(0.0)   | 7(2.2)    |
| By app                                                                                     | 3(1.3)    | 0(0.0)   | 0(0.0)   | 3(0.9)    |
| <b>Most of the time our staff is able to contact a physician: Problems</b>                 |           |          |          |           |
| Agree                                                                                      | 221(99.5) | 54(98.2) | 42(100)  | 317(99.4) |
| Other                                                                                      | 1(0.5)    | 1(1.8)   | 0(0.0)   | 2(0.6)    |
| <b>Most of the time our staff is able to contact a physician: Residents' Routine Needs</b> |           |          |          |           |
| Agree                                                                                      | 222(100)  | 54(98.2) | 42(100)  | 318(99.7) |
| Other                                                                                      | 0(0.0)    | 1(1.8)   | 0(0.0)   | 1(0.3)    |
| <b>Generally, residents' physicians are actively involved in manage care planning, yes</b> |           |          |          |           |
| Agree                                                                                      | 160(72.1) | 38(69.1) | 31(73.8) | 229(71.8) |
| Other                                                                                      | 62(27.9)  | 17(30.9) | 11(26.2) | 90(28.2)  |

Table 1-6 Staff Responses Regarding NP Access for Nursing Homes in Wave 5 (N=320).

|                                                                                                        | <b>Wave 5<br/>(N=320) N(%)</b> |
|--------------------------------------------------------------------------------------------------------|--------------------------------|
| <b>Do you have nurse practitioners on your unit, yes</b>                                               | 69(21.6)                       |
| <b>If yes, how many days do they work in a week, days</b>                                              |                                |
| 1-2                                                                                                    | 17(4.3)                        |
| 3-5                                                                                                    | 48(15)                         |
| 6-7                                                                                                    | 0(0.0)                         |
| on-call only                                                                                           | 4(1.3)                         |
| N/A                                                                                                    | 251(78.4)                      |
| <b>On a typical weekday would at least one NP have routine visits with residents on unit, yes</b>      | 50(15.7)                       |
| <b>On a typical weekend, would at least one NP have routine visits with residents on the unit, yes</b> | 0(0.0)                         |
| <b>How are medical orders usually obtained (not mutually exclusive), yes</b>                           |                                |
| In person                                                                                              | 57(17.8)                       |
| By phone                                                                                               | 46(14.4)                       |
| By fax                                                                                                 | 22(6.9)                        |
| By email                                                                                               | 0(0.0)                         |
| By text                                                                                                | 0(0.0)                         |
| By app                                                                                                 | 0(0.0)                         |
| <b>Most of the time our staff is able to contact a NP for residents' routine needs</b>                 |                                |
| Agree                                                                                                  | 24(7.6)                        |
| Strongly Agree                                                                                         | 39(12.3)                       |
| Neither Agree or Disagree                                                                              | 1(0.3)                         |
| Disagree                                                                                               | 1(0.3)                         |
| Strongly Disagree                                                                                      | 0(0.0)                         |
| N/A                                                                                                    | 251(79.4)                      |
| <b>Most of the time our staff is able to contact a NP for residents' problems</b>                      |                                |
| Agree                                                                                                  | 16(5.0)                        |
| Strongly Agree                                                                                         | 41(12.9)                       |
| Neither Agree or Disagree                                                                              | 4(1.3)                         |
| Disagree                                                                                               | 6(1.9)                         |
| Strongly disagree                                                                                      | 0(0.0)                         |

|                                                                            |           |
|----------------------------------------------------------------------------|-----------|
|                                                                            |           |
| N/A                                                                        | 251(78.9) |
| <b>Generally, the NP is actively involved in manage care planning, yes</b> |           |
| Agree                                                                      | 18(5.6)   |
| Strongly Agree                                                             | 33(10.3)  |
| Neither Agree or Disagree                                                  | 7(2.2)    |
| Disagree                                                                   | 9(2.8)    |
| Strongly disagree                                                          | 1(0.3)    |
| N/A                                                                        | 251(78.7) |

Table 1-7 Number and proportion of units that reported at least one resident who experienced each outcome during the TREC Wave 5 data collection period.

| Variable                                                | RAI-MDS 2.0 items                            | Lay definition                                                                                                                                   | Wave 5 (N=320), N(%) |
|---------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>Antipsychotic use with no diagnosis of psychosis</b> | O4a (number of days received antipsychotics) | Any use of antipsychotics without schizophrenia, Huntington's disease, or hallucinations in the last week.                                       | 51(15.9)             |
| <b>Physical restraint use</b>                           | P4a, P4b,P4c, P4d, P4e                       | Any physical restraint used in the last week including Full bed rails and other types of side rails on all open side of bed used daily           | 183(57.2)            |
| <b>Hospitalization or ER department transfers</b>       | P5 and P6                                    | Number of times resident was admitted to hospital with an overnight stay in last 90 days and number of times resident visited ER in last 90 days | 33(10.3)             |
| <b>Polypharmacy</b>                                     | O1                                           | The resident has been given 9+ medications (over-the-counter and prescription drugs in the past 7 days)                                          | 111(34.7)            |



Table 1-8 Number and proportion of residents who experienced each outcome measure during the TREC Wave 5 data collection period (N=10,888).

| Variable                                                | RAI-MDS 2.0 items                            | Lay definition                                                                                                                         | Wave 5 (N=10888) N(%) |
|---------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Antipsychotic use with no diagnosis of psychosis</b> | O4a (number of days received antipsychotics) | Any use of antipsychotics without schizophrenia, Huntington's disease, or hallucinations in the last week.                             | 2493(22.9)            |
| <b>Physical restraint use</b>                           | P4a, P4b,P4c, P4d, P4e                       | Any physical restraint used in the last week including Full bed rails and other types of side rails on all open side of bed used daily | 6551(60.2)            |
| <b>Hospitalization or ER department transfers</b>       | P5 and P6                                    | Number of times resident was admitted to hospital in last 90 days and number of times resident visited ER in last 90 days              | 1567(14.5)            |
| <b>Polypharmacy</b>                                     | O1                                           | 9 or more medications that the resident has received in the past 7 days prior to assessment                                            | 5270(48.4)            |

Table 1-9 Resident outcomes with respect to frequency of visits on a typical weekday by a physician for Wave 5 (N=320).

|                                                         | <b>On a typical weekday would at least one physician have routine visits with residents on unit</b> |                       |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------|
|                                                         | <b>Yes (N=277) N(%)</b>                                                                             | <b>No (N=43) N(%)</b> |
| <b>Antipsychotic use with no diagnosis of psychosis</b> | 43(15.5)                                                                                            | 8(18.6)               |
| <b>Physical restraint Use</b>                           | 172(62.1)                                                                                           | 11(25.6)              |
| <b>Hospitalization or ER department transfers</b>       | 32(11.6)                                                                                            | 1(2.4)                |
| <b>Polypharmacy</b>                                     | 98(35.4)                                                                                            | 13(30.2)              |

Table 1-10 Resident outcomes with respect to frequency of visits on a typical weekday by an NP for Wave 5 (N=320).

| Variable                                                | <b>On a typical weekday would at least one NP have routine visits with residents on unit:</b> |                       |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------|
|                                                         | <b>Yes (N=1537) N(%)</b>                                                                      | <b>No(N=569) N(%)</b> |
| <b>Antipsychotic use with no diagnosis of psychosis</b> | 367(23.9)                                                                                     | 121(21.3)             |
| <b>Physical restraint Use</b>                           | 848(55.2)                                                                                     | 440(77.3)             |
| <b>Hospitalization or ER department transfers</b>       | 180(11.9)                                                                                     | 93(16.8)              |
| <b>Polypharmacy</b>                                     | 697(45.3)                                                                                     | 329(57.8)             |

Table 2-1 Unadjusted and adjusted odds ratios for the association between units that reported that at least one physician or NP had routine visits with residents (UVAR086 and UVAR097) on a typical weekday and antipsychotic use without indication of psychosis among residents in Wave 5. (N=2493)

|                                                                                      | <b>Residents with any antipsychotic use without indication (N=2493)<br/>N (%)</b> | <b>N(%) of residents without any antipsychotic use without indication (N=8395)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>On a typical weekday would at least one physician have routine visits on unit</b> |                                                                                   |                                                                                    |                                             |                                                       |
| MD only                                                                              | 1784(72.4)                                                                        | 6469(77.1)                                                                         | 0.68 (0.50-0.90)                            | 0.80 (0.60-1.06)                                      |
| NP only                                                                              | 42(1.7)                                                                           | 79(0.9)                                                                            | 1.23 (0.53-2.86)                            | 1.18 (0.56-2.53)                                      |
| Either                                                                               | 325(13.2)                                                                         | 1091(13.0)                                                                         | 0.83 (0.34-1.99)                            | 0.78 (0.36-1.73)                                      |
| Neither                                                                              | 314(12.7)                                                                         | 749(8.9)                                                                           | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, diagnoses, number of beds, province, sex, CPS, CHESS and age at assessment.*

Table 2-2 Unadjusted and adjusted odds ratios for the association between units that reported residents' physicians being actively involved in managing care planning (UVAR094) and use of antipsychotic medication without indication of psychosis among residents in Wave 5 (N=2,493).

|                                                                                       | <b>N(%) of residents with any antipsychotic use without indication (N=2493)</b> | <b>N(%) of residents without any antipsychotic use without indication (N=8395)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> |                                                                                 |                                                                                    |                                             |                                                       |
| Strongly agree or Agree                                                               | 1771(71.1)                                                                      | 6286(75.1)                                                                         | 1.22 (1.11-1.35)                            | 0.92(0.75-1.12)                                       |
| All other response options                                                            | 722(28.9)                                                                       | 2109 (24.9)                                                                        | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*

Table 2-3 Unadjusted and adjusted odds ratio of the association between units that reported at least one physician or NP having routine visits with residents (UVAR086 and UVAR097) on a typical weekday and physical restraint use among residents in Wave 5. (N=6551).

|                                                                                                      | <b>N(%) of residents with any physical restraint use (N=6551)</b> | <b>N(%) of residents without any physical restraint use (N=4337)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                                                   |                                                                      |                                             |                                                       |
| MD only                                                                                              | 5324(81.7)                                                        | 2929(67.6)                                                           | 1.65 (0.62-4.38)                            | 1.42(0.54-3.75)                                       |
| NP only                                                                                              | 37(0.6)                                                           | 84(1.9)                                                              | 1.98(0.24-16.34)                            | 2.08 (0.26-2.10)                                      |
| Either                                                                                               | 811(12.4)                                                         | 605(14.0)                                                            | 0.33 (0.05-2.48)                            | 0.46 (0.06-3.43)                                      |
| Neither                                                                                              | 346(5.3)                                                          | 717(16.5)                                                            | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*

Table 2-4 Unadjusted and adjusted odds ratios for the association between units that reported residents' physicians being actively involved in managing care planning (UVAR094) on unit and physical restraint use among residents belonging to Wave 5 (N=6551).

|                                                                                       | <b>N(%) of residents with any physical restraint use (N=6551)</b> | <b>N(%) of residents without any physical restraint use (N=4337)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> |                                                                   |                                                                      |                                             |                                                       |
| Strongly agree or Agree                                                               | 4747(72.7)                                                        | 3310(76.3)                                                           | 1.21 (1.11-1.32)                            | 1.34(0.67-2.67)                                       |
| All other response options                                                            | 1780(27.3)                                                        | 1026(23.7)                                                           | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*

Table 2-5 Unadjusted and adjusted odds ratios for the association between units that reported at least one physician or NP having routine visits with residents (UVAR086 and UVAR097) on a typical weekday and hospitalization rates/ED transfer among residents belonging to Wave 5 (N=1567).

|                                                                                                      | <b>N(%) of residents with any hospitalizations/ED transfers (N=1567)</b> | <b>N(%) of residents without any hospitalizations/ED transfers (N=9221)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                                                          |                                                                             |                                             |                                                       |
| MD only                                                                                              | 1251(80.0)                                                               | 6948(75.6)                                                                  | 0.88 (0.58-1.31)                            | 0.92 (0.63-1.36)                                      |
| NP only                                                                                              | 15(1.0)                                                                  | 103(1.1)                                                                    | 0.66 (0.25-1.73)                            | 1.13(0.45-2.83)                                       |
| Either                                                                                               | 165(10.6)                                                                | 1228(13.4)                                                                  | 1.45(0.55-3.83)                             | 1.17(.46-3.10)                                        |
| Neither                                                                                              | 132(8.4)                                                                 | 912(9.9)                                                                    | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*



Table 2-6 Unadjusted and adjusted odds ratios for the association between units that reported residents' physicians being actively involved in managing care planning (UVAR094) and hospitalization rates/ED department visits among Wave 5 residents (N=1567).

|                                                                                       | <b>N(%) of residents with any hospitalizations/ER dept transfers (N=1567)</b> | <b>N(%) of residents without any hospitalizations/ED transfers (N=9221)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> |                                                                               |                                                                             |                                             |                                                       |
| Strongly agree or Agree                                                               | 1175(75.1)                                                                    | 6815(74.1)                                                                  | 0.95(0.84-1.07)                             | 0.93 (0.74-1.18)                                      |
| All other response options                                                            | 389(24.9)                                                                     | 2386(25.9)                                                                  | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*

Table 2-7 Unadjusted and adjusted association between units that reported having at least one physician or NP having routine visits with residents on the unit (UVAR086 and UVAR097) and polypharmacy among residents in Wave 5. (N=5270)

|                                                                                                      | <b>N(%) of residents with any polypharmacy use (N=5270)</b> | <b>N(%) of residents without any polypharmacy use (N=5618)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                                             |                                                                |                                             |                                                       |
| MD only                                                                                              | 4051(77.3)                                                  | 4202(74.8)                                                     | 1.25(0.86-1.83)                             | 0.99(0.74-1.32)                                       |
| NP only                                                                                              | 37(0.7)                                                     | 84(1.5)                                                        | 0.88(0.36-2.17)                             | 0.79(0.38-1.64)                                       |
| Either                                                                                               | 660(12.6)                                                   | 756(13.5)                                                      | 1.04(0.41-2.62)                             | 1.37(0.64-2.93)                                       |
| Neither                                                                                              | 491(9.4)                                                    | 572(10.2)                                                      | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*

Table 2-8 Unadjusted and adjusted odds ratios of the association between units that reported residents' physicians being actively involved in managing care planning and polypharmacy issues among residents in Wave 5 (N=5270)

|                                                                                       | <b>N(%) of residents with any polypharmacy (N=5270)</b> | <b>N(%) of residents without any polypharmacy use (N=5618)</b> | <b>Odds Ratio (95% confidence interval)</b> | <b>Adjusted Odds Ratio (95% confidence interval)*</b> |
|---------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> |                                                         |                                                                |                                             |                                                       |
| Strongly agree or Agree                                                               | 3821(72.7)                                              | 4236(75.5)                                                     | 1.16(1.06-1.27)                             | 0.93(0.77-1.12)                                       |
|                                                                                       | 1435(27.3)                                              | 1371(24.5)                                                     | REF                                         | REF                                                   |

*\*Confounding variables included: total number of beds in facility, owner-operator model, project facility size, number of beds, province, sex, CPS, CHESS and age at assessment.*

## References

1. Estabrooks CA, Poss JW, Squires JE, Teare GF, Morgan DG, Stewart N, Doupe MB, Cummings GG, Norton PG. A profile of residents in prairie nursing homes. *Canadian Journal on Aging/La Revue canadienne du vieillissement*. 2013 Sep;32(3):223-31.
2. Gruneir A, Cigsar C, Wang X, Newman A, Bronskill SE, Anderson GM, Rochon PA. Repeat emergency department visits by nursing home residents: a cohort study using health administrative data. *BMC geriatrics*. 2018 Dec;18(1):1-1.
3. Hawes C, Mor V, Phillips CD, Fries BE, Morris JN, Steele-Friedlob E, Greene AM, Nennstiel M. The OBRA-87 nursing home regulations and implementation of the Resident Assessment Instrument: Effects on process quality. *Journal of the American Geriatrics Society*. 1997 Aug;45(8):977-85.
4. Hirdes JP, Mitchell L, Maxwell CJ, White N. Beyond the 'iron lungs of gerontology': using evidence to shape the future of nursing homes in Canada. *Canadian Journal on Aging/La Revue canadienne du vieillissement*. 2011 Sep;30(3):371-90.
5. Tomiak M, Berthelot JM, Guimond E, Mustard CA. Factors associated with nursing-home entry for elders in Manitoba, Canada. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2000 May 1;55(5):M279-87.

6. Moore KL, Boscardin WJ, Steinman MA, Schwartz JB. Patterns of chronic co-morbid medical conditions in older residents of US nursing homes: differences between the sexes and across the agespan. *The journal of nutrition, health & aging*. 2014 Apr;18(4):429-36.
7. Hoben M, Chamberlain SA, Knopp-Sihota JA, Poss JW, Thompson GN, Estabrooks CA. Impact of symptoms and care practices on nursing home residents at the end of life: a rating by front-line care providers. *Journal of the American Medical Directors Association*. 2016 Feb 1;17(2):155-61.
8. Moore KL, Boscardin WJ, Steinman MA, Schwartz JB. Age and Sex Variation in Prevalence of Chronic Medical Conditions in Older Residents of US. Nursing Homes. *Journal of the American Geriatrics Society*. 2012 Apr;60(4):756-64.
9. Nicolle LE, Strausbaugh LJ, Garibaldi R. Infections and antibiotic resistance in nursing homes. *Clinical microbiology reviews*. 1996 Jan;9(1):1-7.
10. Rubenstein LZ, Josephson KR, Robbins AS. Falls in the nursing home. *Annals of internal medicine*. 1994 Sep 15;121(6):442-51.
11. Sudarsky L. Gait disorders in the elderly. *New England Journal of Medicine*. 1990 May 17;322(20):1441-6.

12. Weech-Maldonado R, Meret-Hanke L, Neff MC, Mor V. Nurse staffing patterns and quality of care in nursing homes. *Health Care Management Review*. 2004 Apr 1;29(2):107-16.
13. Squires JE, Baumbusch J, Varin MD, MacDonald I, Chamberlain S, Boström AM, Thompson G, Cummings G, Estabrooks CA. A profile of regulated nurses employed in Canadian long-term care facilities. *Canadian Journal on Aging/La Revue canadienne du vieillissement*. 2019 Jun;38(2):130-42.
14. Corazzini KN, Anderson RA, Mueller C, Thorpe JM, McConnell ES. Licensed practical nurse scope of practice and quality of nursing home care. *Nursing Research*. 2013 Sep 1;62(5):315-24.
15. Lima JC, Intrator O, Wetle T. Physicians in nursing homes: Effectiveness of physician accountability and communication. *Journal of the American Medical Directors Association*. 2015 Sep 1;16(9):755-61.
16. Katz PR, Karuza J, Intrator O, Mor V. Nursing home physician specialists: a response to the workforce crisis in long-term care.
17. Song Y, Hoben M, Weeks L, Boström AM, Goodarzi ZS, Squires J, Doan H, Wagg A, Reid RC, Estabrooks C. Factors associated with the responsive behaviours of older adults living in long-term care homes towards staff: a systematic review protocol. *BMJ open*. 2019 May 1;9(5):e028416.
18. Maxwell CJ, Soo A, Hogan DB, Wodchis WP, Gilbert E, Amuah J, Eliasziw M, Hagen B, Strain LA. Predictors of nursing home placement from assisted living settings in

Canada. Canadian Journal on Aging/La Revue canadienne du vieillissement. 2013 Dec;32(4):333-48.

19. Lane NE, Wodchis WP, Boyd CM, Stukel TA. Disability in long-term care residents explained by prevalent geriatric syndromes, not long-term care home characteristics: a cross-sectional study. BMC geriatrics. 2017 Dec;17(1):1-4.
20. Horowitz A. Vision impairment and functional disability among nursing home residents. The Gerontologist. 1994 Jun 1;34(3):316-23.
21. Jutkowitz E, Brasure M, Fuchs E, Shippee T, Kane RA, Fink HA, Butler M, Sylvanus T, Kane RL. Care-delivery interventions to manage agitation and aggression in dementia nursing home and assisted living residents: a systematic review and meta-analysis. Journal of the American Geriatrics Society. 2016 Mar;64(3):477-88.
22. Loeb M, Carusone SC, Goeree R, Walter SD, Brazil K, Krueger P, Simor A, Moss L, Marrie T. Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial. Jama. 2006 Jun 7;295(21):2503-10.
23. Fahey T, Montgomery AA, Barnes J, Protheroe J. Quality of care for elderly residents in nursing homes and elderly people living at home: controlled observational study. Bmj. 2003 Mar 15;326(7389):580.

24. Ågotnes G, McGregor MJ, Lexchin J, Doupe MB, Müller B, Harrington C. An international mapping of medical care in nursing homes. *Health services insights*. 2019 Jan;12:1178632918825083.
25. Katz PR, Karuza J. Physician practice in the nursing home: Missing in action or misunderstood.
26. Katz PR, Karuza J, Lawhorne L, Schnelle JF. The nursing home physician workforce. *Journal of the American Medical Directors Association*. 2006 Jul 1;7(6):394-8.
27. Chamberlain SA, Estabrooks CA, Keefe JM, Hoben M, Berendonk C, Corbett K, Gruneir A. Citizen and stakeholder led priority setting for long-term care research: identifying research priorities within the Translating Research in Elder Care (TREC) Program. *Research involvement and engagement*. 2020 Dec;6:1-9.
28. Milliman M, editor. *Access to health care in America*. Institute of Medicine (US) Committee on Monitoring Access to Personal Health Care. Washington (DC): National Academies Press (US); 1993.
29. Morris JN, Fries BE, Morris SA. Scaling ADLs within the MDS. *The Journals of Gerontology: Series A*. 1999 Nov 1;54(11):M546-53.



30. Peter Kemper, Harriet L. Komisar, & Lisa Alecxih. (2005). Long-term care over an uncertain future: What can current retirees expect? *Inquiry (Chicago)*, 42(4), 335-350. doi:10.5034/inquiryjrnl\_42.4.335
31. Wong, K. Y., Jeeneea, R., Healey, A., Abernethy, L., Corbett, H. J., McAndrew, H. F., & Losty, P. D. (2018). Management of paediatric high-grade blunt renal trauma: A 10-year single-centre UK experience. *BJU International*, 121(6), 923-927. doi:10.1111/bju.14142
32. Konetzka RT, Spector W, Limcangco MR. Reducing hospitalizations from long-term care settings. *Medical Care Research and Review*. 2008 Feb;65(1):40-66.
33. Estabrooks CA, Squires JE, Cummings GG, Teare GF, Norton PG. Study protocol for the translating research in elder care (TREC): building context—an organizational monitoring program in long-term care project (project one). *Implementation Science*. 2009 Dec;4(1):1-3.
34. Armstrong H, Daly TJ, Choiniere JA. Policies and practices: The case of RAI-MDS in Canadian long-term care homes. *Journal of Canadian Studies*. 2017 May;50(2):348-67.
35. Poss JW, Jutan NM, Hirdes JP, Fries BE, Morris JN, Teare GF, Reidel K. A review of evidence on the reliability and validity of Minimum Data Set data. In *Healthcare Management Forum* 2008 Apr (Vol. 21, No. 1, pp. 33-39). Sage CA: Los Angeles, CA: SAGE Publications.

36. Murtaugh CM, Freiman MP. Nursing home residents at risk of hospitalization and the characteristics of their hospital stays. *The Gerontologist*. 1995 Feb 1;35(1):35-43.
37. Linn MW, Gurel L, Linn BS. Patient outcome as a measure of quality of nursing home care. *American Journal of Public Health*. 1977 Apr;67(4):337-44.
38. Hutchinson AM, Milke DL, Maisey S, Johnson C, Squires JE, Teare G, Estabrooks CA. The resident assessment instrument-minimum data set 2.0 quality indicators: a systematic review. *BMC health services research*. 2010 Dec;10(1):1-4.
39. Morris JN, Fries BE, Mehr DR, Hawes C, Phillips C, Mor V, Lipsitz LA. MDS cognitive performance scale©. *Journal of gerontology*. 1994 Jul 1;49(4):M174-82.
40. Szumilas M. Explaining odds ratios. *Journal of the Canadian academy of child and adolescent psychiatry*. 2010 Aug;19(3):227.
41. Kamangar F. Confounding variables in epidemiologic studies: basics and beyond. *Archives of Iranian medicine*. 2012 Aug 1;15(8):0-.
42. Lucas JA, Chakravarty S, Bowblis JR, Gerhard T, Kalay E, Paek EK, Crystal S. Antipsychotic medication use in nursing homes: a proposed measure of quality. *International journal of geriatric psychiatry*. 2014 Oct;29(10):1049-61.

43. Desveaux L, Saragosa M, Rogers J, Bevan L, Loshak H, Moser A, Feldman S, Regier L, Jeffs L, Ivers NM. Improving the appropriateness of antipsychotic prescribing in nursing homes: a mixed-methods process evaluation of an academic detailing intervention. *Implementation Science*. 2017 Dec;12(1):1-4.
44. Engberg J, Castle NG, McCaffrey D. Physical restraint initiation in nursing homes and subsequent resident health. *The Gerontologist*. 2008 Aug 1;48(4):442-52.
45. Balzer K, Butz S, Bentzel J, Boulkhemair D, Lühmann D. Medical specialist attendance in nursing homes. *GMS health technology assessment*. 2013;9.
46. Mion LC, Minnick A, Palmer R, Kapp MB, Lamb K. Physical restraint use in the hospital setting: Unresolved issues and directions for research. *The Milbank Quarterly*. 1996 Jan 1:411-47. (r) Alden-Bugden D. The role and scope of the NP in Canada. *The Nurse Practitioner*. 2019 Sep 1;44(9):8-10.
47. Kaasalainen S, Ploeg J, McAiney C, Martin LS, Donald F, Martin-Misener R, Brazil K, Taniguchi A, Wickson-Griffiths A, Carter N, Sangster-Gormley E. Role of the nurse practitioner in providing palliative care in long-term care homes. *International journal of palliative nursing*. 2013 Oct;19(10):477-85.

48. Rycroft-Malone J, Dopson S, Degner L, Hutchinson AM, Morgan D, Stewart N, Estabrooks CA. Study protocol for the Translating Research in Elder Care (TREC): building context through case studies in long-term care project (project two). *Implementation Science*. 2009 Dec;4(1):1-0.
49. Estabrooks CA, Squires JE, Carleton HL, Cummings GG, Norton PG. Who is looking after Mom and Dad? Unregulated workers in Canadian long-term care homes. *Canadian Journal on Aging/La Revue canadienne du vieillissement*. 2015 Mar;34(1):47-59.
50. Gracner T, Stone PW, Agarwal M, Sorbero M, Mitchell SL, Dick AW. Advanced cognitive impairment among older nursing home residents. *BMC Geriatrics*. 2021 Dec;21(1):1-0.
51. Bala SS, Chen TF, Nishtala PS. Reducing potentially inappropriate medications in older adults: a way forward. *Canadian Journal on Aging/La Revue canadienne du vieillissement*. 2019 Dec;38(4):419-33.
52. Lovink MH, van Vught A, Persoon A, Koopmans RT, Laurant MG, Schoonhoven L. Skill mix change between physicians, nurse practitioners, physician assistants, and nurses in nursing homes: A qualitative study. *Nursing & health sciences*. 2019 Sep;21(3):282-90.

53. Lovink MH, Persoon A, van Vught AJ, Koopmans RT, Schoonhoven L, Laurant MG.

Physician substitution by mid-level providers in primary healthcare for older people and long-term care facilities: protocol for a systematic literature review. *Journal of advanced nursing*. 2015 Dec;71(12):2998-3005.

54. Wilson DM, Brow RR, Playfair R. What is the “right” number of nursing home beds for

population needs? An indicator development project. *Jour Nursing Home Res*. 2017;3:16-21.

55. Canadian Institute for Health Information. Describing Outcome Scales (RAI-MDS 2.0);

Available from: [pdf4pro.com/view/describing-outcome-scales-rai-mds-2-0-4e4ba8.html](https://pdf4pro.com/view/describing-outcome-scales-rai-mds-2-0-4e4ba8.html)

56. Seniors Health Research PSP. Alberta Health Services 2021. Accessed 14 Aug 2021.

Available from [https://www.albertahealthservices.ca/scns/ Page13481.aspx](https://www.albertahealthservices.ca/scns/Page13481.aspx).

## Appendix

Appendix Table 1: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between units reporting at least one MD/NP having routine visits with residents on a typical weekday (UVAR086 and UVAR097) and antipsychotic medication use without any indication of psychosis.

| Variable                                                                                             | Adjusted Odds Ratio: OR (95% CI) |
|------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                  |
| MD Only                                                                                              | 0.80 (0.60-1.06)                 |
| NP Only                                                                                              | 1.18 (0.56-2.53)                 |
| Both                                                                                                 | 0.78 (0.36-1.73)                 |
| <b>Age</b>                                                                                           |                                  |
| MD Only                                                                                              | 0.70 (0.52-0.94)                 |
| NP Only                                                                                              | 1.30 (0.57-2.97)                 |
| Both                                                                                                 | 0.76 (0.32-1.80)                 |
| <b>Sex</b>                                                                                           |                                  |
| MD Only                                                                                              | 0.68 (0.51-0.93)                 |
| NP Only                                                                                              | 1.24 (0.54-2.89)                 |
| Both                                                                                                 | 0.83 (0.34-1.99)                 |
| <b>Province</b>                                                                                      |                                  |
| MD Only                                                                                              | 0.76 (0.56-1.03)                 |
| NP Only                                                                                              | 1.26 (0.55-2.89)                 |
| Both                                                                                                 | 0.78 (0.33-1.86)                 |
| <b>Owner-operator Model</b>                                                                          |                                  |
| MD Only                                                                                              | 0.70 (0.52-0.95)                 |
| NP Only                                                                                              | 1.29 (0.56-3.01)                 |
| Both                                                                                                 | 0.80 (0.33-1.93)                 |
| <b>Facility Size</b>                                                                                 |                                  |
| MD Only                                                                                              | 0.69 (0.51-0.93)                 |
| NP Only                                                                                              | 1.23 (0.53-2.90)                 |
| Both                                                                                                 | 0.83 (0.34-2.01)                 |
| <b>Number of Beds in Facility</b>                                                                    |                                  |
| MD Only                                                                                              | 0.69 (0.51-0.94)                 |
| NP Only                                                                                              | 1.23 (0.53-2.87)                 |
| Both                                                                                                 | 0.82 (0.34-2.00)                 |

|                                       |                  |
|---------------------------------------|------------------|
| <b>Number of Beds in Unit</b>         |                  |
| MD Only                               | 0.75 (0.55-1.01) |
| NP Only                               | 1.18 (0.52-2.71) |
| Both                                  | 0.79 (0.33-1.87) |
| <b>Diagnosis: Parkinson's Disease</b> |                  |
| MD Only                               | 0.69 (0.51-0.93) |
| NP Only                               | 1.28 (0.55-3.01) |
| Both                                  | 0.79 (0.32-1.92) |
| <b>Diagnosis: Schizophrenia</b>       |                  |
| MD Only                               | 0.66 (0.49-0.90) |
| NP Only                               | 1.18 (0.51-2.75) |
| Both                                  | 0.84 (0.35-2.02) |
| <b>CPS</b>                            |                  |
| MD Only                               | 0.64 (0.44-0.86) |
| NP Only                               | 1.09 (0.48-2.50) |
| Both                                  | 0.98 (0.41-2.33) |
| <b>CHESS</b>                          |                  |
| MD Only                               | 0.69 (0.51-0.93) |
| NP Only                               | 1.25 (0.54-2.90) |
| Both                                  | 0.82 (0.34-1.98) |

Appendix Table 2: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between physicians being actively involved in managing care planning for residents (UVAR094) and antipsychotic medication use without any indication of psychosis.

| Variable                                                                              | Adjusted Odds Ratio: OR (95% CI) |
|---------------------------------------------------------------------------------------|----------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> | 0.92(0.75-1.12)                  |
| <b>Age</b>                                                                            | 0.88 (0.74-1.10)                 |
| <b>Sex</b>                                                                            | 0.87 (0.70-1.09)                 |
| <b>Province</b>                                                                       | 0.87 (0.70-1.09)                 |
| <b>Owner-operator Model</b>                                                           | 0.86 (0.68-1.07)                 |
| <b>Facility Size</b>                                                                  | 0.87 (0.70-1.09)                 |
| <b>Number of Beds in Facility</b>                                                     | 0.87 (0.70-1.09)                 |
| <b>Number of Beds in Unit</b>                                                         | 0.91 (0.74-1.13)                 |
| <b>Diagnosis: Parkinson's Disease</b>                                                 | 0.88 (0.70-1.10)                 |
| <b>Diagnosis: Schizophrenia</b>                                                       | 0.84 (0.67-1.05)                 |
| <b>CPS</b>                                                                            | 0.87 (0.70-1.09)                 |
| <b>CHESS</b>                                                                          | 0.87 (0.70- 1.09)                |



Appendix Table 3: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between units reporting at least one MD/NP having routine visits with residents on a typical weekday (UVAR086 and UVAR097) and physical restraint use.

| Variable                                                                                             | Adjusted Odds Ratio: OR (95% CI) |
|------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                  |
| MD Only                                                                                              | 1.42(0.54-3.75)                  |
| NP Only                                                                                              | 2.08 (0.26-2.10)                 |
| Both                                                                                                 | 0.46 (0.06-3.43)                 |
| <b>Age</b>                                                                                           |                                  |
| MD Only                                                                                              | 1.65 (0.61-4.37)                 |
| NP Only                                                                                              | 1.99 (0.24-16.40)                |
| Both                                                                                                 | 0.34 (0.05-2.48)                 |
| <b>Sex</b>                                                                                           |                                  |
| MD Only                                                                                              | 1.65 (0.62-4.40)                 |
| NP Only                                                                                              | 1.98 (0.24-16.38)                |
| Both                                                                                                 | 0.33 (0.05-2.47)                 |
| <b>Province</b>                                                                                      |                                  |
| MD Only                                                                                              | 1.43 (0.55-3.69)                 |
| NP Only                                                                                              | 2.42 (0.31-18.80)                |
| Both                                                                                                 | 0.41 (0.06-2.98)                 |
| <b>Owner-operator Model</b>                                                                          |                                  |
| MD Only                                                                                              | 1.76 (0.66-4.67)                 |
| NP Only                                                                                              | 1.73 (0.21-14.09)                |
| Both                                                                                                 | 0.33 (0.04-2.40)                 |
| <b>Facility Size</b>                                                                                 |                                  |
| MD Only                                                                                              | 1.67 (0.63-4.40)                 |
| NP Only                                                                                              | 1.97 (0.24-16.12)                |
| Both                                                                                                 | 0.35 (0.05-2.60)                 |
| <b>Number of Beds in Facility</b>                                                                    |                                  |
| MD Only                                                                                              | 1.57 (0.60-4.14)                 |
| NP Only                                                                                              | 1.87 (0.23-15.13)                |
| Both                                                                                                 | 0.35 (0.05-2.55)                 |
| <b>ADL</b>                                                                                           |                                  |
| MD Only                                                                                              | 1.75 (0.65-4.70)                 |
| NP Only                                                                                              | 2.07 (0.25-17.38)                |
| Both                                                                                                 | 0.32 (0.04-2.43)                 |

|              |                   |
|--------------|-------------------|
| <b>CPS</b>   |                   |
| MD Only      | 1.69 (0.63-4.53)  |
| NP Only      | 1.99 (0.24-16.6)  |
| Both         | 0.33 (0.04-2.48)  |
| <b>CHESS</b> |                   |
| MD Only      | 1.71 (0.64-4.55)  |
| NP Only      | 2.05 (0.49-16.92) |
| Both         | 0.33 (0.64-2.42)  |

Appendix Table 4: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between residents' physicians being actively involved in managing care planning for residents (UVAR094) and physical restraint use.

| <b>Variable</b>                                                                       | <b>Adjusted Odds Ratio: OR (95% CI)</b> |
|---------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> | 1.34(0.67-2.67)                         |
| <b>Age</b>                                                                            | 1.27 (0.63-2.60)                        |
| <b>Sex</b>                                                                            | 1.28 (0.63-2.60)                        |
| <b>Province</b>                                                                       | 1.22 (0.61-2.42)                        |
| <b>Owner-operator Model</b>                                                           | 1.40 (0.68-2.85)                        |
| <b>Facility Size</b>                                                                  | 1.30 (0.63-2.62)                        |
| <b>Number of Beds in Facility</b>                                                     | 1.24 (0.61-2.51)                        |
| <b>Number of Beds in Unit</b>                                                         | 1.30 (0.64-2.62)                        |
| <b>Diagnosis: Alzheimer's</b>                                                         | 1.25 (0.61-2.55)                        |
| <b>Diagnosis: TBI</b>                                                                 | 1.25 (0.61-2.55)                        |
| <b>CPS</b>                                                                            | 1.27 (0.62-2.60)                        |
| <b>ADL</b>                                                                            | 1.30 (0.63-2.63)                        |
| <b>Pain Scale</b>                                                                     | 1.28 (0.63-2.61)                        |
| <b>CHESS</b>                                                                          | 1.29 (0.63-2.63)                        |

Appendix Table 5: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between units reporting at least one MD/NP having routine visits with residents on a typical weekday (UVAR086 and UVAR097) and hospitalization and ED (Emergency department) transfers.

| Variable                                                                                             | Adjusted Odds Ratio: OR (95% CI) |
|------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                  |
| MD Only                                                                                              | 0.92 (0.63-1.36)                 |
| NP Only                                                                                              | 1.13(0.45-2.83)                  |
| Both                                                                                                 | 1.17(.46-3.10)                   |
| <b>Age</b>                                                                                           |                                  |
| MD Only                                                                                              | 0.88 (0.58-1.31)                 |
| NP Only                                                                                              | 0.66(0.25-1.74)                  |
| Both                                                                                                 | 1.44 (0.54-3.80)                 |
| <b>Sex</b>                                                                                           |                                  |
| MD Only                                                                                              | 0.89 (0.60-1.33)                 |
| NP Only                                                                                              | 0.68 (0.26-1.79)                 |
| Both                                                                                                 | 1.42(0.54-3.75)                  |
| <b>Province</b>                                                                                      |                                  |
| MD Only                                                                                              | 0.84 (0.58-1.20)                 |
| NP Only                                                                                              | 0.94 (0.39-2.30)                 |
| Both                                                                                                 | 1.26 (0.50-3.15)                 |
| <b>Owner-operator Model</b>                                                                          |                                  |
| MD Only                                                                                              | 0.88 (0.59-1.33)                 |
| NP Only                                                                                              | 0.66 (0.25-1.74)                 |
| Both                                                                                                 | 1.45 (0.55-3.86)                 |
| <b>Number of Beds in Facility</b>                                                                    |                                  |
| MD Only                                                                                              | 0.84 (0.56-1.25)                 |
| NP Only                                                                                              | 0.66 (0.26-1.71)                 |
| Both                                                                                                 | 1.46(0.56-3.84)                  |
| <b>Number of Beds in Unit</b>                                                                        |                                  |
| MD Only                                                                                              | 0.86 (0.58-1.30)                 |
| NP Only                                                                                              | 0.67 (0.27-1.76)                 |
| Both                                                                                                 | 1.46(0.55-3.86)                  |
| <b>CHESS</b>                                                                                         |                                  |
| MD Only                                                                                              | 0.93 (0.62-1.39)                 |

|                   |                  |
|-------------------|------------------|
| NP Only           | 0.72(0.28-1.88)  |
| Both              | 1.37(0.52-3.62)  |
| <b>ADL</b>        |                  |
| MD Only           | 0.86(0.57-1.27)  |
| NP Only           | 0.67(0.26-1.73)  |
| Both              | 1.46 (0.56-3.80) |
| <b>Pain Scale</b> |                  |
| MD Only           | 0.89 (0.60-1.33) |
| NP Only           | 0.68 (0.26-1.80) |
| Both              | 1.38 (0.52-3.64) |

Appendix Table 6: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between residents' physicians being actively involved in managing care planning for residents (UVAR094) and hospitalization and ED (Emergency department) transfers.

| Variable                                                                              | Adjusted Odds Ratio: OR (95% CI) |
|---------------------------------------------------------------------------------------|----------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> | 0.93 (0.74-1.18)                 |
| <b>Age</b>                                                                            | 0.89 (0.69-1.14)                 |
| <b>Sex</b>                                                                            | 0.88 (0.69-1.13)                 |
| <b>Province</b>                                                                       | 0.91 (0.73-1.13)                 |
| <b>Owner-operator Model</b>                                                           | 0.88 (0.69-1.13)                 |
| <b>Facility Size</b>                                                                  | 0.88 (0.69-1.13)                 |
| <b>Number of Beds in Facility</b>                                                     | 0.87 (0.68-1.11)                 |
| <b>Number of Beds in Unit</b>                                                         | 0.91 (0.70-1.17)                 |
| <b>Diagnosis: CHF</b>                                                                 | 0.88 (0.69-1.13)                 |
| <b>Diagnosis: Pneumonia</b>                                                           | 0.88 (0.69-1.13)                 |
| <b>ADL</b>                                                                            | 0.88 (0.69-1.13)                 |
| <b>Pain Scale</b>                                                                     | 0.89 (0.69-1.14)                 |
| <b>CHESS</b>                                                                          | 0.90 (0.70-1.15)                 |

Appendix Table 7: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between units reporting at least one MD/NP having routine visits with residents on a typical weekday (UVAR086 and UVAR097) and polypharmacy use.

| Variable                                                                                             | Adjusted Odds Ratio: OR (95% CI) |
|------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>On a typical weekday, would at least one physician have routine visits with residents on unit</b> |                                  |
| MD Only                                                                                              | 0.99(0.74-1.32)                  |
| NP Only                                                                                              | 0.79(0.38-1.64)                  |
| Both                                                                                                 | 1.37(0.64-2.93)                  |
| <b>Age</b>                                                                                           |                                  |
| MD Only                                                                                              | 1.27 (0.87-1.85)                 |
| NP Only                                                                                              | 0.82 (0.36-2.17)                 |
| Both                                                                                                 | 1.01 (0.40-2.53)                 |
| <b>Sex</b>                                                                                           |                                  |
| MD Only                                                                                              | 1.27 (0.87-1.85)                 |
| NP Only                                                                                              | 0.90 (0.36-2.21)                 |
| Both                                                                                                 | 1.02 (0.41-2.57)                 |
| <b>Province</b>                                                                                      |                                  |
| MD Only                                                                                              | 0.81(0.60-1.09)                  |
| NP Only                                                                                              | 0.74 (0.34-1.61)                 |
| Both                                                                                                 | 1.61 (0.72-3.60)                 |
| <b>Owner-operator Model</b>                                                                          |                                  |
| MD Only                                                                                              | 1.26 (0.86-1.84)                 |
| NP Only                                                                                              | 0.82 (0.33-2.02)                 |
| Both                                                                                                 | 1.07 (0.43-2.70)                 |
| <b>Facility Size</b>                                                                                 |                                  |
| MD Only                                                                                              | 1.22 (0.84-1.78)                 |
| NP Only                                                                                              | 0.84 (0.34-2.05)                 |
| Both                                                                                                 | 1.06 (0.43-2.66)                 |
| <b>Number of Beds in Facility</b>                                                                    |                                  |
| MD Only                                                                                              | 1.19 (0.82-1.73)                 |
| NP Only                                                                                              | 0.85 (0.34-2.07)                 |
| Both                                                                                                 | 1.08(0.43-2.72)                  |
| <b>Number of Beds on Unit</b>                                                                        |                                  |
| MD Only                                                                                              | 1.21 (0.83-1.77)                 |
| NP Only                                                                                              | 0.87 (0.35-2.16)                 |

|              |                  |
|--------------|------------------|
| Both         | 1.07 (0.43-2.70) |
| <b>CPS</b>   |                  |
| MD Only      | 1.26 (0.88-1.81) |
| NP Only      | 0.91 (0.39-2.12) |
| Both         | 0.96 (0.41-2.28) |
| <b>CHESS</b> |                  |
| MD Only      | 1.28 (0.87-1.86) |
| NP Only      | 0.89 (0.41-2.62) |
| Both         | 1.04 (0.41-2.62) |

Appendix Table 8: Adjusted odds ratios and 95% confidence intervals for all variables included in the final model to test the association between residents' physicians being actively involved in managing care planning for residents (UVAR094) and polypharmacy.

| Variable                                                                              | Adjusted Odds Ratio: OR (95% CI) |
|---------------------------------------------------------------------------------------|----------------------------------|
| <b>Generally, residents' physicians are actively involved in manage care planning</b> | 0.93(0.77-1.12)                  |
| <b>Age</b>                                                                            | 0.92 (0.72-1.18)                 |
| <b>Sex</b>                                                                            | 0.91 (0.70-1.16)                 |
| <b>Province</b>                                                                       | 0.85 (0.70-1.03)                 |
| <b>Owner-operator Model</b>                                                           | 0.94 (0.73-1.21)                 |
| <b>Facility Size</b>                                                                  | 0.90 (0.70-1.16)                 |
| <b>Number of Beds in Facility</b>                                                     | 0.89 (0.69-1.14)                 |
| <b>Number of Beds in Unit</b>                                                         | 0.91 (0.70-1.17)                 |
| <b>Diagnosis: Allergies</b>                                                           | 0.88 (0.69-1.15)                 |
| <b>Number of Medications</b>                                                          | 0.88 (0.85-1.10)                 |
| <b>CPS</b>                                                                            | 0.92 (0.73-1.17)                 |
| <b>CHESS</b>                                                                          | 0.91 (0.70-1.17)                 |