Transitions in Mood Among Residents of Canadian Long-Term Care Facilities: The Effects of COVID-19 Individual Risk Factors and Regional Characteristics

by

Reem Taj-assir Mulla

A thesis

presented to the University of Waterloo

in fulfilment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Public Health Sciences (Aging, Health and Well-Being)

Waterloo, Ontario, Canada, 2024

© Reem Taj-assir Mulla 2024

Examining Committee Membership

The following served on the Examining Committee for this thesis. The decision of the Examining Committee is by majority vote.

External Examiner	**DR. DAVID CONN** Professor, Department of Geriatric Psychiatry University of Toronto
Supervisor	**DR. JOHN P. HIRDES** Professor, School of Public Health Sciences University of Waterloo
Internal Members	**DR. GEORGE A. HECKMAN** Associate Professor, School of Public Health Sciences University of Waterloo **DR. CARRIE MCAINEY** Associate Professor, School of Public Health Sciences University of Waterloo
Internal-External Member	**DR. LAURA MIDDLETON** Associate Professor, Department of Kinesiology and Health Sciences University of Waterloo

Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

Reem Taj-assir Mulla was the sole author for Chapters 1, 2, 4, 5, and 6 which were written under the supervision of Professor John Hirdes and were not written for publication prior to defense.

This thesis consists in part of four manuscripts written for publication. Exceptions to sole authorship of material is as follows:

Research presented in Chapter 3

As the lead author, I conceptualized the study question, design, and methodology with guidance from Professor Hirdes. I performed all data analysis with methodological advice from Professor Hirdes, the committee members and Dr. Luke Turcotte one of the co-authors. I led the interpretation of findings and drafted the initial manuscript with guidance and contribution from Professor Hirdes. My co-authors contributed to interpreting the findings and writing the final manuscript.

Abstract

Long-term care home residents are among the most vulnerable populations due to their advanced age. Their health and well-being can be influenced by physical and psychosocial factors, the surrounding physical environment, and practice patterns that make them more susceptible to increased morbidity, disability, and mortality.

Mental health disorders are particularly common among residents of long-term care (LTC) homes affecting between 27% and 40% of all LTC residents in Canada. The COVID-19 pandemic had a substantial impact on the physical and mental health and well-being of residents of long-term care (LTC) homes. The increased vulnerability of older adults combined with essential preventive and infection control measures led to a challenging environment in these care facilities. The COVID-19 pandemic highlighted and magnified pre-existing challenges in the LTC system, emphasizing the importance of comprehensive strategies to safeguard the mental health of LTC residents.

Study 1 is a scoping review that investigates the effect of isolation and loneliness on the mood of long-term care (LTC) home residents, both before and during the COVID-19 pandemic. It provides an overview of existing literature to understand the effects of family and friends' visits or loneliness and of COVID-19 restrictions on residents' mood. The review shows a diversity of findings highlighting the complexity of factors influencing residents' mood during a global health crisis such as that of COVID-19. It suggests a need for a nuanced understanding of the interplay between social interactions, pandemic-induced restrictions, and individual

coping mechanisms. It also highlights the need to use a standardized measure for depressive symptoms globally to prevent biases and inconsistencies that might arise from research based on different measures.

Study 2 is a longitudinal study evaluating the effect of COVID-19 pandemic on incident mood disturbance among Canadian long-term care home residents. It also examines the effects of COVID-19 in stratified models using resident and facility-level variables. This study shows that a variety of factors contributed to an increase in mental health challenges during the initial waves of the pandemic including, but not limited to, the potential effects of lockdown procedures. Our findings highlight the importance of implementing broad-based multidimensional interventions to ensure the mental well-being of all individuals during outbreaks.

Study 3 is a pan-Canadian retrospective longitudinal analysis of residents in long-term care homes**.** It examines the complex transition between the different mood states and absorbing states out of LTC settings using a one-step multistate Markov transition analysis. Study 2 reports incident mood disturbance among Canadian long-term care home residents; however, it does not address the multidirectional changes or the absorbing states that act as competing risks. This study can inform decisions on programs that can enhance the mood of long-term care residents by examining predictors of worsening or improving mood as well as factors predicting transition to the absorbing states.

Study 4 expands on our knowledge from study 3 by treating COVID-19 as a covariate to examine the effects of COVID-19 on transitions between the transient

mood states and the absorbing states in comparison to the pre-pandemic period. A one-step multistate Markov transition analysis was used in a pan-Canadian retrospective longitudinal analysis. The findings suggest further knowledge on the effects of COVID-19 on mood and inform decisions on the effective programs that can improve mood during periods of outbreaks.

The importance of this thesis lies in its comprehensive examination of the multifaceted complex interplay between social interactions, pandemic-related measures, as well as individual and facility-level variables pre-pandemic and during the COVID-19 pandemic. The included studies provide important insights for developing targeted interventions to support positive mood of LTC residents. In conclusion, this thesis not only advances our understanding of the mental health implications for LTC residents but also informs the development of evidence-based strategies to mitigate the adverse effects of isolation and pandemic-related stressors on this vulnerable population.

Acknowledgements

I owe my heartfelt thanks to the incredible people who have made this journey possible. First and foremost, I express my deepest gratitude to my supervisor, Professor John Hirdes, whose unwavering support, insightful guidance (both professional and personal), endless patience and invaluable mentorship have helped me navigate through the challenges of my PhD journey. Your guidance has been a great source of inspiration even in the most uncertain times.

To my committee members Dr. Carrie McAiney and Dr. George Heckman for your priceless scholarly guidance and dedicated efforts in assessing this research, which has been truly appreciated. Your dedication to the well-being of older adults has been a constant source of inspiration for various aspects of this study.

I extend my gratitude to Dr. Luke Turcotte, your insightful feedback, and your careful attention to detail, were invaluable and consistently encouraged me to pursue the highest quality in my work.

To professor Haider Abu Ahmed, thank you for believing in me. I am deeply grateful for your faith in my abilities, which has played a significant role in my academic journey.

To my University of Waterloo and interRAI family, Julie Koreck, my hero, you have been continuously supporting me throughout my journey in all aspects. Your dedication and assistance, both administratively and emotionally, have been invaluable to me. Micaela Jantzi, and Jonthan Chen, our SAS geniuses, you have made my life much easier, and spared me numerous headaches. Melissa Ziraldo, thank you for your continuous support. To Daniel Da Cunha Leme, thank you for

spending hours teaching me the ins and outs of coding and running R. To Bon Egbujie, Amanda Mofina and all my interRAI colleagues who have shared both the triumphs and tribulations of this adventure thank you for the fruitful discussions and insights.

My special thanks to Jane Russwurm from the Writing and Communication Centre for the incredible support you have provided throughout my PhD journey. Your presence and willingness to listen have been a tremendous source of comfort and strength for me. I would also like to thank Jackie Stapleton, the School of Public Health Sciences and Kinesiology Librarian for supporting me with developing a search strategy for my scoping review.

To my friends, Judy Castañeda and Martin Holmes thank you for the friendship, laughter, and moments of respite that have made this journey not just academically enriching but also personally fulfilling.

To my family, who have been working with me behind the scenes. I extend my love and appreciation. Your encouragement, understanding, prayers and sacrifices mean the world to me.

Funding Acknowledgement

The study is supported in part by funding from the Government of Canada's New Frontiers in Research Fund (NFRF; NFRFG-2020-00500) for collaboration in the EU Horizon 2020 research and innovation project Individualized CARE for Older Persons with Complex Chronic Conditions in Home Care and Nursing Homes (I-CARE4OLD, Grant Agreement No 965341). In addition, it received funding through the Canadian Institute for Health Research (CIHR Reference # GA6-177780).

Dedication

In the loving memory of my father, Dr. Taj-assir Mulla, whose support and boundless love accompanied me throughout my life and academic journey. Though he left us during my PhD pursuit, his spirit, guidance, encouragement, and above all, belief in my abilities kept me going and continue to resonate on every page of this thesis. I dedicate this thesis to you, a remarkable soul whose impact transcends time and whose absence is deeply felt.

To my husband, Husham Magzoub Ahmed, and my children, Ahmed, Omer and Yousif, your support, patience, and understanding during the challenges of this journey have been my anchor. Your love and encouragement gave me strength when I needed it the most.

To my mother, Samira Elbanna, and my siblings, Aseel, Ahmed and Nada your continuous prayers, enduring support and belief in my abilities have been a constant source of inspiration.

This thesis is dedicated to each of you, my pillars of strength, who have played unique and invaluable roles in this journey. Your presence, love, and sacrifices have kept me going and contributed immensely to this achievement.

With deepest love.

Table of Contents

Examining Committee Membership ii
Author's Declaration iii
Statement of Contributions iv
Abstract v
Acknowledgements viii
Dedication x
List of Figures xv
List of Tables xviii
List of Abbreviations xxii
Chapter 1: Introduction 1
1.1 Mental Health 2
1.1.1 Depressive Disorders Among Residents of LTC 5
1.1.2 Measures of Depression 7
1.1.3 Mental Health Issues Associated with Depression 12
1.2 COVID-19 and Mental Health 15
1.3 Distinction Between Mood, Depressive Symptoms, and Depression 18
1.4.1 Study Rationale 19
1.4.2 Purpose 20
1.4.3 Objectives 20
1.5 Methodological Summaries of Studies 21
1.5.1 Study 1 21
1.5.2 Study 2 21
1.5.3 Study 3 22
1.5.4 Study 4 23
Chapter 2: Manuscript 1 24
Consequences of Isolation and Visitation Restrictions on Mood of Long-Term Care Residents Pre-COVID and During COVID-19: A Scoping Review 24
2.1 Introduction 25
2.1.1 COVID-19 and Mental Health 26
2.2 Methods 28
2.2.1 Research Questions 28
2.2.2 Search Strategy 29

2.2.3 Charting the Data 31
2.3 Results 31
2.3.1 Search and Article Selection 31
2.3.2 Characteristics of the Studies 34
2.3.3 Quality of Included Studies 38
2.3.4 Summary of Findings 41
2.4 Discussion 45
2.5 Implications and Future Directions 47
2.6 Limitations 48
2.7 Conclusion 49
Chapter 3: Manuscript 2 50
What Happened to Residents' Mood in Canadian Long-Term Care Homes During the COVID-19 Pandemic? A Longitudinal Analysis 50
3.1 Introduction 51
3.2 Methods 53
3.2.1 Study Design and Setting 53
3.2.2 Data Source 53
3.2.3 Study Cohort 54
3.2.4 Outcome of Interest 56
3.2.5 Independent Variables and Exposures 57
3.2.6 Statistical Analysis 57
3.3 Results 58
3.3.1 Baseline Characteristics 58
3.3.2 Incident Depressive Symptoms by Exposure Group 61
3.3.3 Factors Associated with New Depressive Symptoms Among Unexposed Group and Exposed Group 66
3.3.4 Effect of COVID-19 Exposure on Incident Depressive Symptoms 71
3.4 Discussion 73
3.5 Strengths and Limitations 76
3.6 Conclusion and Implications 77
Chapter 4: Manuscript 3 79
Factors Associated with Mood Transitions Among Canadian Long-Term Care Residents: A Multistate Transition Model 79

4.1 Introduction 80
4.2 Methods 83
4.2.1 Study Design and Setting 83
4.2.2 Data Source 83
4.2.3 Study Cohort 84
4.2.4 Outcomes of Interest 84
4.2.5 Independent Variables and Exposures 86
4.2.6 Statistical Analysis 87
4.3 Results 89
4.3.1 Baseline Characteristics 89
4.3.2 Sojourn Time and Transitioning Probabilities 96
4.3.3 Transition Patterns Between Transient Mood States 97
4.3.4 Transition Patterns to Absorbing States 98
4.3.5 Independent Factors Associated with Transitions to Transient and Absorbing States 101
Pre-COVID Period Among Long-Term Care Residents 2010-2019 123
4.4 Discussion 126
4.5 Strengths and Limitations 132
4.6 Conclusion and Implications 133
Chapter 5: Manuscript 4 135
Factors Associated with Mood Transitions Among Canadian LTC Residents During COVID-19: A Multistate Transition Model 135
5.1 Introduction 136
5.2 Methods 137
5.2.1 Study Design and Setting 137
5.2.2 Data Source 138
5.2.3 Study Cohort 139
5.2.4 Outcomes of Interest 139
5.2.5 Independent Variables and Exposures 141
5.3 Results 143
5.3.1 Baseline Characteristics 143
5.3.2 Sojourn Time and Transition Patterns Between Transient Mood States During the First Two COVID Waves 147

5.3.3 Transition Patterns to Absorbing States 149

5.3.4 Independent Factors Associated with Transitions to Transient and Absorbing States 151

5.4 Discussion 159

5.5 Strengths and Limitations 163

5.6 Conclusion and Implications 164

Chapter 6: General Discussion and Conclusion 166

6.1 Background 167

6.2 Summary of Findings 167

6.2.1 Why Are Our Findings Different from Other Studies and Media Reports? 171

6.2.2 What Do Our Findings Imply? 173

6.3 Practical Implications 173

6.3.1 Clinical Practice 174

6.3.2 Policy Implications 176

6.3.3 Research Implications 178

6.4 Methodological issues, Strengths, and Limitations 179

6.4.1 Strengths 180

6.4.2 Limitations 181

6.5 Conclusion 182

References 184

Appendices 199

Appendix A (Chapter 2; Manuscript 1) 199

Appendix B (Chapter 3; Manuscript 2) 210

Appendix C (Chapter 4; Manuscript 3) 212

Appendix D (Chapter 5; Manuscript 4) 230

List of Figures

FIGURE 2.1: PRISMA FLOW DIAGRAM FOR ARTICLE SELECTION..... 33

FIGURE 2.2: TYPES OF ARTICLES INCLUDED IN THE SCOPING REVIEW 35

FIGURE 2.3: DISTRIBUTION OF ARTICLES BY COUNTRY OF ORIGIN 36

FIGURE 2.4: DEPRESSION MEASURES USED IN THE INCLUDED QUANTITATIVE STUDIES 37

FIGURE 2.5: DISTRIBUTION OF DEPRESSION MEASURES BY COUNTRY OF STUDY 38

FIGURE 3.1: FLOW DIAGRAM OF COHORT AND MOOD DECLINE PRE-COVID AND DURING COVID IN LONG-TERM CARE RESIDENTS IN CANADA 55

FIGURE 3.2: DEPRESSION RATING SCALE SCORE AT FOLLOW-UP AMONG RESIDENTS EXPERIENCING NEW DEPRESSIVE SYMPTOMS, STRATIFIED BY COVID-19 PANDEMIC PERIOD AND CANADIAN PROVINCE 2019-2020, CANADA N= 22,441. VALUE LABELS LESS THAN 1.0% REMOVED..... 65

FIGURE 4.1: STATE-SPACE DIAGRAM OF POSSIBLE TRANSITIONS FROM LONG-TERM CARE HOME IN MULTISTATE MARKOV MODEL 88

FIGURE 4.2: AVERAGE TIME SPENT IN MONTHS IN EACH OF THE TRANSIENT STATES BEFORE TRANSITIONING TO THE ABSORBING STATES 2010-2019, CANADA 97

FIGURE 4.3: THE PROBABILITY OF TRANSITIONING TO THE DIFFERENT TRANSIENT STATES AND ABSORBING STATES AMONG LONG-TERM CARE RESIDENTS (2010-2019), CANADA 99

FIGURE 4.4: CUMULATIVE INCIDENCE FUNCTION (CIF) PLOTS FOR 4 TYPES OF TRANSITIONS 365 DAYS AFTER ADMISSION ASSESSMENT BY BASELINE DRS SCORE PRE-COVID AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA. NOTE: Y-AXES HAVE DIFFERENT MAXIMUM VALUES FOR PRESENTATION PURPOSES. 100

FIGURE 4.5: ADJUSTED ODDS OF TRANSITIONING FROM NO MOOD DISTURBANCE (STATE 1) TO DIFFERENT DRS STATES AND ABSORBING STATES DURING 123

FIGURE 4.6: ADJUSTED ODDS OF TRANSITIONING FROM MILD MOOD DISTURBANCE (STATE 2) TO DIFFERENT DRS STATES AND ABSORBING STATES DURING..... 124

FIGURE 4.7: ADJUSTED ODDS OF TRANSITIONING FROM MODERATE/SEVERE MOOD DISTURBANCE (STATE 3) TO DIFFERENT DRS STATES AND ABSORBING..... 125

FIGURE 5.1: STATE-SPACE DIAGRAM OF POSSIBLE TRANSITIONS FROM LONG-TERM CARE HOME IN MULTISTATE MARKOV MODEL 142

FIGURE 5.2: AVERAGE TIME SPENT IN MONTHS IN EACH OF THE TRANSIENT STATES BEFORE TRANSITIONING TO THE ABSORBING STATES AMONG LONG-TERM CARE RESIDENTS, CANADA..... 149

FIGURE 5.3: DISTRIBUTION OF PROBABILITY OF TRANSITIONING FROM DRS CATEGORIES TO DIFFERENT ABSORBING STATES WITHIN 90 DAYS AMONG LONG-TERM CARE RESIDENTS, CANADA..... 150

FIGURE 5.4: ADJUSTED ODDS OF TRANSITIONING FROM NO MOOD DISTURBANCE (STATE 1) TO DIFFERENT DRS STATES AND ABSORBING STATES..... 156

FIGURE 5.5: ADJUSTED ODDS OF TRANSITIONING FROM MILD MOOD DISTURBANCE (STATE 2) TO DIFFERENT DRS STATES AND ABSORBING 157

FIGURE 5.6: ADJUSTED ODDS OF TRANSITIONING FROM MODERATE/SEVERE MOOD DISTURBANCE (STATE 3) TO DIFFERENT DRS STATES..... 158

List of Tables

TABLE 2.1: MAIN CONCEPTS AND KEYWORDS 30

TABLE 2.2: SAMPLE SIZE AND SAMPLING STRATEGIES FOR THE QUANTITATIVE STUDIES 39

TABLE 3.1: BASELINE CHARACTERISTICS BY COVID-19 PERIOD IN CANADIAN LONG-TERM CARE HOMES 2019-2020, CANADA N=22,441 59

TABLE 3.2: TRANSITIONS IN MOOD AMONG PERSONS WITH A BASELINE DEPRESSION RATING SCALE SCORE OF 0 MOVING TO 0, 1-2, 3+ DURING PRE-COVID/COVID AMONG DIFFERENT VARIABLES AT FOLLOW-UP IN CANADIAN LONG-TERM CARE HOMES 2019-2020, CANADA N=22,441 62

TABLE 3.3: FINAL MODEL, ADJUSTED ODDS RATIO FOR HAVING NEW MOOD SYMPTOMS DURING PRE-COVID AND COVID AMONG CANADIAN LONG-TERM CARE HOME RESIDENTS 2019-2020, CANADA N=22,441 68

TABLE 3.4: PROPORTIONAL ODDS RATIO STATISTICS FOR THE EFFECT OF COVID PERIOD ON DEPRESSION RATING SCALE SCORE AT FOLLOW-UP 2019-2020, CANADA N=22,441 72

TABLE 4.1: BASELINE CHARACTERISTICS OF LTC RESIDENTS ON ADMISSION AND BETWEEN THE THREE DIFFERENT STATES OF MOOD, NO MOOD DISTURBANCE (DRS0), MILD MOOD DISTURBANCE (DRS 1-2), AND MODERATE TO SEVERE MOOD DISTURBANCE (DRS3+) DURING THE PRE-COVID-19 PERIOD 2010-2019, CANADA N=314,042 90

TABLE 4.2: NINETY DAY TRANSITION RATES (%) TO DIFFERENT CARE SETTINGS AND MORTALITY BY DRS SCORE AND DAY OF STAY AT START OF ASSESSMENT PERIOD, 2010-2019, CANADA N=314,042 94

TABLE 5.1: BASELINE CHARACTERISTICS OF LTC RESIDENTS BY STUDY PERIOD (PRE-COVID-19, COVID-19 WAVE 1, AND COVID-19 WAVE 2) 2010-2021, CANADA N=410,991 144

TABLE 5.2: ADJUSTED ODDS OF TRANSITIONING FROM DIFFERENT DRS STATES TO OTHER DRS AND TERMINAL STATES 2010 – 2021, CANADA N=410,991 155

TABLE A.1: LIST AND DETAILS OF INCLUDED QUANTITATIVE ARTICLES 199

TABLE A.2: LIST AND DETAILS OF INCLUDED QUALITATIVE ARTICLES 206

TABLE A.3: LIST AND DETAILS OF INCLUDED LETTERS TO THE EDITOR, BOOK CHAPTERS AND REPORTS 209

TABLE B.1: FACTORS ASSOCIATED WITH NEW DEPRESSIVE SYMPTOMS AMONG UNEXPOSED GROUP OF RESIDENTS IN LONG-TERM CARE 2019-2020, CANADA N=22,441 210

TABLE C.1: COMPLETE LIST OF INDEPENDENT VARIABLES INCLUDED IN THE MODEL .. 212

TABLE C.2: ADJUSTED ODDS OF TRANSITION TO OTHER DRS AND ABSORBING STATES FROM A STATE OF NO MOOD DISTURBANCE AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 216

TABLE C.3: ADJUSTED ODDS OF TRANSITION TO OTHER DRS AND ABSORBING STATES FROM A STATE OF MILD MOOD DISTURBANCE AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 218

TABLE C.4: ADJUSTED ODDS OF TRANSITION TO OTHER DRS AND ABSORBING STATES FROM A STATE OF MODERATE/SEVERE MOOD DISTURBANCE AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 220

TABLE C.5: ADJUSTED ODDS OF TRANSITION TO OTHER DRS AND ABSORBING STATES FROM A STATE OF NO MOOD DISTURBANCE AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 (RECREATION THERAPY DAYS VARIABLE AS A CONTINUOUS VARIABLE) 222

TABLE C.6: ADJUSTED ODDS OF TRANSITION TO OTHER DRS AND ABSORBING STATES FROM A STATE OF MILD MOOD DISTURBANCE AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 (RECREATION THERAPY DAYS VARIABLE AS A CONTINUOUS VARIABLE) 224

TABLE C.7: ADJUSTED ODDS OF TRANSITION TO OTHER DRS AND ABSORBING STATES FROM A STATE OF MODERATE/SEVERE MOOD DISTURBANCE AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 (RECREATION THERAPY DAYS VARIABLE AS A CONTINUOUS VARIABLE) 226

TABLE C.8: NINETY DAY TRANSITION RATES (TABLE %) TO DIFFERENT CARE SETTINGS AND MORTALITY BY DRS SCORE AND DAY OF STAY AT START OF ASSESSMENT PERIOD AMONG LONG-TERM CARE RESIDENTS 2010-2019, CANADA N=314,042 228

TABLE C.9: TOTAL SOJOURN TIME IN EACH MOOD STATE BEFORE TRANSITIONING TO ABSORBING STATES **(MONTHS)** AMONG LONG-TERM CARE RESIDENTS, CANADA. 229

List of Abbreviations

ABS	Aggressive Behaviour Scale
ADLH	Activities of Daily Living Hierarchy
ADRD	Alzheimer's Disease and Related Dementias
aOR	Adjusted Odds Ratio
CAGP	Canadian Academy of Geriatric Psychiatry
CAP	Clinical Assessment Protocol
CCRS	Continuing Care Reporting System
CCRRS	COVID19 Rapid Response Study
CCSMH	Canadian Coalition for Seniors' Mental Health
CES-D	Center for Epidemiological Studies Depression Scale
CHARIOT	Cognitive Health in Ageing Register for Interventional and Observation Trials
CHESS	Changes in Health, End Stage Disease and Signs and Symptoms
CI	Confidence Interval
CIHI	Canadian Institute for Health Information
CINHAL	Cumulated Index to Nursing and Allied Health Literature
CMS	Composite Mood Scale
COVID-19	Coronavirus Disease 2019
CPS	Cognitive Performance Scale
DAD	Discharge Abstract Dataset
DALYs	Disability-Adjusted Life Years

DRS	Depression rating Scale
DSM-5	Diagnostic and Statistical Manual of Mental Disorders-Fifth edition
DSM-IV-TR	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision
GDS	Geriatric Depression Scale
HCSSPs	Health Care and Social Service Professionals
IPAC	Infection Prevention and Control
IRRS	Integrated interRAI Reporting System
ISE	Index of Social Engagement
LTC	Long-term Care
LTCF	Long-term Care Facilities
MCC	Major Comorbidity Count
MDD	Major Depressive Disorder
MDS	Minimum Data Set
medRixv	Preprint Server for Health Sciences
MMSE	Mini-Mental State Examination
MoCA	Montreal Cognitive Assessment
MSPSS	Multidimensional Scale of Perceived Social Support
NACRS	National Ambulatory Care Reporting System
PHQ	Patient Health Questionnaire
PPE	Personal Protective Equipment

PRIME-MD	Primary Care Evaluation of Mental Disorders
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
QI	Quality Indicator
QoL	Quality of Life
RAI	Resident Assessment Instrument
RAP	Resident Assessment Protocol
RISE	Revised Index of Social Engagement
SAEP	Residents in Sheltered Accommodation for Elderly People
WHO	World Health Organization
YLD	Years Lived with Disability

Chapter 1: Introduction

1.1 Mental Health

The World Health Organization (WHO) defines mental health as "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (Pan American Health Organization, 2014; World Health Organization, 2022). Keyes and Lopez (2009) defined mental health as "a complete state consisting of the absence of mental illness and the presence of high-level well-being" (Keyes & Lopez, 2009).

Mental health disorders are particularly common among residents of long-term care (LTC) homes (Chau et al., 2019; Seitz et al., 2010), affecting between 27% (Hoben et al., 2019) and 40% of all LTC residents in Canada (Kehyayan et al., 2021). Factors that can negatively affect mental health include stressors (such as an ongoing health issue, bereavement or separation), impaired functional ability, isolation, social problems (e.g., loneliness), and chronic health problems (Aydın et al., 2020; Barak & Gale, 2019). Common chronic conditions later in life have known associations with mental health issues (Barak & Gale, 2019; MacCourt P., 2011). Mental health disorders are reported to affect at least 60% of U.S. LTC residents, the most common being mood and anxiety disorders, cognitive and mental disorders due to a medical condition (including dementia and delirium), serious mental illnesses (schizophrenia, other psychoses, and bipolar disorder), depressive disorders, and substance misuse (including prescription drugs and alcohol) (Brennan & SooHoo, 2020; Kehyayan et al., 2021; MacCourt P., 2011).

Due to its chronicity, and associated morbidity, depression exerts the greatest burden of all mental illnesses (Tanner et al., 2020). Depression affects the quality of life of an individual and was found to be a leading cause of disability and excess mortality in Canada (GBD 2019 Mental Disorders Collaborators, 2022; Tanner et al., 2020). Studies have shown that the odds of dying in older adults with depression was 1.5 to 2 times greater than those without depression (Blazer et al., 2001).

A third of older adults experience depressive symptoms affecting their cognitive function, functional ability, and pain levels (Rodda et al., 2011; Wilkinson et al., 2018). Depressive disorders can affect anyone at any time during the life course. Wilkinson et al. (2018) stated that the course of depression can worsen with age; yet others added that this can be affected by external factors like national economic fluctuations and area of residence (whether it be urban or rural). The Canadian Coalition for Seniors' Mental Health stated that in middle- and higher-income countries depression is one of the leading causes of disease burden (Canadian Coalition for Seniors' Mental Health, 2021b). However, it was shown that depressive symptoms might improve with age in developed countries and urban areas when compared to low-income countries and rural areas (Kessler et al., 2010; Lys et al., 2019; Mechakra-Tahiri et al., 2009). Also, gender differences were found to be among the risk factors for depressed mood, with females as a risk factor for depressive symptoms in some reports (Girgus et al., 2017; Whiteman et al., 2016). Others report interactions with age such that among 60-80 year olds, men had worse depressive symptoms than women (Barefoot et al., 2001). Further, a systematic review

conducted in 2016 identified several other risk factors for depressed mood that include poor sleep, negative social interactions, and stressful negative events (Pemberton & Tyszkiewicz, 2016). Protective factors include exercise and positive social interactions (Pemberton & Tyszkiewicz, 2016).

One of the serious problems with mental health is suicidal thoughts and behaviours. Over a 13-year period, approximately 2.2% of suicides among adults 55 years and older were associated with LTC (Mezuk et al., 2019). Among some of the risk factors for suicide in older adults are loneliness and social isolation (Chai et al., 2021).

The DSM 5 categorizes mood disorders into two categories, bipolar and related disorders and depressive disorders (Ehreta & Berkingb, 2013). Bipolar disorders are further categorized into different types. There are 3 main types of depressive disorders described in the literature based on the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision and the Fifth edition (DSM-IV-TR & DSM-5). These include major depression, dysthymia (a chronic less severe form of depression), and adjustment disorder with depressed mood (Abou-Saleh et al., 2011; Cahoon, 2012). Each of the bipolar and depressive disorders with their different types has its own diagnostic criteria; however, differentiating among those types of bipolar or depressive disorders is beyond the scope of this thesis.

1.1.1 Depressive Disorders Among Residents of LTC

In Canada, about 21% of residents are admitted to LTC homes with mood symptoms related to depression that worsen over time (Canadian Institute for Health Information, 2021c).

Depressive disorders are defined in the Diagnostic and Statistical Manual of Mental Disorders-Fifth edition (DSM-5) as "the presence of sad, empty, or irritable mood, accompanied by somatic and cognitive changes that significantly affect the individual's capacity to function" (American Psychiatric Association, 2013). The challenge with older adults is that they can sometimes only report somatic symptoms and symptoms of anhedonia (social withdrawal and loss of interest) and not the presence of symptoms of dysphoria (presence of sad, pained, or worried facial expressions) (American Psychiatric Association, 2013). To complicate matters even more, depression is also reported to have a bidirectional relationship with other physical illnesses which in turn also hinders recovery and rehabilitation (Huang & Carpenter, 2011).

Depression is one of the most common psychiatric conditions among residents of LTC along with dementia and anxiety disorders (Seitz et al., 2010), and is associated with an increased risk of admission to LTC homes (Harris, 2007; Onder et al., 2007). Transitioning to a LTC home in itself could contribute to the development of depressive symptoms (Seitz et al., 2010), maybe because of social disconnectedness and the feeling of loneliness. It is estimated that the rate of underdiagnosed residents of LTC homes with depression is about 42–56% (Huang & Carpenter, 2011), although it is treatable in about 65%-75% of cases (Cahoon, 2012). Depression can be prevented

by using some interventions that have been recommended by the Canadian Coalition for Seniors' Mental Health (CCSMH) (Canadian Coalition for Seniors' Mental Health, 2021a). This underdiagnosis could be attributed to high rates of cognitive impairment among residents of LTC homes and lack of mental health training among staff members.

The prevalence rates of depression are highly variable across both cross-sectional and longitudinal studies with baseline between 6.5%–25.3% for depressive symptomatology among community dwelling older adults (Vaughan et al., 2015). This prevalence also varies among LTC residents with a median of 10% among residents with major depressive disorder and 29% among those with depressive symptoms (Seitz et al., 2010). However, a meta-analysis found that Major Depressive Disorder (MDD) alone has a high prevalence of 25.4% among LTC home residents 65 years of age and older in North America (Fornaro et al., 2020).

In Canada, depressive symptoms affect 27.1% of all LTC residents (Hoben et al., 2019). This variation in prevalence estimates is thought to be due to difference in study designs, data sources and diagnostic criteria, as well as differences in defining LTC homes (Bagchi et al., 2009; Kehyayan et al., 2021).

It has been reported that the rates of depressed LTC residents are increasing due to more older adults from the community are being admitted to LTC homes with depression (Fullerton et al., 2009). This could be partly due to the existence of comorbid conditions in the aging population, more so in those who need more specialized care who are thus admitted to LTC homes (Chau et al., 2019; Fullerton et

al., 2009). Chronic medical conditions increase the risk of experiencing depression (Martin et al., 2008). About 20%–30% of heart disease patients experience depression (National Heart Lung & Blood Institute, 2017). Around 17.6% of those having type 2 diabetes experience some form of depression (Wang et al., 2016). Factors that increase the risk for developing depression include comorbid physical illness (Martin et al., 2008; Wilkinson et al., 2018), poor social support, grieving (Wilkinson et al., 2018) and lack of social engagement (Creighton et al., 2019). Other factors include cognitive impairment, instability of health, medical complexity, daily pain, and impairment in activities of daily living (Szczerbińska et al., 2012). These rates can vary in different health care settings, for example, Szczerbińska et al. (2012) reported higher rates of depressive symptoms in complex continuing care facilities than in home care.

1.1.2 Measures of Depression

There are different tools to measure depressive symptoms in clinical settings. Some are based on clinician judgment, and others are self-report measures. Self-report measures deal with the subjective dimensions of mood from the person's perspective. However, concerns related to the person's insight to their own mental health conditions can be a threat to the validity of such measures (Brown & Astell, 2012) particularly in populations with pervasive cognitive impairment. Among the most used instruments to measure depression in LTC homes are the Geriatric Depression Scale (GDS) and the Depression Rating Scale (DRS) from interRAI assessments. The GDS which is a self-report measure is widely used in research settings (Koehler et al., 2005). Different versions are available for the GDS

instrument ranging from 30 items in the original version to as little as five items in the newer version (Koehler et al., 2005). The sensitivity and specificity of the GDS original version comprising the 30 items was found to be 80% and 100% respectively, with ≥14 as "definite depression" taken as the cutoff value (Durmaz et al., 2018).

On the other hand, the DRS provides a standardized and comprehensive clinician rated assessment of residents in LTC homes. It is widely used internationally (Guthrie et al., 2016; Hall et al., 2020; Hirdes et al., 2011; Hoben et al., 2019; Koehler et al., 2005; Neufeld et al., 2014). The DRS is a parallel-form summary scale that uses seven mood items and has been shown to be a reliable and valid measure of depressive symptoms among LTC home residents (Burrows, 2000; Hoben et al., 2019; Koehler et al., 2005) and psychiatric in-patients (Hirdes et al., 2002). The DRS on its own cannot be used as the basis for diagnosing depression (Penny et al., 2016); however, the original derivation study by Burrows et al. (2000) used psychiatric diagnosis of depression as a criterion measure for validation and Martin et al. (2008) showed that DRS scores were significant predictors for new future diagnoses of depression (Burrows et al., 2000; Martin et al., 2008). A conventional cut-off score of ≥ 3 is used to indicate a high-risk level for depressive symptoms (Freeman et al., 2014). The DRS was compared to the Hamilton Depression Rating Scale (HDRS) and the Cornell Scale for Depression in Dementia (CSDD), both of which are well-validated for use in elderly populations (Burrows et al., 2000). The HDRS, a 17-item scale, originally developed to be used in hospital inpatients already diagnosed with a depressive affective disorder (Hamilton, 1960).

The CSDD, a 19-items scale administered by clinicians to measure five domains of depression (mood, behavioral disturbance, physical signs, cyclic functions, and ideational disturbance) with a cut-off point of 10 for a probable major depression (Alexopoulos et al., 1988).

The GDS is reported to have high sensitivity and specificity (Durmaz et al., 2018), as well as good internal consistency reliability due to its greater scale length. However, it depends on the person's ability to self-report mood symptoms (Brown & Astell, 2012) and was found to have a high frequency of missing data in LTC settings (Koehler et al., 2005). Also, the GDS does not consider the somatic complaints of an individual, but rather captures the unhappy thoughts and not the presence of depression (Koehler et al., 2005). As a final note, both GDS and DRS were found to measure different aspects of depression among older adults residing in LTC homes (individual's feelings and satisfaction vs. visible actions), respectively (Koehler et al., 2005).

Another scale that is also used to measure depressive symptoms is the Patient Health Questionnaire (PHQ). The PHQ was derived from the Primary Care Evaluation of Mental Disorders (PRIME-MD) instrument as an improved version of PRIME-MD (Spitzer et al., 1999). This improvement was necessitated by the impractical length of PRIME-MD for use in primary care settings, where it consumed nearly half of the patient's visit time when administered by physicians (Spitzer et al., 1999). The original PRIME-MD components, including the patient questionnaire and

clinician evaluation guide, have been combined into a single, three-page questionnaire, which can be self-administered (Spitzer et al., 1999).

Different shorter versions were developed from the original PHQ including PHQ-9 with 9 items, PHQ-8 with 8 items, PHQ-2 with 2 items and others (Kroenke et al., 2010). Each version is used according to what the outcome of interest is, for example PHQ-9 is used if the condition of interest is depression, PHQ-8 omits the question about thoughts of death or self-harm in PHQ-9, and is used in research, particularly in large epidemiological studies, where depression is not the primary outcome (Kroenke et al., 2010). Further, PHQ-2 uses only two items from PHQ-9 to measure depressed mood and loss of interest (anhedonia) (Kroenke et al., 2010). PHQ has comparable validity and greater efficiency than the original instrument with good sensitivity and specificity to detecting depressive disorders (Kroenke et al., 2010; Spitzer et al., 1999). The 9-item PHQ diagnoses major depression if at least five out of nine depressive symptoms have been experienced for more than half the days in the past two weeks, with one of the symptoms being either depressed mood or anhedonia (Kroenke et al., 2001). For other forms of depression, a diagnosis is made if two, three, or four symptoms are present under similar conditions (Kroenke et al., 2001).

When compared to the shorter GDS versions, the PHQ-9 demonstrates comparable psychometric performance to the GDS and both are suitable for use with diverse elderly populations (Wilkins et al., 2011; Zhang et al., 2020). Both measures can be used in the older adult population; however, some authors suggest that the

GDS should be used in frail older adults with complex medical conditions or inpatients due to its ease of use having a yes/no format. While the same authors recommend that PHQ-9 be used with more stable patients in outpatient clinics given its Likert-based format that poses no burden for this population (Wilkins et al., 2011).

A newer scale has been recently developed, called the interRAI Composite Mood Scale (CMS) which provides reliable and valid person-centered approach to assessment of distressed mood across different settings (Hirdes et al., 2022). The CMS incorporates both the individual's perspective as well as the clinician views, therefore providing sensitive and robust measure of mood disturbance (Hirdes et al., 2022). While a self-report only version of this scale is also available, the high rate of non-response in LTC settings would produce excessive missing data (Hirdes et al., 2022). The CMS has several advantages over the standard DRS (Hirdes et al., 2022) including:

- Self-report measures will allow for the inclusion of the individual's perspective.
- Since it uses both clinician rating and self-report measures it is more sensitive than the DRS and therefore decreases the rate of under detection of mood disturbance.
- It includes measures of anhedonia which is missing in the DRS and thus a gap in the content validity is present.

However, the older RAI 2.0 assessment does not include all the needed items for the CMS, so it was not possible to use this measure during the COVID-19 pandemic. On the other hand, the transition toward the interRAI Long-Term Care Facility

(LTCF) assessment system (Hirdes et al., 2008; Hirdes, Van Everdingen, et al., 2020) will allow the use of the CMS in future research.

Another way of measuring depressive symptoms is the interRAI Worsened Mood Quality Indicator (QI). This approach to measuring depressive symptoms uses standardized items from two subsequent assessments to evaluate quality of care for national benchmarking purposes (R. N. Jones et al., 2010). The QI is triggered when the mood item score worsens on the second assessment. Risk adjustment is used to control for differences between LTC homes (R. N. Jones et al., 2010). In LTC homes in British Columbia, Alberta, Saskatchewan, Ontario, New Brunswick, Newfoundland, and Yukon, the adjusted rate of worsened mood is 21.4% (Your Health System-CIHI, 2022).

1.1.3 Mental Health Issues Associated with Depression

Anxiety

Another important common mental health issue among LTC residents is anxiety, with 29.7% reporting anxiety symptoms (Hoben et al., 2019). Others report the prevalence of anxiety symptoms among residents in residential care facilities to reach as high as 28% in clinical settings (Balsamo et al., 2018) and 58.4% in residential care facilities (Creighton et al., 2019). Despite this high prevalence, research is limited about anxiety in this population (Creighton et al., 2018; Seitz et al., 2010). Further, just like depression, the symptoms of late-life anxiety could pass unnoticed and untreated, which will cause more costs in treatment for the health system, the individual and family members (Balsamo et al., 2018). Anxiety in older

adults within residential care facilities is strongly associated with depression, cognitive impairment, and lower level of self-perceived health, but no association was found with social engagement (Creighton et al., 2019). About 50% of individuals with depression experience anxiety and the opposite is true (Hirschfield, 2001).

The most commonly used measures to assess anxiety in older adults are self-report measures due to their ease of administration (Balsamo et al., 2018). Due to the difference in nature between anxiety symptoms and perception between younger and older adults, age specific instruments were developed for the different age groups (Balsamo et al., 2018). Although one would think that this is advantageous, a problem will arise if it is to be used in longitudinal studies or during the life course of an individual (Balsamo et al., 2018). Even though the interRAI suite of assessments was initially developed for older adults, it has been adjusted to suit various groups, including children, adults, and those with disabilities. This adaptability makes these assessments valuable for monitoring an individual's health changes over time and identifying specific areas of concern that might require additional support or intervention.

Early Cognitive Impairment and Interplay with Depression

Cognitive decline refers to a gradual deterioration in memory, thinking abilities, and/or judgment. Many older adults with depression frequently report cognitive symptoms, spanning from regular cognitive aging to mild and major neurocognitive disorders such as dementia (Wang & Blazer, 2015). Cognitive decline could be the cause of admission to a LTC facility or could be a consequence of other

factors that are common to residents of LTC homes including depression and polypharmacy. Du et al. (2023) found that older adults who experienced an increase in depressive symptoms had a higher likelihood of developing dementia (Du et al., 2023). Nevertheless, there is ongoing debate about whether the presence of depressive symptoms can anticipate a subsequent decrease in cognitive function (Du et al., 2023). Late life depression is associated with cognitive impairment, often times it can present with or even precede cognitive impairment with a prevalence of about 30-40% (Morimoto et al., 2015). Both cognitive impairment and depression can detrimentally affect an individual's quality of life, resulting in social isolation, elevated health risks, and ultimately, an increased reliance on healthcare services. Having depression will exacerbate the symptoms of cognitive impairment and could also lead to delay in diagnosis and treatment.

Different tools can be used to assess cognitive deficits in LTC home residents. Among those are the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA) and the Cognitive Performance Scale (CPS) that is embedded in the interRAI assessment instruments (K. Jones et al., 2010; Morris et al., 1994; Morris et al., 2016). .

Behavioural Problems

Since the prevalence of dementia in newly admitted LTC residents was reported to be 54.1% in 2015 (Ng et al., 2020), and it is forecasted that there will be a 10 fold increase in the demand for LTC due to the increase in dementia prevalence (Alzheimer Society of Canada, 2010; Hirdes et al., 2011), many residents experience

behavioural problems. Behavioural problems are reported in about 26% to 66% of LTC residents across Canada (McArthur et al., 2021). Studies have shown a three times increased odds of experiencing aggressive behaviour with depression among older adults in LTC homes (Canadian Institute for Health Information, 2008). The authors have also seen a rise in prevalence of aggressive behaviour by signs of depression in Nova Scotia LTC homes (2003–2004 to 2006–2007) from about 10% aggressive behaviour in residents with no signs of depression to slightly above 40% prevalence of aggressive behaviour among residents with only signs of depression (Canadian Institute for Health Information, 2008). Behavioural problems are a concern because they can lead to distress, disruption or disputes among other residents, staff, and family members (McArthur et al., 2021). One of the major risk factors among residents of LTC homes that decreases the Quality of Life (QoL) is aggressive behaviour with an estimated prevalence of 84% among residents who have cognitive impairment (Perlman & Hirdes, 2008). A scale was developed to measure aggressive behaviour known as the Aggressive Behaviour Scale (ABS) which is embedded within the interRAI suites of assessment and is described in later sections of the dissertation.

1.2 COVID-19 and Mental Health

COVID-19 created a challenging environment for LTC staff members, residents as well as families of residents. LTC home residents are among the most vulnerable populations due to their old age, comorbid health conditions, chronic illnesses in addition to frailty. These factors can make LTC residents more

susceptible to contracting infections and thus increase morbidity and mortality (Barnett & Grabowski, 2020). The pandemic has shed light on the challenges and problems associated with mental health, especially in LTC homes. Some studies suggest that mental health among residents worsened due to many ongoing factors including staff shortages, limited staff education about mental health among the older population, and poor access to mental health or psychiatric facilities for those residing in LTC homes (Checkland et al., 2021). Other studies found no major impact of the lockdown during the first wave of COVID-19 (McArthur et al., 2021). Concerns were raised by the Canadian Academy of Geriatric Psychiatry (CAGP) and the Canadian Coalition for Seniors' Mental Health (CCSMH) that resident mental health was at risk of deterioration due to these COVID-19 control measures (Checkland et al., 2021).

COVID-19 affected mental health in two different ways, first, people with mental health issues were at a higher risk of getting infected because of social disadvantages such as poor nutrition, also, the inability to follow and comply with the preventative measures that were put in place (Stewart & Appelbaum, 2020). Second, measures taken against the spread of COVID-19 could be the cause of increasing mental health issues or worsening of mental health in LTC residents. Many factors come into play including developing or worsening of mental health issues due to the isolation and disconnectedness experienced by residents of LTC homes during the lockdown (Checkland et al., 2021; Levere et al., 2021; McArthur et al., 2021). High rates of depression and anxiety were reported globally during the pandemic in the

general population (14.6% to 48.3%) and (6.3% to 50.9%) respectively (Xiong et al., 2020).

Contradicting views and findings were observed when comparing different age groups before and during the pandemic. Prior to the COVID-19 pandemic Seitz et al. (2010) reported that LTC residents were more likely to develop psychiatric disorders when compared to community-dwelling older adults. However, others stated that during the pandemic older adults' mental health remained stable despite increased loneliness (Van Tilburg et al., 2021). Moreover, some authors stated that COVID-19 was associated with depression in the general population (Wang et al., 2020; Xiong et al., 2020), while others observed less depression among the older population compared to younger adults (Solomou & Constantinidou, 2020). On the other hand, gender differences in relation to depression remained the same before and during COVID. Depression was more prevalent among older women in both periods (G. S. Betini et al., 2021; Girgus et al., 2017; Neufeld et al., 2014; Whiteman et al., 2016). The Cognitive Health in Ageing Register for Interventional and Observation Trials (CHARIOT) COVID19 Rapid Response Study (CCRRS) in London showed that the predictors of worsened mood within six weeks of lockdown include women, younger participants, those single/widowed/divorced, reporting poor sleep, feelings of loneliness and who reported living alone (Robb et al., 2020). Due to the mixed evidence, this thesis examined four areas: an overview of the association of isolation and mood of residents of LTC homes, the effect of COVID-19 pandemic exposure on incident mood disturbance among Canadian LTC home residents, factors associated

with transitions in mood among the same population, and finally the effects of COVID-19 in the transition in mood among LTC residents.

1.3 Distinction Between Mood, Depressive Symptoms, and Depression

Keyes 2002 defines mental health as a combination of positive emotions (emotional well-being) and effective functioning (psychological and social well-being) in everyday life, thus emphasizing a broader perspective beyond just the absence of illness (Keyes, 2002). The mental health continuum model developed by Keyes (2002) distinguishes between depression and depressive symptoms by conceptualizing mental health as a spectrum ranging from flourishing (complete mental health i.e. high levels of well-being and positive functioning) to languishing (incomplete mental health i.e. low well-being). The model draws a clear line between two distinct concepts: depression and depressive symptoms. Depression refers to a formally diagnosed clinical state characterized by persistent feelings of sadness, hopelessness, and a lack of interest or pleasure in activities, representing a more severe and enduring condition. On the other hand, depressive symptoms are seen as common experiences that can occur in response to stressors or life challenges but do not necessarily indicate a clinical disorder (Keyes, 2002). Depressive symptoms encompass temporary experiences of sadness, low mood, or negative emotions that may fluctuate over time and may not persist or be sufficiently severe to meet the diagnostic criteria for depression.

Sometimes the word depression is used incorrectly to describe the presence of unpleasant feelings or mood (Mondimore, 2006). So, what is mood? Mondimore

defines mood as "a complicated set of feelings both psychological and physical" that influence how we interact with others, our productivity, relaxation, enjoyment, and self-esteem, which can be positive or negative (Mondimore, 2006). To conclude, depressive symptoms could be present in both clinically diagnosed depression and in negative mood or mood disturbance.

In this dissertation I examined mainly depressive symptoms or mood disturbance rather than the presence of depression as a clinical diagnosis. The DRS scores of 0 denoting no mood disturbance, 1-2 mild mood disturbance and 3+ moderate/severe mood disturbance was used in Chapters 3, 4 and 5 to examine incidence of new mood symptoms, transitions in mood before the COVID-19 pandemic and finally, transitions in mood during the pandemic, respectively.

1.4 Methodology

1.4.1 Study Rationale

Mental health issues in older adults are becoming a global burden that is often undiagnosed and unnoticed (Rehm & Shield, 2019; Szczerbińska et al., 2012; Vigo et al., 2016; Weye et al., 2019). Higher levels of stress, anxiety and depression are reported in people with chronic health conditions (Fisher et al., 2021). Therefore, residents of LTC homes would be at particular risk of worsening mental health. It was reported in the United Kingdom, that during the pandemic about 35% of residents who live with long-term health conditions (chronic conditions) experienced poorer mental health due to isolation and self-isolation to reduce risk of exposure to COVID-19 (Fisher et al., 2021). In Canada, about 80%-90% of LTC residents are

affected by some form of mental disorder including dementia (Canadian Mental Health Association, 2016; Kehyayan et al., 2021). The effects of isolation on mental health decline including worsening depression, anxiety and behavioural changes related to dementia was a concern to many when the lockdown measures were mandated during the first wave of the COVID-19 pandemic in Canada (Checkland et al., 2021). In the United States (U.S.), there was a 15% increase in depressive symptoms among LTC residents (Levere et al., 2021). However, given that most mental health research focuses on community-based settings rather than LTC (Creighton et al., 2019), few studies have models of mood transitions in LTC homes (McArthur et al., 2021).

1.4.2 Purpose

The overall goal of this thesis is to assess factors associated with mood transitions based on depressive symptoms among residents of LTC homesin Canada and to investigate the differences in these factors before and during the COVID-19 pandemic. To achieve this goal, I examined the personal and facility level covariates that affect mood or depressive symptoms within this population.

1.4.3 Objectives

This thesis consists of four studies. Study 1 is a scoping review that provides an overview of existing literature to understand the effects of family and friends' visits or loneliness and of COVID-19 restrictions on residents' mood. Study 2 assessed incidence and severity of new depressive symptoms at three-month (i.e., 70-95 day) follow-up as the outcomes of interest among residents of Canadian long-term care

using a longitudinal analysis. Study 3, a retrospective longitudinal study that examined transitions in mood in residents of long-term care before the COVID-19 pandemic. Lastly, Study 4, an extension to Study 3, provides a comparison between transitions in both the pre-pandemic period and the first two waves of COVID-19.

1.5 Methodological Summaries of Studies

1.5.1 Study 1

This study examined existing literature to understand the effect of isolation and loneliness on the mood of long-term care (LTC) home residents, both before and during the COVID-19 pandemic.

1.5.1.1 Methods & framework: The study is a scoping review that used the Arksey and O'Malley (2005), as well as the Levac, Colquhoun, and O'Brien's (2010) suggestions. It also followed the Joanna Briggs institute guidelines to explore and synthesize existing literature information to explore the effects of isolation on the mood of LTC residents, and to compare between both the pre-COVID and COVID-19 periods. It summarizes evidence on the effect of isolation and loneliness on LTC residents by covering evidence from 2010-2023.

1.5.1.2 Research Questions: 1) What are the effects of family or friends' visitations or loneliness on the mood of residents of LTC homes? 2) What are the effects of COVID-19 restrictions on the mood of LTC residents?

1.5.2 Study 2

In this study we evaluated the effect of COVID-19 pandemic on incident mood disturbance among Canadian long-term care (LTC) home residents. Also, we

examined its effect in stratified models using resident (age group, sex, and cognitive performance) and facility-level variables (province, facility size and location).

1.5.2.1 Methods: We us a retrospective longitudinal study using interRAI MDS 2.0 assessment data from LTC homes in five Canadian provinces between March 1- March 31, 2019, and March 1- March 31, 2020. We analyzed our data using logistic regression models among the full cohort both pre-pandemic and during the COVID-19 pandemic to examine the effect of the pandemic exposure on the odds of expressing new depressive symptoms at follow-up. We also fit this model among each of the resident and facility-level strata to examine the effect on different sub-groups, removing the stratifying variable from the set of independent model variables as necessary.

1.5.2.2 Research Questions: 1) What are the person-level effect of COVID-19 pandemic exposure on incident mood disturbance among Canadian LTC home residents? 2) What are the effects of COVID-19 among various LTC home structural strata?

1.5.3 Study 3

This study examined the complex transitions between the different mood states and the absorbing states out of LTC settings. It was conducted as a continuation of Study 2 which only reports on incident mood disturbance among Canadian long-term care home residents and does not address the multidirectional changes or the absorbing states that act as competing risks.

1.5.3.1 Methods: A retrospective longitudinal analysis of residents residing in LTC homes in three Canadian provinces (Alberta, British Columbia, and Ontario) over a 10-year period from January 2010 to February 2020. A one-step Markov multistate transition model was used to examine transitions in mood over time as well as the factors affecting those transitions using the standardized interRAI MDS 2.0 comprehensive health assessment prior to the first year of the COVID-19 pandemic.

1.5.3.2 Research Questions: 1) What are the characteristics of transitions in mood over time and the factors affecting those transitions? 2) How do these factors relate to the absorbing states?

1.5.4 Study 4

This study expands on our knowledge from study 3 by treating COVID-19 as a covariate to examine the effects of COVID-19 on transitions between the transient mood states and the absorbing states in comparison to the pre-pandemic period.

1.5.4.1 Methods: A one-step multistate Markov transition model was used in a pan-Canadian retrospective longitudinal analysis.

1.5.4.2 Research Questions: 1) What are the characteristics of transitions in mood over time during COVID-19, and the factors affecting those transitions? 2) How do these factors relate to the absorbing states?

Chapter 2: Manuscript 1

Consequences of Isolation and Visitation Restrictions on Mood of Long-Term Care Residents Pre-COVID and During COVID-19: A Scoping Review

2.1 Introduction

The global burden of mental illness was estimated to account for between 14.6% and 32.4% of years lived with disability (YLDs) in 2019 (Institute for Health Metrics and Evaluation, 2020; Vigo et al., 2016). In Canada mental disorders were among the leading causes of all-age disability-adjusted life years (DALYs), which together with substance use disorders accounted for 14.5% of DALYs in 2016 (Lang et al., 2018). Mental health disorders are particularly common among residents of long-term care (LTC) homes (Chau et al., 2019; Seitz et al., 2010), affecting between 27% (Hoben et al., 2019) and 40% of all LTC residents in Canada (Kehyayan et al., 2021).

It is reported that about 40% of older adults residing in LTC homes in Ontario require psychiatric services (Estabrooks et al., 2020; Perlman et al., 2019), yet fewer than 5% actually receive such care (Estabrooks et al., 2020). Depression is the most common type of mental illness that affects people from any race, age and different levels of ability to perform their activities of daily living (National Institute of Mental Health, 2021). Among residents of LTC homes, depression is often undiagnosed because it may be difficult to detect due to residents' difficulty with communication, cognitive impairment, and a lack of mental health training among staff members (Hirdes et al., 2000; Huang & Carpenter, 2011; Szczerbińska et al., 2012).

In Canada, about 21% of residents are admitted to LTC homes with depressive symptoms that worsen over time (Canadian Institute for Health Information, 2021c). Due to its prevalence, chronicity and associated morbidity, depression poses a great burden compared with other mental illnesses when it comes to the services used

(Centers for Disease Control Prevention, 2016; Tanner et al., 2020). Depression not only affects the quality of life of individuals but has also been shown to be a leading cause of disability and excess mortality in Canada (GBD 2019 Mental Disorders Collaborators, 2022; Tanner et al., 2020). Notably, studies have reported that the odds of dying in older adults with depression is 1.5 to 2 times greater than those without (Blazer et al., 2001).

2.1.1 COVID-19 and Mental Health

The COVID-19 pandemic has brought needed attention to the mental health challenges faced by older adults, particularly in LTC homes. These challenges are attributed not only to the vulnerability of the residents, given their frailty and comorbidities, but also to the scarcity of essential resources. Staffing levels were an important type of resource limitation, but a shortage of personal protective equipment (Checkland et al., 2021; Chong et al., 2020) might have also contributed to fear of contracting the infection resulting in increased anxiety and stress. Further, LTC homes have a demanding environment that contributes to stress among staff members, families, and residents (Checkland et al., 2021). This stress was amplified by many factors, including the effects of isolation and lockdown measures throughout the pandemic. Under the most severe and worst conditions of COVID-19, Estabrooks et al. (2020) described what happened to the mental health of residents of LTC homes as “mental and emotional suffering”.

At the start of COVID-19, many Canadian provinces have sought to safeguard the well-being of LTC residents and staff by imposing limitations on visitor access.

These visitation restrictions created social disconnectedness, which has been associated with adverse health, psychological, and social outcomes among residents (Checkland et al., 2021; Montgomery et al., 2020; Wister et al., 2022). These restrictions have since been removed; however, it is important to understand their effects to inform future decisions should similar events to the COVID-19 pandemic occur again.

The expected effects of isolation, including worsening depression, was a concern to many in Canada when lockdown measures were mandated during the first wave of the COVID-19 pandemic (Checkland et al., 2021; Montgomery et al., 2020). In the United States, there was a 15% increase in depressive symptoms among LTC residents during the first wave (Levere et al., 2021). However, other studies found that the pandemic had no effect on mental health and mood disturbance (McArthur et al., 2021).Therefore, the available evidence on the mental health effects of the pandemic in LTC settings lacks a clear consensus.

Given that most mental health research has focused on community-based settings rather than LTC (Creighton et al., 2019), few studies have models of new incidence of mood or mood transitions in LTC facilities due to COVID restrictions (McArthur et al., 2021). This scoping review provides an overview of the consequences of isolation and loneliness on the mood of LTC home residents pre-COVID and during the pandemic, to better understand the effect of COVID-19 lockdown measures on mood disturbance in this population.

Due to the lack of a clear-cut definition of mood in the literature and the lack of a standardized measure, we defined it for the purpose of our scoping review and the other studies included in this dissertation as the presence of depressive symptoms and not the presence of depression as a clinical diagnosis. The presence of depressed mood could be due to the presence of a triggering factor and in this study is the presence of isolation/loneliness pre-pandemic and lockdown measures during the pandemic (G. S. Betini et al., 2021; Hirdes et al., 2022).

2.2 Methods

Researchers have investigated the effects of COVID-19 restrictions on the general population as well as vulnerable groups. However, few studies explored the impact of visitors' restrictions on the mood of residents in LTC. As such, we aimed to fill this gap using a scoping review to learn about what is known and unknown from previous studies (Arksey & O'Malley, 2005).

2.2.1 Research Questions

The purpose of this study was to explore the effects of isolation on the mood of LTC residents, and to compare between both the pre-COVID and COVID periods. To do so, we wanted to answer the following two questions:

1) What are the effects of family or friends' visitations or loneliness on the mood of residents of LTC homes?
2) What are the effects of COVID-19 restrictions on the mood of LTC residents?

2.2.2 Search Strategy

Our main approach adhered largely to the scoping review framework established by Arksey and O'Malley (2005), as well as Levac, Colquhoun, and O'Brien's (2010) suggestions. The Joanna Briggs institute guidelines were also followed to (1) develop the research question; (2) identify relevant studies; (3) select studies that meet inclusion criteria; (4) chart data (extraction, analysis and data presentation); and (5) summarize and analyze the results (The Joanna Briggs Institute, 2015). A deadline of November 22, 2023, was set for the inclusion of new studies in our scoping review.

2.2.2.1 Identifying Potentially Relevant Studies

A multi-step literature search was performed by two researchers (RTM, BNK) in 2023, where four academic literature databases were searched for peer-reviewed articles including PubMed, CINAHL, PsychInfo, and SCOPUS. Further, two databases were searched for grey literature including Google Scholar and medRixv (the preprint server for Health Sciences). For additional references, retrieved articles were manually searched for citations not identified in the searched databases.

The search strategy for this review, inclusive of relevant terms and key constructs, was developed in consultation with the health sciences librarian (J.S.) at the University of Waterloo, to capture the articles related to our research question (Table 2.1).

Table 2.1: Main Concepts and Keywords

Concepts	*Older adults 65+*	*Isolation*	*Long-term care homes*	*Mood disturbances*
Keywords	Aged Seniors Older adults Older Elderly	Restrictions Restrictive measures Loneliness Visits Visitations	LTC Long term care facilities Long-term care homes Nursing homes Residential facilities	Depression Depressive symptoms Depressive Mood Mood disturbance

2.2.2.2 Study Selection and Inclusion Criteria

Studies covering the period between 2010 and 2023 were kept in the scoping review if they met the following eligibility criteria: (1) assessed the mood or mental health status of residents of LTC homes; (2) mood disturbance was a consequence of restrictions on family and friend visitations; (3) residents were cognitively intact with no moderate or severe cognitive impairment; and (4) studies were available in the English language. Studies were excluded during the title, abstract, and full-text review if they (1) were review articles or controlled clinical trials; (2) assessed the implementation of an intervention to alleviate depressive symptoms from isolation/loneliness; or (3) assessed mood of residents using a proxy.

2.2.3 Charting the Data

2.2.3.1 Extracting Data

The template from Covidence Software was used to guide our extraction process. The extraction was carried out by one author only (R.T.M) where both qualitative and quantitative details were extracted. The quality of included studies was not assessed as the goal of this study was to map existing studies.

2.2.3.2 Collating, Summarizing, and Reporting Results

The findings of this scoping review are organized and presented in a tabular format for a visual representation (Appendix A). Additionally, a descriptive narrative summary has been provided to highlight and elaborate on the key issues, which are presented thematically. This approach allows for a comprehensive understanding of the reviewed material, combining both a visual overview and a detailed narrative exploration of the identified themes.

2.3 Results

2.3.1 Search and Article Selection

This scoping review retrieved a total of 3,652 articles from four academic literature databases and those used to search for grey literature. A total of 409 duplicates were removed, and 3,242 article titles and abstracts were screened independently by the two authors (R.T.M. and B.N.K.) for eligibility. Of those, 3,063 were deemed to be irrelevant and thus were excluded. The remaining 180 full-text studies were reviewed for eligibility, where an additional 149 studies were excluded

as they did not meet the inclusion criteria. This scoping review includes 31 studies (Figure 2.1) covering both the pre-COVID and COVID-19 periods.

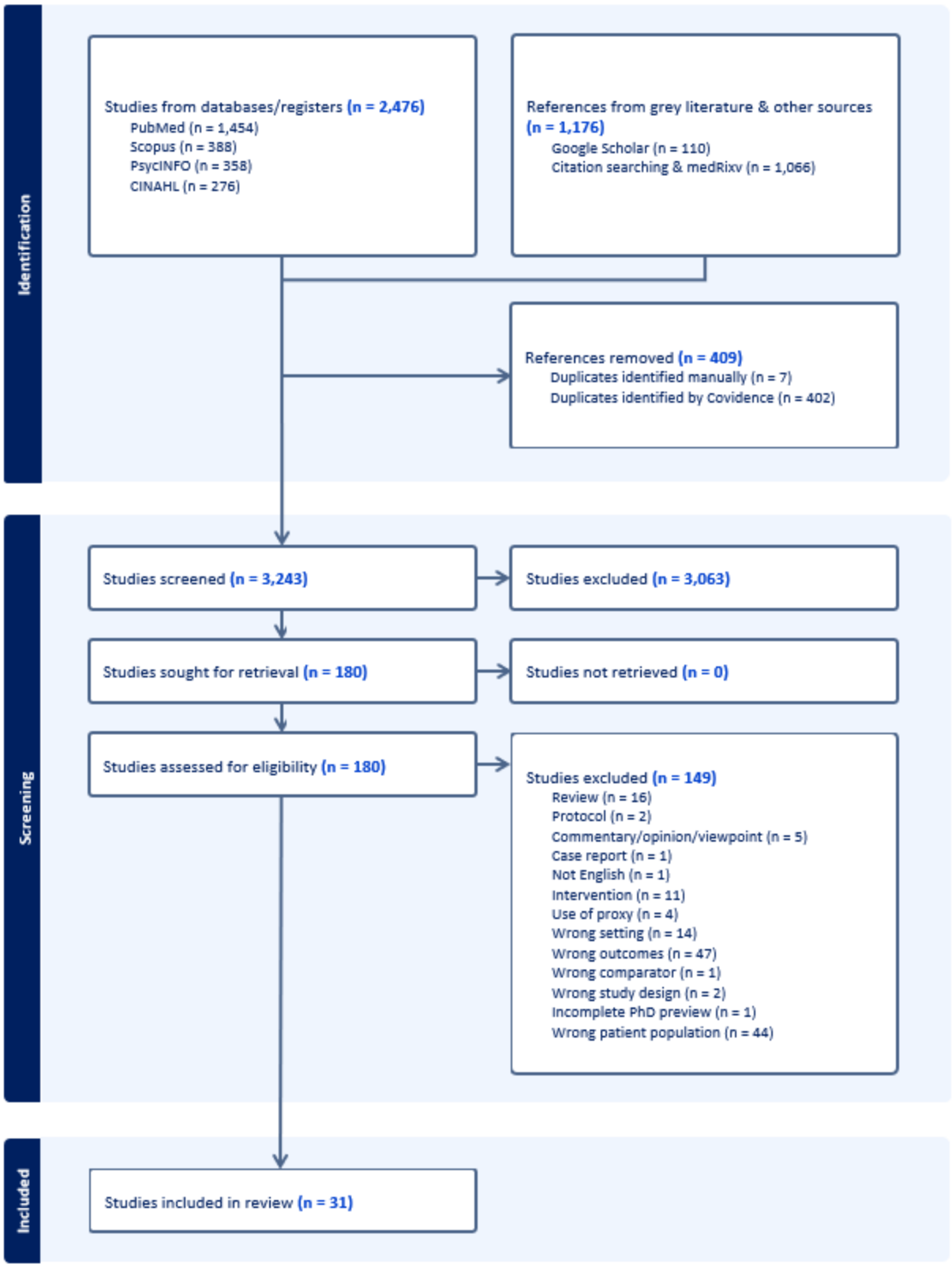


Figure 2.1: PRISMA Flow Diagram for Article Selection

2.3.2 Characteristics of the Studies

The majority of included articles in this scoping review were quantitative in nature (n= 23, 74.2%) (Angevaare, Joling, et al., 2022; Arpacıoğlu et al., 2021; Barnett et al., 2022; Cheng et al., 2010; Cheung et al., 2022; Cortés Zamora et al., 2022; Egeljić-Mihailović et al., 2022; Gan et al., 2015; Gao et al., 2023; Górski et al., 2022; Hsiao & Chen, 2018; Leedahl, 2014; Levere et al., 2021; McArthur et al., 2021; Meyer et al., 2011; Nair et al., 2021; Pascut et al., 2022; Patra et al., 2016; Pereiro et al., 2021; Pereiro et al., 2023; Turcotte et al., 2023; Van Der Roest et al., 2020; Wolff, 2013) including one PhD thesis (Leedahl, 2014), one pilot study (Meyer et al., 2011), one research letter (3.2%) (Van Der Roest et al., 2020), and one Mixed Methods study (3.2%) which was used for its quantitative findings because the focus group discussions did not meet our inclusion criteria (Angevaare, Joling, et al., 2022). There were five qualitative studies (16.1%) (Crespo-Martín et al., 2022; Kaelen et al., 2021; Montgomery et al., 2020; Raciti & Chang, 2023; Wu et al., 2023), Our review also included one book chapter (3.2%) (McArthur et al., 2023), one letter to the editor (3.2%) (Chong et al., 2020), and one report (3.2%) (Estabrooks et al., 2020) (Figure 2.2).

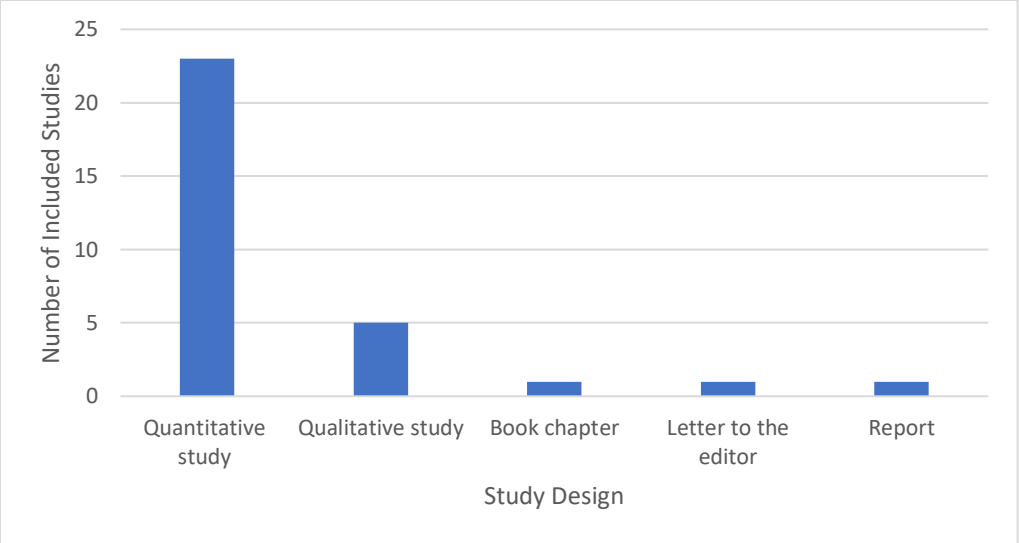


Figure 2.2: Types of Articles Included in the Scoping Review

Most of the included studies were done in the United Sates (n= 6, 20.0%) (Barnett et al., 2022; Leedahl, 2014; Levere et al., 2021; Meyer et al., 2011; Montgomery et al., 2020; Raciti & Chang, 2023), followed by Spain (n= 4, 13.3%) (Cortés Zamora et al., 2022; Crespo-Martín et al., 2022; Pereiro et al., 2021; Pereiro et al., 2023), and then China (n= 3, 10.0%) (Cheng et al., 2010; Gan et al., 2015; Wu et al., 2023). We found a total of four articles from Canada, including two studies related to our research question (6.5%) (McArthur et al., 2021; Turcotte et al., 2023), one report (3.2%) (Estabrooks et al., 2020), and one book chapter (3.2%) (McArthur et al., 2023). All other countries (Appendix A) had only one study each (3.2%) (Angevaare, Joling, et al., 2022; Arpacıoğlu et al., 2021; Cheung et al., 2022; Chong et al., 2020; Gao et al., 2023; Górski et al., 2022; Hsiao & Chen, 2018; Kaelen et al., 2021; Nair et al., 2021; Pascut et al., 2022; Patra et al., 2016; Wolff, 2013) (Figure 2.3).

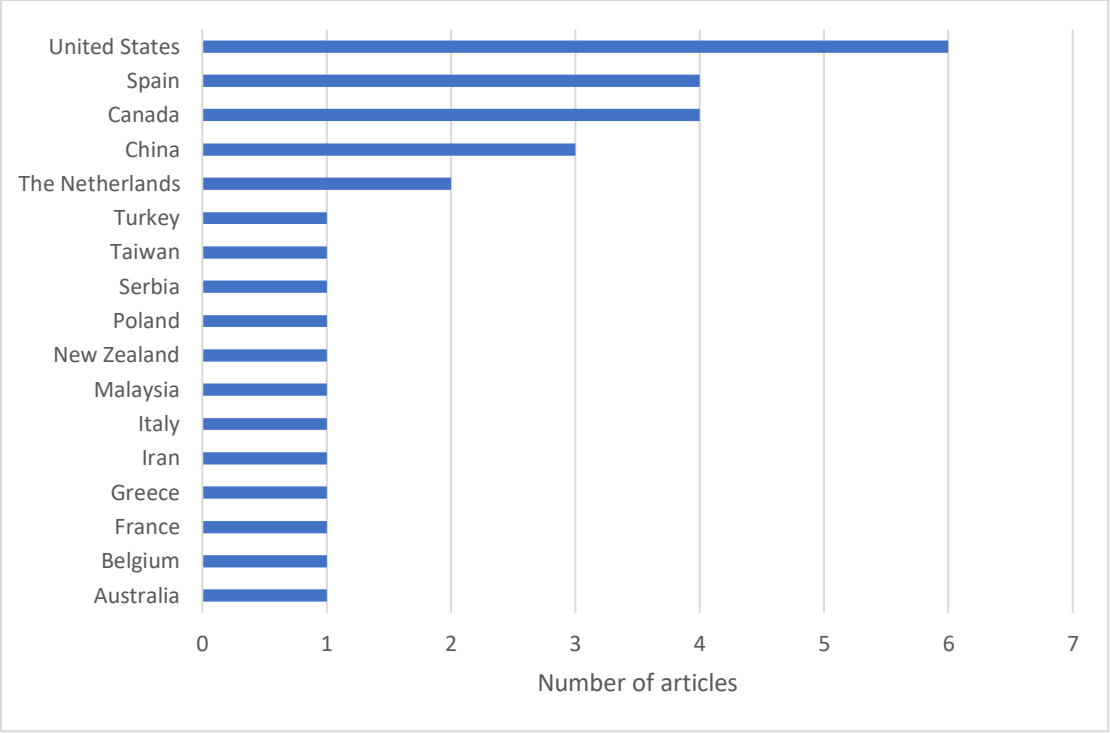


Figure 2.3: Distribution of Articles by Country of Origin

The mean age of older adults residing in LTC homes of 81.6 years was calculated from 19 studies only, since not all studies reported it, with the widest age range of 58-101 (Kaelen et al., 2021). On average, the majority of participants were female residents 63.8%, with the largest female sample of 81.8% (Meyer et al., 2011) and the lowest was 43.7% (Gao et al., 2023).

Figures 2.4 and 2.5 show the depression measures used in the included quantitative studies and the distribution of these measures by country of study. The GDS was used to measure depressive symptoms in the majority of the quantitative studies (n= 11, 52.4%), including the quantitative section from the mixed method study conducted by Angevaare et al. (2022) (Cheng et al., 2010; Cortés Zamora et al.,

2022; Egeljić-Mihailović et al., 2022; Górski et al., 2022; Hsiao & Chen, 2018; Leedahl, 2014; Meyer et al., 2011; Nair et al., 2021; Patra et al., 2016; Pereiro et al., 2021; Pereiro et al., 2023). All the studies included from Spain used GDS (Figure 2.5). The next scales coming in second place were both DRS (n= 3, 14.3%) (Angevaare et al., 2022; Cheung et al., 2022; McArthur et al., 2021) and PHQ-9 (n= 3, 14.3%) (Barnett et al., 2022; Gao et al., 2023; Levere et al., 2021) (Figure 2.4). The DRS was used in the studies conducted in Canada, New Zealand and the Netherlands (Figure 2.5) (Angevaare et al., 2022; Cheung et al., 2022; McArthur et al., 2021). Lastly, the PHQ-9 was used in the study conducted in Iran, and in two studies conducted in the United States (Barnett et al., 2022; Gao et al., 2023; Levere et al., 2021).

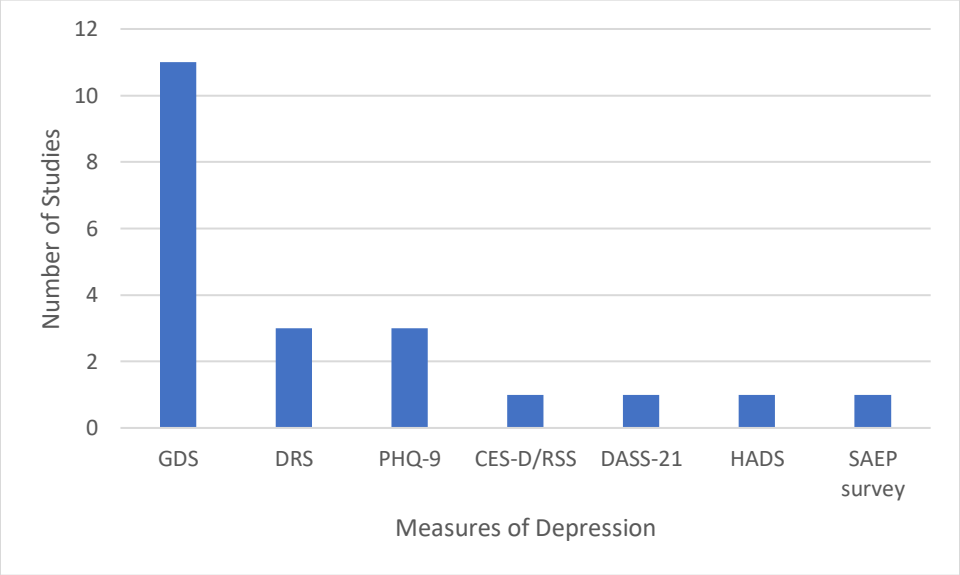


Figure 2.4: Depression Measures Used in the Included Quantitative Studies

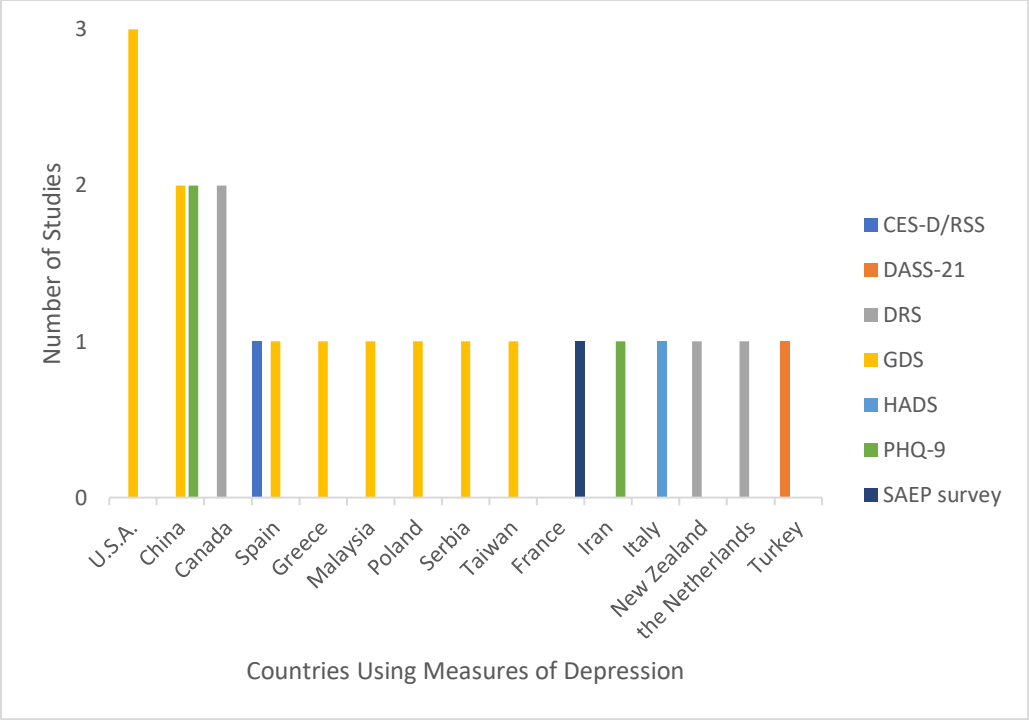


Figure 2.5: Distribution of Depression Measures by Country of Study

2.3.3 Quality of Included Studies

The quality of the included studies was not assessed as mentioned earlier, however, it is very important to note that there are important differences in the sample size, sampling strategies and study designs which affect the quality of evidence as well as replicability and generalizability of the results. The aim for qualitative research is to reflect the experience of individuals and not to generalize the results to the larger population (Austin & Sutton, 2014). In that light Table 2.2 below only includes the quantitative studies.

The following table highlights the sample size, and sampling strategies used for data collection in each study.

Table 2.2: Sample size and sampling strategies for the Quantitative Studies

Author	Year	Sample size	Sampling strategy
Cheng, Lee and Chow	2010	71	Referred by NH managers
Meyer, Marx and Ball-Seiter	2011	33	Potential participants were identified through chart reviews and through recommendations from the directors of nursing at three rural nursing homes.
Wolff	2013	1,802	Random sampling
Leedahl	2014	140	Two-stage multilevel sampling technique to obtain a stratified random sample of nursing homes, and then a random sample of older adult residents from each of the nursing homes
Gan et al.	2015	71	Convenience sampling
Patra et al.	2016	170	Undetermined
Hsiao and Chen	2017	327	Purposive sampling
Van der Roset et al.	2020	193	Undetermined
Arpacioglu et al.	2021	150	Random sampling
Levere et al.	2021	29,097	Secondary data
McArthur et al.	2021	765	Secondary data
Nair et al.	2021	224	Undetermined
Pereiro et al.	2021	98	Undetermined
Angevaare et al.	2022	923	Secondary data
Barnett et al.	2022	997, 418	Secondary data
Cheung et al.	2022	25,300	Secondary data
Corte's Zamora et al.	2022	215	Undetermined
Egeljić-Mihailović et al.	2022	299	Convenience sampling
Gorski et al.	2022	58	Undetermined

Author	Year	Sample size	Sampling strategy
Pascut et al.	2022	282	Undetermined
Gao, Mosazadeh, and Nazari	2023	323	Convenience sampling
Pereiro et al.	2023	365	Secondary data
Turcotte et al.	2023	508,842 observations	Secondary data

Six studies only were conducted during the pandemic, all of which compared between pre-COVID and COVID time periods (Angevaare, Joling, et al., 2022; Barnett et al., 2022; Cheung et al., 2022; Levere et al., 2021; McArthur et al., 2021; Turcotte et al., 2023). Of those, three studies were nationwide (Barnett et al., 2022; Cheung et al., 2022; Turcotte et al., 2023), the largest two were those of Barnett et al. (2022) with 997,418 individuals and Turcotte et al. (2023) with 508,842 observations from three fiscal years. The exact number of unique individuals in the study by Turcotte et al. (2023) was not possible to identify, and an individual could have appeared in multiple years.

Due to the large number of individuals, observations, and the nationwide data collection from two periods pre-COVID and during COVID, this makes Barnett's and Turcotte's findings robust and generalizable.

Another study that examined 224 LTC homes across Connecticut in the United Sates was by Levere et al. (2021) with a large sample size of 29,097 individuals, also comparing between pre-COVID and the pandemic period. Similarly, a nationwide study in New Zealand by Cheung et al. (2022) examined 25,300 individuals and comparing both time periods.

2.3.4 Summary of Findings

2.3.4.1 Effects of Family, Friends' Visitations or Social Interaction on the Mood of LTC Home Residents Pre-COVID

Studies conducted prior to the pandemic highlighted the crucial role of family, staff, and fellow resident interactions for positive well-being in institutionalized individuals. Cheng et al. (2010) stated that what matters is the quality of the interaction regardless of the network size.

Studies showed a noteworthy positive significant correlation between different measures of depression, social isolation, and loneliness (Pearson's r = 0.30, 0.48, 0.043), respectively (Gan et al., 2015; Meyer et al., 2011; Wolff, 2013), and negative correlation between scores on the GDS and the Multidimensional Scale of Perceived Social Support (MSPSS) (Pearson's r = -0.55) (Patra et al., 2016). This indicates that greater perceived social support is associated with lower depression scores .These findings align with another study demonstrating significant negative correlations between social engagement and depression (Leedahl, 2014).

The exploration of social contact patterns and frequency among institutionalized residents showed that the quality of support and contact provided is more significant than the frequency of visitations and number of visitors in relationship to well-being (Cheng et al., 2010). These results were similar to those found by Hsiao and Chen (2018) that showed family closeness and number of family members visiting were not statistically significance as predictors of depression. This

was also seen in Wolff's (2013) study where friendship ties appeared to be more important than visits from family and relatives.

In agreement with the above findings, interactions with care setting residents, and civic engagement were found to be protective against depression (Hsiao & Chen, 2018). Together, these results point to the positive role of social support and contact in the mental well-being of institutionalized individuals.

2.3.4.2 Effects of Family, Friends' Visitations or Social Interaction on the Mood of LTC Home Residents During COVID-19

During COVID-19 pandemic, lockdown and visitation restrictions took place to limit the exposure of residents to COVID and to limit its spread among them. Studies on the mental health of older adults during the initial phases of the pandemic presented conflicting findings. The majority of included studies showed similar findings for the effect of isolation and visitors' restrictions on the mental health and mood status of older adults residing in LTC homes. After the initial phase of restrictions (six to ten weeks after visitors' ban) there were reports of heightened levels of loneliness, depression, and a notable increase in mood and behavioral problems (Van Der Roest et al., 2020). Residents without cognitive impairment seemed to experience the most substantial impact (Van Der Roest et al., 2020).

The increase in prevalence of depression and anxiety symptoms during the pandemic may be attributed to isolation, which could be a result of several factors including a decline in direct care provision due to staff shortage or the implementation of policies restricting visitor access (Levere et al., 2021; Nair et al.,

2021; Wu et al., 2023). Residents felt lonely, sad, experienced bouts of crying, confusion, and experienced weight loss and anger (Crespo-Martín et al., 2022; Kaelen et al., 2021; Montgomery et al., 2020; Raciti & Chang, 2023; Wu et al., 2023). Kaelan et al. (2021) in their qualitative study hypothesized that loss of freedom, stimulation, autonomy, and social life that some LTC residents experienced during lockdowns may have contributed to the residents' feelings during this time period (Kaelen et al., 2021). LTC residents displayed significantly higher scores in depression during COVID's lockdown when compared to pre-COVID and community-dwelling older adults (Arpacıoğlu et al., 2021; Barnett et al., 2022; Cheung et al., 2022; Egeljić-Mihailović et al., 2022; Gao et al., 2023; Górski et al., 2022; Nair et al., 2021; Pascut et al., 2022). Further, residents who spent time alone or those with no social participation (95% CI 0.024-0.32) or with no activities/hobbies (95% CI 1.73-67.35) showed more depressive symptoms respectively, than those who were socially engaged (Arpacıoğlu et al., 2021; Nair et al., 2021; Pascut et al., 2022). This was also observed in the longitudinal study by Pereiro et al. (2021) where there was a significantly higher depressive symptomology in the post-lockdown than the pre-lockdown period ($\eta_p^2 = 0.125$) (Pereiro et al., 2021).

The pandemic may have altered residents' mood due to the fear of COVID, leading many to isolate themselves and subsequently experience feelings of loneliness and depression (Chong et al., 2020; Gao et al., 2023). Anxiety could have also been triggered among residents of LTC homes by the use of protective personal equipment (PPE) by staff members, where the familiar faces became not so much familiar

anymore that could have elevated stress levels (Estabrooks et al., 2020) which in turn could affect mood.

All the above findings differed from the findings of McArthur et al. (2021) and Angevaare et al. (2022) that showed a decrease in the percentage of residents showing signs of depression from 19.9% before lockdown to 11.5% after lockdown in the former and no clinically significant adverse effects of the lockdown on the mood of residents in Dutch long-term care facilities in the latter (Angevaare, Joling, et al., 2022; McArthur et al., 2021). Turcotte et al. (2023) also was in agreement with McArthur and Angevaare's findings where the authors found that in Manitoba and Ontario, a decreased number of residents experienced worsening in depressive symptoms. Despite a small but statistically significant rise in self-reported mood symptoms during the lockdown, the overall effect size was minimal (Angevaare, Joling, et al., 2022). Further, Pereiro et al. (2023) and Cortés Zamora et al. had similar findings where the authors stated their results did not show evidence for worsening of the pre-pandemic GDS measures that were associated with lockdown restrictions during the pandemic. Some of these homes adopted and implemented strategies to maintain social engagement during the pandemic (McArthur et al., 2021).

2.4 Discussion

Social engagement and support play important roles in influencing mental well-being. The findings of this scoping review provide insights into the possible associations of visits and social interactions with family and friends on mood of residents in long-term care (LTC) homes, both prior to and during the COVID-19 pandemic. It is noteworthy, however, that most of the quantitative studies encompassed in this review are cross-sectional, posing challenges in establishing causal relationships and capturing mood changes over time. These limitations are particularly relevant in the context of the unique preventive measures implemented during the COVID-19 pandemic, as these measures were unprecedented and affected all populations. While initially constituting a potential shock, individuals have shown resilience and an inherent capacity to adapt to such novel circumstances. Understanding the nuanced dynamics of these effects over time is critical, especially in the context of a pandemic like COVID-19 where the nature of preventive measures differs significantly from routine experiences.

Prior to the pandemic, research consistently emphasized the important role of social interactions in the well-being of institutionalized individuals. Neither the government nor LTC homes were prepared for such a pandemic as that of COVID-19. The restrictions mandated have resulted in undesired consequences among residents of LTC homes. It was very important to mandate these safety measures, but the lack of comprehensive, person-centered care and without considering the residents' mental needs led to the unintended consequences (Office of the Chief Science Advisor

of Canada, 2020), like social isolation that negatively affected mood and other mental health aspects like increasing anxiety of residents. It was not until Summer of 2020 when the special task force suggested in their report to the chief science advisor of Canada that that "a humane and compassionate approach with LTC residents, their families, and the staff who care for them" should be adopted (Office of the Chief Science Advisor of Canada, 2020). We believe that findings from previous research prior to the pandemic could have been used to inform approaches about how to balance the risks of physical health and mental health associated with restrictions in visiting patterns. Most included articles focused on the effects of visitation restrictions on the mental health of LTC home residents during the pandemic; however, those restrictions may not have been ***solely*** responsible for changes in mood or depressive symptoms at that time.

Many other factors may have contributed to the mental health disturbances that occurred, including staff shortages, use of external agency staff, limited staff education about mental health among the older population, reduced presence by medical directors (Checkland et al., 2021; McArthur et al., 2023). In addition to constraints on recreation therapy and other activity programs, functional decline, restrictions on movement within facilities, changing in dining experiences due to infection control protocols, stress among staff members, reduced volunteer involvement, and poor access to mental health services for those residing in LTC homes (Checkland et al., 2021; McArthur et al., 2023). Uncertainty about risks and concerns for the well-being of family members outside of the home were among the

other factors that could have affected mood of residents of LTC homes (Wu et al., 2023).

The noted variation in findings could be attributed to methodological differences between studies including differences in the measures of depression or depressive symptoms, sample size and representativeness, consideration of structure and process indicators (e.g., staffing patterns) and timing of the observation during different waves of the pandemic. During the pandemic numerous homes successfully implemented measures to alleviate these challenges, which might have also contributed to the variation in findings (McArthur et al., 2023). Hence, the adverse effects associated with the pandemic may not have been uniformly distributed across all homes. The diversity of findings underscores the complexity of factors influencing residents' mood during a global health crisis. It suggests a need for a nuanced understanding of the interplay between social interactions, pandemic-induced restrictions, and individual coping mechanisms. It also highlights the need to use a standardized measure for depressive symptoms globally to prevent biases and inconsistencies that might arise from using different measures. Future research should explore these dynamics further to inform targeted interventions and support systems for LTC residents facing unprecedented challenges in maintaining their mental well-being.

2.5 Implications and Future Directions

Dealing with a global pandemic like COVID-19 forces us to make difficult choices where navigating the challenges involves striking a delicate balance between

mitigating risks to physical health and addressing the impact on mental well-being. The experience of this pandemic highlights the need for future approaches to adopt a nuanced perspective, learning from the lessons of COVID-19. While safeguarding physical health remains paramount, it is very important to consider and minimize the potential harm to mental health. It is about finding a balanced approach that recognizes the interconnectedness of these two aspects.

Additionally, interventions aimed at mitigating the mental health impact of lockdowns should be explored, including innovative approaches to facilitate social connections while adhering to safety measures such as using effective communication (Angevaare, Joling, et al., 2022; McArthur et al., 2023; Wu et al., 2023), personalization of PPEs and training the staff on empathy and compassion. Longitudinal studies are needed to understand the sustained effects of the pandemic on LTC residents' mental well-being and to inform targeted interventions that promote resilience in the face of future challenges.

2.6 Limitations

Our scoping review has some limitations, first we have decided to understand only one aspect that might influence mood, which is visitation restrictions. Although, other factors such as staff shortage and lack of resources not explored by the included studies may have also contributed to the change in mood of residents of LTC homes. Exploring other factors would have helped us better understand the association with mood to explore more interventions to improve the mental health well-being of older adults.

2.7 Conclusion

The COVID-19 pandemic has had a substantial impact on long-term care (LTC) homes, significantly influencing the physical and mental well-being of residents. The increased vulnerability of older adults, along with essential preventive and infection control measures, has led to a challenging environment in these care facilities. The COVID-19 pandemic highlighted pre-existing challenges in the LTC system, emphasizing the importance of comprehensive strategies to safeguard the mental health of LTC home residents. It is important to plan in a way that combines measures ensuring both physical safety and mental well-being acknowledging the intricate relationship between infectious disease control and psychological health.

Chapter 3: Manuscript 2

What Happened to Residents' Mood in Canadian Long-Term Care Homes During the COVID-19 Pandemic? A Longitudinal Analysis

3.1 Introduction

Long-term care (LTC) residents were at high risk of contracting and dying from COVID-19, accounting for 43% deaths among Canadians during the first 18 months of the pandemic (Canadian Institute for Health Information, 2021a). This is due to several factors, including medical vulnerability caused by to frailty and multimorbidity, infection prevention and control challenges associated with congregate living in outdated facility designs, and limited staff resources to deliver care during outbreaks (Declercq et al., 2020; Heckman et al., 2021; Hirdes, Declercq, et al., 2020; Ontario's Long-Term Care COVID-19 Commission, 2021; N. Stall et al., 2021).

In Canada, multiple COVID-19 policy directives were implemented at provincial levels to protect LTC residents, particularly in advance of priority access to vaccines. These strategies included non-pharmacological measures such as isolation and resident cohorting, visitor restrictions, hand hygiene, and mask-wearing (Vilches et al., 2021). The aim was to limit the spread of infection.

However, concerns were raised by the Canadian Academy of Geriatric Psychiatry (CAGP) and Canadian Coalition for Seniors' Mental Health (CCSMH) that resident mental health was at risk of deterioration due to these control measures (Checkland et al., 2021). Indeed, a 15% increase in depressive symptoms was observed between mid-April to mid-May, 2020 among LTC residents in the United States (Levere et al., 2021). Conversely, a single-province study where COVID-19 was not yet widespread found no impact of lockdown measures on resident mental health

during the first wave of the COVID-19 pandemic in Canada (McArthur et al., 2021). The authors suggested that negative mental health effects linked to lockdowns may have been alleviated through careful intervention, increased activity staff resources, effective communication with family, and continuous assessment using clinical information systems. A different study of subjective quality of life ratings by LTC residents in Canada and the US showed that there were worsened ratings of social life in those settings using the interRAI Self-Report Quality of Life assessment. However, the authors found no adverse effect on dimensions like staff responsiveness or caring staff (McArthur et al., 2023).

In 2019-2020, prior to the start of the COVID-19 pandemic, national-level risk-adjusted quality indicators that are publicly reported by the Canadian Institute for Health Information (CIHI) and calculated using data from interRAI Resident Assessment Instrument (RAI) Minimum Dataset 2.0 (MDS 2.0) comprehensive health assessments, indicate that about 21% of LTC residents experienced worsening depressive symptoms between routine consecutive three-month assessments (Canadian Institute for Health Information, 2019). A similar province level rate (21.0%) was reported in 2020-2021 (Canadian Institute for Health Information, 2021c). These two reports combined all assessments from those fiscal years at the provincial level which may have masked the effects of the pandemic and associated lockdowns at the home and individual levels that were specific to more limited time periods.

Using routinely collected, pan-Canadian MDS 2.0 assessment data, the objective of this study was to evaluate the person-level effect of COVID-19 pandemic exposure on incident mood disturbance among Canadian LTC home residents. Given previously documented variation in the effects of COVID-19 among LTC homes located in various provincial, urban/rural, and facility size-based sub-groups, we also examined the effect of COVID-19 among various LTC home structural strata.

3.2 Methods

3.2.1 Study Design and Setting

We completed a longitudinal study of LTC home residents in Alberta, British Columbia, Manitoba, Newfoundland and Ontario, Canada who were assessed using the standardized interRAI MDS 2.0 comprehensive health assessment prior to, and during, the first year of the COVID-19 pandemic.

3.2.2 Data Source

We used interRAI MDS 2.0 assessment records from CIHI's Continuing Care Reporting System (CCRS). The MDS 2.0 assessment is used to plan care, evaluate quality, and allocate funding based on individual resident needs (Fries et al., 2007; Hirdes et al., 2003; Morris et al., 1999). Reliability and validity of the MDS 2.0 is well established (Hirdes et al., 2013; Morris et al., 1997; Poss et al., 2008; Turcotte et al., 2018). As part of routine care, residents are assessed within 14 days of admission to LTC homes. Subsequent assessments are administered every three months, or sooner if there is a significant change in their health status.

3.2.3 Study Cohort

The study cohort comprised LTC residents that were assessed with the MDS 2.0 between March 1st and March 31st in the 2019 (i.e., pre-COVID) or 2020 (i.e., COVID) calendar years. We selected baseline MDS 2.0 assessments within these dates as they coincide with March 17th, 2020, the date of the first COVID-19 outbreak in a Canadian LTC home (Hsu et al., 2021). Residents were retained in the cohort if a subsequent MDS 2.0 assessment, completed 70 days and 95 days from the baseline assessment was available. CIHI reports indicated that most homes continued to provide these assessments on time; however, homes that were struggling with severe outbreaks may have been excluded if they submitted data outside of these time periods.

The aim of this study was to identify risk factors for ***new*** onset of depressive symptoms. Therefore, we restricted the cohort to residents with no depressive symptoms (Figure 3.1) or depression diagnoses indicated on the baseline MDS 2.0 assessment. In addition to residents aged 18 years or less at baseline, we excluded residents that were comatose at either baseline or follow-up.

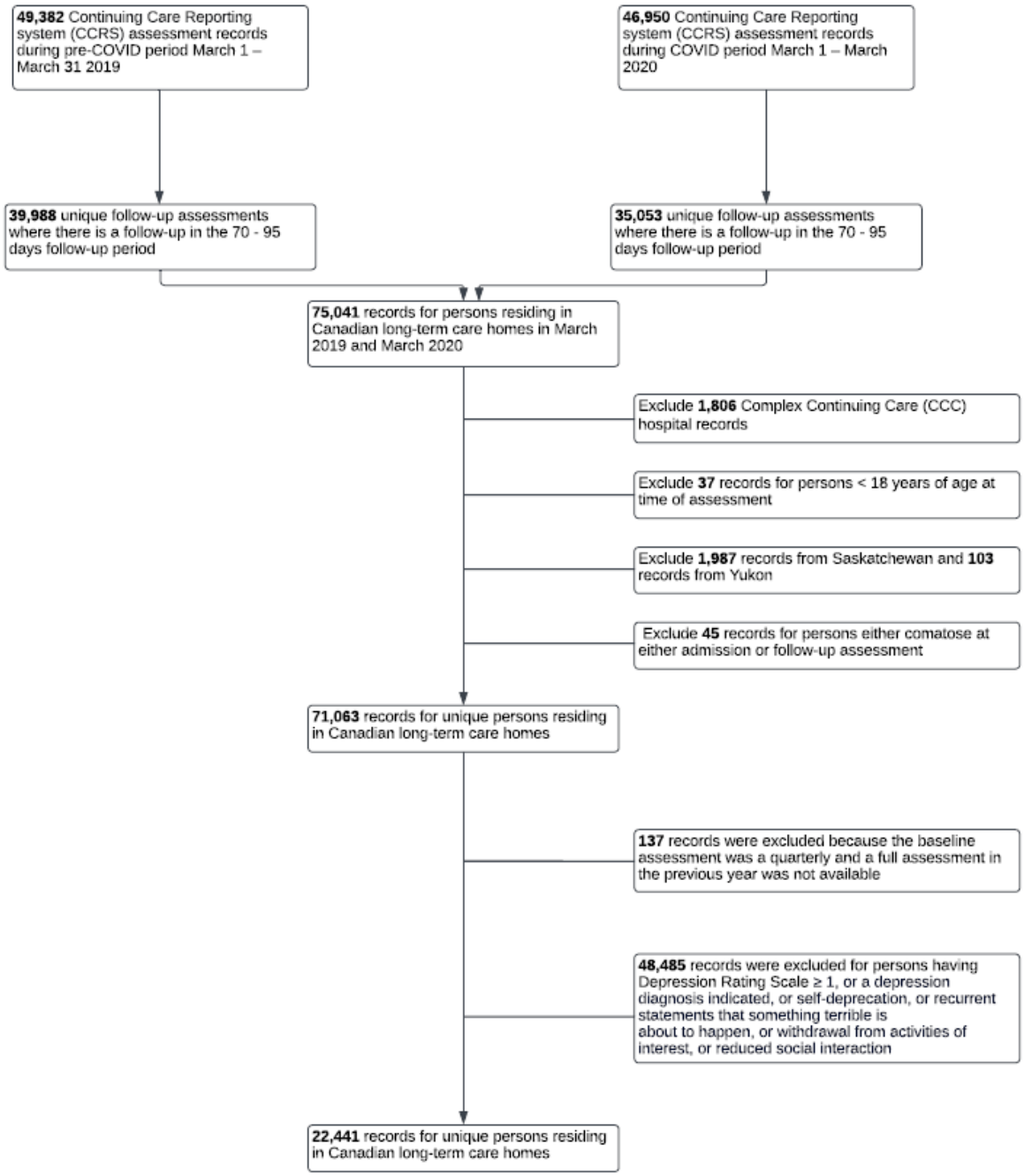


Figure 3.1: Flow Diagram of Cohort and Mood Decline Pre-COVID and During COVID in Long-term Care Residents in Canada

3.2.4 Outcome of Interest

We measured incidence and severity of new depressive symptoms at three-month (i.e., 70-95 day) follow-up as the outcomes of interest. These outcomes were measured using the Depression Rating Scale (DRS), which is calculated based on 30-day clinician observation of the frequency of seven mood and behaviour items (i.e., negative statements, persistent anger, unrealistic fears, repetitive health complaints, repetitive anxious complaints, sad or worried or facial expression, and crying) (Burrows, 2000; Szczerbińska et al., 2012).

Prior validation studies indicate that DRS scores of three and greater are positively associated with diagnoses of depressive disorders (Burrows, 2000; Hoben et al., 2019; Koehler et al., 2005; Martin et al., 2008). DRS provides a standardized, and comprehensive clinician rated assessment of residents in LTC homes. It is widely used internationally, including in different Canadian provinces (Hirdes et al., 2011; Hoben et al., 2019; Koehler et al., 2005; Neufeld et al., 2014).

To allow reporting of class-level odds ratio statistics, we collapsed the 14-point DRS into three ordinal categories using groups specified in the interRAI care planning protocols for mood disturbance (Morris et al., 2011). A DRS score of 0 at follow-up indicated no new depressive symptoms. DRS scores of 1-2 represented the incidence of mild depressive symptoms, whereas scores of 3 or greater represented progression to moderate or worse depressive symptoms.

3.2.5 Independent Variables and Exposures

All independent variables used in this study were measured using the baseline MDS 2.0 assessment. Sociodemographic variables include age group, sex, and marital status. Measures of health and well-being included chronic conditions and psychosocial well-being. We also used several validated summary scales including the Cognitive Performance Scale (CPS) (Morris et al., 1994), Activities of Daily Living Self-Performance Hierarchy (ADLH) Scale (Morris et al., 2013; Morris et al., 1999), Changes in Health, End-Stage Disease, Signs, and Symptoms Scale (CHESS) (Hirdes et al., 2003; Hirdes et al., 2014), Aggressive Behaviour Scale (ABS) (Perlman & Hirdes, 2008), Pain Scale (Fries et al., 2001), Major Comorbidity Count (MCC) (Hirdes, Declercq, et al., 2020), and the Index of Social Engagement (ISE) (Gilbart & Hirdes, 2000). Facility-level variables included Canadian province, urban/rural location, and LTC home size.

Our primary exposure of interest was care received at the beginning of the COVID-19 pandemic (i.e., baseline assessment completed between March 1st and March 31st, 2020). Resident and facility-level factors hypothesized to reflect variation in perceived and realized COVID-19 pandemic exposure included age group, sex, Canadian province, LTC home location, and size. These variables were used to differentiate cohorts in stratified explanatory models.

3.2.6 Statistical Analysis

We computed descriptive statistics for all independent variables to identify potential exposure period (i.e., pre-COVID vs. COVID) within the overall analytic

cohort. Chi-square tests using a 0.05 alpha threshold were used to identify statistically significant differences between exposure periods (Appendix B).

We identified factors associated with the incidence and severity of new depressive symptoms at follow-up among the unexposed, pre-COVID, portion of the overall cohort by fitting a partial proportional odds logistic regression model. Candidate variables for the model were selected based on the literature review and were retained in the final model based on P-value < 0.05.

Next, we fit a partial proportional odds logistic regression model among the full cohort to examine the effect of the pandemic exposure on the odds of expressing new depressive symptoms at follow-up, thereby adjusting for empirically identified confounders. We also fit this model among each of the resident and facility-level strata to examine the effect on different sub-groups, removing the stratifying variable from the set of independent model variables as necessary.

All analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NC).

3.3 Results

3.3.1 Baseline Characteristics

Our cohort comprised a total of 22,441 LTC residents, of whom 11,532 were residents of LTC during the pre-COVID period and 10,909 during COVID-19 period (Figure 3.1). The baseline characteristics of pre-pandemic and pandemic period exposure groups were comparable (Table 3.1).

Table 3.1: Baseline Characteristics by COVID-19 Period in Canadian Long-term Care Homes 2019-2020, Canada N=22,441

Variable	Pre-COVID (n = 11,532)	COVID (n = 10,909)	P-vale
Sex			0.49
Male	35.7% (4,122)	36.2% (3,948)	
Female	64.3% (7,410)	63.8% (6,961)	
Age Group			0.38
18 to 44	0.6% (71)	0.7% (73)	
45 to 64	6.1% (706)	5.8% (632)	
65-74	11.3% (1,302)	11.2% (1,218)	
75-84	25.9% (2,982)	26.5% (2,895)	
85-94	43.6% (5,032)	42.7% (4,659)	
95+	12.5% (1,439)	13.1% (1,432)	
Marital Status			0.86
Not Married	77.5% (8,942)	77.4% (8,448)	
Married	22.5% (2,590)	22.6% (2,461)	
Cognitive Performance Scale			0.86
0	12.6% (1,456)	12.7% (1,385)	
1 to 2	30.7% (3,535)	30.2% (3,295)	
3 to 4	37.4% (4,315)	37.4% (4,084)	
5 to 6	19.3% (2,226)	19.7% (2,145)	
Activities of Daily Living Hierarchy Scale			0.006
0	4.9% (569)	4.1% (446)	
1 to 2	18.1% (2,088)	17.4% (1,896)	
3 to 4	47.1% (5,428)	48.0% (5,239)	
5 to 6	29.9% (3,447)	30.5% (3,328)	
Changes in Health, End-stage disease and Signs and Symptoms Scale			0.60
0	56.8% (6,550)	56.7% (6,189)	
1 to 2	40.9% (4,718)	40.8% (4,448)	
3+	2.3% (264)	2.5% (272)	
Aggressive Behaviour Scale			0.14
0	81.2% (9,366)	81.6% (8,901)	
1 to 4	17.5% (2,021)	17.4% (1,901)	
5+	1.3% (145)	1.0% (107)	
Index of Social Engagement			0.06
0	7.0% (810)	6.7% (734)	
1 to 2	27.0% (3,108)	27.9% (3,044)	
3 to 4	41.2% (4,754)	41.9% (4,570)	
5 to 6	24.8% (2,860)	23.5% (2,561)	
Pain Scale			0.0006
0	80.0% (9,226)	81.8% (8,924)	
1	15.3% (1,766)	14.5% (1,580)	
2	4.3% (497)	3.4% (372)	
3	0.4% (43)	0.3% (33)	

***Major Comorbidity Count**			0.27
0	12.2% (549)	11.9% (484)	
1 to 2	79.6 % (3,583)	78.9% (3,198)	
3+	8.2% (369)	9.2% (372)	
Anxiety Diagnosis			0.91
No	93.1 % (10,739)	93.2% (10,163)	
Yes	6.9% (793)	6.8% (746)	
Conflict with Staff, Family, Friends, or Other Residents			0.93
No	96.1% (11,076)	96.0 (10,475)	
Yes	4.0% (456)	4.0% (434)	
Does Not Adjust Easily to Change in Routines			0.77
No	92.8% (10,699)	92.7% (10,110)	
Yes	7.2% (833)	7.3% (799)	
Newly Admitted Resident Status			0.06
No	88.2% (10,176)	89.0% (9,713)	
Yes	11.8% (1,356)	11.0% (1,196)	
Canadian Province			0.008
Alberta	10.0% (1,153)	10.9% (1,192)	
British Columbia	23.8% (2,747)	22.5% (2,450)	
Manitoba	5.9% (677)	6.5% (704)	
Newfoundland	2.2% (257)	2.5% (271)	
Ontario	58.1% (6,698)	57.7% (6,292)	
LTC Home Size			0.70
Small	1.5% (170)	1.4% (148)	
Medium	22.8% (2,627)	23.0% (2,512)	
Large	75.8% (8,735)	75.6% (8,249)	
LTC Home Location			0.10
Urban	89.6% (10,334)	90.3% (9,847)	
Rural	10.4% (1,198)	9.7% (1,062)	

*Major Comorbidity Count has large missing values

3.3.2 Incident Depressive Symptoms by Exposure Group

Among the pre-COVID period exposure group, 13.7% (n = 1,585) of residents experienced new mild depressive symptoms (DRS 1-2) at follow-up, with an additional 4.7% (n = 541) experiencing moderate to severe symptoms (DRS 3+). Respectively, these rates increased to 15.1% (n = 1,649) and 5.1% (561) among residents who received care during the COVID period (Table 3.2). Higher transition rates in mood were seen in females in the COVID period. This was also seen in the 75–84 year-old category and was not significant for those who were married. Residents with CPS scores of 1-2 were more likely to have higher rates of transitions in mood during COVID and those with ADLH scores of 3-4, CHESS of 1-2, and ABS 0. Further, residents with ISE 3-4 and 5-6 were more likely to have higher rates of transitions in mood during COVID, as well as those with no pain. Although the absolute rates of new mood symptoms at follow-up differed across each of the provinces, a significant increase was observed in British Columbia, and Alberta when compared to Ontario (Figure 3.2). In Newfoundland, fewer residents exhibited depressive symptoms at follow up during the COVID period (Table 3.2).

Table 3.2: Transitions in Mood Among Persons with a Baseline Depression Rating Scale Score of 0 moving to 0, 1-2, 3+ During Pre-COVID/COVID Among Different Variables at Follow-up in Canadian Long-Term Care Homes 2019-2020, Canada N=22,441

	DRS 0		**DRS 1-2**		**DRS 3+**		**P-value (pertaining to DRS scores during COVID among different variables**
	Pre-COVID	**COVID**	**Pre-COVID**	**COVID**	**Pre-COVID**	**COVID**	
Overall	81.6% (9,406)	79.7% (8,699)	13 .7% (1,585)	15.1% (1,649)	4.7% (541)	5.1% (561)	0.003
Sex							
Male	80.5% (3,319)	79.4% (3,133)	15.0% (617)	16.2% (638)	4.5% (186)	4.5% (177)	0.34
Female	82.2% (6,087)	80.0% (5,566)	13.1% (968)	14.5% (1,011)	4.8% (355)	5.5% (384)	0.003
Age Group							
18-44	83.1% (59)	82.2% (60)	15.5% (11)	17.8% (13)	1.4% (1)	0.0% (0)	0.56
45-64	82.4% (582)	78.3% (495)	14.0% (99)	16.9% (107)	3.5% (25)	4.8% (30)	0.16
65-74	82.0% (1,067)	81.2% (989)	14.4% (188)	14.6% (178)	3.6% (47)	4.2% (51)	0.74
75-84	81.5% (2,431)	79.1% (2,290)	13.9% (414)	15.1% (438)	4.6% (137)	5.8% (167)	0.04
85-94	81.2% (4,087)	79.7% (3,715)	13.5% (680)	15.1% (701)	5.3% (265)	5.2% (243)	0.10
95+	82.0% (1,180)	80.3% (1,150)	13.4% (193)	14.8% (212)	4.6% (66)	4.9% (70)	0.50
Marital Status							
Not Married	81.5% (7,284)	79.7% (6,736)	13.8% (1,232)	15.1% (1,275)	4.8% (426)	5.2% (437)	0.02
Married	81.9% (2,122)	79.8% (1,963)	13.6% (353)	15.2% (374)	4.4% (115)	5.0% (124)	0.15
Cognitive Performance Scale							
0	83.8% (1,220)	82.3% (1,140)	12.6% (184)	12.9% (178)	3.6% (52)	4.8% (67)	0.23
1 to 2	81.6% (2,886)	78.5% (2,585)	13.1% (464)	15.8% (520)	5.2% (185)	5.8% (190)	0.003
3 to 4	79.4% (3,427)	77.6% (3,171)	15.0% (646)	16.5% (673)	5.6% (242)	5.9% (240)	0.13
5 to 6	84.1% (1,873)	84.1% (1,803)	13.1% (291)	13.0% (278)	2.8% (62)	3.0% (64)	0.92
Activities of Daily Living Hierarchy Scale							

0	82.3% (468)	80.7% (360)	13.4% (76)	16.1% (72)	4.4% (25)	3.1% (14)	0.30
1 to 2	81.7% (1,705)	79.9% (1,514)	13.0% (272)	14.4% (272)	5.3% (111)	5.8% (110)	0.35
3 to 4	79.3% (4,306)	76.8% (4,022)	15.0% (812)	17.0% (885)	5.7% (310)	6.3% (332)	0.006
5 to 6	84.9% (2,927)	84.2% (2,803)	12.3% (425)	12.6% (420)	2.8% (95)	3.2% (105)	0.57
Changes in Health, End-stage disease and Signs and Symptoms Scale							
0	82.9% (5,428)	81.5% (5,046)	12.8% (838)	13.8% (856)	4.3% (284)	4.6% (287)	0.14
1 to 2	80.2% (3,785)	77.6% (3,453)	14.8% (700)	16.6% (739)	4.9% (233)	5.8% (256)	0.009
3+	73.1% (193)	73.5% (200)	17.8% (47)	19.9% (54)	0.1% (24)	6.6% (18)	0.51
Aggressive Behaviour Scale							
0	83.7% (7,843)	81.7% (7,273)	11.9% (1,116)	13.6% (1,212)	4.4% (407)	4.7% (416)	0.001
1 to 4	72.7% (1,469)	71.0% (1,350)	21.4% (433)	21.8% (415)	5.9% (119)	7.2% (136)	0.24
5+	64.8% (94)	71.0% (76)	24.8% (36)	20.6% (22)	10.3% (15)	8.4% (9)	0.58
Index of Social Engagement							
0	82.2% (666)	85.0% (624)	14.0% (113)	11.7% (86)	3.8% (31)	3.3% (24)	0.34
1 to 2	82.3% (2,558)	80.3% (2,444)	13.6% (424)	14.7% (448)	4.1% (126)	5.0% (152)	0.08
3 to 4	81.0% (3,850)	78.8% (3,600)	14.2% (674)	15.6% (713)	4.8% (230)	5.6% (257)	0.03
5 to 6	81.5% (2,332)	79.3% (2,031)	13.1% (374)	15.7% (402)	5.4% (154)	5.0% (128)	0.02
Pain Scale							
0	83.3% (7,689)	81.0% (7,228)	12.7% (1,172)	14.5% (1,294)	4.0% (365)	4.5% (402)	0.0002
1	74.6% (1,317)	74.7% (1,180)	18.1% (319)	17.5% (276)	7.4% (130)	7.9% (124)	0.81
2	74.5 % (370)	72.9% (271)	17.1% (85)	18.6% (69)	8.5% (42)	8.6% (32)	0.85
3	69.8% (30)	60.6% (20)	20.9% (9)	30.3% (10)	9.3% (4)	9.1% (3)	0.64
***Major Comorbidity Count**							
0	83.4% (458)	79.6% (385)	12.8% (70)	14.1% (68)	3.8% (21)	6.4% (31)	0.12
1 to 2	79.2% (2,836)	77.7% (2,485)	15.4% (550)	15.8% (504)	5.5% (197)	6.5% (209)	0.16
3 +	74.5% (275)	75.0% (279)	19.8% (73)	19.1% (71)	5.7% (21)	5.9% (22)	1.00
Anxiety Diagnosis							
No	82.0% (8,807)	79.9% (8,121)	13.5% (1,444)	15.1% (1,530)	4.5% (488)	5.0% (512)	0.0006
Yes	75.5% (599)	77.8% (578)	17.8% (141)	16.0% (119)	6.7% (53)	6.6% (49)	0.62
Conflict with Staff, Family, Friends, or Other Residents							
No	82.1% (9,088)	80.2% (8,403)	13.5% (1,495)	14.7% (1,543)	4.5% (493)	5.1% (529)	0.002
Yes	69.7 (318)	68.2% (296)	19.7% (90)	24.4% (106)	10.5% (48)	7.4% (32)	0.09
Adjust Easily to Change in Routines							
No	82.3% (8,807)	80.4% (8,126)	13.3% (1,419)	14.7% (1,490)	4.4% (473)	4.9% (494)	0.002

Yes	71.9% (599)	71.7% (573)	19.9% (166)	19.9% (159)	8.2% (68)	8.4% (67)	0.99
Newly Admitted Resident Status							
No	83.2% (8,464)	81.4% (7,904)	12.8% (1,307)	14.4% (1,396)	4.0% (405)	4.3% (413)	0.003
Yes	69.5% (942)	66.5% (795)	20.5% (278)	21.2% (253)	10.0% (136)	12.4% (148)	0.13
Canadian Province							
Alberta	75.0% (865)	70.7% (843)	19.8% (228)	22.8% (272)	5.2% (60)	6.5% (77)	0.06
British Columbia	85.2% (2,339)	81.6% (1,999)	11.5% (317)	13.8% (338)	3.3% (91)	4.6% (113)	0.002
Manitoba	94.1% (637)	93.6% (659)	5.3% (36)	5.7% (40)	0.6% (4)	0.7% (5)	0.92
Newfoundland	81.7% (210)	86.4% (124)	10.5% (27)	10.3% (28)	7.8% (20)	3.3% (9)	0.08
Ontario	80.0% (5,355)	78.9% (4,964)	14.6% (977)	15.4% (971)	5.5% (366)	5.7% (357)	0.32
LTC Home Size							
Small	77.1% (131)	80.4% (119)	16.5% (28)	13.5% (20)	6.5% (11)	6.1% (9)	0.74
Medium	78.5% (2,063)	77.5% (1,946)	16.0% (421)	16.8% (423)	5.4% (143)	5.7% (143)	0.66
Large	82.6% (7,212)	80.4% (6,634)	13.0% (1,136)	14.6% (1,206)	4.4% (387)	5.0% (409)	0.002
LTC Home Location							
Urban	82.3% (8,503)	80.5% (7,926)	13.4% (1,384)	14.6% (1,437)	4.3% (447)	4.9% (484)	0.004
Rural	75.4% (903)	72.8% (773)	16.8% (201)	20.0% (212)	7.9% (94)	7.3% (77)	0.14

*Major Comorbidity Count was excluded from the pre-COVID and COVID models due to large missing values

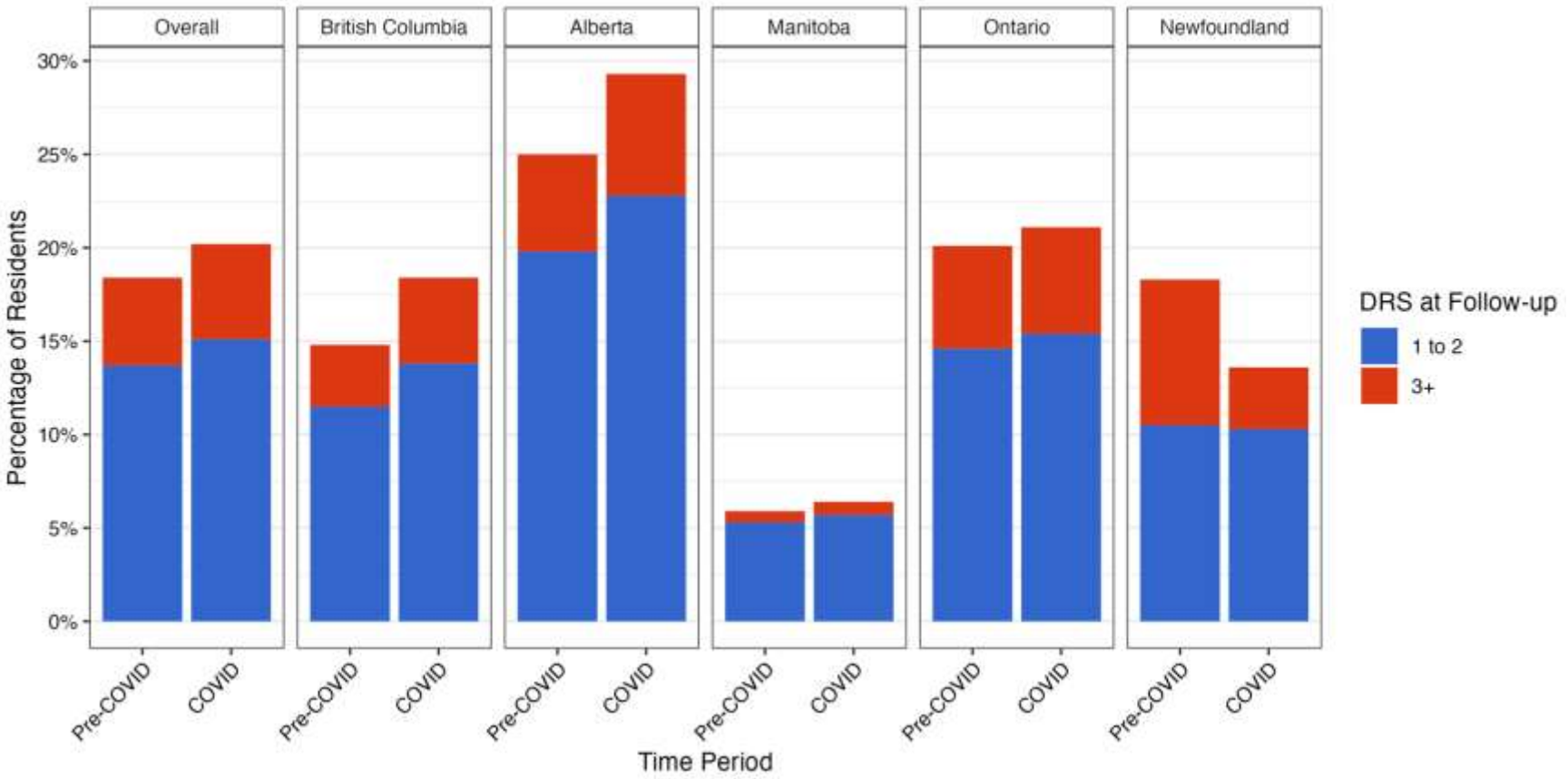


Figure 3.2: Depression Rating Scale Score at Follow-Up Among Residents Experiencing New Depressive Symptoms, Stratified by COVID-19 Pandemic Period and Canadian Province 2019-2020, Canada N= 22,441. Value labels less than 1.0% removed.

3.3.3 Factors Associated with New Depressive Symptoms Among Unexposed Group and Exposed Group

Resident-level risk factors associated with both mild, and moderate to severe new depressive symptoms among the pre-COVID exposure group (Table 3.3) include moderate cognitive impairment (CPS 3-4), mild changes in health, end-stage disease and signs and symptoms scale (CHESS 1-2) and severe aggressive behaviour (ABS ≥ 5). Residents experiencing any frequency or intensity of pain with a score ≥ 1 were also more likely to experience both mild, and moderate to severe new depressive symptoms. In addition, having conflict with staff, family, friends, or other residents or those that do not adjust easily to change in routines were more likely to experience both mild, and moderate to severe new depressive symptoms at follow-up. Also, newly admitted residents were more likely to experience both mild and moderate to severe new depressive symptoms during pre-COVID.

Table 3.3 also shows that relative to Ontario-based LTC homes, residents in Alberta were more likely to experience new mild depressive symptoms at follow-up, but not moderate to severe symptoms. The odds of experiencing new mood symptoms at follow-up, regardless of severity, were lower in British Columbia and Manitoba. Having anxiety diagnosis showed no significant difference. Moreover, differences between facility-size classes and type of residence whether urban or rural were not significant.

Similar results were shown during the COVID period where residents with CPS 3-4 or ABS ≥ 5 were more likely to experience new mild depressive symptoms at

follow-up. Further, those with CHESS ≥ 1 or ABS 1-4 or Pain scale 2 or those that do not adjust easily to change in routines or residents newly admitted were more likely to experience both mild and moderate to severe new depressive symptoms during COVID.

Like our pre-COVID analysis, we found that relative to Ontario-based LTC homes, residents in Alberta were more likely to experience new mild depressive symptoms at follow-up, but not moderate to severe symptoms, and those residing in Manitoba LTC homes were less likely to experience new depressive symptoms. Unlike our analysis from pre-COVID, residents residing in urban areas were less likely to experience new depressive symptoms. Differences between facility-size classes were not significant.

Table 3.3: Final Model, Adjusted Odds Ratio for Having New Mood Symptoms During Pre-COVID and COVID Among Canadian Long-Term Care Home Residents 2019-2020, Canada N=22,441

	Pre-COVID			**COVID**		
	P-value	**Adjusted Odds Ratio DRS 1-2 vs. 0 (95% CI)**	**Adjusted Odds Ratio DRS 3+ vs. 0-2 (95% CI)**	**P-value**	**Adjusted Odds Ratio DRS 1-2 vs. 0 (95% CI)**	**Adjusted Odds Ratio DRS 3+ vs. 0-2 (95% CI)**
Sex	0.03			0.0008		
Male		Ref	Ref		Ref	Ref
Female		0.92 (0.83-1.02)	1.12 (0.93-1.34)		1.06 (0.96-1.18)	1.43 (1.18-1.72)
Age Group	0.84			0.70		
18-44		Ref	Ref			
45-64		1.08 (0.56-2.11)	1.08 (0.56-2.11)		1.20 (0.63-2.27)	1.20 (0.63-2.27)
65-74		1.07 (0.56-2.05)	1.07 (0.56-2.05)		1.03 (0.55-1.92)	1.03 (0.55-1.92)
75-84		1.13 (0.60-2.15)	1.13 (0.60-2.15)		1.17 (0.63-2.17)	1.17 (0.63-2.17)
85-94		1.17 (0.62-2.21)	1.17 (0.62-2.21)		1.11 (0.60-2.05)	1.11 (0.60-2.05)
95+		1.21 (0.63-2.32)	1.21 (0.63-2.32)		1.10 (0.59-2.06)	1.10 (0.59-2.06)
Cognitive Performance Scale	0.002			0.0006		
0		Ref	Ref		Ref	Ref
1 to 2		1.18 (0.99-1.39)	1.51 (1.10-2.08)		1.28 (1.09-1.52)	1.14 (0.86-1.53)
3 to 4		1.31 (1.11-1.56)	1.69 (1.23-2.32)		1.29 (1.09-1.52)	1.13 (0.84-1.50)
5 to 6		1.11 (0.90-1.37)	1.08 (0.72-1.63)		1.00 (0.82-1.23)	0.71 (0.49-1.03)
Activities of Daily Living Hierarchy Scale	<0.0001			<0.0001		
0		Ref	Ref		Ref	Ref
1 to 2		0.96 (0.75-1.42)	1.12 (0.71-1.74)		0.95 (0.73-1.25)	1.66 (0.94-2.95)
3 to 4		1.03 (0.81-1.31)	1.09 (0.71-1.66)		1.07 (0.83-1.39)	1.79 (1.02-3.11)
5 to 6		0.77 (0.60-1.00)	0.61 (0.38-0.97)		0.75 (0.57-0.98)	1.02 (0.57-1.83)
Changes in Health, End-stage disease	0.009			0.001		

and Signs and Symptoms Scale						
0		Ref	Ref		Ref	Ref
1-2		1.08 (0.98-1.19)	1.08 (0.98-1.19)		1.17 (1.05-1.29)	1.17 (1.05-1.29)
3+		1.54 (1.54-2.06)	1.54 (1.54-2.06)		1.47 (1.10-1.95)	1.47 (1.10-1.95)
Aggressive Behaviour Scale	<0.0001			<0.0001		
0		Ref	Ref		Ref	Ref
1 to 4		1.85 (1.64-2.09)	1.33 (1.07-1.66)		1.83 (1.63-2.07)	1.66 (1.34-2.05)
5+		3.14 (2.18-4.52)	3.24 (1.84-5.70)		1.90 (1.22-2.94)	2.39 (1.18-4.84)
Pain Scale	<0.0001			<0.0001		
0		Ref	Ref		Ref	Ref
1		1.65 (1.45-1.87)	1.65 (1.45-1.87)		1.28 (1.12-1.46)	1.28 (1.12-1.46)
2		1.67 (1.34-2.08)	1.67 (1.34-2.08)		1.51 (1.18-1.92)	1.51 (1.18-1.92)
3		2.34 (1.20-4.58)	2.34 (1.20-4.58)		2.35 (1.17-4.71)	2.35 (1.17-4.71)
Anxiety Diagnosis	<0.0001	1.45 (1.22-1.73)	1.45 (1.22-1.73)	0.12	1.16 (0.96-1.40)	1.16 (0.96-1.40)
Conflict with Staff, Family, Friends, or Other Residents	<0.0001	1.71 (1.38-2.13)	1.71 (1.38-2.13)	0.0002	1.51 (1.22-1.88)	1.51 (1.22-1.88)
Does Not Adjust Easily to Change in Routines	<0.0001	1.57 (1.33-1.85)	1.57 (1.33-1.85)	<0.0001	1.46 (1.23-2.73)	1.46 (1.23-2.73)
Newly Admitted Resident Status	<0.0001	2.00 (1.74-2.27)	2.32 (1.89-2.85)	<0.0001	2.16 (1.88-2.47)	3.08 (2.52-3.76)
Canadian Province	<0.0001			<0.0001		
Ontario		Ref	Ref		Ref	Ref
Alberta		1.23 (1.05-1.43)	0.85 (0.64-1.14)		1.43 (1.24-1.66)	1.04 (0.81-1.35)
British Columbia		0.70 (0.61-0.79)	0.61 (0.48-0.77)		0.88 (0.77-1.00)	0.85 (0.68-1.06)
Manitoba		0.26 (0.19-0.36)	0.11 (0.04-0.30)		0.26 (0.19-0.36)	0.12 (0.05-0.29)
Newfoundland		0.86 (0.61-1.20)	1.47 (0.91-2.39)		0.56 (0.39-0.81)	0.55 (0.28-1.08)
LTC Home Size	0.03			0.30		
Small		Ref	Ref		Ref	Ref

Medium		0.94 (0.64-1.38)	0.94 (0.64-1.38)		1.38 (0.90-2.12)	1.38 (0.90-2.12)
Large		0.80 (0.54-1.78)	0.80 (0.54-1.78)		1.32 (0.86-2.04)	1.32 (0.86-2.04)
Facility Location	0.09			0.001		
Rural		Ref	Ref		Ref	Ref
Urban		0.88 (0.74-1.03)	0.76 (0.59-0.98)		0.73 (0.61-0.86)	0.73 (0.56-0.95)
C-statistics	0.663			0.659		

3.3.4 Effect of COVID-19 Exposure on Incident Depressive Symptoms

Among the overall cohort, the adjusted proportional odds of experiencing incident depressive symptoms were 16% greater during the COVID pandemic exposure period (aOR 1.16, 95% CI 1.08 - 1.24; Table 3.4).

Table 3.4 also reports the unadjusted and adjusted odds for incident depressive symptoms within various strata during the COVID exposure period. The adjusted proportional odds of experiencing incident depressive symptoms were greater during that period among female residents (aOR 1.21, 95% CI 1.11-1.31) than male residents. There were also greater odds of experiencing incident depressive symptoms in two age groups (age 75-84; aOR 1.21, 95% CI 1.06-1.38; and age 85-94; aOR 1.14, 95% CI 1.03-1.26) and two CPS strata (CPS 1-2; aOR 1.25, 95% CI 1.11-1.42; and CPS 3-4; aOR 1.14, 95% CI 1.03-1.27; Table 3.4).

When comparing provincial differences, the adjusted proportional odds of experiencing incident depressive symptoms were greater during the COVID exposure period than pre-COVID among residents in Alberta (aOR 1.26, 95% CI 1.05-1.51), British Columbia (aOR 1.33, 95% CI 1.15-1.55), and Ontario (aOR 1.11, 95% CI 1.02 - 1.21). This was also the case among large facilities (aOR 1.18, 95% CI 1.09-1.27) and urban location strata (aOR 1.16, 95% CI 1.08-1.24; Table 3.4).

Table 3.4: Proportional Odds Ratio Statistics for the Effect of COVID Period on Depression Rating Scale Score at Follow-Up 2019-2020, Canada N=22,441

Strata for unadjusted and adjusted models	Unadjusted Proportional Odds Ratio (95% CI)	Adjusted Proportional Odds Ratio (95% CI)
Overall Cohort (n = 22,441)	1.12 (1.05 - 1.20)	1.16 (1.08 - 1.24)
Sex		
Female (n = 14,371)	1.15 (1.06 - 1.25)	1.21 (1.11 - 1.31)
Male/Other (n = 8,070)	1.07 (0.96 - 1.19)	1.08 (0.97 - 1.21)
Age Group		
18-44 (n= 144)	1.05 (0.44 - 2.48)	1.02 (0.43 - 2.45)
45-64 (n = 1,338)	1.30 (0.99 - 1.71)	1.25 (0.95 - 1.65)
65-74 (n = 2,520)	1.06 (0.86 - 1.30)	1.09 (0.89 - 1.34)
75-84 (n = 5,877)	1.17 (1.03 - 1.33)	1.21 (1.06 - 1.38)
85-94 (n = 9,691)	1.09 (0.99 - 1.21)	1.14 (1.03 - 1.26)
95+ (n = 2,871)	1.12 (0.93 - 1.34)	1.13 (0.94 - 1.37)
Baseline Cognitive Performance Scale		
0 (n = 2,841)	1.12 (0.92 - 1.37)	1.16 (0.95 -1.41)
1 to 2 (n = 6,830)	1.21 (1.08 - 1.37)	1.25 (1.11 - 1.42)
4-5 (n = 8,399)	1.11 (1.00 - 1.23)	1.14 (1.03 - 1.27)
5-6 (n= 4,371)	1.01 (0.86 - 1.19)	1.04 (0.88 - 1.23)
Canadian Province		
Alberta (n = 2,345)	1.24 (1.04 - 1.49)	1.26 (1.05 - 1.51)
British Columbia (n = 5,197)	1.30 (1.12 - 1.50)	1.33 (1.15 - 1.55)
Manitoba (n = 1,381)	1.09 (0.70 - 1.69)	1.07 (0.69 - 1.67)
Newfoundland (n = 528)	0.68 (0.43 - 1.09)	0.68 (0.42 - 1.09)
Ontario (n = 12,990)	1.07 (0.98 - 1.16)	1.11 (1.02 - 1.21)
LTC Home Size		
Small (n = 318)	0.83 (0.48 - 1.42)	0.79 (0.45 - 1.37)
Medium (n = 5,139)	1.06 (0.93 - 1.21)	1.14 (0.99 - 1.30)
Large (n = 16,984)	1.15 (1.07 - 1.24)	1.18 (1.09 - 1.27)
LTC Home Location		
Urban (n = 20,181)	1.13 (1.05 - 1.21)	1.16 (1.08 - 1.24)
Rural (n = 2,260)	1.12 (0.93 - 1.35)	1.17 (0.97 - 1.42)

Adjusted models control for resident characteristics measured at baseline including Sex, Age, Cognitive Performance Scale, Activities of Daily Living, Changes in Health, End-stage disease and Signs and Symptoms Scale, Aggressive Behaviour scale, pain scale, anxiety diagnosis, conflict with staff, family, friends, or other residents, does not adjust easily to change in routines, newly admitted resident status, Canadian province, facility size and facility location.

3.4 Discussion

Many factors may have contributed to transitions in depressive symptoms at the start of the COVID-19 pandemic and it is unlikely that these can be effectively disaggregated. These include lockdown measures, including mandatory quarantines, closing of non-essential services, limits on social gatherings, reduced contact with family members, stress levels among staff, fear of exposure to the virus, uncertainty about risks, and concerns for the well-being of family members. In LTC homes, visitor restrictions were in effect in the different provinces around the same time, but severity of community outbreaks varied between provinces. Restrictions took place on March 16 in British Columbia and Alberta, followed by Ontario that mandated visitor restrictions on March 17 (Canadian Institute for Health Information, 2022a).

Lockdowns may be effective as public health measures to manage threats to physical well-being, but consideration should also be given to ways to mitigate their effects on psychosocial outcomes. The New Brunswick experience reported by McArthur et al., (2021) suggests that in the absent of widespread community and within-home outbreaks the effects of lockdowns were not noticeable (McArthur et al., 2021). However, in Ontario, Alberta, and British Columbia there were notable outbreaks in the community and within homes. The combined effects of widespread infections and lockdowns may therefore be different than lockdowns alone. Using validated measures of mood status previously collected during routine comprehensive health assessments, we found that the mental health of long-term care home residents was also adversely affected during the COVID-19 pandemic. Overall, we

observed a 16% increase in the adjusted odds of experiencing new depressive symptoms in this population segment during the pandemic period.

Several factors may have contributed to the observed increase of new depressive symptoms among residents during the pandemic period. These might include lack of family visits; isolation during outbreak periods where residents lacked interactions during mealtimes, social and recreational activities, loss of loved ones, fear from contracting illness; and changes in staffing patterns (critical staff shortages, use of temporary/agency staff).

Some studies report similar findings about worsened mental health among LTC residents. This worsening might have been due to many ongoing factors including staff shortages, limited staff education about mental health among the older population, and poor access to mental health or psychiatric facilities for those residing in LTC homes (McArthur et al., 2021).

Our analysis indicates that the pandemic was associated with greater odds of developing new depressive symptoms among long-term care home residents living in Alberta and British Columbia than was noted in Ontario (March 2020) (Table 3.4). On the other hand, there was no apparent effect in Manitoba and the odds of this transition *decreased* in Newfoundland. It is not clear whether these differences relate to differences in healthcare policies, funding, and resources allocated to long-term care homes. Differences in social support networks and connections through staff to the local community could also influence mental well-being. Moreover, contextual factors such as regional disparities in COVID-19 containment measures and

availability of mental health resources may have further contributed to the contrasting rates of depressive symptoms among long-term care home residents in these provinces. It is important to note the different timelines for guidelines and policies that took place in the different provinces. For example, virtual care resources for psychologists were published first on March 16, 2020, in British Columbia, but visitor restrictions in LTC homes were the longest and lasted until June 30,2020. In Alberta virtual care resources for psychologists were published after both British Columbia and Ontario on March 27, but visitor restrictions lasted the least until April 28, 2020. Finally, in Ontario virtual care resources for psychologists were published on March 17 and visitor restriction lasted until June 18, 2020 (Canadian Institute for Health Information, 2022a). The length of these restrictions and the delay in availability of virtual psychologists' services could have influenced mental health and mood of residents of different LTC homes in different provinces.

Our person-level findings contrast with those of the provincial-level results reported by Turcotte et al. (2023) for the initial 12 months of the COVID-19 pandemic. In that study, a similar proportion of individuals in Alberta, Manitoba and Ontario experienced worsening depressive symptoms, compared to pre-pandemic reference periods (Turcotte et al., 2023). Our analytical approach yielded different results from Turcotte et al. (2023) because we used a smaller timeframe specific to the first wave of COVID in Canada and we examined individual-level changes in mood among persons without pre-existing depressive symptoms. Turcotte et al. (2023) used provincial level analysis of risk adjusted quality indicators related to worsening of

mood. The Turcotte analysis was based on all assessments during the fiscal year but ours included only residents initially assessed between March 1 and March 31, 2020, allowing for closer timing related to the COVID-19 pandemic onset.

We did not find strong evidence of patient sub-groups that were substantially more likely to experience new depressive symptoms because of COVID-19 period exposure. Thus, our findings suggest that a broadly applicable intervention to all LTC residents should be used, encompassing various key components, is vital for safeguarding the mental well-being of all residents during COVID-19 outbreak periods. Some components tailored for residents may include transparent communication, social connections, engaging cognitive and physical activities. Also, uninterrupted care access, proactive mental health training for staff, and use of mental health interventions may be helpful. By focusing on these strategies, healthcare providers can effectively nurture the well-being of residents, promoting collective mental health during these challenging times without focusing on specific sub-groups.

3.5 Strengths and Limitations

Our analysis focused on those without depressive symptoms at baseline and does not include those with existing depression or mild depressive symptoms. In many cases, a history of adverse outcomes is the best predictor of future adverse outcomes. Our analysis allows for an examination of adverse changes in a subpopulation of persons who may have been coping reasonably well in LTC environments prior to the pandemic. In addition, the stratified analyses allowed for

the identification of subgroups where the effects of the pandemic were especially pronounced.

An important limitation is the lack of information about outbreaks (and associated resident isolation/confinement, staff shortages etc.) within homes, which hinders a comprehensive analysis of the effects of these variables on depressive symptoms.

To address this limitation in future research, researchers should contemplate integrating data collection techniques that help capture details about outbreaks and related factors into their data. This approach could entail systematically tracking and documenting the frequency of outbreaks, the duration and scope of resident isolation, and any consequent shortages of staff. Incorporating these variables would help researchers gain additional insights into how particular events influence the association between social isolation, loneliness, and depressive symptoms.

3.6 Conclusion and Implications

To control the spread of COVID-19 during the early phases of the pandemic in Canada, stringent lockdown measures were used. Although lockdowns have proven effective as public health measures, it is important to acknowledge their potential contribution to an increase in mental health challenges. Our findings showed a 16% increase in odds of experiencing incident depressive symptoms among residents of LTC homes during the COVID pandemic exposure period. There was limited evidence suggesting that certain patient sub-groups were notably more susceptible to developing new depressive symptoms because of their exposure during the COVID-

19 period. Thus, our results highlight the importance of implementing a diverse array of interventions to ensure the mental well-being of all individuals during outbreaks of COVID-19. Policy makers and health providers must use a comprehensive and balanced approach that not only addresses the immediate health crisis during a pandemic, but also proactively safeguards mental health in the face of challenging circumstances.

Chapter 4: Manuscript 3

Factors Associated with Mood Transitions Among Canadian Long-Term Care Residents: A Multistate Transition Model

4.1 Introduction

Depression has been recognized by the World Health Organization (WHO) as the third major factor in the global burden of disease, with predictions that it will become the primary cause by 2030 (Kessler & Bromet, 2013; Qiao et al., 2021). It stands out as a highly prevalent psychiatric diagnosis affecting about 32% of older adults admitted to Canadian long-term care (LTC) homes in 2021-2022 that worsen over time (Canadian Institute for Health Information, 2024b). It is important to note that not all individuals with depressive symptoms have a diagnosis of depression (Ferrand et al., 2020; Montagnier et al., 2014). Nonetheless, the experience of these symptoms may still affect an older person's quality of life.

Some studies report rates of depressive symptoms up to 82% among residents of LTC homes (Seitz et al., 2010) with others reporting rates ranging from 54.3% at initial assessment and increasing to 60.8 % at follow-up (Neufeld et al., 2014). However, these results are higher than those reported by the Canadian Institute of Health Information (CIHI) in (2021-2022) which reported a prevalence of 28.9% and 24.9% for some and possible depressive symptoms, respectively (Canadian Institute for Health Information, 2024b). The discrepancy in findings may be due to sample selection or how depressive symptoms were defined. CIHI defined depressive symptoms according to the Depression Rating Scale (DRS) which is based on clinician observations of the frequency of seven mood and behavior items.

Different incidence rates for depression have been reported by Neufeld et al. (2014) from studies after the first year of admission, ranging from 6% to 13.6%

(Neufeld et al., 2014), and more recently to 16% (Mulla, R T., Manuscript 2). The occurrence of depressive symptoms in older individuals has been associated with various adverse consequences, such as premature admission to formal care facilities and elevated mortality rates (Neufeld et al., 2014). However, most studies do not explore alternative outcomes among individuals who do not experience the primary outcome of interest in this case worsening depressive symptoms. Residents of LTC homes can enter the LTC home with depressive symptoms or can develop depressive symptoms later after their admission. They can either worsen or improve during their stay, or remain in the same state unchanged, or they can transition into different settings such as hospital, home, other settings, or death.

Examining the transitions from one state to another or between different care settings is important to improve the well-being of individuals. This will help healthcare providers to understand factors that play a role in these transitions and to make healthcare more efficient in adopting and creating effective policies and practices for the smooth transition of care (Hudon et al., 2022). Understanding both negative and positive transitions in health is essential for a comprehensive understanding of the dynamic nature of health, enabling better care, prevention, and resource management in healthcare systems.

International research examined transitions in mood among different groups of the general population using a variety of scales to screen for depressive symptoms. Some used different approaches to assess the transitions (Chui et al., 2015; Ellis et al., 2017; Ferrand et al., 2020; Ge et al., 1994; Heikkinen & Kauppinen, 2004; Korf,

2014; Merikangas et al., 2003; Montagnier et al., 2014; Shin & Cho, 2022; Sun et al., 2012; Sutin et al., 2013). Among those, six studies were related to mood transitions in older adults in the general population (Chui et al., 2015; Ferrand et al., 2020; Heikkinen & Kauppinen, 2004; Montagnier et al., 2014; Shin & Cho, 2022; Sun et al., 2012) and one examined the transition across the life span of participants (Sutin et al., 2013). Different scales were used in those studies to assess depressive symptoms, including, the Center for Epidemiological Studies Depression Scale (CES-D) with a cut-off of 16 for depression in the majority of studies (Chui et al., 2015; Heikkinen & Kauppinen, 2004; Montagnier et al., 2014; Shin & Cho, 2022; Sutin et al., 2013), the Geriatric Depression Scale (GDS) with a cutoff of 5+ indicating risk of depression in one study and 6+ in the second (Ferrand et al., 2020; Sun et al., 2012). Predictors of mood transition are similar to those of newly diagnosed depressive symptoms (Manuscript 2) including higher previous depressive symptoms, more chronic diseases (Chui et al., 2015), lower physical function (Fukukawa et al., 2004; Hsu, 2012; Ku et al., 2009; Lampinen et al., 2000), and lower economic satisfaction (Hsu, 2012).

The present study used multistate transition models to simultaneously investigate the effect of different risk factors for transitioning into different states of depressive symptoms as well as transitions into different states or settings including hospital, home, other settings, and death.

4.2 Methods

4.2.1 Study Design and Setting

We conducted a retrospective longitudinal analysis of residents residing in LTC homes in three Canadian provinces (Alberta, British Columbia, and Ontario) over a 10-year period from January 2010 to February 2020. We used a one-step Markov multistate transition model to examine transitions in mood over time as well as the factors affecting those transitions using the standardized interRAI MDS 2.0 comprehensive health assessment prior to the first year of the COVID-19 pandemic.

4.2.2 Data Source

We used a linked dataset provided by the Canadian Institute for Health Information's (CIHI) including Continuing Care Reporting System (CCRS), Data from Discharge Abstract Dataset (DAD), and the National Ambulatory Care Reporting System (NACRS). CCRS offers a comprehensive view of services provided in facilities for both frail older adults and people with disabilities across Canada (Hirdes et al., 2013). The MDS 2.0 assessment is used to plan care, evaluate quality, and allocate funding based on individual resident needs (Fries et al., 2007; Hirdes et al., 2003; Morris et al., 1999). DAD captures administrative, clinical and demographic information on hospital discharges (including deaths, sign-outs and transfers) (Canadian Institute for Health Information, 1996-2024a). NACRS contains data for hospital-based and community-based ambulatory care including day surgery, outpatient and community-based clinics, emergency departments, and also client visit data that is collected at time of service in participating facilities (Canadian

Institute for Health Information, 1996-2024b). Reliability and validity of the MDS 2.0 is well established (Hirdes et al., 2013; Morris et al., 1997; Poss et al., 2008; Turcotte et al., 2018). As part of routine care, residents are assessed within 14 days of admission to LTC. Subsequent assessments are administered every three months (90 days), or sooner if there is a significant change in their health status.

4.2.3 Study Cohort

Our study cohort included residents who received care before the COVID-19 pandemic (from January 2010 to February 2020). Those included met the following inclusion criteria: a) 65 years or older b) not in a comatose state c) have either two completed assessments or one assessment with discharge details, and d) initial assessment to fall in the study period. Exclusion criteria included: a) residents admitted for less than 90 days b) having only one assessment and lacking discharge information.

After selecting the eligible candidates, transition pairs were established for each resident, starting with the first assessment as the originating state and the second assessment as the subsequent state. This process of creating transition pairs continued until residents reached an absorbing state or the end of the data series. Subsequently, the transition matrix was developed, and a one-step Markov model was created.

4.2.4 Outcomes of Interest

Our primary outcome of interest in this study is mood disturbance measured using the Depression Rating Scale (DRS), which is calculated based on 30-day

clinician observation of the frequency of seven mood and behavior items (i.e., negative statements, persistent anger, unrealistic fears, repetitive health complaints, repetitive anxious complaints, sad or worried or facial expression, and crying) from the MDS 2.0 assessment (Burrows, 2000).

Prior validation studies indicate that DRS scores of three and greater are positively associated with major and minor depressive disorders (Burrows, 2000; Hoben et al., 2019; Koehler et al., 2005; Martin et al., 2008). DRS provides a standardized, and comprehensive clinician rated assessment of residents in LTC homes. It is also widely used internationally, including in different Canadian provinces (Hirdes et al., 2011; Hoben et al., 2019; Koehler et al., 2005; Neufeld et al., 2014).

To allow reporting of class-level odds ratio statistics, we collapsed the 14-point DRS into three categories. A DRS score of 0 indicates no mood disturbance. A DRS score of 1-2 indicates the presence of mild mood disturbance, whereas a score of 3 or greater indicates presence of moderate/severe mood disturbance.

The secondary outcome of interest in this study is the final state that residents go to once they leave the LTC home or die. Residents can transition into four different states comprised of transitioning to Home (residents discharged to home), Hospital (Individuals released to a hospital for acute care, with no anticipated prompt return and without confirmation of their death during their hospital stay), Other (residents discharge to other destinations such as Assisted Living or others) or transition to

Death (including any death within the LTC home or are known to have died following hospital or ER admission).

4.2.5 Independent Variables and Exposures

All variables that were associated with incidence of new mood (Manuscript 2) as well as additional variables were tested first and included in this paper if they were statistically significant with a p-value of less than 0.05. Examples of independent variables included in this study are sociodemographic variables like age group, sex, and marital status, measures of health conditions (e.g., Alzheimer's disease related dementias, anxiety, bipolar disorder, depression, and schizophrenia), mood and behaviour patterns and psychological well-being items (e.g., sleep patterns, and conflict with staff, family, friends, or other residents), treatment including medications (e.g., antianxiety medications, antidepressants, antipsychotics, and hypnotics), and different therapies (e.g., psychological therapy, and recreational therapy). We also used several validated summary scales including the Cognitive Performance Scale (CPS) (Morris et al., 1994), Changes in Health, End-Stage Disease, Signs, and Symptoms Scale (CHESS) (Hirdes et al., 2003; Hirdes et al., 2014), the Index of Social Engagement (ISE) (Gilbart & Hirdes, 2000), Activities of Daily Living Self-Performance Hierarchy (ADLH) Scale (Morris et al., 2013; Morris et al., 1999), Aggressive Behaviour Scale (ABS) (Perlman & Hirdes, 2008),Major Comorbidity Count Algorithm (MCC) (Hirdes, Declercq, et al., 2020), and Pain Scale (Fries et al., 2001). Facility-level variables expected to have an effect in our analysis such as urban and rural location, and LTC home size (Baldwin et al., 2017; Wilkinson

et al., 2019) as well as some Canadian provinces were added to our analysis as independent variables. A complete list of all variables used in this study is included in Appendix C (Table1).

4.2.6 Statistical Analysis

We computed descriptive statistics for all independent variables measured at baseline to identify potential exposure period differences among independent variables within the overall analytic cohort between 2010-2020. Chi-square tests using a 0.05 alpha threshold were used to identify statistically significant differences between exposure periods. Candidate variables for the model were selected based on literature review and were retained in the final model based on P-value.

Next, a one-step Markov multistate transition model was used to investigate movement between the different states of mood and the other settings (Figure 4.1). DRS scores for the different mood states were categorized as **State 1** (DRS 0 indicating No Mood Disturbance), **State 2** (DRS1-2 indicating Mild Mood Disturbance), and **State 3** (DRS3+ indicating Moderate/Severe Mood Disturbance).

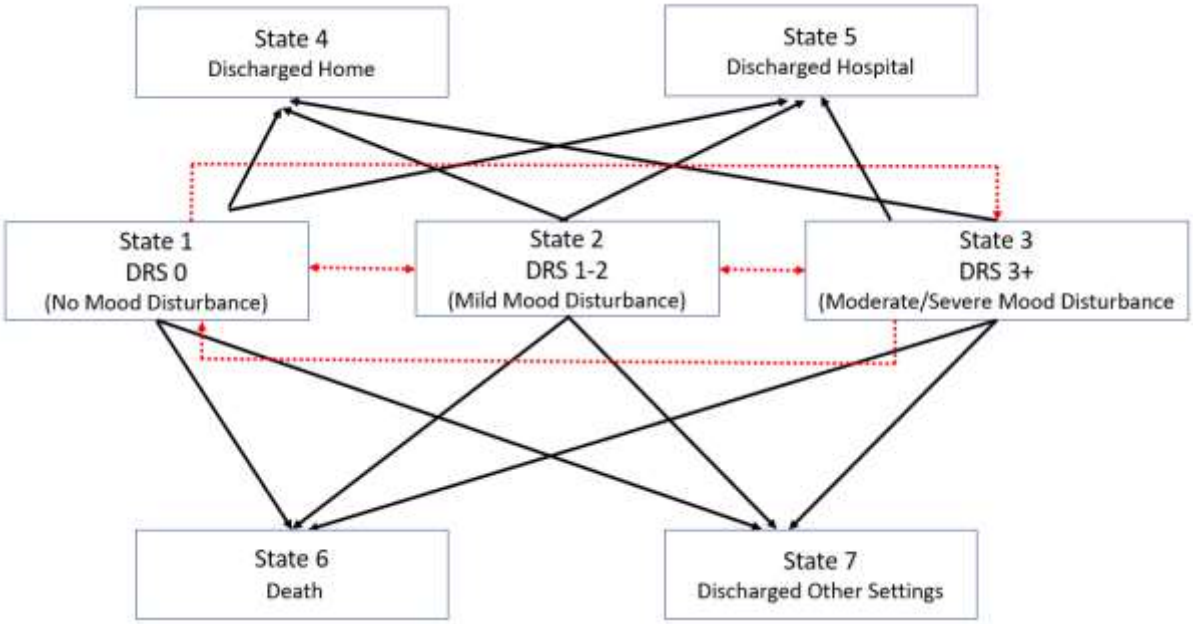


Figure 4.1: State-Space Diagram of Possible Transitions From Long-Term Care Home in Multistate Markov Model

Movement from state 1 to state 2, state 1 to state 3, or state 2 to state 3 all correspond to worsening in mood, whereas transitions in the reverse direction correspond to mood improvement. States 4 (discharged home), 5 (discharged to hospital), 6 (death), and 7 (discharged to other settings) represent potential reasons for discharge from the LTC home and are so-called absorbing states, since transitioning to one of these defines the end of the engagement with the LTC home (Cook et al., 2013; Heckman et al., 2019).

This model provides a framework for modeling trajectories of change in mood of residents of LTC homes over time (Cook et al., 2013) to examine whether the residents worsened or improved over time or remained the same.

All analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NC).

4.3 Results

4.3.1 Baseline Characteristics

Our cohort was comprised of 314,042 unique individuals, with 63.4% females and 55.1% aged 85 years and older. Those with anxiety diagnosis represent 9.3% of the sample, 22.8% had depression diagnosis and 62.4% had Alzheimer's disease related dementias (ADRD). About 57.6% of residents had mid to high index of social engagement (ISE 3+) and 55.4% had moderate to severe cognitive impairment (CPS 3-4 = 44.5% and CPS 5-6 = 10.9%, respectively). Most residents were from Ontario (68.6%), followed by British Columbia (16.4%) and then Alberta (14.9%).

Table 4.1 shows the admission characteristics of all residents, of whom 145,433 (46.3%) individuals had no mood disturbance on admission (DRS 0; **State 1**), 95,865 (30.5%) individuals had mild mood disturbance (DRS 1-2; **State 2**), and 72,744 (23.2%) had moderate to severe mood disturbance (DRS 3+; **State 3**). On admission, there was a statistically significant difference between residents according to their DRS status with a p-value < 0.0001. Being a female or being in the age category of 85-94, or not married were associated with having moderate/severe mood disturbance on admission. Further, residents with moderate/severe mood disturbance included higher percentages of persons with moderate cognitive impairment (CPS 3-4), severe functional decline (ADLH 3+), health instability (CHESS 0), aggressive behaviour (ABS > 1), no social engagement (ISE 0) to low social engagement (ISE 1-2), and pain.

Table 4.1: Baseline Characteristics of LTC Residents on Admission and Between the Three Different States of Mood, No Mood Disturbance (DRS0), Mild Mood Disturbance (DRS 1-2), and Moderate to Severe Mood Disturbance (DRS3+) During the Pre-COVID-19 Period 2010-2019, Canada N=314,042

Variable	**No Mood Disturbance (n =**145,433**)**	**Mild Mood Disturbance (n =** 95,865**)**	**Moderate/Severe Mood Disturbance (n =** 72,744**)**	**P-value**
Demography				
Sex				<0.0001
Male	38.9% (56,548)	37.5% (35,962)	30.9% (22,441)	
Female	61.1% (88,885)	62.5% (59,903)	69.2% (50,303)	
Age Group				<0.0001
65-74	11.0% (15,918)	11.5% (11,041)	12.0% (8,759)	
75-84	32.2% (46,887)	34.4% (32,929)	35.2% (25,634)	
85-94	48.2% (70,164)	46.5% (44,555)	45.6% (33,199)	
95+	8.6% (12,464)	7.7% (7,340)	7.1% (5,152)	
Marital Status				0.05
Not Married	78.0% (113,366)	77.9% (74,713)	78.4% (57,010)	
Married	22.1% (32,067)	22.1% (21,152)	21.6% (15,734)	
Clinical Severity Scales				
Cognitive Performance Scale				<0.0001
0	13.9% (20,163)	7.0% (6,694)	4.8% (3,456)	
1 to 2	40.1% (58,261)	32.6% (31,211)	27.8% (20,191)	
3 to 4	37.2% (54,165)	48.3% (46,281)	54.0% (39,277)	
5 to 6	8.8% (12,844)	12.2% (11,679)	13.5% (9,820)	
Activities of Daily Living Hierarchy Scale				<0.0001
0	5.4% (7,889)	3.0% (2,883)	2.2% (1,626)	
1 to 2	26.7% (38,788)	22.1% (21,214)	21.2% (15,449)	
3 +	67.9% (98,756)	74.9% (71,768)	76.5% (55,669)	
Changes in Health, End-stage disease and Signs and Symptoms Scale				
0	69.0% (100,320)	61.0% (58,495)	53.5% (38,916)	<0.0001
1 to 2	29.2% (42,427)	35.3% (33,868)	40.4% (29,400)	
3+	1.9% (2,686)	3.7% (3,502)	6.1% (4,428)	
Aggressive Behaviour Scale				
0	80.9% (117,598)	54.4% (52,156)	31.5% (22,890)	<0.0001
1 to 4	17.9% (26,085)	39.5% (37,838)	49.1% (35,684)	
5+	1.2% (1,750)	6.1% (5,871)	19.5% (14,170)	

Index of Social Engagement				<0.0001
0	5.8% (8,409)	8.5% (8,181)	11.5% (8,355)	
1 to 2	31.1% (45,246)	36.2% (34,653)	38.8% (28,212)	
3 to 4	42.1% (61,289)	38.9% (37,240)	36.0% (26,198)	
5 to 6	21.0% (30,489)	16.5% (15,791)	13.7% (9,979)	
Pain Scale				<0.0001
0	64.6% (93,962)	57.9% (55,493)	48.6% (35,323)	
1 to 2	34.2% (49,663)	40.2% (38,505)	47.7% (34,687)	
3	1.2% (1,808)	2.0% (1,867)	3.8% (2,734)	
Major Comorbidity Count				<0.0001
0	11.1% (16,125)	7.7% (7,371)	6.4% (4,667)	
1 to 2	77.1% (112,072)	79.7% (76,375)	80.1% (58,285)	
3+	11.9% (17,236)	12.6% (12,119)	13.5% (9,792)	
Treatment				
Physician Visit	78.4% (113,958)	81.6% (78,212)	82.4% (59,963)	<0.0001
Psychological Therapy	1.0% (1,463)	1.4% (1,385)	2.0% (1,464)	<0.0001
Recreational Therapy	10.9% (15,807)	11.2% (10,761)	13.0% (9,485)	<0.0001
Anxiolytic Use	7.6% (11,041)	10.3% (9,890)	16.6% (12,085)	<0.0001
Antidepressant Use	38.6% (56,086)	44.8% (42,926)	51.5% (37,427)	<0.0001
Antipsychotic Use	20.0% (29,042)	28.5% (27,362)	37.4% (27,232)	<0.0001
Hypnotic Use	8.1% (11,799)	8.5% (8,132)	10.6% (7,743)	<0.0001
Advanced Directives-do not hospitalize	25.3% (33,454)	26.3% (23,141)	27.7% (18,366)	<0.0001
Advanced Directives-do not resuscitate	73.4% (97,613)	74.7% (65,892)	76.2% (50,658)	<0.0001
Health Diagnoses				
Alzheimer's Disease Related Dementias	56.3% (81,898)	65.6% (62,902)	70.4% (51,216)	<0.0001
Anxiety	7.0% (10,207)	9.1% (8,678)	14.1% (10,243)	<0.0001
Bipolar Disorder	1.3% (1,837)	1.4% (1,294)	1.5% (1,062)	0.0007
Depression	19.7% (28,609)	23.4% (22,412)	28.2% (20,511)	<0.0001
Schizophrenia	1.4% (2,065)	1.4% (1,311)	1.3% (935)	0.04
Mood and Behaviour Patterns and Psychological Well-Being Items				
Poor Sleep	0.4% (569)	3.3% (3,133)	13.3% (9,676)	<0.0001
Conflict with Staff, Family, Friends, or Other Residents	3.4% (4,899)	8.5% (8,166)	20.8% (15,105)	<0.0001
Facility Attributes				
Canadian Province				<0.0001
Alberta	12.2% (17,684)	16.7% (15,976)	18.2% (13,207)	

British Columbia	21.0% (30,462)	13.4% (12,845)	11.4% (8,323)	
Ontario	66.9% (97,287)	69.9% (67,044)	70.4% (51,214)	
LTC Home Size				<0.0001
Small	1.1% (1,564)	1.2% (1,177)	1.5% (1,071)	
Medium	25.0% (36,332)	26.8% (25,686)	28.7% (20,833)	
Large	73.9% (107,522)	72.0% (68,981)	69.9% (50,824)	
LTC Home Location				<0.0001
Urban	87.7% (127,583)	86.5% (81,965)	82.9% (60,275)	
Rural	12.3% (17,850)	14.5% (13,900)	17.1% (12,469)	

Table 4.2 below shows the rates of transition out of LTC homes, categorized by quarterly assessments. These transitions are analyzed based on the initial DRS score at the beginning of the follow-up and further by assessment periods within the individual's episode. The highest rate of residents being discharged to home occurs early in the admission process, and it is at its lowest at later stages. However, this is different when it comes to being discharged to other settings where the rates tend to decrease for all DRS categories until the second year, after which the rates start to increase. Combined hospitalization rates (with or without death) tend to be similar for all DRS categories, except for individuals with no mood disturbance (DRS 0), which was lower in the first quarter than the other two DRS categories. In the second year the transition rate was lower in the DRS 1-2 category. Rates of death occurring in LTC homes were substantially higher than those occurring in hospital. The probability of remaining in the LTC home after 90 days is higher for those in the DRS 0 category and lower for both DRS 1-2 and DRS3+. Further, the probability of remaining in the LTC home showed an increasing trend in the first year for those with no mood disturbance and started to decline thereafter. For residents with either

mild or moderate/severe mood disturbance the increase was observed in the first year and then the decline happened from the second year.

Table 4.2: Ninety Day Transition Rates (%) to Different Care Settings and Mortality by DRS Score and Day of Stay at Start of Assessment Period, 2010-2019, Canada N=314,042

Status at End of 90-Day Follow-Up	**Assessment Period**							
	First Year (n= 696,317)				**Second Year (n= 196,733)**	**Third Year (n= 117,698)**	**Fourth Year (n= 74,224)**	**Fifth Year (n= 46,051)**
	First Quarter (n= 2,938)	**Second Quarter (n = 257,443)**	**Third Quarter (n= 232,320)**	**Fourth Quarter (n= 203,623)**				
DRS=0								
Discharged home	1.7	0.8	0.6	0.5	0.3	0.3	0.2	0.2
Hospitalized (no death)	11.9	10.5	10.0	9.3	8.8	8.3	7.7	7.5
Died in hospital	2.6	3.4	3.2	3.1	2.9	2.7	2.5	2.6
Died in LTC home	15.7	12.8	12.6	12.6	13.0	16.9	18.8	20.1
Discharged other setting	1.2	0.6	0.5	0.4	0.3	0.2	0.2	0.1
Remain in LTC home	66.9	71.8	73.2	74.2	74.6	71.6	70.7	69.3
DRS = 1-2								
Discharged home	1.8	0.6	0.4	0.3	0.3	0.2	0.2	0.3
Hospitalized (no death)	12.4	10.5	9.8	9.5	8.9	8.0	7.2	6.7
Died in hospital	3.4	3.6	3.2	3.0	2.9	2.5	2.6	2.6
Died in LTC home	16.3	15.8	15.4	15.7	16.6	20.3	22.4	23.0
Discharged other setting	1.2	0.7	0.5	0.4	0.3	0.3	0.2	0.3
Remain in LTC home	64.7	68.8	70.7	71.1	71.1	69.7	67.4	67.2
DRS = 3+								

Discharged home	1.3	0.5	0.4	0.3	0.3	0.2	0.2	0.3
Hospitalized (no death)	12.5	10.5	9.9	9.5	8.8	7.8	7.7	7.1
Died in hospital	3.2	3.4	3.1	2.9	2.7	2.5	2.3	2.4
Died in LTC home	16.3	18.0	17.6	17.5	18.4	22.2	23.1	23.7
Discharged other setting	1.9	0.8	0.6	0.5	0.4	0.3	0.2	0.2
Remain in LTC home	64.8	66.9	68.5	69.4	69.3	67.1	66.6	66.3

4.3.2 Sojourn Time and Transitioning Probabilities

Figure 4.2 below shows the time residents spent in each transient state for an average 12-month period. Residents whose initial state was no mood disturbance spent an average of 7.8 months without mood disturbance, followed by approximately 2.4 months with mild mood disturbance. Subsequently, these residents progressed to a state of moderate/severe mood disturbance, where they spent an average of approximately 1.8 months. On the other hand, those residents who started with mild mood disturbance spent an average of 6.6 months in the same state until they transitioned to either no mood disturbance, or moderate/severe mood disturbance. However, they stayed an average of 2.7 months in the no mood disturbance state and the same time was spent in the moderate/severe mood disturbance state. For residents admitted with moderate/severe mood disturbance, their average duration in this state was approximately 7.8 months, with approximately 2.4 months spent in a mild mood disturbance state and 1.8 months without mood disturbance before transitioning to an absorbing state.

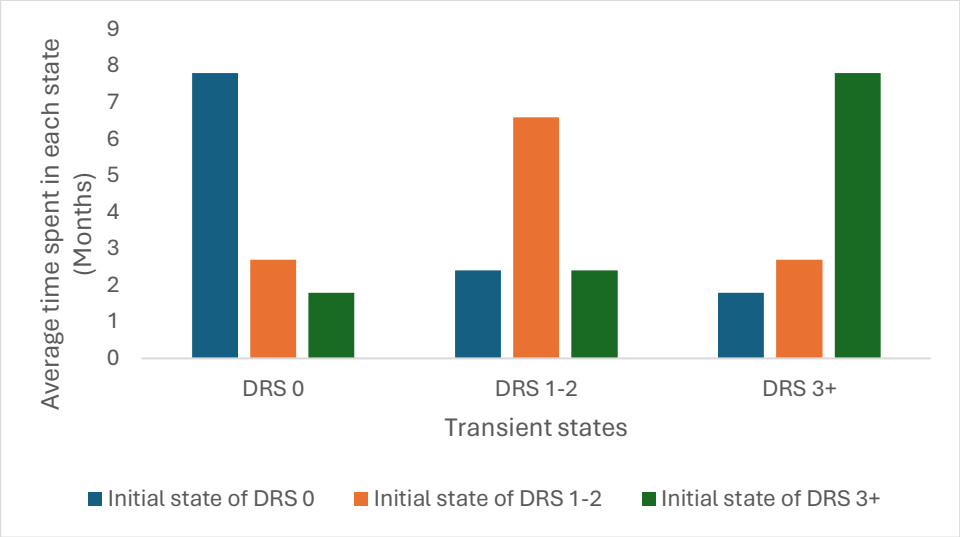


Figure 4.2: Average Time Spent in Months in Each of the Transient States Before Transitioning to the Absorbing States 2010-2019, Canada

4.3.3 Transition Patterns Between Transient Mood States

The probability of worsening mood and transitioning from no mood disturbance to mild and moderate/severe mood disturbance was 0.14 and 0.06, respectively.

Next, transitioning from mild mood disturbance could go in one of two directions either improving to no mood disturbance with a probability of 0.17 or to worsening mood and transitioning to moderate/severe mood disturbance with the same probability of 0.17.

This was not the same for transitioning from moderate/severe mood disturbance which could only go in the direction of improvement to either mild mood disturbance with a probability of 0.15 or even to improve further to no mood disturbance with a probability of 0.05.

Staying in the Same Mood State

The majority of residents remained in their same mood state in the first 90 days of admission. Residents admitted with no mood disturbance had the highest probability of 0.56 to staying in the same state after 90 days, followed by those entering with moderate/severe mood disturbance who had 0.54 probability, and then those with mild mood disturbance with a 0.41 probability of remaining in the same state.

4.3.4 Transition Patterns to Absorbing States

The probability of transitioning to home was highest with no mood disturbance of 0.005 in the other transient states, but the same for both mild and moderate to severe mood disturbance with a probability of 0.003. Transitioning to hospital from either no mood disturbance or from mild mood disturbance had almost the same probability of 0.16, but a lower probability to transition from moderate/severe mood disturbance to hospital of 0.15. This was not the case to transition from the different mood states to death, where transitioning from the highest level of mood disturbance had the highest probability of dying. Transitioning from the different states of mood to other settings had the same probability of 0.004.

Figures 4.3 and 4.4 show the different transition probabilities and cumulative incidence functions for the four different absorbing states by DRS scores at admission for 365 days (1 year).

Transitioning to home was a rare event, with the highest rates occurring early in the episode of care (see Figures 4.3 and 4.4A). Transitioning to hospital (Figures 4.3 and

4.4B), dying (Figures 4.3 and 4.4C), or to other settings (Figures 4.3 and 4.4D) had a higher cumulative incidence on admission than transition home. For each of those transitions, the cumulative incidence functions were highest among those with moderate/severe mood disturbance.

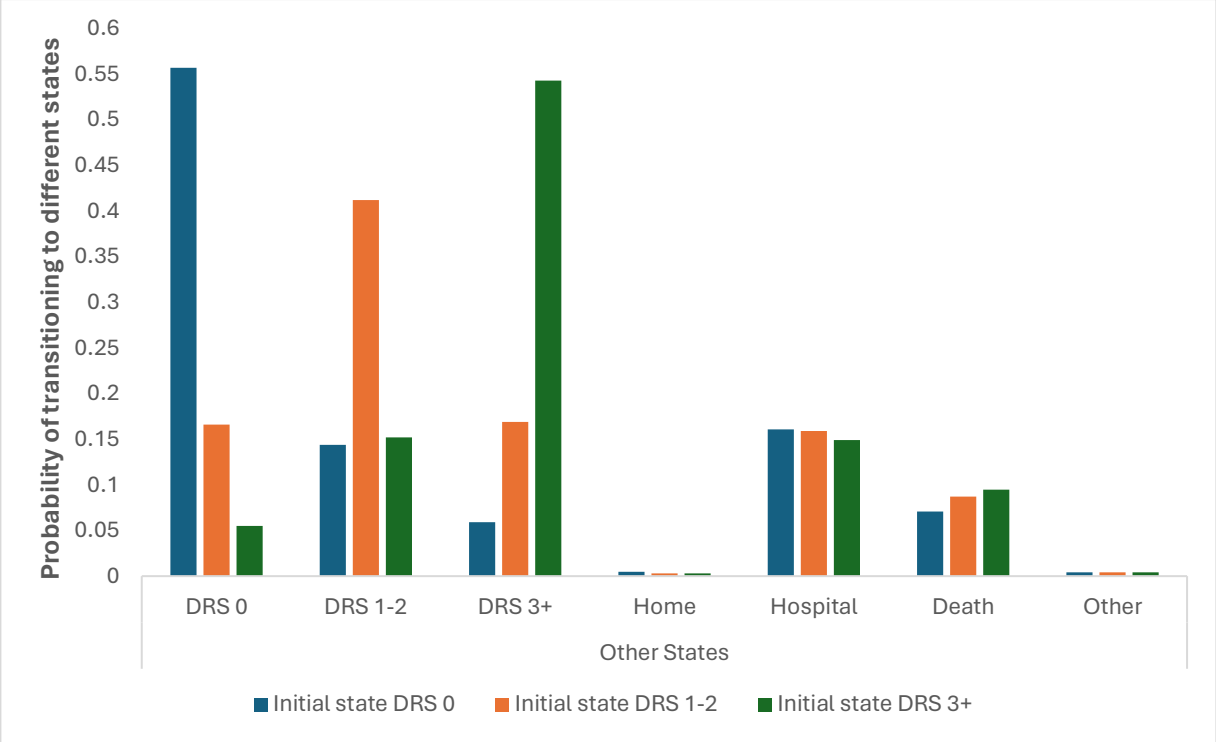


Figure 4.3: The Probability of Transitioning to the Different Transient States and Absorbing States Among Long-Term Care Residents (2010-2019), Canada

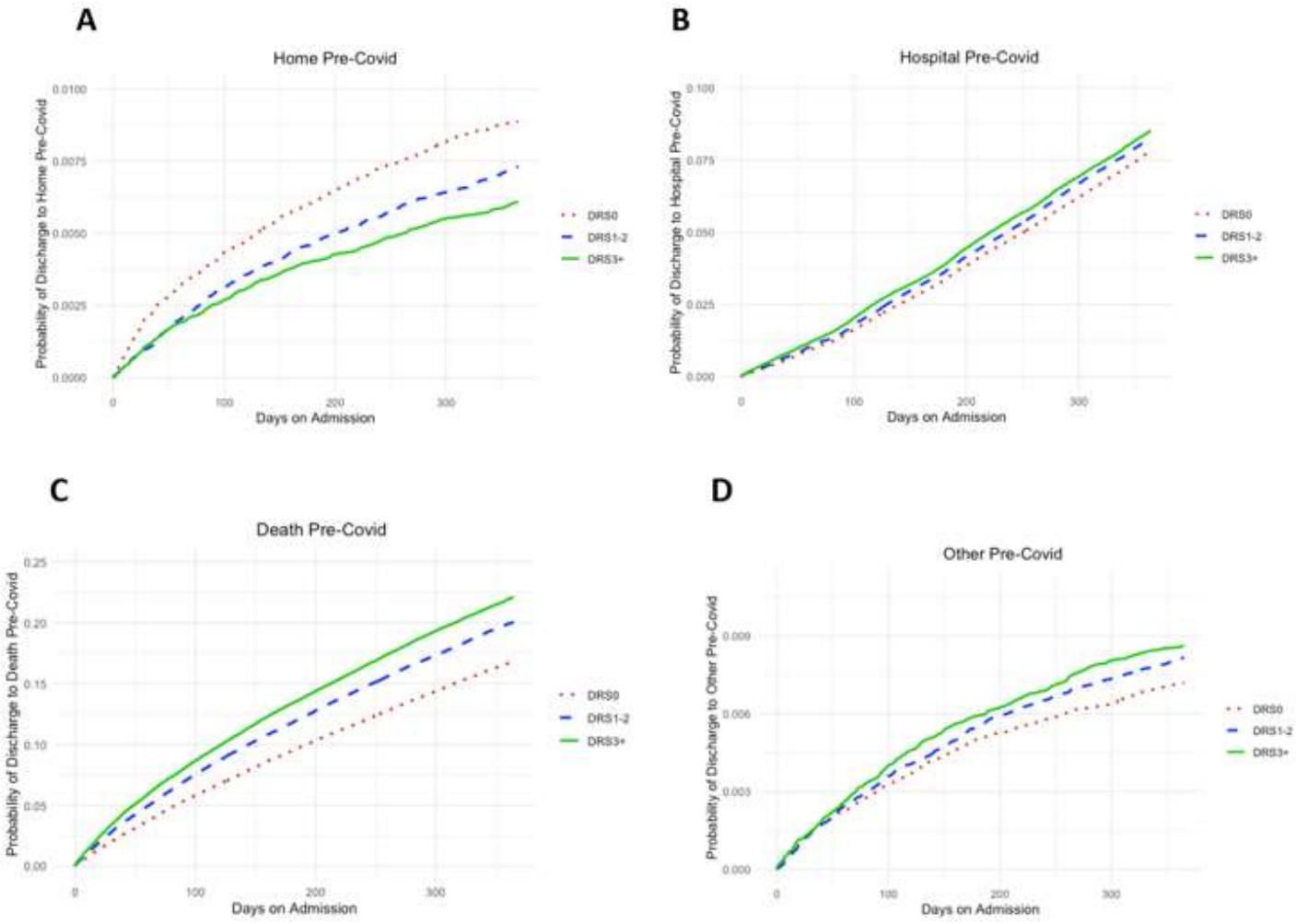


Figure 4.4: Cumulative Incidence Function (CIF) Plots For 4 Types of Transitions 365 Days After Admission Assessment by Baseline DRS Score Pre-COVID Among Long-Term Care Residents 2010-2019, Canada. Note: Y-Axes Have Different Maximum Values for Presentation Purposes.

4.3.5 Independent Factors Associated with Transitions to Transient and Absorbing States

The forest plots below show the adjusted odds ratios of transitioning from one DRS state to another mood state or to absorbing states (discharged home, admitted to hospital, died, and discharged to other settings) for residents who remain in the LTC home after 90 days, compared to remaining in the initial state. A complete list of all variables is found in Appendix C (Tables 2-4).

Worsening Mood – Transitioning From No Mood Disturbance

Figure 4.5 shows that several factors were associated with transitioning from no mood disturbance to worsening mood either mild or moderate to severe mood disturbance. The magnitudes and directions of associations for both transitions are similar across DRS states (Figure 4.5).

Common factors associated with increased odds of worsening mood include being a female, recreation therapy days[1], anxiolytic use, antidepressant use, antipsychotic use, hypnotic use, worse CHESS scores, ADLH 1-2, mild and moderate cognitive impairment, all pain categories, all ABS scores, and presence of major co-morbidities. Other common factors *include* having conflict with staff, family, friends, or other residents; having poor sleep; anxiety diagnosis; and residing in Alberta facilities.

[1] The recreation therapy days variable was tested and coded in different ways (as a continuous, binary, and categorical variable) to explore the true effect of the variable. In all three cases it acted similarly and had weak marginal effect. In this manuscript we kept the binary variable.

The factors associated with a strong effect with transitioning from *no mood to mild mood disturbance* (Figure 4.5) include pain score 3 (OR 1.58, 95% CI 1.46-1.70), ABS 1-4 (OR 1.55, 95% CI 1.53-1.58), or ABS 5+ (OR 1.81, 95% CI 1.72-1.91). Also, among the strongest factors were conflict with staff, family, friends, or other residents (OR 1.41, 95% CI 1.36-1.45), and poor sleep (OR 1.62, 95% CI 1.49-1.76).

Factors with a moderate effect for transitioning from *no mood to mild mood disturbance* (Figure 4.5) include anxiolytic use (OR 1.12, 95% CI 1.09-1.15), antidepressant use (OR 1.12, 95% CI 1.10-1.14), and antipsychotic use (OR 1.19, 95% CI 1.17-1.21). Other factors with moderate effects include CHESS 3+ (OR 1.13, 95% CI 1.07-1.19), CPS 1-2 (OR 1.17, 95% CI 1.14-1.20), CPS 3-4 (OR 1.29, 95% CI 1.25-1.32), MCC 3+ (OR 1.11, 95% CI 1.08-1.15), and facilities in Alberta (OR 1.27, 95% CI 1.25-1.30).

Factors with weak effects for transitioning from *no mood to mild mood disturbance* (Figure 4.5) include being a female (OR 1.03, 95% CI 1.02-1.05), recreation therapy days (OR 1.04, 95% CI 1.02-1.06), and hypnotic use (OR 1.04, 95% CI 1.01-1.07). Others with weak effects include CHESS 1-2 (OR 1.10, 95% CI 1.08-1.12), ADLH 1-2 (OR 1.09, 95% CI 1.05-1.12), ADLH 3+ (OR 1.05, 95% CI 1.01-1.08), MCC 1-2 (OR 1.08, 95% CI 1.05-1.10), anxiety diagnosis (OR 1.08, 95% CI 1.06-1.11), and ADRD diagnosis (OR 1.07, 95% CI 1.05-1.08).

The factors with strongest effect associated with the major transition from *no mood to moderate/severe mood disturbance* (Figure 4.5) include antipsychotics (OR 1.31, 95% CI 1.28-1.35), pain 1-2 (OR 1.52, 95% CI 1.48-1.55), pain score 3 (OR 2.29,

95% CI 2.07-2.52), ABS 1-4 (OR 1.71, 95% CI 1.67-1.75), ABS 5+ (OR 2.21, 95% CI 2.06-2.37). Further, conflict with staff, family, friends, or other residents (OR 1.82, 95% CI 1.75-1.89), and poor sleep (OR 1.58, 95% CI 1.40-1.77).

Factors with a moderate effect for transitioning from *no mood to moderate/severe mood disturbance* (Figure 4.5) include being female (OR 1.22, 95% CI 1.20-1.25), age 85-94 (OR 1.17, 95% CI 1.13-1.21), and age 95+ (OR 1.19, 95% CI 1.14-1.25), recreation therapy days (OR 1.11, 95% CI 1.08-1.15), anxiolytic use (OR 1.27, 95% CI 1.23-1.32), antidepressant use (OR 1.16, 95% CI 1.14-1.19), and hypnotic use (OR1.10, 95% CI 1.06-1.15). They also include CHESS 1-2 (OR 1.13, 95% CI 1.11-1.16), CHESS 3+ (OR 1.27, 95% CI 1.18-1.37), CPS 1-2 (OR 1.25, 95% CI 1.21-1.30), CPS 3-4 (1.29, 95% CI 1.24-1.34), and MCC 3+ (OR 1.16, 95% CI 1.10-1.22), anxiety diagnosis (OR 1.25, 95% CI 1.21-1.30), and residing in Alberta facilities (OR 1.22, 95% CI 1.18-1.26).

Factors with weak effects for the major transition from *no mood to moderate/severe mood disturbance* (Figure 4.5) include being married (OR 1.03, 95% CI 1.01-1.06), age 75-84 (OR 1.09, 95% CI 1.05-1.12), number of medications (OR 1.01, 95% CI 1.01-1.02), ISE 1-2 (OR 1.07, 95% CI 1.01-1.12), ADLH 1-2 (OR 1.09, 95% CI 1.05-1.15), MCC 1-2 (OR 1.08, 95% CI 1.04-1.12), and depression diagnosis (OR 1.03, 95% 1.01-1.06).

Worsening Mood - Transitioning From Mild Mood Disturbance

Figure 4.6 deals with transitions for persons in the mid-level of mild mood disturbance. The factors strongly associated with transitioning from *mild mood to*

moderate/severe mood disturbance include pain 3 (OR 1.38, 95% CI 1.29-1.47), and conflict with staff, family, friends, or other residents (OR 1.30, 95% CI 1.27-1.34).

Factors with a moderate effect for transitioning from *mild to moderate/severe mood disturbance* (Figure 4.6) include being female (OR 1.19, 95% CI 1.17-1.21), age 85-94 (OR 1.11, 95% CI 1.09-1.14), and age 95+ (OR 1.16, 95% CI 1.11-1.20). They also include anxiolytics (OR 1.12, 95% CI 1.09-1.15) and antipsychotics (OR 1.11, 95% CI 1.09-1.13). In addition, they include ISE 3-4 (OR 1.14, 95% CI 1.11-1.18), ISE 5-6 (OR 1.13, 95% CI 1.09-1.17), Pain 1-2 (OR 1.21, 95% CI 1.19-1.23), ABS 1-4 (OR 1.18, 95% CI 1.16-1.20), and ABS 5+ (OR 1.25, 95% CI 1.21-1.29). Lastly, they include poor sleep (OR 1.16, 95% CI 1.12-1.21) and anxiety (OR 1.17, 95% CI 1.14-1.20).

Factors with weak effects for transitioning from *mild to moderate/severe mood disturbance* (Figure 4.6) include being married (OR 1.07, 95% CI 1.05-1.10), age 75-84 (1.05, 95% CI 1.02-1.07), recreation therapy days (OR 1.08, 95% CI 1.05-1.11), number of medications (OR 1.01, 95% CI 1.01-1.01), antidepressants (OR 1.05, 95% CI 1.04-1.07), and hypnotics (OR 1.03, 95% CI 1.00-1.06). They also include ISE 1-2 (OR 1.09, 95% CI 1.06-1.13), CHESS 1-2 (OR 1.03, 95% CI 1.02-1.05), ADLH 1-2 (OR 1.08, 95% CI 1.03-1.13), CPS 1-2 (OR 1.06, 95% CI 1.02-1.10), MCC 3+ (OR 1.05, 95% CI 1.01-1.09), ADRD (OR 1.02, 95% CI 1.00-1.05), and bipolar disorder (OR 1.07, 95% CI 1.01-1.14).

A limited number of factors were protective of the transition to worsened mood states. Covariates associated with lower odds of *worsening mood from no mood disturbance* (Figure 4.5) include physician visits (OR 0.94, 95% CI 0.93-0.96), British

Columbia facilities (OR 0.66, 95% CI 0.65-0.68), urban locations (OR 0.83, 95% CI 0.81-0.85), and larger facilities (>100 beds) (OR 0.83, 95% CI 0.77-0.88).

Covariates associated with lower odds of *transitioning from* no mood disturbance to moderate/severe mood disturbance (Figure 4.5) include psychological therapy days (OR 0.89, 95% CI 0.81-0.99) and CPS 5-6 (OR 0.72, 95% CI 0.69-0.76).

Covariates associated with lower odds of transitioning *from* mild mood disturbance to moderate/severe mood disturbance (Figure 4.6) include CPS 5-6 (OR 0.69, 95% 0.67-0.72), residing in British Columbia facilities (OR 0.69, 95% CI 0.68-0.71), and urban locations (OR 0.86, 95% CI 0.84-0.88).

Improving Mood – Transitioning From Mild Mood Disturbance

There are also residents who transitioned from having mild mood disturbance to no mood disturbance. In addition, some residents in the moderate/severe mood disturbance levels also transitioned to either no mood disturbance or mild mood disturbance (Figures 4.6 and 4.7).

Common factors associated with increased odds of *improving mood to either no or mild mood disturbance* (Figure 4.7) include physician visits, Alberta, British Columbia facilities and urban locations.

The strongest covariates associated with transitioning from *mild mood to no mood disturbance* (Figure 4.6) include British Columbia facilities (OR 1.33, 95% CI 1.30-1.36). The factors with a weak effect in improving mood from *mild to no mood disturbance* include being married (Or 1.07, 95% CI 1.05-1.10), ISE 3-4 (OR 1.07, 95%

CI 1.04-1.11), ISE 5-6 (OR 1.05, 95% CI 1.01-1.08), and urban locations (OR 1.05, 95% CI 1.03-1.08).

Improving Mood – Transitioning From Moderate/Severe Mood Disturbance

For residents with *moderate/severe mood disturbance the* strongest associations for the transition *to no mood disturbance* (Figure 4.7) include British Columbia facilities (OR 1.81, 95% CI 1.75-1.88). The factors with a moderate effect in improving mood *from moderate/severe to no mood disturbance* include urban locations (OR 1.19, 95% CI 1.15-1.24). The covariates with only a weak effect in improving mood from *moderate/severe to no mood disturbance* include physician visits (OR 1.04, 95% CI 1.02-1.07), and Alberta facilities (1.07, 95% CI 1.03-1.11).

There were no factors with a strong effect in residents improving mood from *moderate/severe to mild disturbance;* however, covariates with a moderate effect include British Columbia facilities (OR 1.15, 95% CI 1.12-1.18), and urban locations (OR 1.12, 95% CI 1.09-1.15). There were also covariates with a weak effect including physician visits (OR 1.03, 95% CI 1.01-1.05), CPS 5-6 (OR 1.06, 95% CI 1.01-1.11), and Alberta facilities (1.08, 95% CI 1.06-1.11).

The common factors associated with lower odds of *improving mood from* moderate/severe mood disturbance to any of the improved states (Figure 4.7) include female, age groups 75+, psychological therapy days, anxiolytics, and antidepressants. They also include CHESS 1-2, CHESS 3+, ADLH 1-2, ADLH 3+, CPS 1-2, CPS 3-4, pain 1-2, Pain 3, ABS 1-4, ABS 5+, conflict with staff, family, friends, or other

residents, and poor sleep. Further, they include anxiety, and both large and medium facility size.

The factors associated with lower odds of *transitioning from mild mood to no mood disturbance* (Figure 4.6) include psychological therapy days (OR 0.86, 95% 0.80-0.93), CHESS 3+ (OR 0.88, 95% CI 0.84-0.92), ADLH 1-2 (OR 0.88, 95% CI 0.84-0.92), ADLH 3+ (OR 0.87, 95% CI 0.83-0.90), CPS 1-2 (OR 0.82, 95% CI 0.79-0.85), CPS 3-4 (OR 0.71, 95% CI 0.69-0.74), CPS 5-6 (OR 0.74, 95% CI 0.71-0.77), pain 1-2 (OR 0.88, 95% CI 0.87-0.90), pain 3 (OR 0.8, 95% CI 0.74-0.86), ABS 1-4 (OR 0.80, 95% CI 0.79-0.81), ABS 5+ (OR 0.59, 95% CI 0.57-0.61). They also include conflict with staff, family, friends, or other residents (OR 0.83, 95% 0.81-0.85), and poor sleep (OR 0.80, 95% CI 0.77-0.83).

In residents with *moderate/severe mood disturbance*, the factors associated with lower odds of *transitioning to no mood disturbance* (Figure 4.7) include females (OR 0.81, 95% CI 0.78-0.83), age 85-94 (OR 0.89, 95% CI 0.86-0.93), age 95+ (OR 0.88, 95% CI 0.83-0.93), psychological therapy days (OR 0.62, 95% CI 0.55-0.69), anxiolytics (OR 0.86, 95% CI 0.83-0.90), antidepressant use (OR 0.88, 95% CI 0.85-0.90), and antipsychotics (OR 0.97, 95% CI 0.94-0.99). In addition to CHESS 1-2 (OR 0.91, 95% CI 0.88-0.93), CHESS 3+ (OR 0.87, 95% CI 0.82-0.92), ADLH 1-2 (OR 0.80, 95% CI 0.74-0.85), ADLH 3+ (OR 0.76, 95% CI 0.71-0.81), CPS 1-2 (OR 0.76, 95% CI 0.72-0.80), CPS 3-4 (OR 0.63, 95% CI 0.60-0.66), CPS 5-6 (OR 0.75, 95% CI 0.71-0.80), pain 1-2 (OR 0.75, 95% CI 0.73-0.77), pain3 (OR 0.66, 95% CI 0.61-0.72), ABS 1-4 (OR 0.62, 95% CI 0.60-0.63), and ABS 5+ (OR 0.37, 95% CI 0.35-0.39). They also include conflict

with staff, family, friends, or other residents (OR 0.66, 95% CI 0.64-0.68), poor sleep (OR 0.70, 95% CI 0.68-0.73), anxiety (OR 0.81, 95% CI 0.78-0.84), and ADRD (OR 0.90, 95% CI 0.88-0.93). Lastly, they include large (OR 0.86, 95% CI 0.78-0.96), and medium facilities (OR 0.88, 95% CI 0.79-0.98).

Those that are associated with lower odds of transitioning from moderate/severe mood to mild mood disturbance (Figure 4.7) include females (OR 0.81, 95% CI 0.79-0.82), age 75-84 (OR 0.95, 95% CI 0.92-0.97), age 85-94 (OR 0.90, 95% CI 0.87-0.92), age 95+ (OR 0.87, 95% CI 0.84-0.91), psychological therapy days (OR 0.69, 95% CI 0.64-0.73), recreation therapy days (OR 0.93, 95% CI 0.92-0.96), anxiolytics (OR 0.88, 95% CI 0.86-0.90), antidepressant use (OR 0.94, 95% CI 0.92-0.96), and hypnotics (OR 0.95, 95% CI 0.93-0.98). In addition to ISE 1-2 (OR 0.95, 95% CI 0.92-0.97), ISE 3-4 (OR 0.94, 95% CI 0.91-0.97), ISE 5-6 (OR 0.89, 95% CI 0.86-0.92), CHESS 1-2 (OR 0.94, 95% CI 0.93-0.96), CHESS 3+ (OR 0.85, 95% CI 0.82-0.88), ADLH 1-2 (OR 0.86-95% CI 0.86-0.90), ADLH 3+ (OR 0.85, 95% CI 0.81-0.89), CPS 1-2 (OR 0.88, 95% CI 0.85-0.92), CPS 3-4 (OR 0.86, 95% CI 0.83-0.90), pain 1-2 (OR 0.79, 95% CI 0.78-0.80), pain3 (OR 0.64, 95% CI 0.61-0.68), ABS 1-4 (OR 0.80, 95% CI 0.79-0.82), ABS 5+ (OR 0.58, 95% CI 0.57-0.59), and MCC 3+ (OR 0.93, 95% CI 0.89-0.97). They also include conflict with staff, family, friends, or other residents (OR 0.74, 95% CI 0.72-0.76), poor sleep (OR 0.71, 95% CI 0.70-0.73), anxiety (OR 0.82, 95% CI 0.80-0.84), and depression (OR 0.96, 95% CI 0.95-0.98). They also include large (OR 0.85, 95% CI 0.79-0.92), and medium facilities (OR 0.92, 95% CI 0.86-0.99).

Transitions to Absorbing States: Home Discharge

There were only four common factors associated with higher odds of transitioning to *home from any mood state,* these include being married, physician visits, CHESS 3+, and pain score 3.

For residents with *no mood disturbance,* the factors strongly associated with transitioning *to home* (Figure 4.5) include being married (OR 1.49, 95% CI 1.37-1.61), physician visits (OR 1.32, 95% CI 1.21-1.43), CHESS 3+ (OR 1.54, 95% CI 1.20-1.97), pain 1-2 (OR 1.32, 95% CI 1.22-1.42), pain 3 (OR 1.52, 95% CI 1.09-2.12). There was only one factor with a moderate effect including conflict with staff, family, friends, or other residents (OR 1.19, 95% CI 1.01-1.40).

The strongest factors associated with transitioning *to home* for residents with *mild mood disturbance* (Figure 4.6) include being married (OR 1.66, 95% CI 1.48-1.85), and CHESS 3+ (OR 1.50, 95% CI 1.19-1.88), and pain 3 (OR 1.48, 95% CI 1.06-2.07). Other factors showed a moderate effect like physician visits (OR 1.23, 95% CI 1.20-1.37), and pain 1-2 (OR 1.22, 95% CI 1.10-1.34).

For residents transitioning from *moderate/severe mood disturbance to home* (Figure 4.7), all factors showed a strong effect, and these include being married (OR 1.57, 95% CI 1.39-1.78), physician visits (OR 1.32, 95% CI 1.17-1.50), CHESS 3+ (OR 1.46, 95% CI 1.19-1.79), pain 3 (OR 1.54, 95% CI 1.20-1.98), and MCC 3+ (OR 1.33, 95% CI 1.05-1.69).

The common factors associated with lower odds of transitioning to *home from any mood state include* all age groups 75+, antipsychotics, ISE 3-4, ISE 5-6, and ADLH 1+, CPS 1+.

Residents with *no mood disturbance* had a lower odd of transitioning *to home* (Figure 4.5) if they were in age group 75-84 (OR 0.64, 95% CI 0.58-0.70), age 85-94 (OR 0.39, 95% CI 0.35-0.43), age 95+ (OR 0.33, 95% CI 0.28-0.40), had antidepressants (OR 0.75, 95% CI 0.69-0.82), antipsychotics (OR 0.86, 95% CI 0.77-0.95). Other factors include ISE 1-2 (OR 0.71, 95% CI 0.60-0.84), ISE 3-4 (OR 0.62, 95% CI 0.53-0.73), ISE 5-6 (OR 0.53, 95% CI 0.45-0.63), ADLH 1-2 (OR 0.88, 95% CI 0.78-0.99), ADLH 3+ (OR 0.58, 95% CI 0.51-0.65), CPS 1-2 (OR 0.65, 95% CI 0.59-0.71), CPS 3-4 (OR 0.48, 95% CI 0.43-0.54), CPS 5-6 (OR 0.39, 95% CI 0.33-0.47), and MCC 1-2 (OR 0.84, 95% CI 0.76-0.93). Further, they include anxiety (OR 0.83, 95% CI 0.71-0.96), ADRD (OR 0.68, 95% CI 0.62-0.74), Alberta facilities (OR 0.88, 95% CI 0.77-0.99), British Columbia facilities (OR 0.41, 95% CI 0.37-0.46), and medium size facilities (OR 0.71, 95% CI 0.52-0.98).

Factors associated with lower odds of transitioning from *mild mood disturbance to home* (Figure 4.6) include age group 75-84 (OR 0.63, 95% CI 0.56-0.71), age 85-94 (OR 0.49, 95% CI 0.43-0.56), age 95+ (OR 0.35, 95% CI 0.27-0.46), recreation therapy days (OR 0.70, 95% CI 0.58-0.83), antidepressants (OR 0.88, 95% CI 0.79-0.97), antipsychotics (OR 0.84, 95% CI 0.75-0.95). ISE 3-4 (OR 0.75, 95% CI 0.62-0.92), ISE 5-6 (OR 0.61, 95% CI 0.49-0.76), ADLH 1-2 (OR 0.75, 95% CI 0.62-0.91), ADLH 3+ (OR 0.46, 95% CI 0.38-0.56), CPS 1-2 (OR 0.63, 95% CI 0.54-0.72),

CPS 3-4 (OR 0.39, 95% CI 0.33-0.46), CPS 5-6 (OR 0.34, 95% CI 0.27-0.42), and ABS 5+ (OR 0.65, 95% CI 0.50-0.84). Moreover, factors associated with lower odds of transitioning from *mild mood disturbance to home also include* ADRD (OR 0.72, 95% CI 0.64-0.81), depression (OR 0.86, 95% CI 0.76-0.97), and British Columbia facilities (OR 0.55, 95% CI 0.46-0.65).

For residents with *moderate/severe mood disturbance*, factors associated with lower odds of transitioning *to home* (Figure 4.7) include being a female (OR 0.73, 95% CI 0.65-0.82), age group 75-84 (OR 0.69, 95% CI 0.59-0.79), age 85-94 (OR 0.53, 95% CI 0.46-0.62), age 95+ (OR 0.54, 95% CI 0.42-0.71). Additionally, recreation therapy days (OR 0.79, 95% CI 0.66-0.95), antipsychotics (OR 0.79, 95% CI 0.71-0.89), ISE 1-2 (OR 0.78, 95% CI 0.64-0.94), ISE 3-4 (OR 0.65, 95% CI 0.54-0.79), ISE 5-6 (OR 0.47, 95% CI 0.37-0.58), CHESS 1-2 (OR 0.89, 95% CI 0.79-0.99), ADLH 1-2 (OR 0.56, 95% CI 0.44-0.70), ADLH 3+ (OR 0.35, 95% CI 0.28-0.43), CPS 1-2 (OR 0.71, 95% CI 0.59-0.86), CPS 3-4 (OR 0.45, 95% CI 0.37-0.56), CPS 5-6 (OR 0.43, 95% CI 0.33-0.55), and ABS 5+ (OR 0.66, 95% CI 0.55-0.80). They also include factors like poor sleep (OR 0.83, 95% 0.72-0.97), and ADRD (OR 0.69, 95% CI 0.61-0.79).

Transitions to Absorbing States: Hospitalization

The common factors associated with higher odds of transitioning to *hospital from any mood state* include physician visits, CHESS 3+, MCC 1-2, MCC 3+, urban locations, medium facility size, and large facility size.

The strongest factors for residents transitioning from *no mood states to Hospital* (Figure 4.5) include CHESS 3+ (OR 1.43, 95% CI 1.37-1.50), pain 3 (OR 1.53,

95% CI 1.43-1.65), MCC 3+ (OR 1.73, 95% CI 1.67-1.78), and urban locations (OR 1.30, 95% CI 1.27-1.34). Other factors but with a moderate effect include age 75-84 (OR 1.10, 95% CI 1.07-1.12), physician visits (OR 1.19, 95% CI 1.18-1.21), CHESS 1-2 (OR 1.16, 95% CI 1.14-1.18), ADLH 3+ (OR 1.26, 95% CI 1.22-1.30), pain 1-2 (OR 1.13, 95% CI 1.11-1.15), ABS 1-4 (OR 1.11, 95% CI 1.09-1.13), ABS 5+ (OR 1.29, 95% CI 1.22-1.37), and MCC 1-2 (OR 1.27, 95% CI 1.24-1.31). Additionally, poor sleep (OR 1.14 95% CI 1.04-1.26), medium facility size (OR 1.16, 95% CI 1.05-1.28), and large facility size (OR 1.26, 95% CI 1.15-1.40). There were also factors with a weak effect that include number of medications (OR 1.05, 95% CI 1.04-1.05), anxiolytics (OR 1.08, 95%CI 1.05-1.11), antipsychotics (OR 1.05, 95% CI 1.03-1.07), ADLH 1-2 (OR 1.07, 95% CI 1.03-1.10), and conflict with staff, family, friends, or other residents (OR 1.06, 95% CI 1.03-1.10).

The factors with a strong association to transitioning to *hospital from mild mood disturbance* are MCC 3+ (OR 1.63, 95% CI 1.57-1.70), urban locations (OR 1.42, 95% CI 1.38-1.46), and large facilities (OR 1.40, 95% CI 1.26-1.55). Factors with a moderate effect include physician visits (OR 1.18, 95% CI 1.16-1.21), CHESS 1-2 (OR 1.10, 95% CI 1.09-1.12), CHESS 3+ (OR 1.25, 95% CI 1.20-1.30), ADLH 3+ (OR 1.16, 95% CI 1.10-1.21), pain 3 (OR 1.22, 95% CI 1.14-1.31), and MCC 1-2 (OR 1.23, 95% CI 1.19-1.27). Lastly, factors with a weaker effect include residents with age 75-84 (OR 1.08, 95% CI 1.05-1.10), number of medications (OR 1.05, 95% CI 1.04-1.05), CHESS 1-2 (OR 1.10, 95% CI 1.09-1.12), pain score of 1-2 (OR 1.08, 95% CI 1.06-1.10), and bipolar disorder (OR 1.09, 95% CI 1.02-1.16).

Again, there were factors with strong, moderate, and weak effects for residents transitioning from *moderate/severe mood states to Hospital* (Figure 4.7). The factors strongly associated with higher odds of transitioning to hospital include CHESS 3+ (OR 1.33, 95% CI 1.29-1.38), MCC 3+ (OR 1.67, 95% CI 1.59-1.72), urban locations (OR 1.38, 95% CI 1.35-1.42), medium (OR 1.49, 95% CI 1.34-1.65), and larger facilities (OR 1.64, 95% CI 1.48-1.83). Factors with a moderate effect include physician visits (OR 1.18, 95% CI 1.16-1.20), ADLH 3+ (OR 1.10, 95% CI 1.04-1.16), MCC 1-2 (OR 1.29, 95% CI 1.24-1.33), and bipolar disorder (OR 1.14, 95% CI 1.08-1.20). Finally, factors associated with higher odd of transitioning from moderate/severe mood disturbance to hospital but with a weak effect include number of medications (OR 1.04, 95% CI 1.04-1.05), and CHESS 1-2 (OR 1.09, 95% CI 1.07-1.11).

The common factors that were found to be associated with lower odds of transitioning to *hospital from any mood state* include females, married, age 95+, psychological therapy days, recreation therapy days, antidepressants, ISE 1-2, ISE 3-4, ISE 5-6, CPS 1-2, and CPS 5-6, anxiety, ADRD, facilities in Alberta, and British Columbia.

Factors associated with lower odds of transitioning from *no mood disturbance to Hospital* (Figure 4.5) include females (OR 0.65, 95% CI 0.64-0.66), married (OR 0.89, 95% CI 0.88-0.91), age 95+ (OR 0.83, 95% CI 0.80-0.86), psychological therapy days (OR 0.83, 95% CI 0.77-0.89), recreation therapy (OR 0.97, 95% CI 0.94-0.99), antidepressants (OR 0.88, 95% CI 0.87-0.90), and hypnotics (OR 0.96, 95% CI 0.94-0.99). Additionally, ISE 1-2 (OR 0.92, 95% CI 0.89-0.95), ISE 3-4 (OR 0.79, 95% CI

0.76-0.81), ISE 5-6 (OR 0.74, 95% CI 0.72-0.77), CPS 1-2 (OR 0.97, 95% CI 0.95-0.99), CPS 3-4 (OR 0.95, 95% CI 0.92-0.97), CPS 5-6 (OR 0.83, 95% CI 0.80-0.85), anxiety (OR 0.85, 95% CI 0.83-0.87), ADRD (OR 0.78, 95% CI 0.76-0.79), depression (OR 0.97, 95% CI 0.95-0.98), Alberta facilities (OR 0.32, 95% CI 0.31-0.33), and British Columbia facilities (OR 0.25, 95% CI 0.25-0.26).

For residents with *mild mood disturbance*, the factors associated with lower odds of transitioning *to Hospital* (Figure 4.6) include females (OR 0.63, 95% CI 0.62-0.64), married (OR 0.92, 95% CI 0.90-0.94), age 95+ (OR 0.77, 95% CI 0.74-0.81), psychological therapy (OR 0.90, 95% CI 0.83-0.97), recreation therapy (OR 0.91, 95% CI 0.88-0.94), antidepressants (OR 0.87, 95% CI 0.86-0.89), antipsychotics (OR 0.97, 95% CI 0.95-0.99), and hypnotics (OR 0.91, 95% CI 0.88-0.94). Moreover, factors associated with lower odds of transitioning to hospital include ISE 1-2 (OR 0.92, 95% CI 0.90-0.96), ISE 3-4 (OR 0.85, 95% CI 0.82-0.88), ISE 5-6 (OR 0.80, 95% CI 0.77-0.83), CPS 1-2 (OR 0.86, 95% CI 0.84-0.89), CPS 3-4 (OR 0.76, 95% CI 0.73-0.78), CPS 5-6 (OR 0.63, 95% CI 0.60-0.65), anxiety (OR 0.89, 95% CI 0.87-0.92), ADRD (OR 0.76, 95% CI 0.74-0.77), depression (OR 0.97, 95% CI 0.95-0.99), Alberta facilities (OR 0.35, 95% CI 0.34-0.36), and British Columbia (OR 0.31, 95% CI 0.30-0.32).

For those residents *moderate/severe mood disturbance, the factors associated with lower* odds of transitioning *to Hospital* (Figure 4.7) include female (OR 0.58, 95%CI 0.57-0.60), married (OR 0.86, 95% CI 0.84-0.87), age 75-84 (OR 0.96, 95% CI 0.94-0.99), and age 85-94 (OR 0.83, 95% CI 0.81-0.86), age 95+ (OR 0.63, 95% CI 0.60-0.66). Additionally, psychological therapy (OR 0.89, 95% CI 0.84-0.94), recreation

therapy (OR 0.89, 95% CI 0.86-0.91), antidepressants (OR 0.93, 95% CI 0.92-0.95), antipsychotics (OR 0.84, 95% CI 0.83-0.86), ISE 1-2 (OR 0.94, 95% CI 0.91-0.97), ISE 3-4 (OR 0.88, 95% CI 0.85-0.91), ISE 5-6 (OR 0.84, 95% CI 0.81-0.86), CPS 1-2 (OR 0.86, 95% CI 0.83-0.89), CPS 3-4 (OR 0.74, 95% CI 0.71-0.77), CPS 5-6 (OR 0.65, 95% CI 0.62-0.68), ABS 1-4 (OR 0.91, 95% CI 0.90-0.93), and ABS 5+ (OR 0.89, 95% CI 0.87-0.92). Other factors include having conflict with staff, family, friends, or other residents (OR 0.89,95% CI 0.87-0.91), poor sleep (OR 0.88, 95% CI 0.86-0.90), anxiety (OR 0.88, 95% CI 0.86-0.90), ADRD (OR 0.71, 95% CI 0.70-0.73), depression (OR 0.96, 95% CI 0.94-0.98), Alberta facilities (OR 0.43, 95% CI 0.42-0.44), and British Columbia (OR 0.40, 95% CI 0.39-0.42).

Transitions to Absorbing States: Mortality

Common factors associated with higher odds of transitioning to *death from any mood state* include age 75-84, age 85-94, and age 95+, physician visits, number of medications, anxiolytics, CHESS 1-2, CHESS 3+, ADLH 3+, CPS 3-4, CPS 5-6, pain 1-2, pain 3, MCC 1-2, and MCC 3+, and British Columbia facilities.

For residents with *no mood disturbance,* the factors with a strong association with higher odds of transitioning *to Mortality* (Figure 4.5) are age 75-84 (OR 1.34, 95% CI 1.29-1.39), age 85-94 (OR 1.84, 95% CI 1.78-1.91), and age 95+ (OR 2.53, 95%CI 2.42-2.65), CHESS 1-2 (OR 2.12, 95% CI 2.08-2.16), CHESS 3+ (OR 10.43, 95% CI 10.03-10.84), ADLH 3+ (OR 2.79, 95% CI 2.59-3.01), CPS 3-4 (OR 1.42, 95% CI 1.36-1.48), CPS 5-6 (OR 2.55, 95% CI 2.44-2.68), pain 3 (OR 2.03, 95% CI 1.86-2.23), and MCC 3+ (OR 1.94, 95% CI 1.84-2.03).

Other factors associated with higher odds of transitioning from *no mood disturbance to Mortality* but with a moderate effect include ADLH 1-2 (OR 1.21, 95% CI 1.12-1.31), pain 1-2 (OR 1.24, 95% CI 1.21-1.27), ABS 1-4 (OR 1.13, 95% CI 1.10-1.16), and MCC 1-2 (OR 1.28, 95% CI 1.23-1.34). Facility attributes include Alberta facilities (OR 1.14, 95% CI 1.10-1.17), and British Columbia facilities (OR 1.12, 95% CI 1.09-1.15). Those with a weak effect include physician visits (OR 1.07, 95% CI 1.05-1.10), number of medications (OR 1.01, 95% CI 1.01-1.01), anxiolytics (OR 1.09, 95% CI 1.05-1.14), CPS 1-2 (OR 1.04, 95% CI 1.00-1.09), and depression (OR 1.09, 95% CI 1.06-1.11).

The strongest factors associated with higher odds of transitioning from *mild mood disturbance to Mortality* (Figure 4.6) include age 75-84 (OR 1.38, 95% CI 1.33-1.44), age 85-94 (OR 1.90, 95% CI 1.83-1.98), age 95+ (OR 2.58, 95%CI 2.45-2.71), CHESS 1-2 (OR 1.92, 95% CI 1.88-1.97), CHESS 3+ (OR 7.69, 95% CI 7.42-7.97), ADLH 3+ (OR 2.49, 95% CI 2.25-2.77), CPS 5-6 (OR 2.01, 95% CI 1.89-2.13), pain 3 (OR 1.83, 95% CI 1.70-1.97), and MCC 3+ (OR 1.77, 95% CI 1.67-1.87).

Other factors associated with higher odds of transitioning from *mild mood disturbance to Mortality* (Figure 4.6) with a moderate effect include CPS 3-4 (OR 1.19, 95% CI 1.12-1.26), pain 1-2 (OR 1.25, 95% CI 1.22-1.28), MCC 1-2 (OR 1.19, 95% CI 1.13-1.25), and British Columbia facilities (OR 1.27, 95% CI 1.23-1.32). Other factors with a weak effect include physician visits (OR 1.09, 95% CI 1.07-1.12), number of medications (OR 1.01, 95% CI 1.01-1.01), anxiolytics (OR 1.07, 95% CI 1.03-1.11), and depression (OR 1.07, 95% CI 1.04-1.10).

The strongest factors associated with higher odds in *residents with moderate/severe mood disturbance* transitioning *to Mortality* (Figure 4.7) include age 75-84 (OR 1.37, 95% CI 1.32-1.42), age 85-94 (OR 1.95, 95% CI 1.88-2.02), age 95+ (OR 2.61, 95% CI 2.49-2.74), CHESS 1-2 (OR 1.76, 95% CI 1.72-1.80), CHESS 3+ (OR 6.31, 95% CI 6.12-6.50), ADLH 3+ (OR 2.43, 95% CI 2.16-2.74), CPS 5-6 (OR 1.84, 95% CI 1.73-1.96), pain 3 (OR 1.58, 95% CI 1.51-1.66), MCC 3+ (OR 1.87, 95% CI 1.77-1.97), and British Columbia facilities (OR 1.36, 95% CI 1.31-1.40).

Other factors associated with higher odds of transitioning from *moderate/severe mood disturbance to Mortality* (Figure 4.7) with a moderate effect

include physician visits (OR 1.13, 95% CI 1.10-1.15), pain 1-2 (OR 1.14, 95% CI 1.12-1.17), and MCC 1-2 (OR 1.29, 95% CI 1.23-1.35).

Factors associated with transitioning from *moderate/severe mood disturbance to mortality* with a weak effect include number of medications (OR 1.01, 95% CI 1.01-1.02), anxiolytics (OR 1.05, 95% CI 1.02-1.08), and CPS 3-4 (OR 1.08, 95% CI 1.02-1.14)

The common factors found to be associated with lower odds of transitioning *to Mortality from any mood sta*te include females, married, antipsychotics, ISE 1-2, ISE 3-4, ISE 5-6, ABS 5+, conflict with staff, family, friends, or other residents, ADRD, and large facility size.

Those factors associated with lower odds of transitioning from *no mood disturbance to Mortality* (Figure 4.5) include female (OR 0.79, 95% CI 0.78-0.81), married (OR 0.95, 95% CI 0.92-0.97), psychological therapy days (OR 0.73, 95% CI 0.64-0.82), recreation therapy days (OR 0.95, 95% CI 0.92-0.99), and antipsychotics (OR 0.86, 95% CI 0.84-0.89). In addition to ISE 1-2 (OR 0.65, 95% CI 0.63-0.67), ISE 3-4 (OR 0.42, 95% CI 0.41-0.43), and ISE 5-6 (OR 0.29, 95% CI 0.27-0.30). Finally, conflict with staff, family, friends, or other residents (OR 0.93, 95% CI 0.88-0.98), ADRD (OR 0.84, 95% CI 0.82-0.86), urban locations (OR 0.95, 95% CI 0.92-0.98), and large facility size (OR 0.85, 95% CI 0.77-0.94).

Factors associated with lower odds of transitioning from *mild mood disturbance to Mortality* (Figure 4.6) include female (OR 0.75, 95% CI 0.74-0.77), married (OR 0.95, 95% CI 0.92-0.97), psychological therapy days (OR 0.71, 95% CI

0.63-0.79), antidepressants (OR 0.94, 95% CI 0.92-0.96), and antipsychotics (OR 0.84, 95% CI 0.82-0.86). Others include ISE 1-2 (OR 0.67, 95% CI 0.65-0.69), ISE 3-4 (OR 0.46, 95% CI 0.44-0.48), ISE 5-6 (OR 0.32, 95% CI 0.30-0.33), CPS 1-2 (OR 0.94, 95% CI 0.89-0.99), and ABS 5+ (OR 0.81, 95% CI 0.77-0.84). Additionally, they also include conflict with staff, family, friends, or other residents (OR 0.85, 95% CI 0.81-0.88), poor sleep (OR 0.92, 95% CI 0.88-0.97), ADRD (OR 0.76, 95% CI 0.74-0.78), urban locations (OR 0.93, 95% CI 0.90-0.96), and large facility size (OR 0.84, 95% CI 0.76-0.92).

For residents with *moderate/severe mood disturbance, the* factors associated with lower odds of transitioning *to Mortality* (Figure 4.7) include females (OR 0.65, 95% CI 0.64-0.67), being married (OR 0.88, 95% CI 0.86-0.91), psychological therapy days (OR 0.68, 95% CI 0.62-0.74), recreation therapy days (OR 0.93, 95% CI 0.90-0.96), antidepressants (OR 0.88, 95% CI 0.86-0.90), antipsychotics (OR 0.97, 95% CI 0.95-0.99), and hypnotics (OR 0.95, 95% CI 0.91-0.98). Other covariates include ISE 1-2 (OR 0.64, 95% CI 0.63-0.66), ISE 3-4 (OR 0.43, 95% CI 0.42-0.45), ISE 5-6 (OR 0.30, 95% CI 0.29-0.31), CPS 1-2 (OR 0.90, 95% CI 0.85-0.96), ABS 1-4 (OR 0.95, 95% CI 0.93-0.97), and ABS 5+ (OR 0.81, 95% CI 0.79-0.84). Further, conflict with staff, family, friends, or other residents (OR 0.77, 95% CI 0.75-0.79), anxiety (OR 0.90, 95% CI 0.87-0.92), and ADRD (OR 0.70, 95% CI 0.68-0.72). Lastly, Alberta facilities (OR 0.94, 95% CI 0.91-0.97), and large facilities (OR 0.86, 95% CI 0.79-0.93).

Transitions to Absorbing States: Other Settings

Common factors associated with higher odds of transitioning to *other settings from any mood state* include physician visits, CHESS 3+, ABS 5+, and AB facilities.

The strongest factors associated with higher odds of transitioning *from no mood disturbance to Other Settings* (Figure 4.5) items include physician visits (OR 1.45, 95% CI 1.32-1.58), CHESS 3+ (OR 2.59, 95% CI 2.11-3.18), pain 1-2 (OR 1.30, 95% CI 1.20-1.41), pain 3 (OR 2.10, 95% CI 1.54-2.88), ABS 5+ (OR 1.99, 95% CI 1.49-2.65), and Alberta facilities (OR 3.22, 95% CI 2.92-3.56). Other factors associated with transitioning from *no mood disturbance to Other Settings* with moderate effect include antipsychotics (OR 1.18, 95% CI 1.06-1.30), CHESS 1-2 (OR 1.14, 95% CI 1.05-1.24), and ABS 1-4 (OR 1.24, 95% CI 1.12-1.38). No predictors with a weak effect were found.

The strongest factors associated with higher odds of transitioning from *mild mood disturbance to Other Settings* (Figure 4.6) include physician visits (OR 1.34, 95% CI 1.21-1.49), CHESS 3+ (OR 1.70, 95% CI 1.39-2.07), ABS 5+ (OR 1.51, 95% CI 1.27-1.80), and Alberta facilities (OR 2.43, 95% CI 2.16-2.72), and British Columbia (OR 1.38, 95% CI 1.21-1.58). Other factors with a moderate effect were being married (OR 1.25, 95% CI 1.11-1.40), anxiolytics (OR 1.25, 95% CI 1.09-1.43), pain 1-2 (OR 1.18, 95% CI 1.08-1.30), and ABS 1-4 (OR 1.11, 95% CI 1.01-1.23). Again, no factors with a weak effect were found.

For those residents with *moderate/severe mood disturbance* the strongest factors associated with higher odds of transitioning from *to Other Settings* (Figure

4.7) include physician visits (OR 1.47, 95% CI 1.32-1.64), CHESS 3+ (OR 1.54, 95% CI 1.31-1.81), Alberta (OR 2.20, 95% CI 1.97-2.47), and British Columbia facilities (OR 1.36, 95% CI 1.17-1.58). Other factors predictors with a moderate effect include being married (OR 1.18, 95% CI 1.06-1.33), anxiolytics (OR 1.29, 95% CI 1.16-1.44), antidepressant (OR 1.27, 95% CI 1.16-1.40), hypnotics (OR 1.18, 95% CI 1.04-1.34), and ABS 5+ (OR 1.19, 95% CI 1.04-1.36). The rest of the factors were not significant.

The common factors associated with lower odds of transitioning to other settings from *any mood state to Other Settings* include being a female, age 75-84, age 85-94, age 95+, ISE 1-2, ISE 3-4, ISE 5-6, ADLH 3+, CPS 1-2, CPS 3-4, and CPS 5-6.

Those associated with lower odds of transitioning from *no mood disturbance to Other Settings* (Figure 4.5) females (OR 0.74, 95% CI 0.68-0.80), age 75-84 (OR 0.83, 95% CI 0.74-0.92), age 85-94 (OR 0.76, 95% CI 0.68-0.85), age 95+ (OR 0.67, 95% CI 0.56-0.81), recreation therapy days (OR 0.89, 95% CI 0.79-0.99). Moreover, ISE 1-2 (OR 0.80, 95% CI 0.68-0.95), ISE 3-4 (OR 0.62, 95% CI 0.52-0.74), ISE 5-6 (OR 0.59, 95% CI 0.49-0.71), ADLH 1-2 (OR 0.84, 95% CI 0.73-0.96), ADLH 3+ (OR 0.51, 95% CI 0.44-0.58), CPS 1-2 (OR 0.80, 95% CI 0.72-0.89), CPS 3-4 (OR 0.63, 95% CI 0.55-0.71), CPS 5-6 (OR 0.58, 95% CI 0.49-0.70), and ADRD (OR 0.80, 95% CI 0.73-0.88).

Factors associated with lower odds of transitioning from *mild mood disturbance to Other Settings* (Figure 4.6) include being a female (OR 0.74, 95% CI 0.67-0.81), age 75-84 (OR 0.80, 95% CI 0.71-0.91), age 85-94 (OR 0.66, 95% CI 0.58-0.75), and age 95+ (OR 0.56, 95% CI 0.44-0.71). In addition to include ISE 1-2 (OR 0.73, 95% CI 0.62-0.85), ISE 3-4 (OR 0.65, 95% CI 0.55-0.76), ISE 5-6 (OR 0.57, 95%

CI 0.48-0.69), ADLH 3+ (OR 0.50, 95% CI 0.41-0.61), CPS 1-2 (OR 0.74, 95% CI 0.64-0.87), CPS 3-4 (OR 0.55, 95% CI 0.46-0.65), and CPS 5-6 (OR 0.49, 95% CI 0.40-0.61). Lastly, ADRD (OR 0.75, 95% CI 0.67-0.84), depression (OR 0.87, 95% CI 0.78-0.97), urban locations (OR 0.82, 95% CI 0.73-0.94), and large facilities (OR 0.66, 95% CI 0.49-0.89).

Residents with moderate/severe mood disturbance had a lower odd of transitioning *to Other Settings* (Figure 4.7) if they were females (OR 0.59, 95% CI 0.54-0.65), age 75-84 (OR 0.88, 95% CI 0.78-0.99), age 85-94 (OR 0.63, 95% CI 0.56-0.72), and age 95+ (OR 0.55, 95% CI 0.43-0.69). Other factors associated with lower odds of transitioning from moderate/severe mood disturbance to other settings include recreation therapy days (OR 0.89, 95% CI 0.78-0.99), and antipsychotics (OR 0.89, 95% CI 0.81-0.98). In addition to ISE 1-2 (OR 0.73, 95% CI 0.64-0.83), ISE 3-4 (OR 0.58, 95% CI 0.50-0.66), ISE 5-6 (OR 0.48, 95% CI 0.40-0.56), ADLH 1-2 (OR 0.78, 95% CI 0.62-0.98), ADLH 3+ (OR 0.48, 95% CI 0.38-0.60), CPS 1-2 (OR 0.68, 95% CI 0.57-0.83), CPS 3-4 (OR 0.53, 95% CI 0.44-0.65), CPS 5-6 (OR 0.53, 95% CI 0.43-0.67), and large facilities (OR 0.57, 95% CI 0.43-0.75).

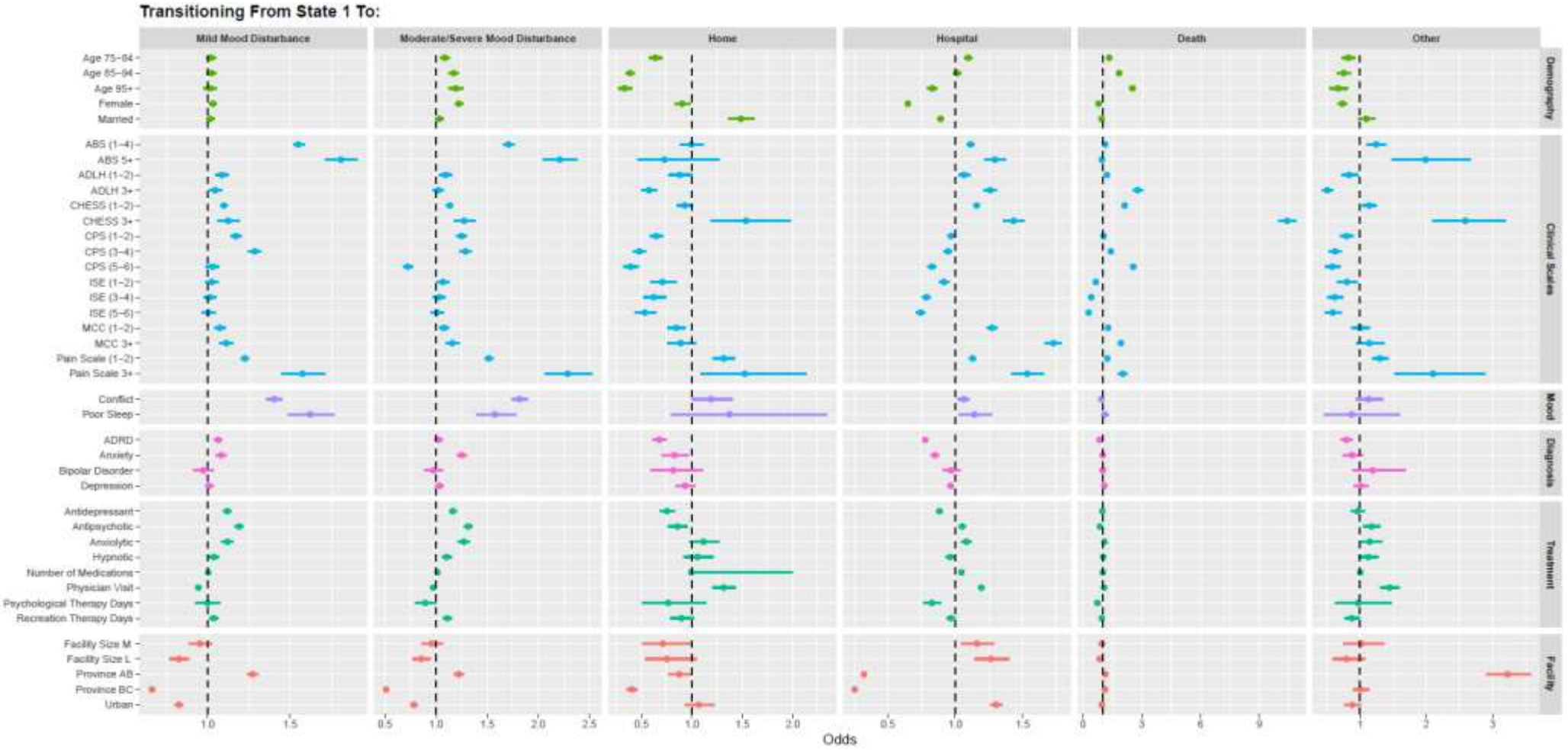


Figure 4.5: Adjusted Odds of Transitioning From No Mood Disturbance (State 1) to Different DRS States and Absorbing States During Pre-COVID Period Among Long-Term Care Residents 2010-2019, Canada N=314,042

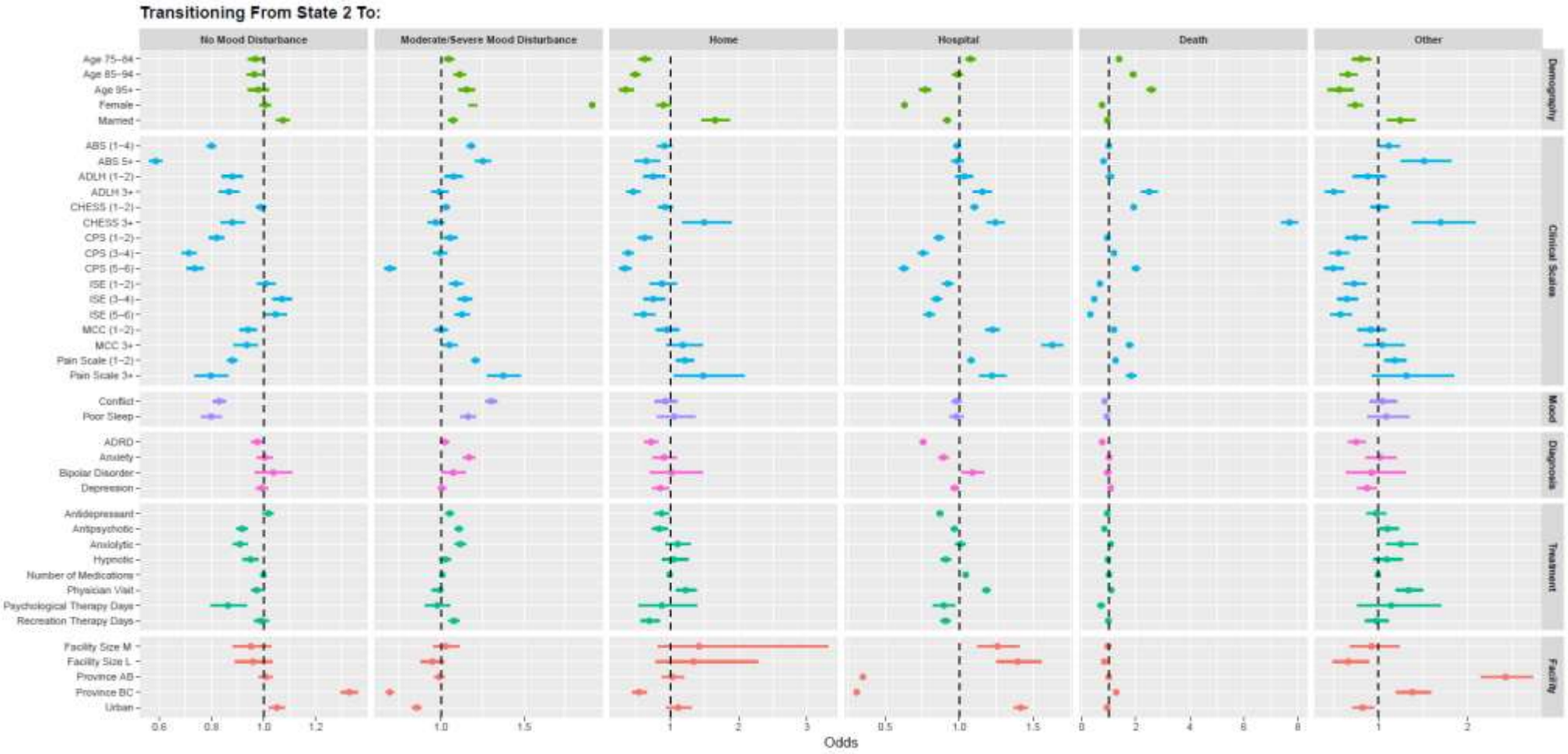


Figure 4.6: Adjusted Odds of Transitioning From Mild Mood Disturbance (State 2) to Different DRS States and Absorbing States During Pre-COVID Period Among Long-Term Care Residents 2010-2019, Canada N=314,042

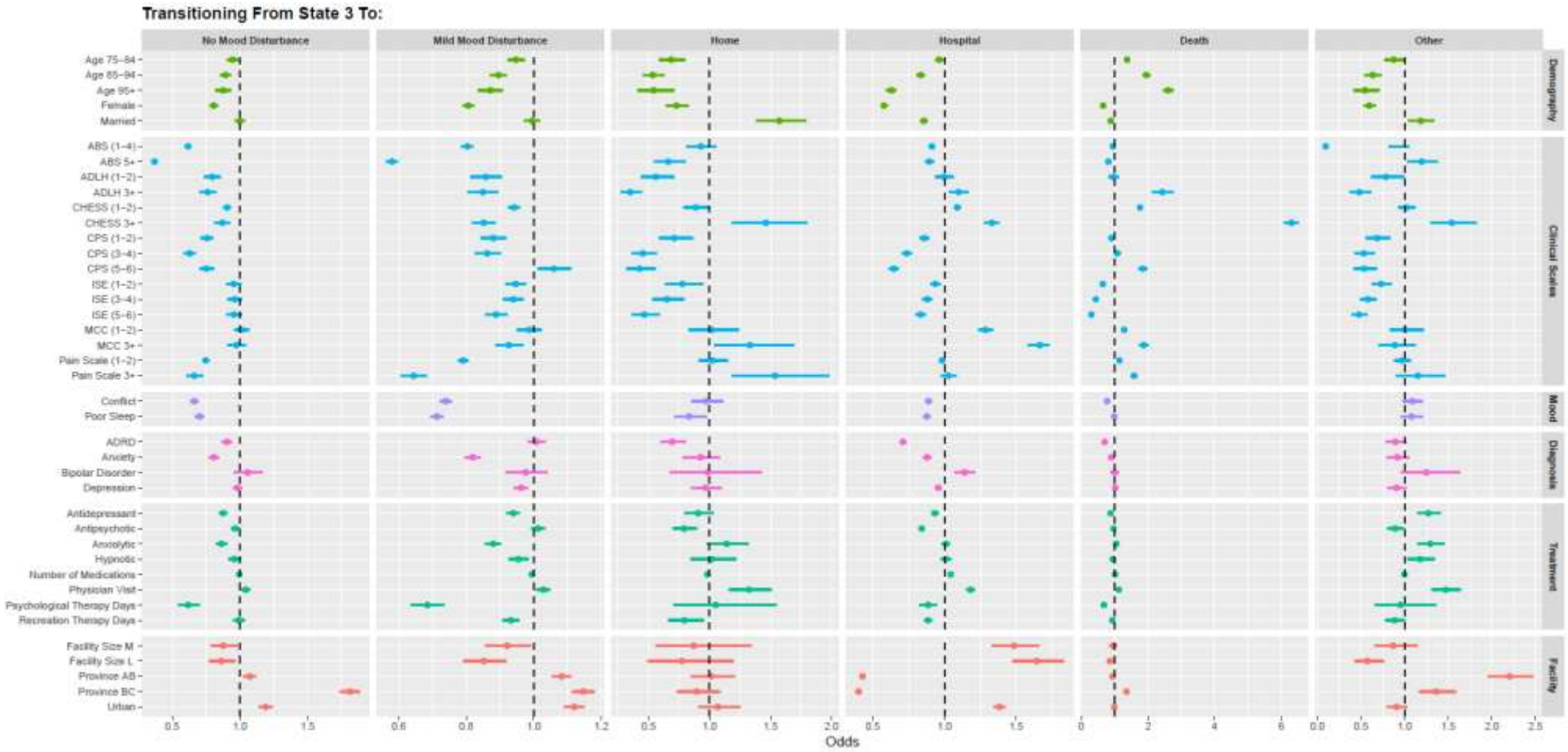


Figure 4.7: Adjusted Odds of Transitioning From Moderate/Severe Mood Disturbance (State 3) to Different DRS States and Absorbing States During COVID Pre-COVID Period Among Long-Term Care Residents 2010-2019, Canada N=314,042

4.4 Discussion

Being admitted to a LTC home is an important stressor that may contribute to developing mood disorders (Seitz et al., 2010). However, there are many factors associated with transitions in mood while in LTC whether it be improvement, worsening in depressive symptoms of mood or remaining the same. This study examined mood transitions between the different transient mood states and absorbing states among residents of LTC homes 65 years of age or older in Canada. It examined both personal-level factors and facility-level factors in three Canadian provinces (Alberta, British Columbia, and Ontario).

Our findings show that about 46.3% of residents initially present with no mood disturbance on admission and that those having mild or moderate/severe mood disturbance represent 30.5% and 23.2% of the residents, respectively. This study showed several statistically significant factors that were either associated with worsening or improvement in mood disturbance. To my knowledge, this is one of the largest samples that has been used in this literature, which means we get more precise estimates, but it also includes the risk that some variables will be statistically significant and may not necessarily mean that they are also clinically significant.

There were several factors associated with worsening mood, the factors with the strongest effects for transitioning from no mood disturbance to mild mood include severe pain, ABS ≥ 1, conflict with staff, family, friends, or other residents, or having poor sleep. Some factors had a moderate effect, and these includes some treatments such as anxiolytics, antidepressants, and antipsychotics. Some clinical severity scales were also among the factors with moderate effect including CHESS ≥ 1, CPS 1-2, CPS

3-4, and MCC 3+. The last factor associated with worsening of mood are facilities in Alberta.

As for worsening to moderate/severe mood disturbance from no mood disturbance, the factors with a strong effect include treatment with antipsychotics, pain ≥ 1, ABS ≥ 1, conflict with staff, family, friends, or other residents and having poor sleep. These were followed by the factors with a moderate effect in transitioning to moderate/severe mood disturbance and these include treatment like recreation therapy, anxiolytics, antidepressants, and hypnotics. In addition to some clinical severity scales like CHESS ≥1, CPS 1-2, CPS 3-4, or MCC 3+, and health diagnosis including anxiety. Again, LTC homes in Alberta had a moderate association with worsening mood disturbance.

The factors strongly associated with transitioning from mild mood disturbance to moderate/severe mood disturbance include severe pain and conflict with staff, family, friends, or other residents. Some factors with a moderate effect include anxiolytics, antipsychotics, ISE 3-4, ISE 5-6, pain 1-2, ABS ≥ 1. Poor sleep and having anxiety were also among the factors with a moderate effect. The above findings were consistent with the findings of others (Canadian Institute for Health Information, 2008; Morimoto et al., 2015; Szczerbińska et al., 2012; Wang & Blazer, 2015).

Demographic variables such as being a female, age categories 75-84, 85-94, and 95+, as well as being married predicted worst outcomes and transitioning from either no mood or mild mood disturbance to moderate/severe mood disturbance.

The common factors that were protective in residents transitioning from moderate/severe mood disturbance to either no mood or mild mood disturbance, include facilities in British Columbia, and those in urban locations.

Cognitive impairment as one of the factors associated with worsening mood and transitioning from no mood disturbance to either mild or moderate/severe disturbance is interesting. The DRS used in this study has some items that may also be related to dementia. For example, repetitive anxious complaints may be an indicator of anxiety, but it might also reflect short term memory loss or reduced capacity to manage stress. Another pathway that may link depression and cognition are the biological factors in the aetiology for both conditions (Wang & Blazer, 2015). The DRS also includes an item related to aggressive behaviour which was a predictor of worsening mood (persistent anger with self or others) because being depressed could also manifest as angry behaviour.

Another factor that was a strongly associated with worsening mood is pain which is consistent with other studies (Denkinger et al., 2014; Erdal et al., 2017; Neufeld et al., 2014; Zis et al., 2017). Again, the DRS includes an item that is related to pain (sad, pained, worried facial expression) which might reflect physical discomfort rather than sadness as a depressive symptom. Pain is an important factor associated with depressive symptoms in older adults which can be managed if detected and diagnosed.

Mood items such as having conflict with staff, family, friends, or other residents and having poor sleep patterns were associated with worsening mood

disturbance, which was consistent with other studies (Angevaare et al., 2023; Angevaare, Van Hout, et al., 2022; Fang et al., 2019; Gentili et al., 1997; Hu et al., 2020). Sleep disturbance is common among older adults due to environmental factors such as noise, light, and temperature changes as well as pain, where its association with depression could be genetic or through a shared biochemical pathway (Fang et al., 2019; Gentili et al., 1997). Another condition that had a strong effect in worsening mood is anxiety which is also related to depressive symptoms. Previous studies have shown that anxiety is common among residents of LTC homes (Creighton et al., 2018; Hoben et al., 2019), where 50% of individuals with depression experience anxiety and the opposite is true (Hirschfield, 2001).

Our scoping review (Chapter 2; Manuscript 1) identified studies reporting that social engagement and interaction play a role in the well-being and improving mood of LTC residents; however, this was not evident in this study. The index of social engagement, recreation and psychological therapies would have been expected to improve mood. However, on the contrary, all three factors were associated with lower odds of improved mood from moderate/severe mood disturbance. Moderate to high levels of social engagement improved mild mood disturbance, but also worsened mild mood to moderate/severe mood disturbance. These inconsistent patterns of ISE as a predictor could point to the need to use of the newer Revised Index of Social Engagement (RISE) which is an improved measure of social engagement in the context of LTC homes (Gerritsen et al., 2008) .

The present analysis also results in weak or counter intuitive results for pharmacological and non-pharmacological interventions. Recreation therapy was associated with worsened mood. Different treatments such as antidepressants, antipsychotics, anxiolytics and hypnotics were associated with worsening of mood with hypnotics having the least effect while antipsychotics had the strongest effect. A systematic review of the treatment of depression in LTC home residents with no significant cognitive impairment stated that half of psychotherapeutic interventions they examined had non-significant effect on depression, unlike some of the recreation and pharmacological treatments (Simning & Simons, 2017). The authors also explained that the medication use and its effectiveness depends on the cognitive function as well as the tolerability which depends on the age of residents (Simning & Simons, 2017). In our study, it was not possible to delineate the specific type of medication used, the type of psychotherapy or whether recreation therapy was based on group time or individually targeted activities. There is also the possibility that outcomes were confounded by indication. Hence, future studies should use a Treatment Effect Analysis to examine the effect of specific treatment modalities on the mood of LTC home residents.

Facility-level attributes including living in larger facilities were found to be associated with lower odds of deterioration or improvement in mood. Urban locations were associated with higher odds of improvement in mood. These results were consistent with our findings from our longitudinal study during the pre-COVID and COVID-19 periods (Chapter 3; Manuscript 2) which found that both factors were not

significant in predicting new mood symptoms. In both studies, British Columbia showed better mood outcomes which might be related to the available mental health services, differences in resources or the models of care employed in their LTC homes. However, the adjusted odds of transitioning to death were also higher in British Columbia, which needs to be further explored.

The patterns of demographic covariates predicting transitioning into the absorbing states were similar for all three mood states. Older age predicted mortality in all three mood states and being married predicted home discharge, and only to other settings in residents with either mild or moderate/severe mood disturbance. For each of the transitions to hospital, mortality or to other settings the cumulative incidence functions were highest among those with moderate/severe mood disturbance. The common factors for transitioning to home from all mood states include CHESS 3+, pain, physician visits, and urban locations. Those predicting transition to hospital from all mood states include ADLH, CHESS, MCC3+ (strongest effect), physician visits, which are expected findings due to complex medical problems residents of LTC homes have, and potentially palliative care. Others include medium and large size facilities and those in urban locations. The common factors of mortality for all mood states include CHESS 3+ (strongest effect), followed by ADLH 3+, CHESS 1-2, CPS 5-6, MCC 3+ and pain 3. Transitioning to other settings had also common factors for all states including the ABS 5+, CHESS 3+, severe pain, anxiolytics, and hypnotics. Further physician visits and facilities in Alberta (strongest effect) were both common with all mood states transitioning to other

settings. The consistencies in these associations across all three mood states suggest that there were no particularly important interaction effects between baseline mood and these other covariates.

Examining and understanding the factors associated with worsening or improving mood is very important given that there are some factors that can be modified or controlled. For example, experiencing pain or aggressive behaviour or inability to carry out activities of daily living, or the number of physician visits and the medications given. Our findings showed the importance of this in the results of the sojourn time where we found that there is approximately 17% probability in transitioning from mild mood disturbance to no mood disturbance in the first 90 days of admission. There was also about 21% probability for improvement from moderate/severe mood disturbance. Many of the factors associated with depressive symptoms worsening (e.g., pain, behaviour, cognition) can be addressed through the Clinical Assessment Protocols (CAPs) included in interRAI systems. Therefore, targeted interventions employing CAP guidelines should be employed to address both these underlying risk factors and associated mood outcomes (Carpenter & Hirdes, 2013; Freeman et al., 2014; Norman & Hirdes, 2020; Sinn et al., 2018).

4.5 Strengths and Limitations

This study used a very large representative sample of 314,042 unique individuals from a longitudinal dataset from a Pan-Canadian perspective, which makes the findings more generalizable to similar populations of residents living in LTC homes. Also, with such a large sample, the results are more stable as it

minimizes the impact of individual variation and outliers. Further, the assessments are carried out by trained clinicians providing a comprehensive view of the person's needs and health outcomes. Our analysis deals with absorbing states as competing risks which can inform decisions on programs that can enhance the mood of LTC residents. This adds to the robustness and validity of our findings.

There were some limitations in our study including the lack of more detailed information about specific medications, and the types of psychotherapy or recreation therapy used. In addition, there is a risk that some unexpected outcomes reflected a confounding by indication for some of these interventions. In terms of the absorbing state of hospital discharge we did not have information whether the hospital was acute care, rehabilitation, or psychiatry hospitals.

4.6 Conclusion and Implications

To our knowledge this is the only study that examined transitions in mood among residents of Canadian long-term care facilities. Our findings showed the factors contributing to transitioning to either improved or worsened mood as well as transitioning to absorbing states. Some of the factors which were among the strongest factors associated with worsening mood were pain and aggressive behaviour which are both modifiable needs that can be targeted with appropriate treatment modalities and programs.

Our analysis of the sojourn time also showed that there is a significant opportunity to improve mood. With such knowledge healthcare providers can implement proactive measures to improve mood through regular mental health

assessments, access to counseling services, and tailored activities that promote emotional well-being. Additionally, such an approach enables staff training to recognize early signs of depression, fostering a compassionate and responsive environment for the residents in LTC homes. There is also an opportunity to use the Mood Disturbance CAP which aims to categorize various risk levels of depressive symptoms based on symptom frequency (Freeman et al., 2014). This will provide further recommended strategies to manage and identify the type of mood disturbance and the best treatment modalities (Freeman et al., 2014).

Finally, it is important to note that there is a new interRAI measure of mood disturbance available with the newer interRAI Long Term Care Facility (LTCF) assessment that replaced the RAI 2.0. The Composite Mood Scale (Hirdes et al., 2022) uses both self-report and clinician rated items related to dysphoria, anxiety and anhedonia. It does not include the DRS pain and behaviour items that may be confounded with other factors. As Canadian provinces transition to use of the LTCF it will be possible to obtain large samples for the types of longitudinal analyses employed here.

Chapter 5: Manuscript 4

Factors Associated with Mood Transitions Among Canadian LTC Residents During COVID-19: A Multistate Transition Model

5.1 Introduction

The heightened susceptibility of older individuals in LTC, coupled with the need to employ important preventive and infection control measures, poses important clinical challenges within these care facilities. The COVID-19 pandemic greatly magnified those existing challenges in the long-term care (LTC) system, such that there was a need for all-encompassing protective strategies to ensure the safety of LTC residents. Mental health is one of the areas that caught the attention of not only healthcare providers, but society at large. The pandemic had a noticeable effect on the emotional well-being and psychological resilience of individuals as they encountered unprecedented challenges, such as isolation, fear, economic instability, and grief from the loss of loved ones. This was observed as either developing new mood symptoms (Mulla, R.T, Manuscript 2) or worsening depressive symptoms (Levere et al., 2021) among residents residing in Canadian LTC homes. An increased incidence of weight loss, cognitive impairment and incontinence were among the other reported negative outcomes of the pandemic (Hoben et al., 2023; Levere et al., 2021; Montgomery et al., 2020).

Many predictors of worsening mood symptoms were reported in the COVID-19 literature including staff shortages, limited mental health resources, and limited staff education about mental health among the older population (Checkland et al., 2021). Psychotropic medications including antidepressants, antipsychotics and benzodiazepine (Harrison et al., 2018) are often used to manage behavioural and mood symptoms in LTC home residents. Quality improvement initiatives to combat the inappropriate use of psychotropics led to the decrease in their prescribing rates

including antipsychotics (Canadian Institute for Health Information, 2024a; Hirdes, Major, et al., 2020; Reppas-Rindlisbacher et al., 2021). However, this was not the case during COVID where an increase in the absolute rates in the proportion of residents receiving prescriptions for some psychotropics was noted (Campitelli et al., 2021; N. M. Stall et al., 2021; Turcotte et al., 2023).

Residents in LTC homes could either experience worsening, improved or unchanged mood symptoms. Most research during the pandemic focused on the cross-sectional prevalence of mood symptoms and depression among nursing staff, care givers and residents of LTC homes and factors affecting mood change during that period. A limited number of studies examine the transition between the different health states among residents of LTC homes. To our knowledge none examined mood transitions in LTC home residents during the COVID-19 pandemic. This study examined the transitions between the three different states of depressive symptoms among residents of LTC homes during the first two waves of the COVID-19 pandemic. It also examined the transitions between the transient and different absorbing states.

5.2 Methods

5.2.1 Study Design and Setting

We conducted a retrospective longitudinal analysis of residents residing in LTC homes in three Canadian provinces (Alberta, British Columbia, and Ontario) over a 10-year period from January 2010 to February 2021. We used a one-step Markov multistate transition model to examine transitions of mood over time as well as the factors affecting those transitions using the standardized interRAI MDS 2.0

comprehensive health assessment prior to, and during, the first year of the COVID-19 pandemic.

5.2.2 Data Source

We used the linked dataset provided by the Canadian Institute for Health Information (CIHI) including Continuing Care Reporting System (CCRS), Data from Discharge Abstract Dataset (DAD), and the National Ambulatory Care Reporting System (NACRS). CCRS offers a comprehensive view of services provided in facilities for both frail older adults and people with disabilities across Canada (Hirdes et al., 2013). The MDS 2.0 assessment is used to plan care, evaluate quality, and allocate funding based on individual resident needs (Fries et al., 2007; Hirdes et al., 2003; Morris et al., 1999). DAD captures administrative, clinical and demographic information on hospital discharges (including deaths, sign-outs and transfers) (Canadian Institute for Health Information, 1996-2024a). NACRS contains data for hospital-based and community-based ambulatory care including day surgery, outpatient and community-based clinics, emergency departments, and also client visit data that is collected at time of service in participating facilities (Canadian Institute for Health Information, 1996-2024b). Reliability and validity of the MDS 2.0 is well established (Hirdes et al., 2013; Morris et al., 1997; Poss et al., 2008; Turcotte et al., 2018). As part of routine care, residents are assessed within 14 days of admission to LTC. Subsequent assessments are administered every three months (90 days), or sooner if there is a significant change in their health status.

5.2.3 Study Cohort

Residents were divided into two cohorts: the first group (pre-COVID cohort) received care before the COVID-19 pandemic (from January 2010 to February 2020, and the second group (COVID cohort) received care during the pandemic (from March 2020 to February 2021). The COVID cohort was further divided into two subgroups: Wave 1, which includes those assessed between March 2020 and August 2020, and Wave 2, which includes those assessed between September 2020 and December 2020.

Those included met the following inclusion criteria: a) 65 years or older, b) not in a comatose state, c) to have either two completed assessments or one assessment with discharge details, and d) initial assessment to fall in the study period. Exclusion criteria included: a) residents admitted for less than 90 days b) having only one assessment and lacking discharge information.

After selecting the eligible candidates, transition pairs were then established for each resident, starting with the first assessment as the originating state and the second assessment as the subsequent state. This process of creating transition pairs continued until residents reached an absorbing state or the end of the data series. Subsequently, the transition matrix was derived, and a one-step Markov model was constructed using these pairs of transitions.

5.2.4 Outcomes of Interest

Our primary outcome of interest in this study is mood disturbance measured using the Depression Rating Scale (DRS), which is calculated based on 30-day clinician observation of the frequency of seven mood and behavior items (i.e., negative

statements, persistent anger, unrealistic fears, repetitive health complaints, repetitive anxious complaints, sad or worried or facial expression, and crying) from the MDS 2.0 assessment (Burrows, 2000).

Prior validation studies indicate that DRS scores of three and greater are positively associated with major and minor depressive disorders (Burrows, 2000; Hoben et al., 2019; Koehler et al., 2005; Martin et al., 2008). DRS provides a standardized, and comprehensive clinician rated assessment of residents in LTC homes. It is also widely used internationally, including in different Canadian provinces (Hirdes et al., 2011; Hoben et al., 2019; Koehler et al., 2005; Neufeld et al., 2014).

To allow reporting of class-level odds ratio statistics, we collapsed the 14-point DRS into three categories. A DRS score of 0 indicates no mood disturbance, a score of 1-2 indicates the presence of mild mood disturbance, whereas a score of 3 or greater indicates presence of moderate/severe mood disturbance.

The secondary outcome of interest in this study is the final state that residents go to once they leave the LTC home or die. Residents can transition into four different states comprised of transitioning to Home (residents discharged to home), Hospital (residents discharged to hospital for acute care with an immediate return not expected but who are not known to have died in the hospital), Other (residents discharge to other destinations such as Assisted Living, Board care, and others) or transition to Death (including any death within the LTC home or are known to have died following hospital or ER admission).

5.2.5 Independent Variables and Exposures

All variables that were associated with incidence of new mood from Chapter 4 were included in this paper. Sociodemographic variables include age group, sex, and marital status. Measures of health and well-being included chronic conditions, psychosocial well-being, medications, and sleep patterns. We also used several validated summary scales including the Cognitive Performance Scale (CPS) (Morris et al., 1994), Changes in Health, End-Stage Disease, Signs, and Symptoms Scale (CHESS) (Hirdes et al., 2003; Hirdes et al., 2014), Major Comorbidity Count (MCC) (Hirdes, Declercq, et al., 2020), the Index of Social Engagement (ISE) (Gilbart & Hirdes, 2000), Activities of Daily Living Self-Performance Hierarchy (ADLH) Scale (Morris et al., 2013; Morris et al., 1999), Aggressive Behaviour Scale (ABS) (Perlman & Hirdes, 2008), and Pain Scale (Fries et al., 2001). Facility-level variables expected to have an effect in our analysis such as urban and rural location, and LTC home size (Baldwin et al., 2017; Wilkinson et al., 2019) as well as some Canadian provinces were added to our analysis as independent variables. In this study we created a COVID variable for the first two waves and were included as independent variables in all our models.

Our primary exposure of interest was the assessment period. The assessment period was operationalized as a nominal variable consisting of three categories: a) pre-COVID, assessments conducted between January 2010 and February 29, 2020; b) COVID Wave 1, assessments conducted between March 1, 2020and August 31, 2020, and c) COVID Wave 2, for assessments conducted between September 1, 2020, and December 31, 2020.

Statistical Analysis

We computed descriptive statistics for all independent variables measured at baseline to identify potential exposure period (i.e., pre-COVID vs. COVID wave 1 and COVID wave 2) differences among independent variables within the overall analytic cohort. Chi-square tests using a 0.05 alpha threshold were used to identify statistically significant differences between exposure periods. Candidate variables for the model were selected based on literature review and were retained in the final model based on P-value.

Next, a one-step Markov multistate transition model was used to investigate movement between the different states of mood and the other settings (Figure 5.1).

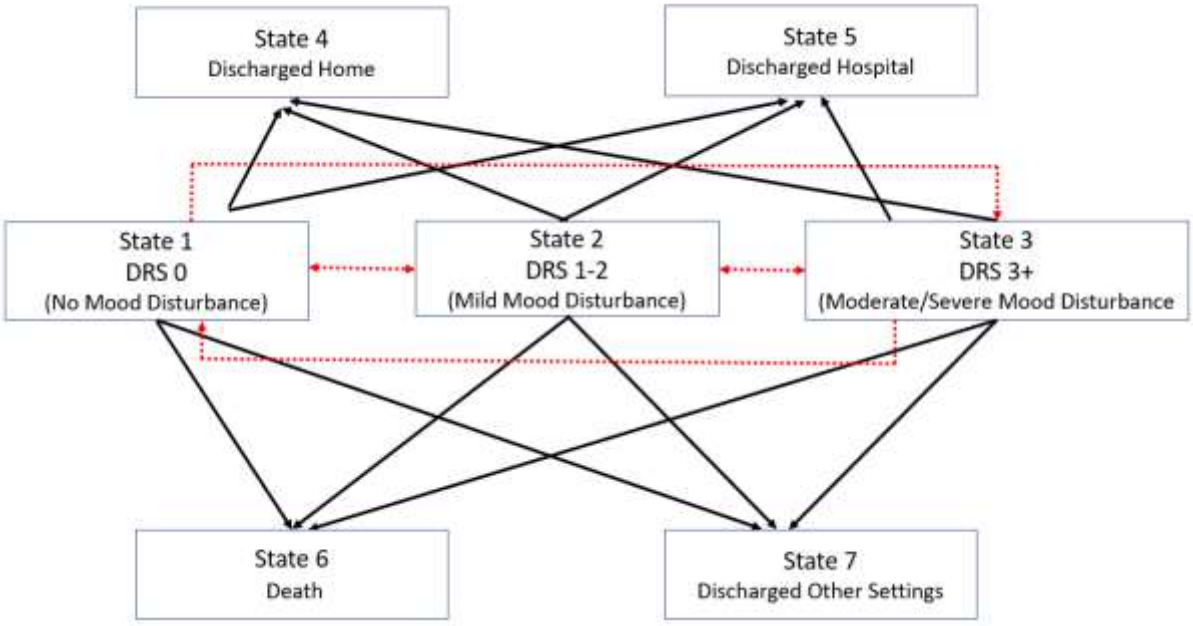


Figure 5.1: State-Space Diagram of Possible Transitions From Long-Term Care Home in Multistate Markov Model

Movement from state 1 to state 2, state 1 to state 3, or state 2 to state 3 all correspond to worsening in mood, whereas transitions in the reverse direction correspond to mood improvement. States 4 (discharged home), 5 (discharged to hospital), 6 (death), and 7 (discharged to other settings) represent potential reasons for discharge from the LTC home and are so-called absorbing states, since transitioning to one of these defines the end of the engagement with the LTC home (Cook et al., 2013; Heckman et al., 2019).

This model provides a framework for modeling trajectories of change in mood of residents of LTC homes over time (Cook et al., 2013) to examine whether the residents worsened or improved or remained the same.

All analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NC).

5.3 Results

5.3.1 Baseline Characteristics

Our cohort was comprised of 410,991 unique individuals 65 years and above, with 314,051 residents admitted into LTC homes before the pandemic and 59,113 and 37,827 residents at the start of waves 1 and 2 of the COVID-19 pandemic, respectively. Females represented 63.1% of the total residents in all periods, and those 85 years and older comprised 54.4%.

Table 5.1 shows the different residents' profiles according to the admission period (pre-COVID, Wave 1 or Wave 2). The distributions of clinical scales differed such that the worst CPS and ADLH scores were seen at the start of COVID wave 1,

whereas those of CHESS, ABS, and MCC scores were worst in wave 2. Pain scores were worse in the pre-COVID period. Physician visits, and use of psychological and recreation therapy as well as anxiolytics were more frequent during the pre-pandemic period. The use of antidepressants slightly increased and antipsychotics slightly decreased, but both were significant. Among the mood items measured, sleep pattern was worst during the second wave of the pandemic.

Table 5.1: Baseline Characteristics of LTC Residents by Study Period (Pre-COVID-19, COVID-19 Wave 1, and COVID-19 Wave 2) 2010-2021, Canada N=410,991

Variable	**Pre-COVID (n = 314,051)**	**COVID Wave 1 (n = 59,113)**	**COVID Wave 2 (n = 37,827)**	**P-value**
Demography				
Sex				<0.0001
Male	36.6% (114,956)	34.9% (20,614)	36.3% (13,732)	
Female	63.4% (199,095)	65.1% (38,499)	63.7% (24,095)	
Age Group				<0.0001
65-74	11.4% (35,720)	13.8% (8,134)	14.0% (5,299)	
75-84	33.6% (105,453)	34.1% (20,176)	33.5% (12,679)	
85-94	47.1% (147,921)	44.5% (26,275)	44.4% (16,780)	
95+	8.0% (24,957)	7.7% (4,528)	8.1% (3,069)	
Marital Status				<0.0001
Not Married	78.0% (245,093)	74.4% (43,990)	73.9% (27,965)	
Married	22.0% (68,958)	25.6% (15,123)	26.1% (9,862)	
Clinical Severity Scales				
Cognitive Performance Scale				<0.0001
0	9.7% (30,316)	7.0 (4,157)	6.9% (2,616)	
1 to 2	34.9% (109,666)	26.7% (15,771)	27.3% (10,314)	
3 to 4	44.5% (139,726)	48.6% (28,745)	48.9% (18,489)	
5 to 6	10.9% (34,343)	17.7% (10,440)	16.9% (6,408)	
Activities of Daily Living Hierarchy Scale				<0.0001
0	4.0% (12,398)	2.7% (1,599)	2.8% (1,061)	
1 to 2	24.0% (75,453)	14.5% (8,582)	14.8% (5,611)	
3 +	72.0% (226,200)	82.8% (48,932)	82.4% (31,155)	
Changes in Health, End-stage disease				

and Signs and Symptoms Scale				
0	63.0% (197,739)	59.4% (35,120)	58.6% (22,154)	<0.0001
1 to 2	33.7% (105,696)	35.2% (20,787)	35.2% (13,319)	
3+	3.4% (10,616)	5.4% (3,206)	6.2% (2,354)	
Aggressive Behaviour Scale				
0	61.3% (192,651)	59.0% (34,901)	58.6% (22,168)	<0.0001
1 to 4	31.7% (99,608)	34.0% (20,078)	34.1% (12,891)	
5+	6.9% (21,792)	7.0% (4,134)	7.3% (2,768)	
Index of Social Engagement				<0.0001
0	7.9% (24,947)	8.1% (4,809)	8.3% (3,126)	
1 to 2	34.4% (108,112)	33.9% (20,008)	35.1% (13,265)	
3 to 4	39.7% (124,732)	40.8% (24,112)	40.6% (15,342)	
5 to 6	17.9% (56,260)	17.2% (10,184)	16.1% (6,094)	
Pain Scale				<0.0001
0	58.8% (184,783)	69.9% (41,326)	67.5% (25,522)	
1 to 2	39.1% (122,859)	29.0% (17,162)	31.3% (11,824)	
3	2.0% (6,409)	1.1% (625)	1.3% (481)	
Major Comorbidity Count				<0.0001
0	9.0% (28,163)	7.9% (4,667)	8.1% (3,057)	
1 to 2	78.6% (246,740)	79.1% (46,778)	78.5% (29,682)	
3+	12.5% (39,148)	13.0% (7,668)	13.5% (5,088)	
Treatment				
Physician Visit	80.3% (252,140)	63.2% (37,338)	68.0% (25,718)	<0.0001
Psychological Therapy	1.4% (4,312)	0.6% (329)	0.7% (245)	<0.0001
Recreational Therapy	11.5% (36,055)	9.0% (5,342)	8.5% (3,219)	<0.0001
Antianxiety Use	10.51% (33,017)	8.3% (4,901)	8.3% (3,141)	<0.0001
Antidepressant Use	43.5 (136,441)	52.4% (30,994)	52.5% (19,872)	<0.0001
Antipsychotic Use	26.6% (83,637)	26.2% (15,472)	28.6% (10,804)	<0.0001
Hypnotic Use	8.8% (27,674)	6.6% (3,873)	7.0% (2,655)	
Advanced Directives-do not hospitalize	26.1% (74,963)	30.9% (17,227)	31.3% (11,152)	<0.0001
Advanced Directives-do not resuscitate	74.4% (214,169)	85.6% (48,113)	86.2% (30,941)	<0.0001
Health Diagnoses				
Alzheimer's Disease Related Dementias	62.4% (196,023)	66.0% (38,994)	65.3% (24,707)	<0.0001

Anxiety	9.3% (29,128)	14.0% (8,297)	14.0% (5,277)	<0.0001
Bipolar Disorder	1.3% (4,193)	1.9% (1,110)	1.8% (674)	<0.0001
Depression	22.8% (71,535)	27.8% (16,446)	26.7% (10,097)	<0.0001
Mood and Behaviour Patterns and Psychological Well-Being Items				
Poor Sleep	4.3% (13,378)	6.7% (3,959)	7.2% (2,703)	<0.0001
Conflict with Staff, Family, Friends, or Other Residents	9.0% (28,172)	8.0% (4,712)	7.6% (2,869)	<0.0001
Facility Attributes				
Canadian Province				<0.0001
Alberta	14.9% (46,867)	13.6% (8,016)	13.4% (5,078)	
British Columbia	16.4% (51,636)	18.7% (11,070)	20.9% (7,903)	
Ontario	68.6% (215,548)	67.7% (40,027)	65.7% (24,846)	
LTC Home Size				<0.0001
Small	1.2% (3,812)	1.2% (688)	1.2% (456)	
Medium	26.4% (82,851)	24.2% (14,285)	23.9% (8,994)	
Large	72.4% (227,336)	74.6% (44,004)	74.9% (28,203)	
LTC Home Location				<0.0001
Urban	85.9% (269,831)	87.3% (51,625)	86.9% (32,871)	
Rural	14.1% (44,220)	12.7% (7,488)	13.1% (4,956)	

5.3.2 Sojourn Time and Transition Patterns Between Transient Mood States During the First Two COVID Waves

Figure 5.2 below shows the time residents spent in each transient state for an average 12-month period. During the first wave of COVID-19, residents whose initial mood state was DRS 0 with no mood disturbance had a probability of 0.57 to remain in the same state for an average of approximately 8.1 months until transitioning to the other states. The probability of them transitioning to a worsening state of mild mood disturbance was 0.13 and remaining in this state an average of 2.4 months. The probability of transitioning to the next worsening state of moderate/severe mood disturbance was 0.055 with an average time spent in this state of 1.8 months until transitioning to other states. For those whose initial state was mild mood disturbance the probability of them remaining in the same state was 0.41 for an average of 6.3 months, to improve to no mood disturbance 0.18 and staying in this state for an average of 3 months, and to worsen to moderate/severe mood disturbance the probability was 0.16 for 2.7 months on average. As to residents whose initial state was moderate/severe mood disturbance on admission during the first wave of COVID-19, the probability of them to remain on the same state was 0.52 for an average of 7.5 months, while it was 0.16 to improve to mild mood disturbance and stay there for an average of 2.4 months, and 0.06 to transition to no mood disturbance for an average of 2.1 months.

During the second wave of COVID-19, residents whose initial mood state was DRS 0 with no mood disturbance had a probability of 0.57 to remain in the same state

for an average of 8.1 months. The probability of them transitioning to worsened states and transitioning to mild mood disturbance was 0.14 and staying there for an average of approximately 2.4 months. While the probability was 0.057 for transitioning to moderate/severe mood disturbance with an average time spent at that state of 1.8 months. For those whose initial state was mild mood disturbance the probability of them remaining in the same state was 0.40 for an average of 6.3 months, to improve to no mood disturbance 0.18 for 3 months on average to stay in that state, and to worsen to moderate/severe mood disturbance the probability was 0.16 and spending an average of approximately 2.4 months there. As to residents whose initial state was moderate/severe mood disturbance on admission during the second wave of COVID-19, the probability of them to remain on the same state was 0.53 for an average of 7.2 months, while it was 0.15 to improve to mild mood disturbance with an average of 2.4 months spent there, and 0.06 to transition to no mood disturbance and staying there for 2.1 months on average. Therefore, from Figure 5.2 below, it can be seen that the time spent in each transient state as well as the probabilities of transitioning were essentially the same for both waves 1 and 2 for all mood states and transitioning to the no mood and mild mood disturbance. However, there were some modest differences when transitioning to the worst state of moderate/severe mood disturbance.

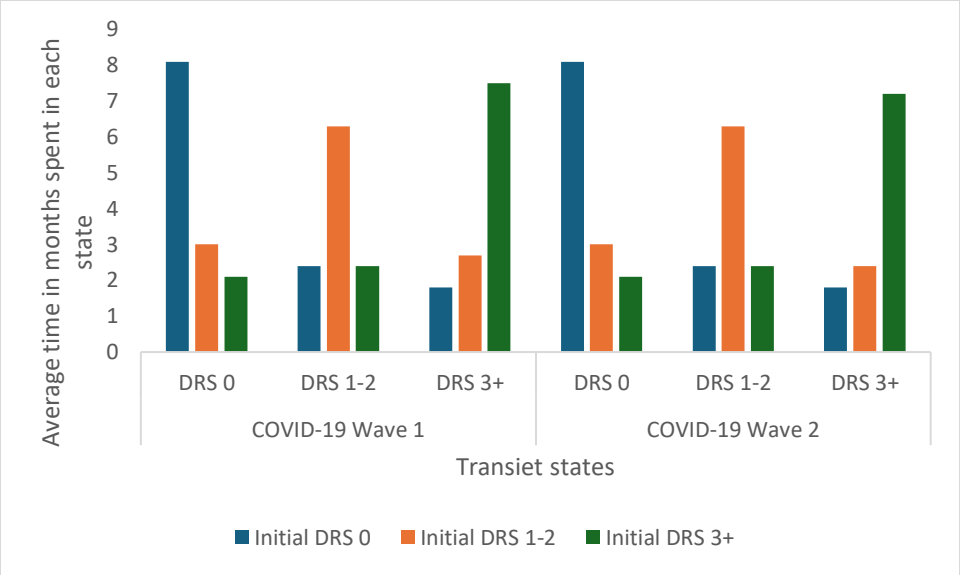


Figure 5.2: Average Time Spent in Months in Each of the Transient States Before Transitioning to the Absorbing States Among Long-Term Care Residents, Canada

5.3.3 Transition Patterns to Absorbing States

Figure 5.3 below shows the transition probabilities of residents to the different absorbing states within 90 days starting at different levels of mood disturbance. Residents with any level of mood disturbance had a higher probability of being hospitalized at all times, but higher during the pre-COVID period. This was followed by the probability of mortality which was consistently higher during both waves of COVID when compared to that of pre-COVID. The probability of death was magnified for those with mood disturbance in both waves. The probability of transitioning to home or other settings was very much lower in all periods when compared to being hospitalized or to dying. However, transitioning to home was slightly higher than to other settings.

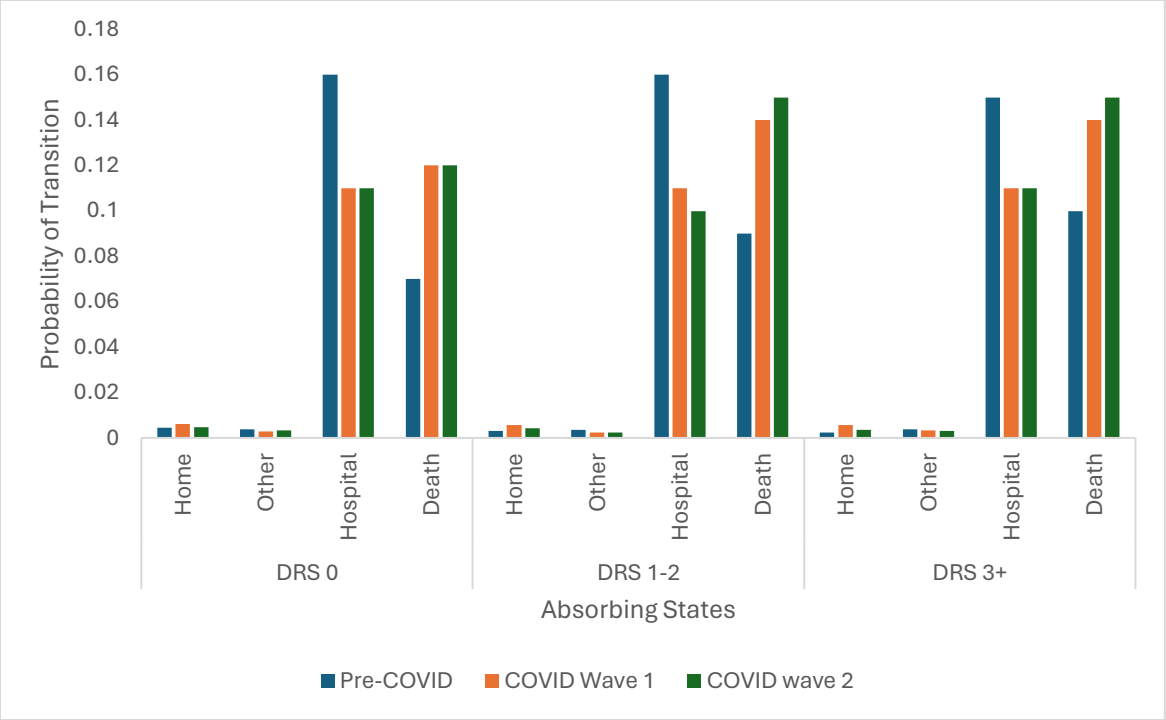


Figure 5.3: Distribution of Probability of Transitioning From DRS Categories to Different Absorbing States Within 90 Days Among Long-Term Care Residents, Canada

5.3.4 Independent Factors Associated with Transitions to Transient and Absorbing States

Table 5.2 and the forest plots below show the adjusted odds ratios of transitioning from one DRS state to the other transient or absorbing states (discharged home, admitted to hospital, died, and discharged to other settings) for residents who remain in the LTC home after 90 days, during the first two waves of the COVID-19 pandemic by treating both waves as independent predictors in the models.

Upon comparing the predictors during the COVID-19 pandemic to the pre-pandemic period, we found that similar covariates predicted worsening or mood improvement and transitions to the absorbing states. The directions and magnitudes of these associations were comparable for both periods. Below, we only report on the mood states and absorbing states during waves 1 and 2 of COVID-19.

Adjusted Odds of Worsening Mood

During the first two waves of COVID-19, little worsening of mood symptoms was observed among residents of Canadian LTC homes after adjusting for other covariates. There was only a weak effect for transitioning from no mood to mild mood disturbance during wave 1 and wave 2 (OR 0.91, 95% CI 0.88-0.94 and OR 0.95, 95% CI 0.91-0.99, respectively). Transitioning from no mood to moderate/severe mood disturbance in wave 1 was not statistically significant in both Wave 1 (OR 0.96, 95% CI 0.92-1.01) and wave 2 (OR 1.00, 95% CI 0.94-1.06). Similar non-significant results

were seen for transitioning from mild to moderate/severe mood disturbance (OR 1.00, 95% CI 0.96-1.04) in wave 1, and (OR 0.97, 95% CI 0.92-1.02).

Adjusted Odds of Improving Mood

During COVID a moderate effect was seen in residents transitioning from moderate/severe mood disturbance to no mood disturbance in wave 1 (OR, 1.14, 95% CI 1.07-1.20), and wave 2 (OR 1.12, 95% CI 1.04-1.20). A weaker effect was seen transitioning from moderate/severe mood disturbance to mild mood disturbance during wave 1 (OR 1.09, 95% CI 1.05-1.13). Improving from mild mood disturbance to no mood disturbance was seen in both wave 1 and wave 2 of COVID with rather a weak but significant effect (OR 1.06, 95% CI 1.02-1.10 and OR 1.08, 95% CI 1.03-1.13, respectively). Lastly, the odds of improving from moderate/severe mood disturbance to mild mood disturbance in wave 2 was not statistically significant (OR 0.98, 95% CI 0.93-1.03).

Transitions to Absorbing States: Home Discharge

Table 5.2 and the forest plots below show that relative to the pre-pandemic period, residents during wave 1 were more likely to get discharged to home with the greatest odds seen if their initial mood state on admission was moderate/severe mood disturbance (OR 2.33, 95% CI 1.95-2.79), followed by mild mood disturbance (OR 1.88, 95% CI 1.59-2.23), and lastly those with an initial state of no mood disturbance on admission (OR 1.42, 95% CI 1.25-1.63). During wave 2, residents with an initial state of moderate/severe mood disturbance had the greatest odds of being discharged home (OR 1.41, 95% CI 1.05-1.90), and those with mild mood disturbance during wave 2

were also more likely to be discharged home (OR 1.39, 95% CI 1.07-1.81). The odds of being discharged home during wave 2 with an initial state of no mood disturbance was not significant (OR 1.09, 95% CI 0.89-1.34).

Transitions to Absorbing States: Hospitalization

During both waves of COVID, there were lower odds for residents to get discharged to hospital for all DRS categories. For residents with no mood disturbance the odds of transitioning to hospital in wave 1 (OR0.71, 95% CI 0.68-0.73), and in wave 2 (OR 0.68, 95% CI 0.65-0.71). Those with mild mood disturbance had the following odds ratios in wave 1 (OR 0.72, 95% CI 0.69-0.75), and in wave 2 (OR 0.69, 95% CI 0.65-0.73). Lastly, residents with moderate/severe mood disturbance had (OR 0.76, 95% CI 0.73-0.80), and (OR 0.74, 95% CI 0.69-0.78) in wave 1 and wave 2, respectively.

Transitions to Absorbing States: Mortality

Transitioning to death was significant with all DRS categories during the first two waves of the COVI-19 pandemic. The odds of dying during wave 1 was highest in residents with an initial state of no mood disturbance (OR 1.54, 95% CI 1.48-1.59), followed by mild mood disturbance (OR 1.52, 95% CI 1.46-1.58), and lastly, those with an initial state of moderate/severe mood disturbance (OR 1.49, 954% CI 1.43-1.55).

During wave 2, the highest odds of dying was seen in residents with mild mood disturbance (OR 1.66, 95% CI 1.57-1.75), followed by residents with an initial state of moderate/severe mood disturbance (OR 1.56, 95% CI 1.48-1.64), and finally those with no mood disturbance (OR 1.50, 95% CI 1.43-1.58).

Transitions to Absorbing States: Other Settings

There were lower odds of transitioning in residents with no mood disturbance to other settings which was significant in wave 1 (OR 0.80, 95% CI 0.66-0.96) and not significant in wave 2 (OR 0.91, 95% CI 0.72-1.15). For residents with an initial state of mild mood disturbance there was also lower odds of transitioning to other settings which was statistically significant in both waves (OR 0.66, 95% CI 0.51-0.86) in wave 1, and (OR 0.69, 95% CI 0.49-0.96) in wave 2. Again, the odds of transitioning from moderate/severe mood disturbance to other settings during wave 1 (OR 0.95, 95% CI 0.76-1.19), and wave 2 (OR 0.90, 95% CI 0.66-1.21), were not statistically significant.

Table 5.2: Adjusted Odds of Transitioning From Different DRS States to Other DRS and Terminal States 2010 – 2021, Canada N=410,991

Period	DRS	Transient DRS States			Home	Hospital	Death	Other
		0	1-2	3+				
Odds ratios (95% CI) with reference = pre-COVID period								
Wave 1	**0**	-	0.91 (0.88-0.94)	0.96 (0.92-1.01)	1.42 (1.25-1.63)	0.71 (0.68-0.73)	1.54 (1.48-1.59)	0.80 (0.66-0.96)
Wave 2		-	0.95 (0.91-0.99)	1.00 (0.94-1.06)	1.09 (0.89-1.34)	0.68 (0.65-0.71)	1.50 (1.43-1.58)	0.91 (0.72-1.15)
Odds ratios (95% CI) with reference = pre-COVID period								
Wave 1	**1-2**	1.06 (1.02-1.10)	-	1.00 (0.96-1.04)	1.88 (1.59-2.23)	0.72 (0.69-0.75)	1.52 (1.46-1.58)	0.66 (0.51-0.86)
Wave 2		1.08 (1.03-1.13)	-	0.97 (0.92-1.02)	1.39 (1.07-1.81)	0.69 (0.65-0.73)	1.66 (1.57-1.75)	0.69 (0.49-0.96)
Odds ratios (95% CI) with reference = pre-COVID period								
Wave 1	**3+**	1.14 (1.08-1.21)	1.09 (1.05-1.13)	-	2.33 (1.95-2.79)	0.76 (0.73-0.80)	1.49 (1.43-1.55)	0.95 (0.76-1.19)
Wave 2		1.14 (1.07-1.20)	0.98 (0.93-1.03)	-	1.41 (1.05-1.90)	0.74 (0.69-0.78)	1.56 (1.48-1.64)	0.90 (0.66-1.21)

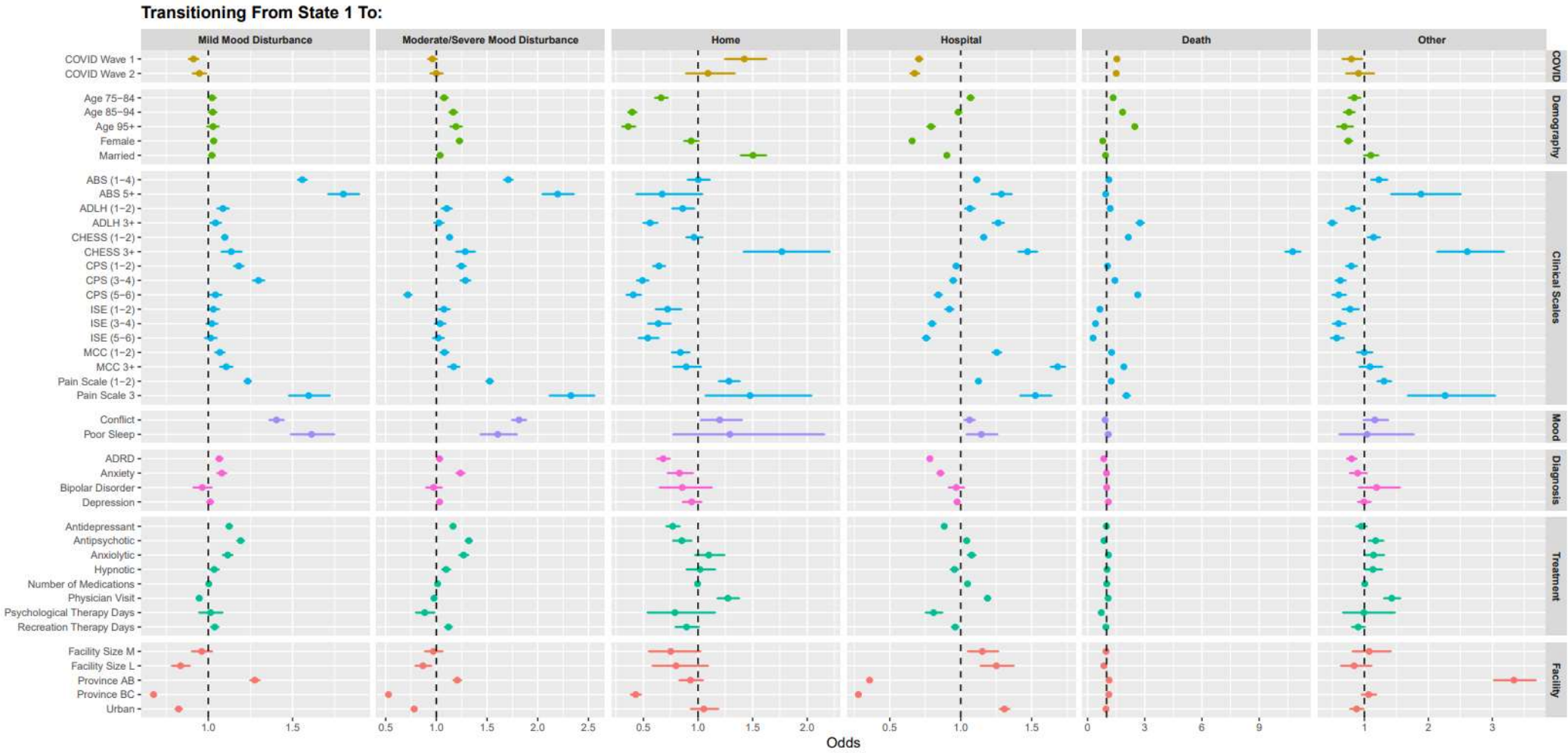


Figure 5.4: Adjusted Odds of Transitioning From No Mood Disturbance (State 1) to Different DRS States and Absorbing States During COVID Period Among Long-term Care Residents 2010-2021, Canada N=410,991

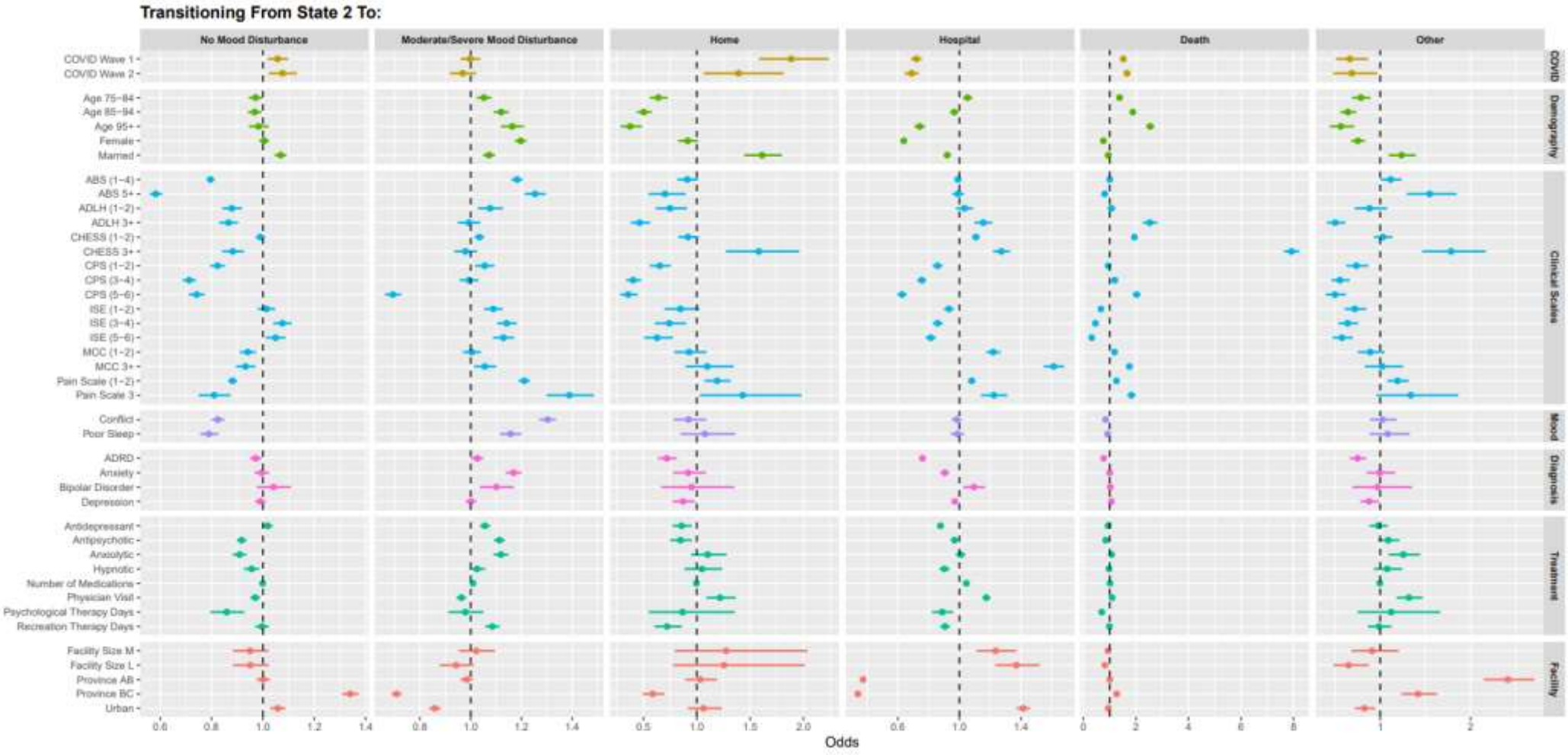


Figure 5.5: Adjusted Odds of Transitioning From Mild Mood Disturbance (State 2) to Different DRS States and Absorbing States During COVID Period Among Long-term Care Residents 2010-2021, Canada N=410,991

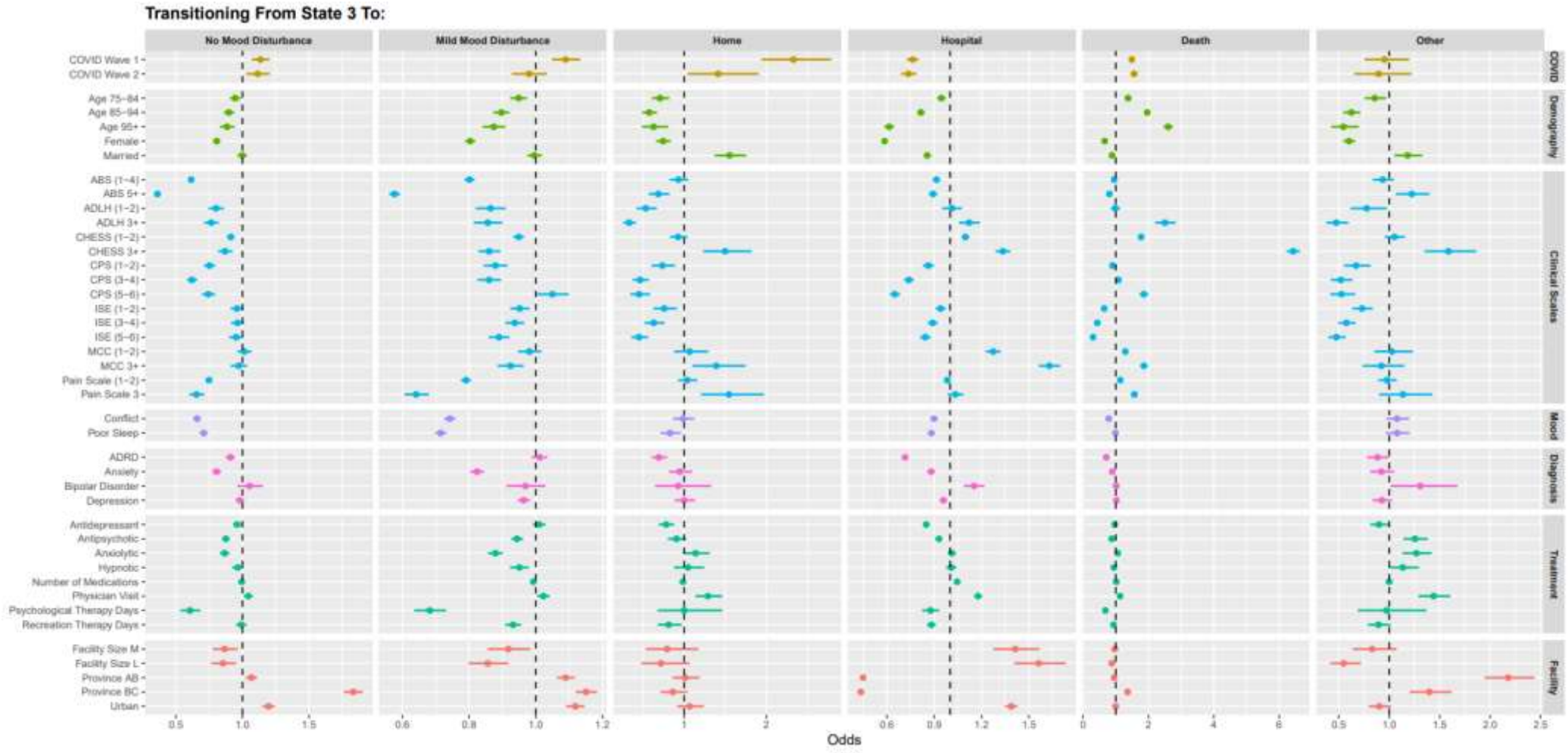


Figure 5.6: Adjusted Odds of Transitioning From Moderate/Severe Mood Disturbance (State 3) to Different DRS States and Absorbing States During COVID Period Among Long-term Care Residents 2010-2021, Canada N=410,991

5.4 Discussion

This study examined transitions between the different mood states and the absorbing states among residents of LTC homes 65 years of age or older in Canada during the first two waves of the COVID-19 pandemic compared to that of the pre-pandemic period. It examined both person-level factors and facility-level factors in three Canadian provinces (Alberta, British Columbia, and Ontario).

Our results showed that the baseline characteristics of residents residing in LTC homes pre and during the pandemic differed significantly. Residents had higher scores in CPS, CHESS, ADLH, ABS and MCC indicating that more residents experienced severe cognitive impairment, severe health instability, worsening in activities of daily living, aggressive behaviour and more comorbid conditions during the pandemic. This was expected due to the challenges in providing mental and health services at the beginning of the pandemic. The treatment items included physician visits which decreased, antidepressant use increased which is in agreement to the literature (Campitelli et al., 2021; N. M. Stall et al., 2021). Further, a decrease in anxiolytic use was seen in our findings, was also seen in Stall et al. (2021) study; however, our study showed decreased use in antipsychotics which was not similar to the findings from the literature (Campitelli et al., 2021; N. M. Stall et al., 2021). Both unadjusted rates of depression diagnosis and poor sleep patterns increased during the pandemic which is a finding similar to the existing literature (R. Betini et al., 2021; Cortés Zamora et al., 2022).

Transitioning from no mood disturbance or from mild mood disturbance to worsened mood categories was not observed in our study which is consistent with the

findings of McArthur et al. (2021). These results are in contrast to the literature included in our scoping review (Manuscript 1) and the findings in our longitudinal study (Manuscript 2) which showed 16% increased odds of developing new depressive symptoms during COVID-19. This could be attributed to the way mood was defined in the various studies including Manuscript two, where we restricted the cohort to residents with no mood symptoms which should have been similar to State 1 in this study of DRS 0. However, in Manuscript 2 we defined mood and coded it differently to exclude any resident with DRS ≥ 1, depression diagnosis, or recurrent statements that something terrible is about to happen, or withdrawal from activities of interest or reduced social interaction to capture development of new mood symptoms. This study is different from other studies conducted during the COVID-19 pandemic as it adds specifics and details about transitions between the different mood states, adding to the depth of knowledge of the literature. Contrary to what the media emphasized; these results suggest that there was actually an improvement in mood symptoms among surviving residents during the first two waves of COVID-19. Mood symptoms improved during wave 1 from mild mood disturbance (DRS 1-2) with greater odds of (OR 1.06, 95% CI 1.02-1.10), and from moderate/severe mood disturbance (DRS 3+) to no mood (DRS 0) and mild mood disturbance (DRS 1-2) with a greater odds of (OR 1.14, 95% CI 1.08-1.21), and (OR 1.09, 95% CI 1.05-1.13), respectively. However, more improvement was seen in transitioning from mild mood disturbance to no mood disturbance (OR 1.08, 95% CI 1.03-1.13) and (OR1.14, 95% CI 1.07-1.20) transitioning from moderate/severe to no mood disturbance in wave 2. This improvement was not

seen transitioning from moderate/severe mood disturbance to mild mood disturbance (DRS 1-2) in wave 2 (OR 0.98, 95% CI 0.93-1.03).

Our findings also highlighted that relative to the pre-pandemic period, residents in the different DRS categories on admission had a greater odds of transitioning to home during both wave 1, DRS 0 (OR 1.42, 95% CI 1.25-1.63), DRS 1-2 (OR 1.88, 95% CI 1.59-2.23), DRS 3+ (OR 2.33, 95% CI 1.95-2.79) and wave 2, DRS 1-2 (OR 1.39, 95% CI 1.07-1.81) and DRS 3+ (OR 1.41, 95% CI 1.05-1.90). Transitioning to home in those with an initial state of DRS 0 had greater odds of 1.09 (95% CI 0.89-1.34) relative to those in the pre-pandemic period, however, this finding was not significant. Perhaps during the pandemic, caregivers and families of older adults residing in LTC homes decided to remove them from such a setting due to their fear of their loved one contracting the virus and dying.

Transition into hospital was different from that of home, where there were lower odds for residents to transition to hospital during both waves 1 and 2 when compared to the pre-pandemic time. This finding was consistent with the literature (R. Betini et al., 2021; Wyer et al., 2024) and was probably the result of increased restrictions in hospital admission patterns.

In terms of mortality, there was greater odds of dying during the first and second waves of COVID-19 in all categories of mood disturbance when compared to the pre-pandemic period. This was true for residents with initial state DRS 0 (1.54), DRS 1-2 (1.52) and DRS 3+ (1.49), with the highest being in residents with no mood disturbance. Also, a similar increase was seen in the odds of dying in wave 2 where

there was greater odds of 1.50, 1.66, and 1.56 in residents with initial state being in DRS 0, DRS1-2 and DRS 3+, respectively. The highest odds were in the mood category of mild mood disturbance. Also, the odds of dying being at State 1 with no mood disturbance was huge in residents with severe health instability CHESS 3+ with an increased likelihood of dying 10.76 times greater than that of the pre-pandemic period. The odds of dying was consistently higher relative to the pre-pandemic period but decreased with the higher DRS categories, DRS 1-2 (OR 7.92) and DRS 3+ had a great odds of dying (OR 6.43). The results show that there was increased mortality during the second wave of the pandemic in those with mild and moderate/severe mood disturbance. This could be explained by the decrease in number of physician visits and hospital admissions seen during the pandemic (R. Betini et al., 2021) and due to the differences in health status and infectivity of residents (Rochon et al., 2022) that occurred during the lockdown period in hope of decreasing transmission of the virus to LTC home residents. It is plausible that mood was linked to a higher risk of mortality, meaning that individuals who survived might have been disproportionately represented by those more inclined to recover and less prone to deteriorate. This warrants deeper exploration in future research.

Although lockdown measures were an essential part of controlling and preventing increased infections among LTC home residents, each province had a different timeline, guidelines, and policies for the containment of infection spread. This along with other factors such as limited mental health services and staff shortages (discussed elsewhere), led to different findings of either worsening or

improved mood symptoms among residents of LTC homes. Our results showed that residents residing in LTC homes in British Columbia showed greater odds of improvement in mood symptoms when compared to those in Alberta. The reasons behind these differences are not clear and could be due to different policies or different resource allocation methods used in the different provinces.

Our analysis of the sojourn time showed that in residents with an initial state of no mood disturbance they spent an average of 8 months in the same state during both COVID-19 waves before worsening in mood or transitioning to any of the absorbing states. If they transition from no mood disturbance to mild mood disturbance, residents spent an extra two months on average in that state making it a total of 10 months before transitioning to the worst mood state to any of the absorbing state. This extended duration provides a critical window of opportunity for healthcare providers to intervene proactively. With such time at hand, implementing targeted programs and measures becomes feasible to prevent further deterioration of mood in these individuals. Such interventions will aim at boosting mental resilience.

5.5 Strengths and Limitations

This study used a large sample of 410,991 unique individuals 65 years and above from a longitudinal dataset from a Pan-Canadian perspective which makes the findings more representative and generalizable to similar populations of residents living in LTC homes. Also, with such a large sample, the results are more reliable as it minimizes the impact of individual variation and outliers. This adds to the robustness and validity of our findings. Our analysis deals with absorbing states as

competing risks offering insights for decision-making regarding programs aimed at improving the mood of LTC residents, which also strengthens the reliability and credibility of our findings. Adding the COVID-19 as a variable and comparing the results to those of the pre-pandemic, allowed for the identification of the effects of the pandemic in the target population.

There are two limitations in this study. First, the study ended in December 2020 and did not assess mood transitions during the complete period of the lockdown. These measures continued until all the restrictions were lifted by the end of April 2022. Transitions in mood could have gotten worse with prolonged periods of lockdown. Second, we did not assess transitions in mood pre and post vaccination. Perhaps residents were more fearful before the introduction of vaccines and may have affected their mood in that period. The effect of lockdown might have changed after the vaccinations took place since residents may have become unhappy with the prolonged lockdown and its associated isolation while their perceptions of physical risk may have been lowered.

5.6 Conclusion and Implications

Adding to our knowledge from the previous manuscript, this is the only study that examined transitions in mood among residents of Canadian long-term care facilities while accounting for competing risks during the COVID-19 pandemic. Our findings showed that COVID-19 did not worsen the mood of LTC home residents as was reflected by other studies, on the contrary in some instances it improved.

Based on our findings and the effect of COVID-19 waves in the transitions to the different absorbing states, future research should explore factors that influence decision on such discharge and explore areas of improvement that would enhance mood of those residents and ensure a better outcome. Further, our analysis of the sojourn time also showed that there was a significant opportunity to improve mood even further during the first two waves of COVID-19. This is an opportunity for health care providers to explore measures to improve mood during times of crisis and outbreaks. The implications of our analysis extend beyond the realm of healthcare provision. It offers valuable insights for policy and decision-makers, empowering them to capitalize on this window of opportunity. Our findings will allow policymakers to form strategies to equip healthcare professionals with the necessary tools and training to identify individuals at risk effectively and manage their mood status with care.

Chapter 6: General Discussion and Conclusion

6.1 Background

Mental health issues are a major global concern in older adults, especially those residing in long-term care (LTC) homes. Nonetheless, these are often overlooked and undiagnosed. Factors such as chronic health conditions contribute to higher levels of stress, anxiety, and depression in this population. During the COVID-19 pandemic, isolation measures were reported to lead to a decline in mental health and an increase in depressive symptoms among LTC residents. However, research on mental health in LTC settings remains limited in scope with most studies focusing on community-based settings.

The overall goal of this thesis is to assess predictors of mood transitions based on depressive symptoms among residents of LTC homes before and during the COVID-19 pandemic.

6.2 Summary of Findings

To contribute to the understanding of mood in older adults in LTC, we conducted four studies of the factors associated with new depressive symptoms and those associated with transitions in mood.

Visitation restrictions were imposed at both sector level and nationwide making it a uniform requirement in LTC homes. Numerous media reports as well as opinion pieces in the academic literature suggested that these restrictions were important factors associated with worsening depression in LTC. This was the impetus for the start of the thesis, which provided a scoping review (Chapter 2) to explore the

effects of isolation on the mood and depressive symptoms of LTC residents during the pre-COVID and COVID periods.

Studies included in the scoping review reported that social engagement and interactions with staff, families and friends contribute to the positive well-being of individuals in LTC and protect against depressive symptoms. Following the initial phase of restrictions during the pandemic, some reports indicated heightened levels of loneliness, depression, and increased mood and behavioral problems among LTC residents. Specifically, residents who spent time alone or lacked social participation and activities displayed more depressive symptoms. These findings contrast with two quantitative studies (Angevaare, Joling, et al., 2022; McArthur et al., 2021) that documented a decrease in the percentage of residents exhibiting signs of depression at the start of the pandemic. This scoping review showed contradictory views which led us to conduct the next study (Chapter 3).

Study 2 (Chapter 3) evaluated the effect of COVID-19 pandemic on incident mood disturbance among Canadian LTC home residents. There was a 16% increase in odds of experiencing new depressive symptoms among residents of LTC homes during the COVID pandemic exposure period. However, there were different experiences within different strata. Not all provinces had the same experience. For example, we found that the pandemic was associated with greater odds of developing new depressive symptoms among LTC residents living in Alberta and British Columbia than was noted in Ontario during the first wave. As for the other provinces there was either no apparent effect or a decrease in transition rates. Several factors

were associated with experiencing new depressive symptoms. These include lack of social engagement, cognitive impairment, moderate impairment in activities of daily living hierarchy, health instability, and absence of aggressive behaviour.

Study 3 (Chapter 4) expands on Study 2 by examining all transitions between the different mood states and the absorbing states out of LTC settings prior to the COVID-19. The aim was to investigate and understand the factors associated with transitions in mood and transitions to the absorbing states prior to the pandemic. This provided evidence for which potential confounders to consider in examining the effects of COVID-19 on mood in the final study 4 (Chapter 5). Several factors were associated with worsening mood including aggressive behaviour, pain, poor sleep, and having conflict with staff, family, friends, or other residents. Also, facilities in urban areas and in British Columbia had higher odds of mood improvement.

After we understood the factors that were associated with worsening or improvement of mood disturbance, we added COVID-19 as a covariate to estimate the effect of the pandemic after controlling for potential confounders. COVID-19 was *not* associated with worsening mood disturbance. Rather, it showed that there was an improvement in mood symptoms among residents during the first two waves of COVID-19. Further, our findings also highlighted some interesting findings regarding the absorbing states.

Relative to the pre-pandemic period, residents in the different DRS categories on admission had greater odds of transitioning to home during both wave 1, and wave 2. This could indicate that families were more concerned about their loved ones and

decided to take them out of the LTC homes during COVID, especially when they had depressive symptoms.

There were lower odds of discharge to hospitals during the pandemic. As highlighted in Ontario's Long-Term Care COVID-19 Commission Final Report, LTC homes were instructed to refrain from transferring their residents to hospitals, and hospitals were reportedly declining to admit patients from these facilities. Further, an inquiry found that most LTC home residents who died during the pandemic did not receive hospital care (Ontario's Long-Term Care COVID-19 Commission, 2021).

Mortality increased during the first wave of COVID-19 and decreased later. Several factors might have contributed to the increased mortality including inability to transfer the most vulnerable to hospitals, lack of personal protective equipment (PPE), as well as inadequate infection prevention and control (IPAC) measures during the first wave of the pandemic. It is also notable that there were higher death rates among those who experienced moderate/severe mood disturbance (DRS 3+). This raises the possibility that the most vulnerable residents who had moderate/severe mood disturbance died at the start of the pandemic, and those who survived were more resilient. This type of survivor bias could also affect the transition rates for mood among those who remained in LTC.

Our results showed that residents residing in LTC homes in British Columbia showed greater odds of improvement in mood symptoms when compared to those in Alberta. This suggests the need for further research to determine whether there were specific strategies and interventions that yielded this differential effect.

6.2.1 Why Are Our Findings Different from Other Studies and Media Reports?

The major findings in this thesis contradict popular media representations and academic opinion pieces regarding mental health consequences of the pandemic in LTC. Several important points must be noted regarding the effect of the COVID-19 pandemic on LTC homes, as well as the nuances and complexities involved in understanding and addressing the issues within LTC homes.

First, there was *variability in experience,* where our findings showed that not all LTC homes had the same experience during the pandemic. There were differences within strata and settings, suggesting that the effect varied widely across different facilities. Second, our multistate model has more adjustments and more sophisticated methodology than any of the available literature to our knowledge. These results suggested that there was not a negative effect in depressive symptoms during COVID-19, in fact there was some evidence of some improvement happening. There was *a biased presentation by media*, which emphasized the most severe effects of the pandemic which were often constrained to a limited number of facilities. For example, the Canadian Armed Forces were deployed to 54 LTC homes in Ontario and Quebec. The situations in those homes undoubtedly posed terrible threats to the well-being of residents to warrant such a drastic action. However, Canada has a total of 2,076 LTC homes, 1,067 of which are in Ontario and Quebec (Canadian Institute for Health Information, 2021b). Those 54 homes represented 5.1% of homes only. It is reasonable to argue that the need for military assistance in ***any*** home represents a major reason

for concern, but it must also be recognized that this did not apply to 95% of the homes. This may explain why the horrendous experiences noted in individual homes may not have represented a uniform, industry-wide experience.

Another important point of divergence of our studies from media reports is the fact that our analysis involved regulated LTC homes only whereas media reports often combined retirement homes, assisted living, and LTC homes into a single category. In fact, these types of organizations are governed by different regulatory requirements, are subject to different types of inspection, have different types and intensities of clinical staff, and involve differing levels of dependence on family members to provide care. So, it is important to note the *difference between LTC and retirement homes.* LTC homes are health care facilities regulated by the government that offer continuous personal and nursing care, along with therapy and support services (Canadian Institute for Health Information, 2021b). Whereas retirement homes are regulated by the Retirement Homes Regulatory Authority (an independent, self-funded, not-for-profit regulator mandated by the government) (The Retirement Homes Regulatory Authority, 2024), catering primarily to seniors desiring an autonomous lifestyle complemented by supplementary services which is paid for out of pocket and no funding is received from the government (Government of Ontario, 2022).

In Ontario, COVID-19 infections were not evenly spread among either LTC homes where 86% of infections occurring in 10% (63) of LTC homes or retirement

homes where 81.7% of infections occurred in 10% (77) homes during the first year of COVID spread, (Brown et al., 2021; Costa et al., 2021).

The above-mentioned points highlight the complexity of the situation in LTC and during the pandemic, emphasizing the need for nuanced analysis, accurate representation in media, and targeted interventions to address the diverse challenges faced by these facilities and their residents.

6.2.2 What Do Our Findings Imply?

There are many different factors that affect mood of residents in LTC homes. Some are personal-level factors and others are facility-level. If we group these factors into modifiable and non-modifiable, then we can target the modifiable risk factors to either improve mood or help with techniques that will maintain or enhance the best possible mood state that the resident is already in. The modifiable factors shown in our results that were associated with worsening mood include aggressive behaviour, pain, poor sleep and conflict with staff, family, friends, or other residents. Those associated with improvement in mood include facility-level variables such as homes in certain provinces, which may have used specific interventions to maintain good or improved mood during the lockdown period of the pandemic. However, different therapies and treatments did not show improved mood of residents and were associated with lower odds of improving mood.

6.3 Practical Implications

The findings of this dissertation hold many practical implications for various stakeholders.

6.3.1 Clinical Practice

The findings from the multistate transition models can be used to inform clinical practice and target the factors that improve mood and use interventions to reduce the effects of those that worsen mood.

An initial step if for Ontario to begin using the interRAI Clinical Assessment Protocols (CAPs) (Morris et al., 2011) instead of the old Resident Assessment Protocols (RAPs) (Fries et al., 2007) . The RAPs which were released in 1994 are still being used in Ontario despite the lack of important protocols for issues such as pain. There are CAPs that can be used in residents with worsened mood disturbance targeting the different risk factors associated with worsened mood. The Mood CAP, based on the Depression Rating Scale (DRS), helps health care providers identify older adults at risk of depression with either a preexisting diagnosis or a depressed mood state. It flags residents with mild (DRS scores 1-2) or moderate/severe (DRS scores 3 or more) risk of depressive symptoms. When triggered, it provides guidelines for addressing immediate safety concerns like self-harm thoughts or harming others and exploring underlying cause of the mood disorder, such as medication review, along with treatment options and monitoring recommendations. Other CAPs that can be used to target the factors associated with mood disturbance include the Behaviour, Pain, Activities and Social Relationship CAP which use both pharmacological and non-pharmacological management and treatment strategies.

There are also additional guidelines to prevent, assess, and treat depression among older adults that could also be used by health care providers such as those developed by the Canadian Coalition for Seniors Mental Health (CCSMH) (Canadian

Coalition for Seniors' Mental Health, 2021a). The CCSMH is a leading organization focused on "supporting the mental health of older adults with the mission of promoting the mental health of seniors by connecting people, ideas, and resources". CCSMH's recommendations and clinical guidelines target isolation and loneliness of residents by using interventions such as reminiscence therapy, physical exercise programs, videoconferences with family, and gender-based social groups (Canadian Coalition for Seniors' Mental Health, 2021a).

In addition to the comprehensive assessment, diagnosis and treatment using both pharmacological and non-pharmacological modalities, there are some simple but effective steps that clinicians can take to enhance and support mental health in LTC. These include setting an individualized person-centered care plan by working with the resident to set the goals they want to achieve, while respecting the resident's cultural background, values, and beliefs. The treating clinician should be able to accommodate the cultural preferences and overcome barriers to the resident's care. Also, the clinician should be able to help with linking the residents to the needed social support networks, including family, friends, support groups, or community resources.

6.3.1.1 Staff Management and Resource Allocation

The Ontario's Long-Term Care COVID-19 Commission Final Report highlights the factors associated with negative outcomes in LTC homes even prior to the COVID-19 pandemic and contributed to the devastating outcomes in this sector during the pandemic. These factors along with the findings of our multistate transition models

highlight the need to assign more trained staff in LTC homes with a balanced skilled staffing mix, and ease of accessibility for residents to health care services, and support training and education of staff (Ontario's Long-Term Care COVID-19 Commission, 2021).

6.3.2 Policy Implications

The pandemic and the preventive measures taken highlighted the inadequate preparedness of the LTC sector. Our analysis showed that certain factors may have contributed to worsened mood and depressive symptoms among residents even prior to the pandemic, and more so increased mortality during the pandemic. However, certain provinces had lower odds of worsening mood symptoms and so it seems that the interventions and strategies used in homes in these provinces should be explored and advocated for. This highlights the importance of allocating funds for interventions such as telecommunication, telepsychiatry and videoconferencing, targeted programs, and measures to prevent further deterioration of mood in these individuals. Allocating funds to hire, train and educate more health care and social service professionals (HCSSPs) on risk factors for social isolation and loneliness in older adults.

6.3.2.1 Lessons Learned for Future Pandemics for Policymakers

Our results showed that there is a window of opportunity to be used in improving or maintaining mood of residents. This highlights the importance of investing some funds in prevention programs that would not only improve the quality of life of residents, but also cut on the costs of health services use and unnecessary

use of pharmacological treatments that could possibly lead to undesirable side effects and impose more expenses.

Our findings showed that COVID-19 did not necessarily result in worsened mood despite the restrictive visiting requirements used to protect against high mortality. This suggests the importance of a balanced approach. To protect against mortality but also against mood disturbance, policymakers should invest more funds in mental health services and programs. They should also aim for a balanced approach that considers both the physical health and mental well-being of the population. This could include developing alternative means to support communication and social engagement with family members during lockdown periods with alternative room configurations, improved ventilation, and use of electronic communication devices as examples. These could require substantial architectural modifications, increased staffing, additional training, and an improved information technology system. However, they may well improve the preparedness of homes for outbreaks of different scales that may occur at any time whether there is another pandemic or not. Implementing a comprehensive, person-centered care protocol considering the residents' mental needs is important. Another important step is developing targeted interventions to support specific groups who are at an increased risk of developing mood disturbance.

There are also some data-related insights to be considered for future pandemics. The integrated interRAI Reporting System (IRRS) which is based on the newer interRAI LTCF system provides near real time data, which makes crucial

evidence about the health and well-being of resident in a more timely manner than the older Continuing Care Reporting System (CCRS) that is still in use in Ontario (Canadian Institute for Health Information, 2022b). This means that policymakers should use IRRS and LTCF reporting systems during future pandemics to enhance pandemic preparedness through better access to timely data.

6.3.3 Research Implications

Our findings in the multistate transition models showed that mood did not worsen during the pandemic but improved, which contrasts with our study in Chapter 3. Differences in defining mood and coding it across the two studies may have led to the different findings. The inclusion criteria also differed in both studies, where in the logistic regression model in Chapter 3 we included all residents 18+, where as in our multistate transition model we have excluded anyone < 65 years of age. Also, the multistate model takes into account competing risks through consideration of multiple absorbing states.

In our multistate models we used sojourn time to approximate the length of stay and transition probabilities between the different states. There is an opportunity for machine learning to be used in future research in predictive modelling to generate more connections and algorithms to make accurate predictions. However, for clinicians and health care providers there should be an understanding as to what goes into the model to be able to explain why such predictions occurred which might not be possible while using machine learning.

IRRS will replace CCRS and will use updated versions of the interRAI instruments. However, the CCRS includes several covariates in the disease diagnosis section that are missing in LTCF that were used to create the major comorbidity count scale (MCC) (Chapters 3, 4, 5). Also, some items in the indicators of depression, anxiety, sad mood section that were used to assess poor sleep (Chapters 3, 4, 5) and in our exclusion criteria (Chapter 3) that we used in our models have been removed. These items should be included in the LTCF assessment tool to ensure that the variables and scales used remain consistent and not to affect our analysis in future research.

There are some facility-level covariates that would have been useful in our analysis to further understand what factors affect mood that were missing in the CCRS data such as the number of residents shared a room, the number of days with absent staff, and the staff mix available. Another important factor is that our analysis was conducted on a broad scale, examining national and provincial trends. We did not analyze the specific dynamics within individual LTC homes. Therefore, future research could focus on the limited set of LTC homes, particularly those exhibiting the most adverse outcomes. By doing so, researchers could ascertain whether mood transitions were more pronounced in these underperforming homes compared to those demonstrating better overall outcomes.

6.4 Methodological issues, Strengths, and Limitations

The studies included in this research used a step-up approach to enhance our knowledge about the factors associated with developing incident mood symptoms and

with transition into the different mood states and to absorbing states in LTC homes and during the pandemic. Through advanced analysis using the multistate models we found interesting findings not evident in other research. We used a wide variety of covariates that were taken from the literature review as well as the ones that were statistically significant to use in our models. However, more variables could have been useful if they were available in our datasets, particularly structural variables such as staffing, absenteeism, medical director involvement, and ownership.

In our analysis we used DRS which has been used as a standard scale to measure depressive symptoms among residents of LTC homes. However, in future research the interRAI Composite Mood Scale (CMS) should be used instead because it is more person-centered and sensitive. Replacing the CCRS with the LTCF will allow use of the CMS in future research. Further, the LTCF will allow the use of the newer Revised Index of Social Engagement (RISE) which is an improved measure of social engagement in the context of LTC homes. The LTCF also includes some new items that are relevant to mood such as presence of fatigue, medicinal use of cannabis, and activity patterns.

6.4.1 Strengths

Our studies included large sample sizes from a Pan-Canadian perspective making these findings more representative, generalizable, and robust. In Chapter 3 (Manuscript 2) we were able to examine adverse changes in a subpopulation of persons who may have been coping reasonably well prior to the pandemic. In addition, the stratified analyses allowed for the identification of subgroups where the effects of

the pandemic were especially pronounced. In Chapters 4 and 5 (Manuscripts 3 and 4) we were able to examine the transitions in mood prior to the pandemic and during the first two waves of the pandemic, which has not been examined in previous studies. Examining absorbing states as competing risks offering insights for decision-making regarding programs aimed at improving the mood of long-term care (LTC) residents, which also strengthens the reliability and credibility of our findings.

6.4.2 Limitations

There were several limitations encountered while conducting this dissertation. We lacked important information about outbreaks (and associated resident isolation/confinement, staff shortages etc.) within homes. This limited the ability to do a comprehensive analysis of the effects of these variables on mood and depressive symptoms. To address this limitation in future research, integrating data collection techniques that help capture details about outbreaks and related factors into the data should be incorporated.

Further, our findings showed that certain treatments did not improve residents' mood. However, information about the specific nature of these treatments was lacking and there is the possibility of being confounded by indication in these results. This limitation could be overcome by conducting a Treatment Effect Analysis to examine the effect of specific treatments including recreation therapy, medications, and physician visits on the mood of LTC home residents. Moreover, due to the complexity of the multistate transition models we were not able to explore interaction effects in the models.

Quebec is an important province that we excluded from our analysis, because they do not use the interRAI assessment tools. They were one of the provinces where their LTC homes were also hit hard by the pandemic and more LTC homes (25) than Ontario (5) needed the armed forced to intervene (Government of Canada: Public Safety Canada, 2020). Data about Quebec could have helped us understand the population's characteristics and assess the mood of that population prior and during the pandemic and examine the factors associated with mood.

Another important limitation is the lack of information that could have been associated with the presence or absence of depressive symptoms among LTC home residents due to privacy constraints including information about linguistic, cultural, racial, or other minorities.

Additionally, we were only able to see the transitions every 90 days because the assessments are conducted on a quarterly basis. Therefore, there is no data in between the quarterly assessments. Moreover, perhaps during the pandemic there was a change in assessment practices that may have affected sensitivity to mood transitions, would not have explained the increased probability in improvement. Finally, we used the CCRS data which uses the older MDS 2.0 because interRAI LTCF is not fully adopted in Canada.

6.5 Conclusion

There will be a growing need for long-term care homes in coming years due to the increase in the number of the aging population. This population, being particularly vulnerable, faces an increased risk of mental health challenges due to

various stressors. These include ongoing declines in physical and cognitive abilities, as well as the disruption of social networks upon relocation to LTC homes or other institutional settings. This will cause increased costs for the health care system to accommodate their needs and provide them with the appropriate management, treatment, and interventions.

The findings of this dissertation highlight the importance of using targeted interventions to address the diverse challenges faced by residents of LTC homes. This could be achieved by education and training of LTC staff, improving leadership and accountability and by developing individualized, and person-centered care plans considering cultural background, values, and beliefs of residents.

There are vast opportunities for future research to build on this dissertation to ultimately develop and implement more effective strategies and interventions for addressing mood disturbance and depressive symptoms that can be prevented and improved if caught early.

References

Abou-Saleh, M. T., Katona, C. L., & Kumar, A. (2011). Principles and practice of geriatric psychiatry.

Alexopoulos, G. S., Abrams, R. C., Young, R. C., & Shamoian, C. A. (1988). Cornell scale for depression in dementia. *Biological psychiatry*, *23*(3), 271-284.

Alzheimer Society of Canada. (2010). *Rising Tide: the Impact of Dementia on Canadian Society*. T. A. S. o. Canada.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders-Fifth edition (DSM-5)* (Fifth ed.). American Psychiatric Association.

Angevaare, M. J., Joling, K. J., Smalbrugge, M., Choi, H., Twisk, J. W. R., Hertogh, C. M. P. M., & Van Hout, H. P. J. (2023). Psychological Resilience in Older Residents of Long-Term Care Facilities: Occurrence and Associated Factors. *Journal of the American Medical Directors Association*, *24*(3), 382-389.e384. https://doi.org/10.1016/j.jamda.2022.12.006

Angevaare, M. J., Joling, K. J., Smalbrugge, M., Hertogh, C. M., Twisk, J. W., & Van Hout, H. P. (2022). The effects of the 2020 COVID-19 lockdown on mood, behavior, and social and cognitive functioning in older long-term care residents. *Journal of the American Medical Directors Association*, *23*(9), 1608. e1609-1608. e1618.

Angevaare, M. J., Van Hout, H. P. J., Smalbrugge, M., Blankenstein, A. H., Hertogh, C. M. P. M., Twisk, J. W. R., & Joling, K. J. (2022). The Association Between Possible Stressors and Mood Outcomes in Older Residents of Long-Term Care Facilities. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.811252

Arksey, H., & O'Malley, L. (2005). Scoping studies: towards a methodological framework. *International journal of social research methodology*, *8*(1), 19-32.

Arpacıoğlu, S., Yalçın, M., Türkmenoğlu, F., Ünübol, B., & Çelebi Çakıroğlu, O. (2021). Mental health and factors related to life satisfaction in nursing home and community-dwelling older adults during COVID-19 pandemic in Turkey [Article]. *Psychogeriatrics*, *21*(6), 881-891. https://doi.org/10.1111/psyg.12762

Austin, Z., & Sutton, J. (2014). Qualitative Research: Getting Started. *The Canadian Journal of Hospital Pharmacy*, *67*(6). https://doi.org/10.4212/cjhp.v67i6.1406

Aydın, A., Işık, A., & Kahraman, N. (2020). Mental health symptoms, spiritual well-being and meaning in life among older adults living in nursing homes and community dwellings. *Psychogeriatrics*, *20*(6), 833-843.

Bagchi, A. D., Verdier, J. M., & Simon, S. E. (2009). How Many Nursing Home Residents Live With a Mental Illness? *Psychiatric Services*, *60*(7), 958-964. https://doi.org/10.1176/ps.2009.60.7.958

Baldwin, R., Chenoweth, L., dela Rama, M., & Wang, A. Y. (2017). Does size matter in aged care facilities? A literature review of the relationship between the number of facility beds and quality. *Health care management review*, *42*(4), 315-327.

Balsamo, M., Cataldi, F., Carlucci, L., & Fairfield, B. (2018). Assessment of anxiety in older adults: a review of self-report measures. *Clinical Interventions in Aging*, *Volume 13*, 573-593. https://doi.org/10.2147/cia.s114100

Barak, Y., & Gale, C. (2019). Suicide in Long-term Care Facilities—The Exception or the Norm? *JAMA Network Open*, *2*(6), e195634. https://doi.org/10.1001/jamanetworkopen.2019.5634

Barefoot, J. C., Mortensen, E. L., Helms, M. J., Avlund, K., & Schroll, M. (2001). A longitudinal study of gender differences in depressive symptoms from age 50 to 80. *Psychology and aging*, *16*(2), 342.

Barnett, M. L., & Grabowski, D. C. (2020). Nursing Homes Are Ground Zero for COVID-19 Pandemic. *JAMA Health Forum*, *1*(3), e200369. https://doi.org/10.1001/jamahealthforum.2020.0369

Barnett, M. L., Waken, R. J., Zheng, J., Orav, E. J., Epstein, A. M., Grabowski, D. C., & Joynt Maddox, K. E. (2022). Changes in Health and Quality of Life in US Skilled Nursing Facilities by COVID-19 Exposure Status in 2020. *JAMA*, *328*(10), 941-950. https://doi.org/10.1001/jama.2022.15071

Betini, G. S., Hirdes, J. P., Adekpedjou, R., Perlman, C. M., Huculak, N., & Hébert, P. (2021). Longitudinal Trends and Risk Factors for Depressed Mood Among Canadian Adults During the First Wave of COVID-19 [Brief Research Report]. *Frontiers in Psychiatry*, *12*. https://doi.org/10.3389/fpsyt.2021.666261

Betini, R., Milicic, S., & Lawand, C. (2021). The Impact of the COVID-19 Pandemic in Long-Term Care in Canada. *Healthcare Quarterly*, *24*(3), 13-15. https://doi.org/10.12927/hcq.2021.26625

Blazer, D. G., Hybels, C. F., & Pieper, C. F. (2001). The association of depression and mortality in elderly persons: a case for multiple, independent pathways. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *56*(8), M505-M509.

Brennan, P. L., & SooHoo, S. (2020). Effects of mental health disorders on nursing home residents' nine-month pain trajectories. *Pain Medicine*, *21*(3), 488-500.

Brown, K. A., Jones, A., Daneman, N., Chan, A. K., Schwartz, K. L., Garber, G. E., Costa, A. P., & Stall, N. M. (2021). Association Between Nursing Home Crowding and COVID-19 Infection and Mortality in Ontario, Canada. *JAMA Internal Medicine*, *181*(2), 229. https://doi.org/10.1001/jamainternmed.2020.6466

Brown, L. J. E., & Astell, A. J. (2012). Assessing mood in older adults: a conceptual review of methods and approaches. *International Psychogeriatrics*, *24*(8), 1197-1206. https://doi.org/10.1017/s1041610212000075

Burrows, A. (2000). Development of a minimum data set-based depression rating scale for use in nursing homes. *Age and ageing*, *29*(2), 165-172. https://doi.org/10.1093/ageing/29.2.165

Burrows, A. B., Morris, J. N., Simon, S. E., Hirdes, J. P., & Phillips, C. (2000). Development of a minimum data set-based depression rating scale for use in nursing homes. *Age and ageing*, *29*(2), 165-172.

Cahoon, C. G. (2012). Depression in Older Adults. *AJN The American Journal of Nursing*, *112*(11), 22-30. https://doi.org/10.1097/01.NAJ.0000422251.65212.4b

Campitelli, M. A., Bronskill, S. E., Maclagan, L. C., Harris, D. A., Cotton, C. A., Tadrous, M., Gruneir, A., Hogan, D. B., & Maxwell, C. J. (2021). Comparison of Medication Prescribing Before and After the COVID-19 Pandemic Among Nursing Home Residents in Ontario, Canada. *JAMA Network Open*, *4*(8), e2118441. https://doi.org/10.1001/jamanetworkopen.2021.18441

Canadian Coalition for Seniors' Mental Health. (2021a). Canadian Guidelines on Prevention, Assessment and Treatment of Depression Among Older Adults. *2024*. https://ccsmh.ca/wp-content/uploads/2021/06/CCSMH_Depression_Guidelines_FINAL_EN.pdf

Canadian Coalition for Seniors' Mental Health. (2021b). Updated Canadian Guidelines on the Prevention, Assessment and Treatment of Depression among Older Adults have been released. https://ccsmh.ca/wp-content/uploads/2021/06/Overview-Depression-Guidelines-English.pdf

Canadian Institute for Health Information. (1996-2024a). *Discharge Abstract Database (DAD) metadata*. https://www.cihi.ca/en/discharge-abstract-database-dad-metadata

Canadian Institute for Health Information. (1996-2024b). National Ambulatory Care Reporting System (NACRS) metadata. https://www.cihi.ca/en/national-ambulatory-care-reporting-system-nacrs-metadata

Canadian Institute for Health Information. (2008). Caring for Nursing Home Residents With Behavioural Symptoms: Information to Support a Quality Response. https://publications.gc.ca/collections/collection_2013/icis-cihi/H117-5-27-2008-eng.pdf
Canadian Institute for Health Information. (2019). Profile of Residents in Residential and Hospital-Based Continuing Care, 2018–2019. In: Canadian Institute for Health Information Ottawa, ON.
Canadian Institute for Health Information. (2021a). *COVID-19's impact on long-term care*.
Canadian Institute for Health Information. (2021b). *Long-term care homes in Canada: How many and who owns them?* https://www.cihi.ca/en/long-term-care-homes-in-canada-how-many-and-who-owns-them
Canadian Institute for Health Information. (2021c). *Profile of Residents in Residential and Hospital-Based Continuing Care, 2020–2021*. O. C. Ottawa.
Canadian Institute for Health Information. (2022a). *Canadian COVID-19 Intervention Timeline*. https://www.cihi.ca/en/canadian-covid-19-intervention-timeline
Canadian Institute for Health Information. (2022b). CIHI's Integrated interRAI Reporting System *Ottawa, ON: CIHI; 2022*.
Canadian Institute for Health Information. (2024a). *Dementia in long-term care*. https://www.cihi.ca/en/dementia-in-canada/dementia-care-across-the-health-system/dementia-in-long-term-care
Canadian Institute for Health Information. (2024b). *Quick Stats*. Retrieved March 10 from https://www.cihi.ca/en/quick-stats
Canadian Mental Health Association. (2016). Mental Health and Addictions Issues for Older Adults: Opening the Doors to a Strategic Framework.(2010). In.
Carpenter, I., & Hirdes, J. P. (2013). Using interRAI assessment systems to measure and maintain quality of long-term care. *A good life in old age*, *17*, 93-139.
Centers for Disease Control Prevention. (2016). Long-term care providers and services users in the United States: Data from the national study of long-term care providers, 2013–2014. *Hyattsville, MD: US National Center for Health Statistics*.
Chai, Y., Luo, H., Yip, P. S., Perlman, C. M., & Hirdes, J. P. (2021). Factors associated with hospital presentation of self-harm among older Canadians in long-term care: a 12-year cohort study. *Journal of the American Medical Directors Association*, *22*(10), 2160-2168. e2118.
Chau, R., Kissane, D. W., & Davison, T. E. (2019). Risk Factors for Depression in Long-Term Care: A Systematic Review. *Clinical Gerontologist*, *42*(3), 224-237. https://doi.org/10.1080/07317115.2018.1490371
Checkland, C., Benjamin, S., Bruneau, M.-A., Cappella, A., Cassidy, B., Conn, D., Grief, C., Keng, A., Kirkham, J., Krishna, P., McMurray, L., Rabheru, K., Tourigny-Rivard, M.-F., & Seitz, D. P. (2021). Position Statement for Mental Health Care in Long-Term Care During COVID-19. *Canadian Geriatrics Journal*, *24*(4), 367-372. https://doi.org/10.5770/cgj.24.514
Cheng, S.-T., Lee, C. K. L., & Chow, P. K.-Y. (2010). Social support and psychological well-being of nursing home residents in Hong Kong. *International Psychogeriatrics*, *22*(7), 1185-1190. https://doi.org/10.1017/s1041610210000220
Cheung, G., Bala, S., Lyndon, M., Ma'u, E., Rivera Rodriguez, C., Waters, D. L., Jamieson, H., Nada-Raja, S., Chan, A. H. Y., Beyene, K., Meehan, B., & Walker, X. (2022). Impact of the first wave of COVID-19 on the health and psychosocial well-being of Māori, Pacific Peoples and New Zealand Europeans living in aged residential care [Article]. *Australasian Journal on Ageing*, *41*(2), 293-300. https://doi.org/10.1111/ajag.13025

Chong, T. W., Curran, E., Ames, D., Lautenschlager, N. T., & Castle, D. J. (2020). Mental health of older adults during the COVID-19 pandemic: Lessons from history to guide our future. *International Psychogeriatrics*, *32*(10), 1249-1250.

Chui, H., Gerstorf, D., Hoppmann, C. A., & Luszcz, M. A. (2015). Trajectories of depressive symptoms in old age: Integrating age-, pathology-, and mortality-related changes. *Psychology and aging*, *30*(4), 940.

Cook, R. J., Berg, K., Lee, K.-A., Poss, J. W., Hirdes, J. P., & Stolee, P. (2013). Rehabilitation in home care is associated with functional improvement and preferred discharge. *Archives of physical medicine and rehabilitation*, *94*(6), 1038-1047.

Cortés Zamora, E. B., Mas Romero, M., Tabernero Sahuquillo, M. T., Avendaño Céspedes, A., Andrés-Petrel, F., Gómez Ballesteros, C., Sánchez-Flor Alfaro, V., López-Bru, R., López-Utiel, M., Celaya Cifuentes, S., Plaza Carmona, L., Gil García, B., Pérez Fernández-Rius, A., Alcantud Córcoles, R., Roldán García, B., Romero Rizos, L., Sánchez-Jurado, P. M., Luengo Márquez, C., Esbrí Víctor, M., . . . Abizanda, P. (2022). Psychological and Functional Impact of COVID-19 in Long-Term Care Facilities: The COVID-A Study [Article]. *American Journal of Geriatric Psychiatry*, *30*(4), 431-443. https://doi.org/10.1016/j.jagp.2022.01.007

Costa, A. P., Manis, D. R., Jones, A., Stall, N. M., Brown, K. A., Boscart, V., Castellino, A., Heckman, G. A., Hillmer, M. P., Ma, C., Pham, P., Rais, S., Sinha, S. K., & Poss, J. W. (2021). Risk factors for outbreaks of SARS-CoV-2 infection at retirement homes in Ontario, Canada: a population-level cohort study. *Canadian Medical Association Journal*, *193*(19), E672-E680. https://doi.org/10.1503/cmaj.202756

Creighton, A. S., Davison, T. E., & Kissane, D. W. (2018). The prevalence, reporting, and treatment of anxiety among older adults in nursing homes and other residential aged care facilities. *Journal of Affective Disorders*, *227*, 416-423.

Creighton, A. S., Davison, T. E., & Kissane, D. W. (2019). The Factors Associated With Anxiety Symptom Severity in Older Adults Living in Nursing Homes and Other Residential Aged Care Facilities. *Journal of Aging and Health*, *31*(7), 1235-1258. https://doi.org/10.1177/0898264318767781

Crespo-Martín, A., Palacios-Ceña, D., Huertas-Hoyas, E., Güeita-Rodríguez, J., Fernández-Gómez, G., & Pérez-Corrales, J. (2022). Emotional Impact and Perception of Support in Nursing Home Residents during the COVID-19 Lockdown: A Qualitative Study [Article]. *International Journal of Environmental Research and Public Health*, *19*(23), Article 15712. https://doi.org/10.3390/ijerph192315712

Declercq, A., de Stampa, M., Geffen, L., Heckman, G., Hirdes, J., Finne-Soveri, H., Lum, T., Millar, N., Morris, J. N., & Onder, G. (2020). Why, in almost all countries, was residential care for older people so badly affected by COVID-19? *Observatoire social européen. Opinion paper*(23), 1-13.

Denkinger, M. D., Lukas, A., Nikolaus, T., Peter, R., Franke, S., & Group, A. S. (2014). Multisite pain, pain frequency and pain severity are associated with depression in older adults: results from the ActiFE Ulm study. *Age and ageing*, *43*(4), 510-514.

Du, M., Liu, M., & Liu, J. (2023). The trajectory of depressive symptoms over time and the presence of depressive symptoms at a single time point with the risk of dementia among older adults: A national prospective cohort study. *Psychiatry and Clinical Neurosciences*. https://doi.org/10.1111/pcn.13620

Durmaz, B., Soysal, P., Ellidokuz, H., & Isik, A. T. (2018). Validity and reliability of geriatric depression scale-15 (short form) in Turkish older adults. *Northern clinics of Istanbul*, *5*(3), 216.

Egeljić-Mihailović, N., Brkić-Jovanović, N., Krstić, T., Simin, D., & Milutinović, D. (2022). Social participation and depressive symptoms among older adults during the Covid-19 pandemic in Serbia: A cross-sectional study [Article]. *Geriatric Nursing*, *44*, 8-14. https://doi.org/10.1016/j.gerinurse.2021.12.014

Ehreta, A. M., & Berkingb, M. (2013). From DSM-IV to DSM-5: What has changed in the new edition. *Verhaltenstherapie*, *23*(4), 258-266.

Ellis, R. E. R., Seal, M. L., Simmons, J. G., Whittle, S., Schwartz, O. S., Byrne, M. L., & Allen, N. B. (2017). Longitudinal Trajectories of Depression Symptoms in Adolescence: Psychosocial Risk Factors and Outcomes. *Child Psychiatry & Human Development*, *48*(4), 554-571. https://doi.org/10.1007/s10578-016-0682-z

Erdal, A., Flo, E., Selbaek, G., Aarsland, D., Bergh, S., Slettebo, D. D., & Husebo, B. S. (2017). Associations between pain and depression in nursing home patients at different stages of dementia. *Journal of Affective Disorders*, *218*, 8-14.

Estabrooks, C., Straus, S., Flood, C., Keefe, J., Armstrong, P., Donner, G., Boscart, V., Ducharme, F., Silvius, J., & M., W. (2020). Restoring trust: COVID-19 and the future of long-term care. Ottawa: Royal Society of Canada. https://rsc-src.ca/en/restoring-trust-covid-19-and-future-long-term-care

Fang, H., Tu, S., Sheng, J., & Shao, A. (2019). Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. *Journal of Cellular and Molecular Medicine*, *23*(4), 2324-2332. https://doi.org/10.1111/jcmm.14170

Ferrand, C., Martinent, G., Bailly, N., Giraudeau, C., Pothier, K., & Agli, O. (2020). Change of depressive symptoms in a French nine-year longitudinal study of aging: Gender differences and relationships between social support, health status and depressive symptoms. *Archives of Gerontology and Geriatrics*, *89*, 104059.

Fornaro, M., Solmi, M., Stubbs, B., Veronese, N., Monaco, F., Novello, S., Fusco, A., Anastasia, A., De Berardis, D., Carvalho, A. F., De Bartolomeis, A., & Vieta, E. (2020). Prevalence and correlates of major depressive disorder, bipolar disorder and schizophrenia among nursing home residents without dementia: systematic review and meta-analysis. *The British Journal of Psychiatry*, *216*(1), 6-15. https://doi.org/10.1192/bjp.2019.5

Freeman, S., Hirdes, J. P., Stolee, P., Garcia, J., Smith, T. F., Steel, K., & Morris, J. N. (2014). Care planning needs of palliative home care clients: Development of the interRAI palliative care assessment clinical assessment protocols (CAPs). *BMC Palliative Care*, *13*(1), 58. https://doi.org/10.1186/1472-684x-13-58

Fries, B. E., Morris, J. N., Bernabei, R., Finne-Soveri, H., & Hirdes, J. P. (2007). Rethinking the resident assessment protocols.

Fries, B. E., Simon, S. E., Morris, J. N., Flodstrom, C., & Bookstein, F. L. (2001). Pain in US nursing homes: validating a pain scale for the minimum data set. *The Gerontologist*, *41*(2), 173-179.

Fukukawa, Y., Nakashima, C., Tsuboi, S., Kozakai, R., Doyo, W., Niino, N., Ando, F., & Shimokata, H. (2004). Age differences in the effect of physical activity on depressive symptoms. *Psychology and aging*, *19*(2), 346.

Fullerton, C. A., McGuire, T. G., Feng, Z., Mor, V., & Grabowski, D. C. (2009). Trends in Mental Health Admissions to Nursing Homes, 1999–2005. *Psychiatric Services*, *60*(7), 965-971. https://doi.org/10.1176/ps.2009.60.7.965

Gan, P., Xie, Y., Duan, W., Deng, Q., & Yu, X. (2015). Rumination and loneliness independently predict six-month later depression symptoms among Chinese elderly in nursing homes. *PLOS ONE*, *10*(9), e0137176.

Gao, P., Mosazadeh, H., & Nazari, N. (2023). The buffering role of self-compassion in the Association between loneliness with depressive symptoms: A cross-sectional Survey Study

among older adults living in Residential Care Homes during COVID-19. *International Journal of Mental Health and Addiction*, 1-21.
GBD 2019 Mental Disorders Collaborators. (2022). Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Psychiatry*, *9*(2), 137-150. https://doi.org/10.1016/s2215-0366(21)00395-3
Ge, X., Lorenz, F. O., Conger, R. D., Elder, G. H., & Simons, R. L. (1994). Trajectories of stressful life events and depressive symptoms during adolescence. *Developmental psychology*, *30*(4), 467.
Gentili, A., Weiner, D. K., Kuchibhatla, M., & Edinger, J. D. (1997). Factors that disturb sleep in nursing home residents. *Aging clinical and experimental research*, *9*(3), 207-213. https://doi.org/10.1007/bf03340151
Gerritsen, D. L., Steverink, N., Frijters, D. H., Hirdes, J. P., Ooms, M. E., & Ribbe, M. W. (2008). A revised Index for Social Engagement for long-term care. *Journal of gerontological nursing*, *34*(4), 40-48.
Gilbart, E. E., & Hirdes, J. P. (2000). Stress, social engagement and psychological well-being in institutional settings: Evidence based on the minimum data set 2.0. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, *19*(S2), 50-66.
Girgus, J. S., Yang, K., & Ferri, C. V. (2017). The Gender Difference in Depression: Are Elderly Women at Greater Risk for Depression Than Elderly Men? *Geriatrics*, *2*(4), 35. https://www.mdpi.com/2308-3417/2/4/35
Górski, M., Garbicz, J., Buczkowska, M., Marsik, G., Grajek, M., Całyniuk, B., & Polaniak, R. (2022). Depressive disorders among long-term care residents in the face of isolation due to COVID-19 pandemic [Article]. *Psychiatria Polska*, *56*(1), 101-114. https://doi.org/10.12740/PP/OnlineFirst/127144
Government of Canada: Public Safety Canada. (2020). Reports On Long Term Care Facilities In Ontario & Quebec. https://www.publicsafety.gc.ca/cnt/trnsprnc/brfng-mtrls/prlmntry-bndrs/20200831/069/index-en.aspx
Government of Ontario. (2022). Seniors: find a place to live. https://www.ontario.ca/page/seniors-find-place-to-live
Guthrie, D. M., Declercq, A., Finne-Soveri, H., Fries, B. E., & Hirdes, J. P. (2016). The Health and Well-Being of Older Adults with Dual Sensory Impairment (DSI) in Four Countries. *PLOS ONE*, *11*(5), e0155073. https://doi.org/10.1371/journal.pone.0155073
Hall, Y., Greco, P., Hau, K., & Barak, Y. (2020). Older adults abuse: analysis of a New Zealand national dataset. *International Psychogeriatrics*, *32*(8), 1003-1008.
Hamilton, M. (1960). A rating scale for depression. *Journal of neurology, neurosurgery, and psychiatry*, *23*(1), 56.
Harris, Y. (2007). Depression as a risk factor for nursing home admission among older individuals. *Journal of the American Medical Directors Association*, *8*(1), 14-20.
Harrison, S. L., Bradley, C., Milte, R., Liu, E., Kouladjian O'Donnell, L., Hilmer, S. N., & Crotty, M. (2018). Psychotropic medications in older people in residential care facilities and associations with quality of life: a cross-sectional study. *BMC Geriatrics*, *18*(1). https://doi.org/10.1186/s12877-018-0752-0
Heckman, G. A., Hirdes, J. P., Hébert, P. C., Morinville, A., Amaral, A. C., Costa, A., & McKelvie, R. S. (2019). Predicting future health transitions among newly admitted nursing home residents with heart failure. *Journal of the American Medical Directors Association*, *20*(4), 438-443.
Heckman, G. A., Kay, K., Morrison, A., Grabowski, D. C., Hirdes, J. P., Mor, V., Shaw, G., Benjamin, S., Boscart, V. M., Costa, A. P., Declercq, A., Geffen, L., Sang Lum, T. Y., Moser, A., Onder,

G., & Van Hout, H. (2021). Proceedings from an International Virtual Townhall: Reflecting on the COVID-19 Pandemic: Themes from Long-Term Care. *Journal of the American Medical Directors Association*, *22*(6), 1128-1132. https://doi.org/10.1016/j.jamda.2021.03.029

Heikkinen, R.-L., & Kauppinen, M. (2004). Depressive symptoms in late life: a 10-year follow-up. *Archives of Gerontology and Geriatrics*, *38*(3), 239-250.

Hirdes, J. P., Declercq, A., Finne-Soveri, H., Fries, B. F., Geffen, L., Heckman, G., Lum, T., Meehan, B., Millar, N., & Morris, J. N. (2020). The long-term care pandemic: International perspectives on COVID-19 and the future of nursing homes.

Hirdes, J. P., Frijters, D. H., & Teare, G. F. (2003). The MDS-CHESS scale: a new measure to predict mortality in institutionalized older people. *Journal of the American Geriatrics Society*, *51*(1), 96-100.

Hirdes, J. P., Ikegami, N., Jónsson, P. V., Topinková, E., Maxwell, C. J., & Yamauchi, K. (2000). Cross-national comparisons of antidepressant use among institutionalized older persons based on the minimum data set (MDS). *Canadian Journal on Aging/La Revue canadienne du vieillissement*, *19*(S2), 18-37.

Hirdes, J. P., Ljunggren, G., Morris, J. N., Frijters, D. H., Soveri, H. F., Gray, L., Björkgren, M., & Gilgen, R. (2008). Reliability of the interRAI suite of assessment instruments: a 12-country study of an integrated health information system. *BMC health services research*, *8*(1), 1-11.

Hirdes, J. P., Major, J., Didic, S., Quinn, C., Mitchell, L., Chen, J., Jantzi, M., & Phillips, K. (2020). A Canadian cohort study to evaluate the outcomes associated with a multicenter initiative to reduce antipsychotic use in long-term care homes. *Journal of the American Medical Directors Association*, *21*(6), 817-822.

Hirdes, J. P., Mitchell, L., Maxwell, C. J., & White, N. (2011). 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*, *30*(3), 371-390.

Hirdes, J. P., Morris, J. N., Perlman, C. M., Saari, M., Betini, G. S., Franco-Martin, M. A., van Hout, H., Stewart, S. L., & Ferris, J. (2022). Mood disturbances across the continuum of care based on self-report and clinician rated measures in the interRAI suite of assessment instruments. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.787463

Hirdes, J. P., Poss, J. W., Caldarelli, H., Fries, B. E., Morris, J. N., Teare, G. F., Reidel, K., & Jutan, N. (2013). An evaluation of data quality in Canada's Continuing Care Reporting System (CCRS): secondary analyses of Ontario data submitted between 1996 and 2011. *BMC Medical Informatics and Decision Making*, *13*(1), 1-27.

Hirdes, J. P., Poss, J. W., Mitchell, L., Korngut, L., & Heckman, G. (2014). Use of the interRAI CHESS scale to predict mortality among persons with neurological conditions in three care settings. *PLOS ONE*, *9*(6), e99066.

Hirdes, J. P., Smith, T. F., Rabinowitz, T., Yamauchi, K., Pérez, E., Telegdi, N. C., Prendergast, P., Morris, J. N., Ikegami, N., Phillips, C. D., & Fries, B. E. (2002). The resident assessment instrument-mental health (RAI-MH): Inter-rater reliability and convergent validity. *The Journal of Behavioral Health Services & Research*, *29*(4), 419-432. https://doi.org/10.1007/bf02287348

Hirdes, J. P., Van Everdingen, C., Ferris, J., Franco-Martin, M., Fries, B. E., Heikkilä, J., Hirdes, A., Hoffman, R., James, M. L., & Martin, L. (2020). The interRAI suite of mental health assessment instruments: an integrated system for the continuum of care. *Frontiers in Psychiatry*, *10*, 491444.

Hirschfield, R. M. A. (2001). The Comorbidity of Major Depression and Anxiety Disorders. *The Primary Care Companion to The Journal of Clinical Psychiatry*, *03*(06), 244-254. https://doi.org/10.4088/pcc.v03n0609

Hoben, M., Heninger, A., Holroyd-Leduc, J., Knopp-Sihota, J., Estabrooks, C., & Goodarzi, Z. (2019). Depressive symptoms in long term care facilities in Western Canada: a cross sectional study. *BMC Geriatrics*, *19*(1), 1-13.

Hoben, M., Hogan, D. B., Poss, J. W., Gruneir, A., McGrail, K., Griffith, L. E., Chamberlain, S. A., Estabrooks, C. A., & Maxwell, C. J. (2023). Comparing quality of care outcomes between assisted living and nursing homes before and during the <scp>COVID</scp>-19 pandemic. *Journal of the American Geriatrics Society*, *71*(11), 3467-3479. https://doi.org/10.1111/jgs.18499

Hsiao, Y.-C., & Chen, C.-Y. (2018). Exploring Individual, Family, and Extrafamilial Factors Associated With Depression Among Elderly Residents of Care Settings. *The International Journal of Aging and Human Development*, *86*(3), 219-241. https://doi.org/10.1177/0091415017699938

Hsu, A., Lane, N., Sinha, S., Dunning, J., Dhuper, M., Kahiel, Z., & Sveistrup, H. (2021). Understanding the impact of COVID-19 on residents of Canada's long-term care homes–ongoing challenges and policy responses. 2020. In.

Hsu, H.-C. (2012). Group-based trajectories of depressive symptoms and the predictors in the older population. *International Journal of Geriatric Psychiatry*, *27*(8), 854-862. https://doi.org/10.1002/gps.2796

Hu, Z., Zhu, X., Kaminga, A. C., Zhu, T., Nie, Y., & Xu, H. (2020). Association between poor sleep quality and depression symptoms among the elderly in nursing homes in Hunan province, China: a cross-sectional study. *BMJ Open*, *10*(7), e036401. https://doi.org/10.1136/bmjopen-2019-036401

Huang, Y., & Carpenter, I. (2011). Identifying elderly depression using the Depression Rating Scale as part of comprehensive standardised care assessment in nursing homes. *Aging & Mental Health*, *15*(8), 1045-1051. https://doi.org/10.1080/13607863.2011.583626

Hudon, C., Aubrey-Bassler, K., Chouinard, M.-C., Doucet, S., Dubois, M.-F., Karam, M., Luke, A., Moullec, G., Pluye, P., Tzenov, A., Ouadfel, S., Lambert, M., Angrignon-Girouard, É., Schwarz, C., Howse, D., Macleod, K. K., Gaudreau, A., & Sabourin, V. (2022). Better understanding care transitions of adults with complex health and social care needs: a study protocol. *BMC health services research*, *22*(1). https://doi.org/10.1186/s12913-022-07588-0

Institute for Health Metrics and Evaluation. (2020). The global burden of disease: GBD reults. In: Institute for Health Metrics and Evaluation Seattle, WA.

Jones, K., Perlman, C. M., Hirdes, J. P., & Scott, T. (2010). Screening Cognitive Performance with the Resident Assessment Instrument for Mental Health Cognitive Performance Scale. *The Canadian Journal of Psychiatry*, *55*(11), 736-740. https://doi.org/10.1177/070674371005501108

Jones, R. N., Hirdes, J. P., Poss, J. W., Kelly, M., Berg, K., Fries, B. E., & Morris, J. N. (2010). Adjustment of nursing home quality indicators. *BMC health services research*, *10*(1), 96. https://doi.org/10.1186/1472-6963-10-96

Kaelen, S., van den Boogaard, W., Pellecchia, U., Spiers, S., de Cramer, C., Demaegd, G., Fouqueray, E., van den Bergh, R., Goublomme, S., Decroo, T., Quinet, M., van Hoof, E., & Draguez, B. (2021). How to bring residents' psychosocial wellbeing to the heart of the fight against Covid-19 in Belgian nursing homes—A qualitative study [Article]. *PLOS ONE*, *16*(3 March), Article e0249098. https://doi.org/10.1371/journal.pone.0249098

Kehyayan, V., Chen, J., & Hirdes, J. P. (2021). Profile of residents with mental disorders in Canadian long-term care facilities: a cross-sectional study. *Journal of Long-Term Care*.

Kessler, R. C., Birnbaum, H. G., Shahly, V., Bromet, E., Hwang, I., McLaughlin, K. A., Sampson, N., Andrade, L. H., De Girolamo, G., Demyttenaere, K., Haro, J. M., Karam, A. N., Kostyuchenko, S., Kovess, V., Lara, C., Levinson, D., Matschinger, H., Nakane, Y., Browne, M. O., . . . Stein, D. J. (2010). Age differences in the prevalence and co-morbidity of DSM-IV major depressive episodes: results from the WHO World Mental Health Survey Initiative. *Depression and Anxiety*, *27*(4), 351-364. https://doi.org/10.1002/da.20634

Kessler, R. C., & Bromet, E. J. (2013). The Epidemiology of Depression Across Cultures. *Annual Review of Public Health*, *34*(1), 119-138. https://doi.org/10.1146/annurev-publhealth-031912-114409

Keyes, C. L. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of health and social behavior*, 207-222.

Keyes, C. L., & Lopez, S. J. (2009). Toward a science of mental health. *Oxford handbook of positive psychology*, *2*, 89-95.

Koehler, M., Rabinowitz, T., Hirdes, J., Stones, M., Carpenter, G. I., Fries, B. E., Morris, J. N., & Jones, R. N. (2005). Measuring depression in nursing home residents with the MDS and GDS: an observational psychometric study. *BMC Geriatrics*, *5*(1). https://doi.org/10.1186/1471-2318-5-1

Korf, J. (2014). Delayed mood transitions in major depressive disorder. *Medical Hypotheses*, *82*(5), 581-588.

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2010). The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. *General hospital psychiatry*, *32*(4), 345-359.

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9. *Journal of general internal medicine*, *16*(9), 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Ku, P.-W., Fox, K. R., & Chen, L.-J. (2009). Physical activity and depressive symptoms in Taiwanese older adults: a seven-year follow-up study. *Preventive Medicine*, *48*(3), 250-255.

Lampinen, P., Heikkinen, R.-L., & Ruoppila, I. (2000). Changes in intensity of physical exercise as predictors of depressive symptoms among older adults: an eight-year follow-up. *Preventive Medicine*, *30*(5), 371-380.

Lang, J. J., Alam, S., Cahill, L. E., Drucker, A. M., Gotay, C., Kayibanda, J. F., Kozloff, N., Mate, K. K. V., Patten, S. B., & Orpana, H. M. (2018). Global Burden of Disease Study trends for Canada from 1990 to 2016. *Canadian Medical Association Journal*, *190*(44), E1296-E1304. https://doi.org/10.1503/cmaj.180698

Leedahl, S. N. (2014). *Older adults in nursing homes: Assessing relationships between multiple constructs of social integration, facility characteristics, and health* ProQuest Information & Learning]. US.

Levere, M., Rowan, P., & Wysocki, A. (2021). The adverse effects of the COVID-19 pandemic on nursing home resident well-being. *Journal of the American Medical Directors Association*, *22*(5), 948-954. e942.

Lys, R., Belanger, E., & Phillips, S. P. (2019). Improved mood despite worsening physical health in older adults: Findings from the International Mobility in Aging Study (IMIAS). *PLOS ONE*, *14*(4), e0214988. https://doi.org/10.1371/journal.pone.0214988

MacCourt P., W. K., & Tourigny-Rivard M-F. (2011). *Guidelines for Comprehensive Mental Health Services for Older Adults in Canada*. http://www.mentalhealthcommission.ca

Martin, L., Poss, J. W., Hirdes, J. P., Jones, R. N., Stones, M. J., & Fries, B. E. (2008). Predictors of a new depression diagnosis among older adults admitted to complex continuing care: implications for the depression rating scale (DRS). *Age and ageing*, *37*(1), 51-56.

McArthur, C., Saari, M., Heckman, G. A., Wellens, N., Weir, J., Hebert, P., Turcotte, L., Jbilou, J., & Hirdes, J. P. (2021). Evaluating the effect of COVID-19 pandemic lockdown on long-term care residents' mental health: A data-driven approach in New Brunswick. *Journal of the American Medical Directors Association*, *22*(1), 187-192.

McArthur, C., T. Mulla, R., Turcotte, L. A., Chu, J. C.-Y., Jantzi, M., & Hirdes, J. P. (2023). Mental Health and Quality of Life in Long-Term Care During the Pandemic. In J. A. Horney (Ed.), *COVID-19, Frontline Responders and Mental Health: A Playbook for Delivering Resilient Public Health Systems Post-Pandemic* (pp. 97-117). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80262-115-020231007

Mechakra-Tahiri, S., Zunzunegui, M. V., Préville, M., & Dubé, M. (2009). Social relationships and depression among people 65 years and over living in rural and urban areas of Quebec. *International Journal of Geriatric Psychiatry*, *24*(11), 1226-1236. https://doi.org/10.1002/gps.2250

Merikangas, K. R., Zhang, H., Avenevoli, S., Acharyya, S., Neuenschwander, M., & Angst, J. (2003). Longitudinal trajectories of depression and anxiety in a prospective community study: the Zurich Cohort Study. *Archives of general psychiatry*, *60*(10), 993-1000.

Meyer, D., Marx, T., & Ball-Seiter, V. (2011). Social isolation and telecommunication in the nursing home: a pilot study. *Gerontechnology*, *10*(1), 51-58. https://doi.org/10.4017/gt.2011.10.01.004.00

Mezuk, B., Ko, T. M., Kalesnikava, V. A., & Jurgens, D. (2019). Suicide Among Older Adults Living in or Transitioning to Residential Long-term Care, 2003 to 2015. *JAMA Network Open*, *2*(6), e195627. https://doi.org/10.1001/jamanetworkopen.2019.5627

Mondimore, F. M. (2006). *Depression, the mood disease*. JHU Press.

Montagnier, D., Dartigues, J.-F., Rouillon, F., Pérès, K., Falissard, B., & Onen, F. (2014). Ageing and trajectories of depressive symptoms in community-dwelling men and women. *International Journal of Geriatric Psychiatry*, *29*(7), 720-729. https://doi.org/10.1002/gps.4054

Montgomery, A., Slocum, S., & Stanik, C. (2020). Experiences of nursing home residents during the pandemic. *Altarum Special Report*, 1-46.

Morimoto, S. S., Kanellopoulos, D., Manning, K. J., & Alexopoulos, G. S. (2015). Diagnosis and treatment of depression and cognitive impairment in late life. *Annals of the new York Academy of Sciences*, *1345*(1), 36-46.

Morris, J. N., Berg, K., Bjorkgren, M., Finne-Soveri, H., Fries, B., Frijters, D., Gilgen, R., Gray, L., Hawes, C., Henrard, J. C., Hirdes, J. P., Ljunggren, G., Nonemaker, S., Steel, K., & Szczerbinska, K. (2011). *interRAI Clinical Assessments Protocols (CAPs) for use with Community and Long-Term Care Assessment Instruments, (Standard English Edition), 9.1.2*. catalog.interrai.org

Morris, J. N., Berg, K., Fries, B. E., Steel, K., & Howard, E. P. (2013). Scaling functional status within the interRAI suite of assessment instruments. *BMC Geriatrics*, *13*(1), 128. https://doi.org/10.1186/1471-2318-13-128

Morris, J. N., Fries, B. E., Mehr, D. R., Hawes, C., Phillips, C., Mor, V., & Lipsitz, L. A. (1994). MDS cognitive performance scale©. *Journal of gerontology*, *49*(4), M174-M182.

Morris, J. N., Fries, B. E., & Morris, S. A. (1999). Scaling ADLs within the MDS. *The Journals of Gerontology: Series A*, *54*(11), M546-M553.

Morris, J. N., Howard, E. P., Steel, K., Perlman, C., Fries, B. E., Garms-Homolová, V., Henrard, J.-C., Hirdes, J. P., Ljunggren, G., & Gray, L. (2016). Updating the cognitive performance scale. *Journal of geriatric psychiatry and neurology*, *29*(1), 47-55.

Morris, J. N., Nonemaker, S., Murphy, K., Hawes, C., Fries, B. E., Mor, V., & Phillips, C. (1997). A commitment to change: revision of HCFA's RAI. *Journal of the American Geriatrics Society*, *45*(8), 1011-1016.

Nair, P., Gill, J. S., Sulaiman, A. H., Koh, O. H., & Francis, B. (2021). Mental health correlates among older persons residing in Malaysian nursing homes during the COVID-19 pandemic. *Asia Pacific Journal of Public Health*, *33*(8), 940-944.

National Heart Lung, & Blood Institute. (2017). Heart disease and depression: A two-way relationship. *Retrieved September*, *2*, 2021.

National Institute of Mental Health. (2021). Depression. In (pp. 1-8).

Neufeld, E., Freeman, S., Joling, K., & Hirdes, J. P. (2014). "When the golden years are blue": Changes in depressive symptoms over time among older adults newly admitted to long-term care facilities. *Clinical Gerontologist*, *37*(3), 298-315.

Ng, R., Lane, N., Tanuseputro, P., Mojaverian, N., Talarico, R., Wodchis, W. P., Bronskill, S. E., & Hsu, A. T. (2020). Increasing Complexity of New Nursing Home Residents in Ontario, Canada: A Serial Cross-Sectional Study. *Journal of the American Geriatrics Society*, *68*(6), 1293-1300. https://doi.org/10.1111/jgs.16394

Norman, K. J., & Hirdes, J. P. (2020). Evaluation of the Predictive Accuracy of the interRAI Falls Clinical Assessment Protocol, Scott Fall Risk Screen, and a Supplementary Falls Risk Assessment Tool Used in Residential Long-Term Care: A Retrospective Cohort Study. *Canadian Journal on Aging / La Revue canadienne du vieillissement*, *39*(4), 521-532. https://doi.org/10.1017/s0714980820000021

Office of the Chief Science Advisor of Canada. (2020). *Long-Term Care and COVID-19*. https://science.gc.ca/site/science/en/office-chief-science-advisor/initiatives-covid-19/long-term-care-and-covid-19

Onder, G., Liperoti, R., Soldato, M., Cipriani, M. C., Bernabei, R., & Landi, F. (2007). Depression and risk of nursing home admission among older adults in home care in Europe: results from the Aged in Home Care (AdHOC) study. *J Clin Psychiatry*, *68*(9), 1392-1398.

Ontario's Long-Term Care COVID-19 Commission. (2021). *Ontario's Long-Term Care COVID-19 Commission Final Report*. http://www.ltccommission-commissionsld.ca/

Pan American Health Organization. (2014). Plan of Action on Mental Health 2015-2020. 53rd Directing Council, 66th Session of the Regional Committee of WHO for the Americas.

Pascut, S., Feruglio, S., Crescentini, C., & Matiz, A. (2022). Predictive factors of anxiety, depression, and health-related quality of life in community-dwelling and institutionalized elderly during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *19*(17), 10913.

Patra, P., Alikari, V., Fradelos, E. C., Sachlas, A., Kourakos, M., Rojas Gil, A. P., Babatsikou, F., & Zyga, S. (2016). Assessment of Depression in Elderly. Is Perceived Social Support Related? A Nursing Home Study. In (pp. 139-150). Springer International Publishing. https://doi.org/10.1007/978-3-319-57379-3_13

Pemberton, R., & Tyszkiewicz, M. D. F. (2016). Factors contributing to depressive mood states in everyday life: a systematic review. *Journal of Affective Disorders*, *200*, 103-110.

Penny, K., Barron, A., Higgins, A.-M., Gee, S., Croucher, M., & Cheung, G. (2016). Convergent validity, concurrent validity, and diagnostic accuracy of the interRAI depression rating scale. *Journal of geriatric psychiatry and neurology*, *29*(6), 361-368.

Pereiro, A. X., Dosil-Díaz, C., Mouriz-Corbelle, R., Pereira-Rodríguez, S., Nieto-Vietes, A., Pinazo-Hernandis, S., Pinazo-Clapés, C., & Facal, D. (2021). Impact of the COVID-19 lockdown on a long-term care facility: The role of social contact [Article]. *Brain sciences*, *11*(8), Article 986. https://doi.org/10.3390/brainsci11080986

Pereiro, A. X., Leiva, D., Galvañ, A., Pinazo-Hernandis, S., Pinazo-Clapés, C., Dosil-Díaz, C., Felpete, A., & Facal, D. (2023). Psychological and functional impacts associated with restrictions in long-term care facilities (LTCF) due to the COVID-19 pandemic: A multicentre study. *Aging & mental health*, *27*(8), 1544-1551. https://doi.org/10.1080/13607863.2022.2158306

Perlman, C., Kirkham, J., Velkers, C., Leung, R. H., Whitehead, M., & Seitz, D. (2019). Access to psychiatrist services for older adults in long-term care: A population-based study. *Journal of the American Medical Directors Association*, *20*(5), 610-616. e612.

Perlman, C. M., & Hirdes, J. P. (2008). The aggressive behavior scale: a new scale to measure aggression based on the minimum data set. *Journal of the American Geriatrics Society*, *56*(12), 2298-2303.

Poss, J. W., Jutan, N. M., Hirdes, J. P., Fries, B. E., Morris, J. N., Teare, G. F., & Reidel, K. (2008). A Review of Evidence on the Reliability and Validity of Minimum Data Set Data. *Healthcare Management Forum*, *21*(1), 33-39. https://doi.org/10.1016/s0840-4704(10)60127-5

Qiao, Y., Liu, S., Li, G., Lu, Y., Wu, Y., Ding, Y., & Ke, C. (2021). Role of depressive symptoms in cardiometabolic diseases and subsequent transitions to all-cause mortality: an application of multistate models in a prospective cohort study. *Stroke and vascular neurology*, *6*(4).

Raciti, A., & Chang, Y.-P. (2023). Nursing Home Residents' Experiences During the COVID-19 Pandemic. *Journal of gerontological nursing*, *49*(4), 27-32. https://doi.org/10.3928/00989134-20230309-05

Reppas-Rindlisbacher, C., Rochon, P. A., & Stall, N. M. (2021). The COVID-19 pandemic and drug prescribing in Ontario nursing homes—from confinement syndrome to unconfined prescribing. *JAMA Network Open*, *4*(8), e2119028-e2119028.

Robb, C. E., De Jager, C. A., Ahmadi-Abhari, S., Giannakopoulou, P., Udeh-Momoh, C., McKeand, J., Price, G., Car, J., Majeed, A., & Ward, H. (2020). Associations of social isolation with anxiety and depression during the early COVID-19 pandemic: a survey of older adults in London, UK. *Frontiers in Psychiatry*, *11*, 591120.

Rochon, P., Li, J., Johnstone, J., Brown, K., Armstrong, P., Tanuseputro, P., Savage, R., Gill, S., Mather, R., & Costa, A. (2022). The COVID-19 pandemic's impact on long-term care homes: Five lessons learned. *Science Briefs of the Ontario COVID-19 Science Advisory Table*, *3*(60), 1-14.

Rodda, J., Walker, Z., & Carter, J. (2011). Depression in older adults. *Bmj*, *343*.

Seitz, D., Purandare, N., & Conn, D. (2010). Prevalence of psychiatric disorders among older adults in long-term care homes: a systematic review. *International Psychogeriatrics*, *22*(7), 1025-1039. https://doi.org/10.1017/s1041610210000608

Shin, J., & Cho, E. (2022). Trajectories of depressive symptoms among community-dwelling Korean older adults: findings from the Korean longitudinal study of aging (2006–2016). *BMC Psychiatry*, *22*(1). https://doi.org/10.1186/s12888-022-03905-3

Simning, A., & Simons, K. V. (2017). Treatment of depression in nursing home residents without significant cognitive impairment: a systematic review. *International Psychogeriatrics*, *29*(2), 209-226. https://doi.org/10.1017/s1041610216001733

Sinn, C.-L. J., Betini, R. S. D., Wright, J., Eckler, L., Chang, B. W., Hogeveen, S., Turcotte, L., & Hirdes, J. P. (2018). Adverse Events in Home Care: Identifying and Responding with interRAI Scales and Clinical Assessment Protocols. *Canadian Journal on Aging / La Revue canadienne du vieillissement*, *37*(1), 60-69. https://doi.org/10.1017/s0714980817000538

Solomou, I., & Constantinidou, F. (2020). Prevalence and Predictors of Anxiety and Depression Symptoms during the COVID-19 Pandemic and Compliance with Precautionary Measures:

Age and Sex Matter. *International Journal of Environmental Research and Public Health*, *17*(14), 4924. https://doi.org/10.3390/ijerph17144924

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Group, a. t. P. H. Q. P. C. S. (1999). Validation and Utility of a Self-report Version of PRIME-MDThe PHQ Primary Care Study. *JAMA*, *282*(18), 1737-1744. https://doi.org/10.1001/jama.282.18.1737

Stall, N., Brown, K., & Maltsev, A. (2021). COVID-19 and Ontario's long-term care homes. Science Briefs of the Ontario COVID-19 Science Advisory Table. 2021; 2 (7). In: This Science Brief was updated with minor changes on January 26, 2021.

Stall, N. M., Zipursky, J. S., Rangrej, J., Jones, A., Costa, A. P., Hillmer, M. P., & Brown, K. (2021). Assessment of Psychotropic Drug Prescribing Among Nursing Home Residents in Ontario, Canada, During the COVID-19 Pandemic. *JAMA Internal Medicine*, *181*(6), 861. https://doi.org/10.1001/jamainternmed.2021.0224

Stewart, D. E., & Appelbaum, P. S. (2020). <scp>COVID</scp> -19 and psychiatrists' responsibilities: a <scp>WPA</scp> position paper. *World Psychiatry*, *19*(3), 406-407. https://doi.org/10.1002/wps.20803

Sun, F., Park, N. S., Roff, L. L., Klemmack, D. L., Parker, M., Koenig, H. G., Sawyer, P., & Allman, R. M. (2012). Predicting the trajectories of depressive symptoms among southern community-dwelling older adults: The role of religiosity. *Aging & mental health*, *16*(2), 189-198.

Sutin, A. R., Terracciano, A., Milaneschi, Y., An, Y., Ferrucci, L., & Zonderman, A. B. (2013). The Trajectory of Depressive Symptoms Across the Adult Life Span. *JAMA Psychiatry*, *70*(8), 803. https://doi.org/10.1001/jamapsychiatry.2013.193

Szczerbińska, K., Hirdes, J. P., & Życzkowska, J. (2012). Good news and bad news: depressive symptoms decline and undertreatment increases with age in home care and institutional settings. *The American Journal of Geriatric Psychiatry*, *20*(12), 1045-1056.

Tanner, J.-A., Hensel, J., Davies, P. E., Brown, L. C., Dechairo, B. M., & Mulsant, B. H. (2020). Economic Burden of Depression and Associated Resource Use in Manitoba, Canada. *The Canadian Journal of Psychiatry*, *65*(5), 338-346. https://doi.org/10.1177/0706743719895342

The Joanna Briggs Institute. (2015). The Joanna Briggs Institute reviewers' manual 2015: methodology for JBI scoping reviews.

The Retirement Homes Regulatory Authority. (2024). About RHRA. https://www.rhra.ca/en/about-rhra/

Turcotte, L. A., McArthur, C., Poss, J. W., Heckman, G., Mitchell, L., Morris, J., Foebel, A. D., & Hirdes, J. P. (2023). Long-Term Care Resident Health and Quality of Care During the COVID-19 Pandemic: A Synthesis Analysis of Canadian Institute for Health Information Data Tables. *Health Services Insights*, *16*, 117863292311747. https://doi.org/10.1177/11786329231174745

Turcotte, L. A., Tran, J., Moralejo, J., Curtin-Telegdi, N., Eckel, L., & Hirdes, J. P. (2018). Evaluation of a staff training programme to reimplement a comprehensive health assessment. *BMJ Open Quality*, *7*(4), e000353. https://doi.org/10.1136/bmjoq-2018-000353

Van Der Roest, H. G., Prins, M., Van Der Velden, C., Steinmetz, S., Stolte, E., Van Tilburg, T. G., & De Vries, D. H. (2020). The Impact of COVID-19 Measures on Well-Being of Older Long-Term Care Facility Residents in the Netherlands. *Journal of the American Medical Directors Association*, *21*(11), 1569-1570. https://doi.org/10.1016/j.jamda.2020.09.007

Van Tilburg, T. G., Steinmetz, S., Stolte, E., Van Der Roest, H., & De Vries, D. H. (2021). Loneliness and Mental Health During the COVID-19 Pandemic: A Study Among Dutch Older Adults. *The Journals of Gerontology: Series B*, *76*(7), e249-e255. https://doi.org/10.1093/geronb/gbaa111

Vaughan, L., Goveas, J., & Corbin, A. (2015). Depression and frailty in later life: a systematic review. *Clinical Interventions in Aging*, 1947. https://doi.org/10.2147/cia.s69632
Vigo, D., Thornicroft, G., & Atun, R. (2016). Estimating the true global burden of mental illness. *The Lancet Psychiatry*, *3*(2), 171-178.
Vilches, T. N., Nourbakhsh, S., Zhang, K., Juden-Kelly, L., Cipriano, L. E., Langley, J. M., Sah, P., Galvani, A. P., & Moghadas, S. M. (2021). Multifaceted strategies for the control of COVID-19 outbreaks in long-term care facilities in Ontario, Canada. *Preventive Medicine*, *148*, 106564. https://doi.org/10.1016/j.ypmed.2021.106564
Wang, S., & Blazer, D. G. (2015). Depression and Cognition in the Elderly. *Annual Review of Clinical Psychology*, *11*(1), 331-360. https://doi.org/10.1146/annurev-clinpsy-032814-112828
Wang, Y.-Y., Yue, J.-R., Xie, D.-M., Carter, P., Li, Q.-L., Gartaganis, S. L., Chen, J., & Inouye, S. K. (2020). Effect of the tailored, family-involved hospital elder life program on postoperative delirium and function in older adults: a randomized clinical trial. *JAMA Internal Medicine*, *180*(1), 17-25.
Wang, Y., Lopez, J. M. S., Bolge, S. C., Zhu, V. J., & Stang, P. E. (2016). Depression among people with type 2 diabetes mellitus, US National Health and Nutrition Examination Survey (NHANES), 2005–2012. *BMC Psychiatry*, *16*(1). https://doi.org/10.1186/s12888-016-0800-2
Whiteman, K., Ruggiano, N., & Thomlison, B. (2016). Transforming mental health services to address gender disparities in depression risk factors. *Journal of Women & Aging*, *28*(6), 521-529. https://doi.org/10.1080/08952841.2015.1072027
Wilkins, S. S., Guzman-Clark, J., Osato, S., Harada, N., Henriques, D., Royer, C., Abouezzedine, T., Castle, S., & Dhanani, S. (2011). Comparing depression screening tests in older veterans. *Fed Pract*, *28*, 11-16.
Wilkinson, A., Haroun, V., Wong, T., Cooper, N., & Chignell, M. (2019). Overall quality performance of long-term care homes in Ontario. *Healthc Q*, *22*(2), 55-62.
Wilkinson, P., Ruane, C., & Tempest, K. (2018). Depression in older adults. *Bmj*, k4922. https://doi.org/10.1136/bmj.k4922
Wister, A., Li, L., Best, J. R., Cosco, T. D., & Kim, B. (2022). Multimorbidity, COVID-19 and Mental Health: Canadian Longitudinal Study on Aging (CLSA) Longitudinal Analyses. *Clinical Gerontologist*, 1-16. https://doi.org/10.1080/07317115.2022.2094742
Wolff, F. C. (2013). Well-Being of Elderly People Living in Nursing Homes: The Benefits of Making Friends. *Kyklos*, *66*(1), 153-171. https://doi.org/10.1111/kykl.12015
World Health Organization. (2022). *Mental health*. https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response
Wu, S., Xiao, L. D., Nan, J., Zhao, S., Yin, P., Zhang, D., Liao, L., Li, M., Yang, X., & Feng, H. (2023). Nursing Home Residents' Perceptions of Challenges and Coping Strategies during COVID-19 Pandemic in China. *Int J Environ Res Public Health*, *20*(2). https://doi.org/10.3390/ijerph20021485
Wyer, L., Guterman, Y., Ewa, V., Lang, E., Faris, P., & Holroyd-Leduc, J. (2024). The impact of the COVID-19 pandemic on transfers between long-term care and emergency departments across Alberta. *BMC Emergency Medicine*, *24*(1). https://doi.org/10.1186/s12873-023-00926-3
Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., & McIntyre, R. S. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of Affective Disorders*, *277*, 55-64. https://doi.org/10.1016/j.jad.2020.08.001
Your Health System-CIHI. (2022). *Worsened Depressive Mood in Long-Term Care details for Ontario*. CIHI.

https://yourhealthsystem.cihi.ca/hsp/indepth;jsessionid=4PGcFpgvxlWALscPH+2Ww3tH.yhs?lang=en#/indicator/055/2/C5001/

Zhang, H., Wang, S., Wang, L., Yi, X., Jia, X., & Jia, C. (2020). Comparison of the Geriatric Depression Scale-15 and the Patient Health Questionnaire-9 for screening depression in older adults. *Geriatrics & Gerontology International*, *20*(2), 138-143.

Zis, P., Daskalaki, A., Bountouni, I., Sykioti, P., Varrassi, G., & Paladini, A. (2017). Depression and chronic pain in the elderly: links and management challenges. *Clinical Interventions in Aging*, *Volume 12*, 709-720. https://doi.org/10.2147/cia.s113576

Appendices

Appendix A (Chapter 2; Manuscript 1)

Table A.1: List and Details of Included Quantitative Articles

Author/Year/Country	Aim(s) *some studies had multiple aims, only aims that met the inclusion criteria of this review were included.	Participants (age, sample size, setting) *Some studies had multiple settings, only LTC homes were included in the review and table. Also, only participants that met the inclusion criteria were included with proxies excluded.	Measures of Depression	Key Findings * some articles are letters to the editor or research letters and here we will reflect their main viewpoint
Cheng, Lee and Chow, 2010 (China)	To investigate the extent to which structural and functional social support promotes psychological well-being among nursing home residents in a Chinese society.	Age: Mean age=80.9 Number: n=71	GDS	58% of participants were likely to be clinically depressed. Residents received a total of 3.6 visits per month from all family members combined, 2.8 visits from other relatives, and 0.8 visits from friends. Network size explained 4–10% of the residual variances in the well-being measures and contact frequency another 9–18%.
Meyer, Marx and Ball-Seiter, 2011 (USA)	To determine the degree of isolation and depression levels among rural nursing home residents.	Age: =65-100 Number: n=33	GDS and MDS	GDS identified 45.5% and MDS identified 33.4% of residents with mild or severe depression. About 80% of residents had daily contact with friends or family measured by MDS.

Wolff, 2013 (France)	To examine the role of individual characteristics that contribute to life satisfaction and depression in nursing homes.	Age: Mean age=85.14 Number: n=1,802	SAEP survey	Feelings of sadness or depression are much more influenced by making friends in the institution than by visits from family and relatives or by any other individual background characteristics. Results showed that not having friends increases the propensity for feeling sad or depressed by about 20%.
Leedahl, 2014 (USA)	To predict the influence of social integration on health for older adults within nursing homes.	Age: Mean age=83.07 Number: n=140	GDS	GDS score was 9.10, indicating average responses of normal to mild depression. Significant negative correlations between social engagement and depression ($p < .001$) were found.
Gan et al., 2015 (China)	To determine the relationship between loneliness and depression among Chinese elderly in nursing homes.	Age: Mean age=82.49 Number: n=71	CES-D	Loneliness was significantly related to depression ($r = .30$, $p < .001$).
Patra et al., 2016 (Greece)	To assess the levels of depression and social support among elderly in nursing homes.	Age: Mean age=79.52 Number: n=170	GDS	31.2% had visits from relatives 5–10 times/month. 37.1% of the residents suffered from depression. GDS-15 score was significantly correlated with the total MSPSS score. Depression score was significantly affected by frequency of visits from relatives ($p < 0.001$).
Hsiao and Chen, 2017 (Taiwan)	To investigate simultaneously the associations among individual, family, and extrafamilial factors and depression among elderly	Age: 65+ Number: n=327	GDS	Family variables (family closeness and number of family members visiting) did not reach the .05 level of statistical significance as predictors of depression. Three of nine extrafamilial factors (interactions with care setting residents, neighborhood convenience, and civic engagement) were significantly protective against depression.

	residents of care settings in Taiwan.			
Van der Roset et al., 2020 (The Netherlands)	To gain insight into the consequences of COVID-19 measures on loneliness, mood, and behavioral problems in residents in Dutch LTCFs.	Age: Older adults Number: n=193	MHI-5	Mean MHI-5 score for residents was 56.6 (SD 20.4), 51% had scores <60 indicating poor mental health. Changes were reported more often in residents without cognitive impairment.
Arpacioglu et al., 2021 (Turkey)	To investigate the levels of depression, anxiety, death anxiety and life satisfaction levels and factors related to life satisfaction in individuals aged 65 years and older during the pandemic and to compare these variables between nursing home (NH) and community-dwelling older adults.	Age: 65+ Number: n=72 and 78	DASS-21	DASS-21 total, and depression subscales scores were found to be significantly higher in individuals aged 80 years and older, with less visitation hours with children and/or grandchildren (p-value < 0.05). Depression scores were significantly higher in residents who spent less time in hobbies or had no hobbies at all (p-value < 0.001).
Levere et al. 2021 (USA)	To quantify the effects of the COVID-19 pandemic on nursing home resident well-being.	Age: Mean age=80 Number: n= 29,097	PHQ-9	The prevalence of depressive symptoms increased by 6 percentage points relative to before the pandemic in the beginning of March representing a 15% increase.

McArthur et al., 2021 (Canada)	To demonstrate how the interRAI LTC facility assessment can inform clinical care and evaluate the effect of strategies to mitigate worsening mental health outcomes during the COVID-19 pandemic.	Age: Mean age =81.4 Number: n=765	DRS	73.2% of residents had in-person visits with family in the last 3 days compared with 17.9% during the lockdown period (P <.001). The proportion of residents with indications of depression decreased from 19.9% before lockdown to 11.5% after lockdown (P <.002). Lockdown did not have a statistically significant effect on rates of depression.
Nair et al., 2021 (Malaysia)	To investigate the prevalence and correlates of depression, anxiety, and perceived social support among older persons in Malaysian nursing homes during the COVID-19 pandemic.	Age: Mean age=80.5 Number: n=224	GDS	The prevalence of depression was 94.2%, with the majority severely depressed (n = 114, 50.9%). One third reported anxiety level between mild (n = 82, 36.6%) and moderate (n = 86, 38.4%). The overall mean for perceived social support was 3.21 (SD = 0.89), which was low. Factors associated with depression were residents staying more than a year (P = .032), with no hobby (P = .011) and low perceived social support (P < .001).
Pereiro et al., 2021 (Spain)	To measure the decline in affective status in a care facility after the lockdown in the first wave of the COVID-19 pandemic.	Age: Mean age=83.41 Number: n=98	GDS	GDS scores were significantly higher in the post-lockdown measurement than in the first pre-lockdown measurement (P-value = 0.03).
Angevaare et al., 2022 (The Netherlands)	To explore the effects of the Dutch COVID-19 lockdown on mood of older residents of long-term care facilities.	Age: 60+ Number: n=298 in lockdown group and 625 in control group	DRS and SRM	Self-reported mood symptoms showed a slightly greater increase during the lockdown which were not clinically significant.

Barnett et al., 2022 (USA)	To assess health outcomes among SNFs with and without known COVID-19 cases.	Age: Median Age=81 Number: n=997, 418	PHQ-9	27.1%had worsened depressive symptoms. In 2020, residents in active COVID-19 SNFs were 4.4% (95%CI, 4.1% to 4.7%) more likely to have worsened depressive symptoms, which was statistically significant. In 2020, residents in no-known COVID-19 SNFs were 3.2%more likely (95%CI, 2.3%to 4.1%) to have statistically significant worsened depressive symptoms.
Cheung et al., 2022 (New Zealand)	To investigate the impact of New Zealand's (NZ) first wave of COVID-19, which included a nationwide lockdown, on the health and psychosocial well-being of Māori, Pacific Peoples and NZ Europeans in aged residential care.	Age: 60+ Number: n=13,164 in 2019 and 12,136 in 2020	DRS	Fewer Māori residents reported feeling lonely in 2020 (2020: n = 24, 4.5%; 2019: n = 43, 7.8%, p = 0.021). New Zealand European ARC residents reported more severe depressive symptoms in 2020 (no-to- minimal depressive symptoms—2020: n = 8564, 75.6%; 2019: n = 9527, 77.0%, adjusted residual = 2.5; and severe depressive symptoms—2020: n = 785, 6.9%; 2019: n = 779, 6.3%, adjusted residual = 2.0, p = 0.028).
Corte's Zamora et al., 2022 (Spain)	To analyze the psychological and functional sequelae of the COVID-19 pandemic among older adults living in long term care facilities	Age: 65+ Number: n=215	GDS-5	57.7% participants presented GDS-5 scores ≥ 2 points suggesting clinically significant depressive symptoms. There were no differences between COVID-19 and non-COVID-19 participants for depressive symptoms.
Egeljić-Mihailović et al., 2022 (Serbia)	To determine the predictors and level of social participation and depressive symptoms within the context of isolation during the COVID-19 pandemic and investigate if the residence and type of housing had a moderating role in the	Age: Mean Age=74.0 Number: n=299	GDS	Social participation was found to contribute negatively to symptoms of depression (b = -0.245, p < .01), with a higher level of depression being found in older adults living in nursing homes (b = -0.152, p < .05).

	relationship between social participation and depressive symptoms.			
Gorski et al., 2022 (Poland)	To assess the effects of social and familial isolation due to COVID19 on the mental well-being of patients staying in a residential medical care facility.	Age: Mean Age=84.14 Number: n=58	GDS	In February 2020, when there was no isolation, 87.9% of the study group did not suffer from depression compared to 72.4% during the period of full isolation, with up to 25.9% of patients with moderate depression. A statistically significant relationship was found between the mean GDS score and the level of isolation ($p<0.001$).
Pascut et al., 2022 (Italy)	To investigate the status of mental health of a sample of older people during the third wave of COVID-19 in Italy.	Age: 65–89 Number: n=282 (76.6% home-dwelling and 23.4% institutionalized)	HADS	HADS Depression scores were positively associated with UCLA scores ($p < 0.001$) and negatively associated with SF-36 scores ($r = -0.67$, $p < 0.001$).
Gao, Mosazadeh, and Nazari, 2023 (Iran)	To examine the relationships between sociodemographic characteristics, fear of COVID-19, loneliness, depression, and self-compassion.	Age: 65+ Number: n=323	PHQ-9	The interaction effect of self-compassion with loneliness on depression was statistically significant $P < 0.001$,95% CI − 0.48 to − 0.30, indicating that self-compassion moderated the effect of loneliness on depression, with $P < 0.001$. The direct effect of loneliness on depression was statistically significant. Loneliness significantly predicted depression in older adults $P < 0.001$. However, for participants with greater self-compassion levels, the effect of loneliness on depression was not significant ($P = 0.70$, 95% CI − 0.03–0.02). The mediating effect of loneliness changed according to the level of the self-compassion and was weakest at self-compassion high level.

Pereiro et al., 2023 (Spain)	To analyze the impacts of the restrictions implemented in LTCF during the COVID-19 pandemic on the psychological status of older adults.	Age: Mean Age=83.86 Number: n=365	GDS	No evidence for worsening of the pre-pandemic decline in affective (GDS) measures associated with lockdown restrictions in the COVID-19 pandemic.
Turcotte et al. 2023 (Canada)	To measure the impact of the COVID-19 pandemic on resident admission and discharge rates, resident health attributes, treatments, and quality of care.	Age: NA Number: n=508,842 observations	DRS	Fewer residents in Manitoba (RR range 0.88-0.91) and Ontario (RR range 0.98-0.99) experienced worsened mood symptoms of depression.

Table A.2: List and Details of Included Qualitative Articles

Author/Year/Country	Aim(s) *some studies had multiple aims, only aims that met the inclusion criteria of this review were included.	Participants (age, sample size, setting) *Some studies had multiple settings, only LTC homes were included in the review and table. Also, only participants that met the inclusion criteria were included with proxies excluded.	Measures of Depression	Key Findings * some articles are letters to the editor or research letters and here we will reflect their main viewpoint
Montgomery et al., 2020 (USA)	To understand the residents' feelings about Covid-19 restrictions and the impact these changes had on their lives.	Age: Older adults Number: n=365	Multiple-choice questions followed by an open text comment section	Pre-COVID visits from friends and family were common—56% of residents had visitors three or more times a week and about 90% had a visitor at least once per week. After mid-March during the pandemic, 79% reported having no visitors at all. After the pandemic 87% of residents were confined to eating in their rooms, often alone. Responses included feeling of sadness, bouts of crying, anxiety, depression, confusion and loneliness. Others missed visitors, volunteers, and activities.
Kaelan et al., 2021 (Belgium)	To understand in depth residents' mental health needs during the "perfect storm" of COVID-19.	Age: 58-100 Number: n=56	In-depth interviews	Six themes were identified in this study including loss of freedom, social life, distraction and stimulation, autonomy, and the themes of need and perception of own well-being emerged. The codes used several words and phrases related to depression including experience and perception of isolation from outside world; prison metaphor; war metaphor; experience of eating alone; loss of social life experience and perception of blockage of entertainment activities; absence of family visits; absence of friends' visits; no more contact with other residents; fear of loneliness, losing interest in doing

				anything, feeling abandoned; feeling useless / unworthy; anger, stress, depressive feelings; perception of own wellbeing, losing hopes, feeling negative; and losing interest in life.
Crespo-Martín et al., 2022 (Spain)	To analyze the lived experience of elderly nursing home residents during the lockdown and social contact restrictions resulting from the COVID-19 pandemic.	Age: Mean Age=81.29 Number: n=24	In-depth interviews and field notes	Two main themes were identified: (1) emotional impact of the experience of COVID-19 lockdown (residents described feeling sad, overwhelmed, and anxious during lockdown. They explained that sadness and grief are associated with the separation from loved ones, as well as a fear of dying without the chance to say goodbye to family); illness and death (described fear and worry); importance of routine (lack of routine and programs resulted in feelings of frustration due to the loss of interaction with other residents, such as sharing meals, loss of freedom of movement due to lockdown in the rooms, and the prohibition of visits from their families). 2) support as a therapeutic tool, family support brought back a sense of happiness they had lost, and the will to keep fighting. Residents explained that talking to their family reassured them, made them feel supported, and increased their confidence and sense of strength to face lockdown.
Raciti and Chang, 2023 (USA)	To explore nursing home residents' experiences during the COVID-19 pandemic.	Age: Mean Age =77.36 Number: n=14 Setting: LTC homes	A semi-structured interview	Four major themes emerged: emotional reactions to lockdown (feelings of being held hostage and frightened over their loss of independence. Expressions of anger, resentment, and sadness over being socially isolated from friends and family), mixed feelings and attitudes toward nursing home staff and family, need for support and connection (feelings of neglect, isolation, anxiety, and depression after being "cooped up" from the outside world), and desire to be informed and involved.

Wu et al., 2023 (China)	To explore and better understand the challenges faced by residents during nursing home lockdown in COVID-19 pandemic.	Age: Mean Age=80 Number: n=14 Setting: LTC homes	Semi-structured interviews	Residents described their feelings of socialization isolation in the nursing home as feeling lonely, missing their children because friends and kids were not allowed to come into the nursing home. Residents also felt anxious as they worried that they and their relatives might be infected with COVID-19

Table A.3: List and Details of Included Letters to the Editor, Book Chapters and Reports

Author/Year/Country	Aim(s) *some studies had multiple aims, only aims that met the inclusion criteria of this review were included.	Design	Key Findings * some articles are letters to the editor or research letters and here we will reflect their main viewpoint
Chong et al., 2020 (Australia)	To discuss issues that include isolation, and loneliness, among others as a result of COVID-19 restrictions and also, to review the mental health effects of past pandemics and interventions that are effective.	Letter to the Editor	Residents have experienced relapse of their mental health condition due to restrictions on visitors and limited access to technology. Lessons learned from past pandemics include strengthening social networks and community support, as well as communication networks. Novel ways are needed to improve the mental health of older adults during COVID-19 and into the future.
Eastabrooks et al., 2020 (Canada)	This section of the report focuses especially on the characteristics of older adults living in nursing homes, their caregivers, and the physical environment of nursing homes as important contributors to the COVID-19 crisis. It also provides principles for action and nine recommendations for action to help solve the workforce crisis in nursing homes.	Report	Many residents have a serious mental illness more than those in the community. About 40% of older adults living in nursing homes in Ontario need psychiatric services, but less than 5% receive that care. Depression is one of the most common mental health problems in nursing homes affecting 27% of residents in Canada. The authors described what happened to the mental health of residents of LTC homes as "mental and emotional suffering" under the most severe and worst conditions of COVID-19.
McArthur et al., 2023 (Canada)	To describe the effect of the pandemic on mental health and quality of life of residents of LTC.	Book Chapter	The evidence describing mental health consequences of the pandemic in LTC is mixed. Lockdown of LTC homes meant disrupted routines and fewer to no visitors within the home. Isolation and lack of contact and stimulation could have led to boredom, loneliness, and depression. The observed discrepancy may be because select homes experienced extreme declines in quality of life and mental health related to rampant COVID-19 infections or staff shortages, but many implemented successful mitigation strategies.

Appendix B (Chapter 3; Manuscript 2)

Table B.1: Factors Associated with New Depressive Symptoms Among Unexposed Group of Residents in Long-Term Care 2019-2020, Canada N=22,441

	P-value Score Test for Proportional Odds Assumption	**Unadjusted Odds Ratio DRS 1-2 vs. 0 (95% CI)**	**Unadjusted Odds Ratio DRS 3+ vs. 0-2 (95% CI)**	**P-value for Chi-square Test**
Sex	0.04			0.02
Male		Ref	Ref	
Female		0.90 (0.82-0.99)	1.07 (0.89-1.28)	
Age Group	0.08			0.88
18-44		Ref	Ref	
45-64		1.07 (0.56-2.06)	1.07 (0.56-2.06)	
65-74		1.11 (0.58-2.10)	1.11 (0.58-2.10)	
75-84		1.15 (0.61-2.17)	1.15 (0.61-2.17)	
85-94		1.18 (0.63-2.22)	1.18 (0.63-2.22)	
95+		1.12 (0.59-2.12)	1.12 (0.59-2.12)	
Married	0.66			0.56
No		Ref	Ref	
Yes		0.97 (0.86-1.08)	0.97 (0.86-1.08)	
Cognitive Performance Scale	0.002			**<0.0001***
0		Ref	Ref	
1 to 2		1.16 (0.99-1.37)	1.49 (1.09-2.04)	
3 to 4		1.34 (1.14-1.57)	1.60 (1.18-2.18)	
5 to 6		0.97 (0.81-1.17)	0.77 (0.53-1.13)	
Activities of Daily Living Hierarchy Scale	0.002			**<0.0001***
0		Ref	Ref	
1 to 2		1.04 (0.82-1.33)	1.22 (0.78-1.91)	
3 to 4		1.21 (0.96-1.51)	1.32 (0.87-2.00)	
5 to 6		0.82 (0.65-1.04)	0.62 (0.39-0.97)	
Changes in Health, End-stage disease and Signs and Symptoms Scale	0.41			**<0.0001***
0		Ref	Ref	
1-2		1.19 (1.08-1.31)	1.19 (1.08-1.31)	
3+		1.82 (1.38-2.40)	1.82 (1.38-2.40)	
Aggressive Behaviour Scale	0.002			**<0.0001***
0		Ref	Ref	
1 to 4		1.94 (1.73-2.17)	1.38 (1.12-1.70)	
5+		2.79 (1.98-3.95)	2.54 (1.48-4.37)	
Index of Social Engagement	0.09			0.42

0		Ref	Ref	
1 to 2		1.00 (0.82-1.22)	1.00 (0.82-1.22)	
3 to 4		1.09 (0.90-1.33)	1.09 (0.90-1.33)	
5 to 6		1.07 (0.87-1.30)	1.07 (0.87-1.30)	
Pain Scale	0.22			**<0.0001***
0		Ref	Ref	
1		1.72 (1.53-1.94)	1.72 (1.53-1.94)	
2		1.76 (1.43-2.16)	1.76 (1.43-2.16)	
3		2.20 (1.15-4.18)	2.20 (1.15-4.18)	
Major Comorbidity Count	0.54			**0.005****
0		Ref	Ref	
1 to 2		1.33 (1.05-1.69)	1.33 (1.05-1.69)	
3 +		1.70 (1.23-2.35)	1.70 (1.23-2.35)	
Anxiety Diagnosis	0.89	1.48 (1.25-1.75)	1.48 (1.25-1.75)	**<0.0001***
Conflict with Staff, Family, Friends, or Other Residents	0.08	2.04 (1.67-2.50)	2.04 (1.67-2.50)	**<0.0001***
Does Not Adjust Easily to Change in Routines	0.65	1.83 (1.56-2.14)	1.83 (1.56-2.14)	**<0.0001***
Newly Admitted Resident Status	0.02	2.17 (1.91-2.47)	2.69 (2.520-3.30)	**<0.0001***
Canadian Province	0.0004			**<0.0001***
Ontario		Ref	Ref	
Alberta		1.33 (1.15-1.54)	0.95 (0.72-1.26)	
British Columbia		0.70 (0.62-0.79)	0.59 (0.47-0.75)	
Manitoba		0.25 (0.18-0.35)	0.10 (0.04-0.28)	
Newfoundland		0.89 (0.65-1.23)	1.46 (0.91-2.33)	
LTC Home Size	0.87			**<0.0001***
Small		Ref	Ref	
Medium		0.91 (0.63-1.32)	0.91 (0.63-1.32)	
Large		0.71 (0.49-1.01)	0.71 (0.49-1.01)	
Facility Location	0.03			**<0.0001***
Rural		Ref	Ref	
Urban		0.66 (0.57-0.76)	0.53 (0.42-0.67)	

*Variables with Chi-square test p-value < 0.05 were kept in the final Pre-COVID and COVID models.

**Major Comorbidity Count was not added to the models due to large missing values.

Appendix C (Chapter 4; Manuscript 3)

Table C.1: Complete List of Independent Variables Included in the Model

Variable	Description	Range	Reference
Clinical Severity Scales			
Cognitive Performance Scale	Describes the cognitive status of a resident.	0 – 6 Higher scores indicate more severe cognitive impairment. [Collapsed into **0, 1-2, 3-4, 5-6]**	Morris et al., 2016
Activities of Daily Living Hierarchy Scale	A measure of functional performance in 4 activities of daily living from early to late loss (hygiene, locomotion, toilet use, eating)	0 - 6 Higher scores indicate greater decline (progressive loss) in ADL performance. [Collapsed into **0, 1-2, 3+**]	Morris et al., 1999; Morris et al., 2013
Changes in Health, End-stage disease and Signs and Symptoms Scale	Measures medical complexity and health instability	0 – 5 Higher scores indicate higher levels of medical complexity and are associated with adverse outcomes, such as mortality, hospitalization, pain, caregiver stress and poor self-rated health. [Collapsed into **0, 1-2, 3+**]	Hirdes et al., 2003; Hirdes et al., 2014
Aggressive Behaviour Scale	Measure of aggressive behaviour	0–12 Higher scores indicate higher levels of aggressive behaviour. [Collapsed into **0, 1-2, 3-4, 5+**]	Hirdes et al., 2020; Perlman & Hirdes, 2008
Index of Social Engagement	Describes the resident's sense of initiative and social involvement within the facility.	0–6 Higher scores indicate a higher level of social engagement [Collapsed into **0, 1-2, 3-4, 5-6**]	Gilbart & Hirdes, 2000

Pain Scale	Summarizes the presence and intensity of pain	**0-3** Higher scores indicate a more severe pain experience. [Collapsed into **0, 1-2, 3]**	MDS 2.0 Manual
Major Comorbidity Count	the sum of six major types of diagnosis/health conditions indicated by the presence of one or more medical diagnoses and/or treatments	[Collapsed into **0, 1-2, 3]**	Hirdes et al., 2020
Treatment			
Physician Visit	In the LAST 14 DAYS (or since admission, if less than 14 days in facility), how many days has the physician (or authorized assistant or practitioner) examined the resident?	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual
Psychological Therapy Days	Number of days administered for 15 minutes or more in the last 7 days	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual
Recreational Therapy Days	Number of days administered for 15 minutes or more in the last 7 days	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual
Anxiolytic Use	Number of days the medication was used in during last 7 days	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual
Antidepressant Use	Number of days the medication was used in during last 7 days	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual
Antipsychotic Use	Number of days the medication was used in during last 7 days	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual

Hypnotic Use	Number of days the medication was used in during last 7 days	**Collapsed to Binary** [**0 = not used, 1 = used**]	MDS 2.0 Manual
Advanced Directives-do not hospitalize	One provision for health care decisions in the event that, in the future, a person is unable to make those decisions in	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Advanced Directives-do not resuscitate	One provision for health care decisions in the event that, in the future, a person is unable to make those decisions	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Alzheimer's Disease Related Dementias	Disease diagnosis	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Anxiety	Disease diagnosis	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Bipolar Disorder	Disease diagnosis	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Depression	Disease diagnosis	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Schizophrenia	Disease diagnosis	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual
Poor Sleep	Indicator of depression, anxiety, sad mood, assesses if there is unpleasant mood in morning or Insomnia or change in usual sleep pattern	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual

Conflict with Staff, Family, Friends, or Other Residents	A psychosocial well-being measure for unsettled relationships if the resident covert/open conflict with or repeated criticism of staff or unhappy with roommate or is unhappy with residents other than roommate or openly expresses conflict/anger with family/friends	**Collapsed to Binary** [**0 = no, 1 = yes**]	MDS 2.0 Manual

Table C.2: Adjusted Odds of Transition to Other DRS and Absorbing States From A State of No Mood Disturbance Among Long-Term Care Residents 2010-2019, Canada N=314,042

	MILD MOOD DISTURBANCE	MODERATE/SEVERE MOOD DISTURBANCE	HOME	HOSPITAL	DEATH	OTHER
Demography						
Female	1.03 (1.02-1.05)	**1.22 (1.20-1.25)**	0.90 (0.84-0.97)	**0.65 (0.64-0.66)**	**0.79 (0.78-0.81)**	**0.74 (0.68-0.80)**
Married	1.02 (1.00-1.03)	1.03 (1.01-1.06)	**1.49 (1.37-1.61)**	**0.89 (0.88-0.91)**	0.95 (0.92-0.97)	1.10 (0.99-1.22)
Age 75-84	1.02 (1.00-1.05)	1.09 (1.05-1.12)	**0.64 (0.58-0.70)**	**1.10 (1.07-1.12)**	**1.34 (1.29-1.39)**	**0.83 (0.74-0.92)**
Age 85-94	1.03 (1.00-1.05)	**1.17 (1.13-1.21)**	**0.39 (0.35-0.43)**	1.01 (0.99-1.04)	**1.84 (1.78-1.91)**	**0.76 (0.68-0.85)**
Age 95+	1.01 (0.98-1.05)	**1.19 (1.14-1.25)**	**0.33 (0.28-0.40)**	**0.83 (0.80-0.86)**	**2.53 (2.42-2.65)**	**0.67 (0.56-0.81)**
Treatment						
Physician Visit	0.94 (0.93-0.96)	0.97 (0.95-0.99)	**1.32 (1.21-1.43)**	**1.19 (1.18-1.21)**	1.07 (1.05-1.10)	**1.45 (1.32-1.58)**
Psychological Therapy Days	1.00 (0.93-1.07)	0.89 (0.81-0.99)	0.77 (0.52-1.14)	**0.83 (0.77-0.89)**	**0.73 (0.64-0.82)**	0.97 (0.65-1.46)
Recreation Therapy Days	1.04 (1.02-1.06)	**1.11 (1.08-1.15)**	0.90 (0.79-1.02)	0.97 (0.94-0.99)	0.95 (0.92-0.99)	**0.88 (0.78-0.98)**
Number of Medications	1.00 (1.00-1.01)	1.01 (1.01-1.02)	1.00 (0.99-1.00)	1.05 (1.04-1.05)	1.01 (1.01-1.01)	1.01 (1.00-1.02)
Anxiolytic	**1.12 (1.09-1.15)**	**1.27 (1.23-1.32)**	1.12 (0.99-1.26)	1.08 (1.05-1.11)	1.09 (1.05-1.14)	1.15 (1.00-1.32)
Antidepressant	**1.12 (1.10-1.14)**	**1.16 (1.14-1.19)**	**0.75 (0.69-0.82)**	**0.88 (0.87-0.90)**	0.99 (0.96-1.01)	0.96 (0.88-1.05)
Antipsychotic	**1.19 (1.17-1.21)**	**1.31 (1.28-1.35)**	**0.86 (0.77-0.95)**	1.05 (1.03-1.07)	**0.86 (0.84-0.89)**	**1.18 (1.06-1.30)**
Hypnotic	1.04 (1.01-1.07)	**1.10 (1.06-1.15)**	1.06 (0.93-1.21)	0.96 (0.94-0.99)	1.02 (0.99-1.06)	1.13 (1.00-1.27)
Clinical Severity Scales						
ISE (1-2)	1.03 (0.99-1.06)	1.07 (1.01-1.12)	**0.71 (0.60-0.84)**	0.92 (0.89-0.95)	**0.65 (0.63-0.67)**	**0.80 (0.68-0.95)**
ISE (3-4)	1.01 (0.98-1.05)	1.03 (0.98-1.09)	**0.62 (0.53-0.73)**	**0.79 (0.76-0.81)**	**0.42 (0.41-0.43)**	**0.62 (0.52-0.74)**
ISE (5-6)	1.01 (0.97-1.04)	1.01 (0.96-1.07)	**0.53 (0.45-0.63)**	**0.74 (0.72-0.77)**	**0.29 (0.27-0.30)**	**0.59 (0.49-0.71)**
CHESS (1-2)	**1.10 (1.08-1.12)**	**1.13 (1.11-1.16)**	0.93 (0.86-1.01)	**1.16 (1.14-1.18)**	**2.12 (2.08-2.16)**	**1.14 (1.05-1.24)**
CHESS 3+	**1.13 (1.07-1.19)**	**1.27 (1.18-1.37)**	**1.54 (1.20-1.97)**	**1.43 (1.37-1.50)**	**10.43 (10.03-10.84)**	**2.59 (2.11-3.18)**
ADLH (1-2)	1.09 (1.05-1.12)	1.09 (1.05-1.15)	0.88 (0.78-0.99)	1.07 (1.03-1.10)	**1.21 (1.12-1.31)**	**0.84 (0.73-0.96)**
ADLH 3+	1.05 (1.01-1.08)	1.02 (0.98-1.07)	**0.58 (0.51-0.65)**	**1.26 (1.22-1.30)**	**2.79 (2.59-3.01)**	**0.51 (0.44-0.58)**
CPS (1-2)	**1.17 (1.14-1.20)**	**1.25 (1.21-1.30)**	**0.65 (0.59-0.71)**	0.97 (0.95-0.99)	1.04 (1.00-1.090)	**0.80 (0.72-0.89)**
CPS (3-4)	**1.29 (1.25-1.32)**	**1.29 (1.24-1.34)**	**0.48 (0.43-0.54)**	0.95 (0.92-0.97)	**1.42 (1.36-1.48)**	**0.63 (0.55-0.71)**
CPS (5-6)	1.03 (1.00-1.07)	**0.72 (0.69-0.76)**	**0.39 (0.33-0.47)**	**0.83 (0.80-0.85)**	**2.55 (2.44-2.68)**	**0.58 (0.49-0.70)**

Pain Scale (1-2)	**1.23 (1.21-1.25)**	**1.52 (1.48-1.55)**	**1.32 (1.22-1.42)**	**1.13 (1.11-1.15)**	**1.24 (1.21-1.27)**	**1.30 (1.20-1.41)**
Pain Scale 3	**1.58 (1.46-1.70)**	**2.29 (2.07-2.52)**	**1.52 (1.09-2.12)**	**1.53 (1.43-1.65)**	**2.03 (1.86-2.23)**	**2.10 (1.54-2.88)**
ABS (1-4)	**1.55 (1.53-1.58)**	**1.71 (1.67-1.75)**	1.00 (0.90-1.11)	**1.11 (1.09-1.13)**	**1.13 (1.10-1.16)**	**1.24 (1.12-1.38)**
ABS 5+	**1.81 (1.72-1.91)**	**2.21 (2.06-2.37)**	0.73 (0.47-1.26)	**1.29 (1.22-1.37)**	0.96 (0.89-1.03)	**1.99 (1.49-2.65)**
MCC (1-2)	1.08 (1.05-1.10)	1.08 (1.04-1.12)	**0.84 (0.76-0.93)**	**1.27 (1.24-1.31)**	**1.28 (1.23-1.34)**	1.00 (0.89-1.13)
MCC 3+	**1.11 (1.08-1.15)**	**1.16 (1.10-1.22)**	0.89 (0.77-1.03)	**1.73 (1.67-1.78)**	**1.94 (1.84-2.03)**	1.14 (0.97-1.35)
Mood and Behaviour Patterns and Psychological Well-Being Items						
Conflict	**1.41 (1.36-1.45)**	**1.82 (1.75-1.89)**	**1.19 (1.01-1.40)**	1.06 (1.03-1.10)	0.93 (0.88-0.98)	1.13 (0.95-1.34)
Poor Sleep	**1.62 (1.49-1.76)**	**1.58 (1.40-1.77)**	1.37 (0.81-2.33)	**1.14 (1.04-1.26)**	1.10 (0.97-1.25)	0.87 (0.48-1.59)
Health Diagnoses						
Anxiety	1.08 (1.06-1.11)	**1.25 (1.21-1.30)**	**0.83 (0.71-0.96)**	**0.85 (0.83-0.87)**	1.01 (0.97-1.05)	0.88 (0.75-1.03)
ADRD	1.07 (1.05-1.08)	1.03 (1.00-1.05)	**0.68 (0.62-0.74)**	**0.78 (0.76-0.79)**	**0.84 (0.82-0.86)**	**0.80 (0.73-0.88)**
Bipolar Disorder	0.97 (0.92-1.03)	0.98 (0.90-1.06)	0.82 (0.61-1.10)	0.97 (0.92-1.03)	1.00 (0.91-1.10)	1.19 (0.91-1.67)
Depression	1.01 (0.99-1.03)	1.03 (1.01-1.06)	0.93 (0.85-1.03)	0.97 (0.95-0.98)	1.09 (1.06-1.11)	1.01 (0.92-1.12)
Facility Attributes						
Province AB	**1.27 (1.25-1.30)**	**1.22 (1.18-1.26)**	0.88 (0.77-0.99)	**0.32 (0.31-0.33)**	**1.14 (1.10-1.17)**	**3.22 (2.92-3.56)**
Province BC	**0.66 (0.65-0.68)**	**0.51 (0.50-0.53)**	**0.41 (0.37-0.46)**	**0.25 (0.25-0.26)**	**1.12 (1.09-1.15)**	1.01 (0.91-1.12)
Urban	**0.83 (0.81-0.85)**	**0.78 (0.76-0.81)**	1.07 (0.94-1.21)	**1.30 (1.27-1.34)**	0.95 (0.92-0.98)	0.88 (0.78-1.00)
Facility Size L	**0.83 (0.77-0.88)**	**0.85 (0.78-0.94)**	0.75 (0.54-1.04)	**1.26 (1.15-1.40)**	**0.85 (0.77-0.94)**	0.80 (0.60-1.06)
Facility Size M	0.95 (0.89-1.02)	0.96 (0.87-1.05)	**0.71 (0.52-0.98)**	**1.16 (1.05-1.28)**	0.96 (0.87-1.06)	1.02 (0.77-1.35)

Table C.3: Adjusted odds of transition to other DRS and Absorbing states From a State of Mild Mood Disturbance Among Long-term Care Residents 2010-2019, Canada N=314,042

	NO MOOD DISTURBANCE	MODERATE/SEVERE MOOD DISTURBANCE	HOME	HOSPITAL	DEATH	OTHER
Demography						
Female	1.01 (0.99-1.02)	**1.19 (1.17-1.21)**	0.90 (0.82-1.00)	**0.63 (0.62-0.64)**	**0.75 (0.74-0.77)**	**0.74 (0.67-0.81)**
Married	1.07 (1.05-1.10)	1.07 (1.05-1.10)	**1.66 (1.48-1.85)**	0.92 (0.90-0.94)	0.95 (0.92-0.97)	**1.25 (1.11-1.40)**
Age 75-84	0.97 (0.94-0.99)	1.05 (1.02-1.07)	**0.63 (0.56-0.71)**	1.08 (1.05-1.10)	**1.38 (1.33-1.44)**	**0.80 (0.71-0.91)**
Age 85-94	0.96 (0.94-0.99)	**1.11 (1.09-1.14)**	**0.49 (0.43-0.56)**	0.99 (0.97-1.02)	**1.90 (1.83-1.98)**	**0.66 (0.58-0.75)**
Age 95+	0.98 (0.94-1.02)	**1.16 (1.11-1.20)**	**0.35 (0.27-0.46)**	**0.77 (0.74-0.81)**	**2.58 (2.45-2.71)**	**0.56 (0.44-0.71)**
Treatment						
Physician Visit	0.97 (0.96-0.99)	1.00 (0.95-0.98)	**1.23 (1.10-1.37)**	**1.18 (1.16-1.21)**	1.09 (1.07-1.12)	**1.34 (1.21-1.49)**
Psychological Therapy Days	**0.86 (0.80-0.93)**	0.98 (0.91-1.05)	0.88 (0.56-1.38)	0.90 (0.83-0.97)	**0.71 (0.63-0.79)**	**1.14 (0.77-1.69)**
Recreation Therapy Days	0.99 (0.97-1.02)	1.08 (1.05-1.11)	**0.70 (0.58-0.83)**	0.91 (0.88-0.94)	0.98 (0.95-1.02)	0.98 (0.86-1.11)
Number of Medications	1.00 (1.00-1.00)	1.01 (1.01-1.01)	0.99 (0.98-1.00)	1.05 (1.04-1.05)	1.01 (1.01-1.01)	1.00 (0.98-1.01)
Anxiolytic	0.91 (0.89-0.93)	**1.12 (1.09-1.15)**	1.11 (0.95-1.29)	1.01 (0.98-1.04)	1.07 (1.03-1.11)	**1.25 (1.09-1.43)**
Antidepressant	1.02 (1.00-1.04)	1.05 (1.04-1.07)	**0.88 (0.79-0.97)**	**0.87 (0.86-0.89)**	0.94 (0.92-0.96)	0.97 (0.88-1.07)
Antipsychotic	0.92 (0.90-0.93)	**1.11 (1.09-1.13)**	**0.84 (0.75-0.95)**	0.97 (0.95-0.99)	**0.84 (0.82-0.86)**	1.10 (0.99-1.22)
Hypnotic	0.95 (0.92-0.98)	1.03 (1.00-1.06)	1.06 (0.89-1.25)	0.91 (0.88-0.94)	0.97 (0.93-1.00)	1.10 (0.95-1.26)
Clinical Severity Scales						
ISE (1-2)	1.01 (0.98-1.04)	1.09 (1.06-1.13)	0.88 (0.72-1.07)	0.92 (0.90-0.96)	**0.67 (0.65-0.69)**	0.73 (0.62-0.85)
ISE (3-4)	1.07 (1.04-1.11)	**1.14 (1.11-1.18)**	**0.75 (0.62-0.92)**	**0.85 (0.82-0.88)**	**0.46 (0.44-0.48)**	0.65 (0.55-0.76)
ISE (5-6)	1.05 (1.01-1.08)	**1.13 (1.09-1.17)**	**0.61 (0.49-0.76)**	**0.80 (0.77-0.83)**	**0.32 (0.30-0.33)**	0.57 (0.48-0.69)
CHESS (1-2)	0.99 (0.97-1.01)	1.03 (1.02-1.05)	0.93 (0.84-1.03)	**1.10 (1.09-1.12)**	**1.92 (1.88-1.97)**	1.01 (0.92-1.11)
CHESS 3+	**0.88 (0.84-0.92)**	0.97 (0.93-1.01)	**1.50 (1.19-1.88)**	**1.25 (1.20-1.30)**	**7.69 (7.42-7.97)**	**1.70 (1.39-2.07)**
ADLH (1-2)	**0.88 (0.84-0.92)**	1.08 (1.03-1.13)	**0.75 (0.62-0.91)**	1.04 (0.98-1.09)	1.05 (0.94-1.17)	**0.88 (0.73-1.07)**
ADLH 3+	**0.87 (0.83-0.90)**	0.99 (0.95-1.04)	**0.46 (0.38-0.56)**	**1.16 (1.10-1.21)**	**2.49 (2.25-2.77)**	**0.50 (0.41-0.61)**
CPS (1-2)	**0.82 (0.79-0.85)**	1.06 (1.02-1.10)	**0.63 (0.54-0.72)**	**0.86 (0.84-0.89)**	0.94 (0.89-0.99)	**0.74 (0.64-0.87)**
CPS (3-4)	**0.71 (0.69-0.74)**	1.00 (0.96-1.03)	**0.39 (0.33-0.46)**	**0.76 (0.73-0.78)**	**1.19 (1.12-1.26)**	**0.55 (0.46-0.65)**
CPS (5-6)	**0.74 (0.71-0.77)**	**0.69 (0.67-0.72)**	**0.34 (0.27-0.42)**	**0.63 (0.60-0.65)**	**2.01 (1.89-2.13)**	**0.49 (0.40-0.61)**

Pain Scale 1-2	**0.88 (0.87-0.90)**	**1.21 (1.19-1.23)**	**1.22 (1.10-1.34)**	1.08 (1.06-1.10)	**1.25 (1.22-1.28)**	**1.18 (1.08-1.30)**
Pain Scale 3	**0.80 (0.74-0.86)**	**1.38 (1.29-1.47)**	**1.48 (1.06-2.07)**	**1.22 (1.14-1.31)**	**1.83 (1.70-1.97)**	1.31 (0.94-1.84)
ABS 1-4	**0.80 (0.79-0.81)**	**1.18 (1.16-1.20)**	0.92 (0.82-1.02)	0.99 (0.97-1.01)	1.00 (0.98-1.02)	**1.11 (1.01-1.23)**
ABS 5+	**0.59 (0.57-0.61)**	**1.25 (1.21-1.29)**	**0.65 (0.50-0.84)**	0.99 (0.96-1.02)	**0.81 (0.77-0.84)**	**1.51 (1.27-1.80)**
MCC 1-2	0.94 (0.91-0.97)	1.00 (0.97-1.04)	0.95 (0.80-1.12)	**1.23 (1.19-1.27)**	**1.19 (1.13-1.25)**	0.91 (0.78-1.08)
MCC 3+	0.94 (0.89-0.97)	1.05 (1.01-1.09)	1.18 (0.96-1.46)	**1.63 (1.57-1.70)**	**1.77 (1.67-1.87)**	1.04 (0.85-1.28)
Mood and Behaviour Patterns and Psychological Well-Being Items						
Conflict	**0.83 (0.81-0.85)**	**1.30 (1.27-1.34)**	0.93 (0.79-1.09)	0.98 (0.95-1.01)	**0.85 (0.81-0.88)**	1.05 (0.91-1.20)
Poor Sleep	**0.80 (0.77-0.83)**	**1.16 (1.12-1.21)**	1.06 (0.83-1.35)	0.98 (0.94-1.02)	0.92 (0.88-0.97)	1.09 (0.89-1.33)
Health Diagnoses						
Anxiety	1.00 (0.98-1.03)	**1.17 (1.14-1.20)**	0.91 (0.77-1.08)	**0.89 (0.87-0.92)**	1.01 (0.98-1.05)	1.02 (0.87-1.19)
ADRD	0.98 (0.96-1.00)	1.02 (1.00-1.05)	0.72 (0.64-0.81)	**0.76 (0.74-0.77)**	**0.76 (0.74-0.78)**	**0.75 (0.67-0.84)**
Bipolar Disorder	1.04 (0.97-1.11)	1.07 (1.01-1.14)	1.02 (0.72-1.46)	1.09 (1.02-1.16)	0.96 (0.87-1.06)	0.92 (0.66-1.30)
Depression	0.99 (0.97-1.01)	1.01 (0.99-1.02)	**0.86 (0.76-0.97)**	0.97 (0.95-0.99)	1.07 (1.04-1.10)	**0.87 (0.78-0.97)**
Facility Attributes						
Province AB	1.01 (0.98-1.03)	0.99 (0.97-1.02)	1.03 (0.89-1.19)	**0.35 (0.34-0.36)**	1.00 (0.97-1.03)	**2.43 (2.16-2.72)**
Province BC	**1.33 (1.30-1.36)**	**0.69 (0.68-0.71)**	**0.55 (0.46-0.65)**	**0.31 (0.30-0.32)**	**1.27 (1.23-1.32)**	**1.38 (1.21-1.58)**
Urban	1.05 (1.03-1.08)	**0.86 (0.84-0.88)**	1.12 (0.96-1.30)	**1.42 (1.38-1.46)**	0.93 (0.90-0.96)	**0.82 (0.73-0.94)**
Facility Size L	0.96 (0.89-1.03)	0.95 (0.89-1.02)	1.34 (0.79-2.27)	**1.40 (1.26-1.55)**	**0.84 (0.76-0.92)**	**0.66 (0.49-0.89)**
Facility Size M	0.95 (0.89-1.02)	1.03 (0.96-1.10)	1.42 (0.84-3.30)	**1.26 (1.13-1.40)**	0.96 (0.88-1.05)	0.92 (0.70-1.22)

Table C.4: Adjusted odds of transition to other DRS and Absorbing states From a State of Moderate/Severe Mood Disturbance Among Long-term Care Residents 2010-2019, Canada N=314,042

	NO MOOD DISTURBANCE	MILD MOOD DISTURBANCE	HOME	HOSPITAL	DEATH	OTHER
Demography						
Female	**0.81 (0.78-0.83)**	**0.81 (0.79-0.82)**	**0.73 (0.65-0.82)**	**0.58 (0.57-0.60)**	**0.65 (0.64-0.67)**	**0.59 (0.54-0.65)**
Married	1.00 (0.97-1.03)	1.00 (0.98-1.02)	**1.57 (1.39-1.78)**	**0.86 (0.84-0.87)**	**0.88 (0.86-0.91)**	**1.18 (1.06-1.33)**
Age 75-84	0.95 (0.91-0.98)	0.95 (0.92-0.97)	**0.69 (0.59-0.79)**	0.96 (0.94-0.99)	**1.37 (1.32-1.42)**	0.88 (0.78-0.99)
Age 85-94	**0.89 (0.86-0.93)**	0.90 (0.87-0.92)	**0.53 (0.46-0.62)**	**0.83 (0.81-0.86)**	**1.95 (1.88-2.02)**	**0.63 (0.56-0.72)**
Age 95+	**0.88 (0.83-0.93)**	**0.87 (0.84-0.91)**	**0.54 (0.42-0.71)**	**0.63 (0.60-0.66)**	**2.61 (2.49-2.74)**	**0.55 (0.43-0.69)**
Treatment						
Physician Visit	1.04 (1.02-1.07)	1.03 (1.01-1.05)	**1.32 (1.17-1.50)**	**1.18 (1.16-1.20)**	**1.13 (1.10-1.15)**	**1.47 (1.32-1.64)**
Psychological Therapy Days	**0.62 (0.55-0.69)**	**0.69 (0.64-0.73)**	1.05 (0.72-1.54)	**0.89 (0.84-0.94)**	**0.68 (0.62-0.74)**	0.95 (0.67-1.34)
Recreation Therapy Days	0.99 (0.96-1.03)	0.93 (0.91-0.96)	**0.79 (0.66-0.95)**	**0.89 (0.86-0.91)**	0.93 (0.90-0.96)	0.89 (0.78-0.99)
Number of Medications	1.00 (0.99-1.00)	0.99 (0.99-1.00)	0.98 (0.97-1.00)	1.04 (1.04-1.05)	1.01 (1.01-1.02)	1.00 (0.99-1.01)
Anxiolytic	**0.86 (0.83-0.90)**	**0.88 (0.86-0.90)**	1.14 (0.99-1.31)	1.01 (0.99-1.03)	1.05 (1.02-1.08)	**1.29 (1.16-1.44)**
Antidepressant	**0.88 (0.85-0.90)**	0.94 (0.92-0.96)	0.91 (0.80-1.02)	0.93 (0.92-0.95)	**0.88 (0.86-0.90)**	**1.27 (1.16-1.40)**
Antipsychotic	0.97 (0.94-0.99)	1.01 (1.00-1.03)	**0.79 (0.71-0.89)**	**0.84 (0.83-0.86)**	0.97 (0.95-0.99)	**0.89 (0.81-0.98)**
Hypnotic	0.96 (0.92-1.00)	0.95 (0.93-0.98)	1.02 (0.85-1.21)	1.01 (0.98-1.04)	0.95 (0.91-0.98)	**1.18 (1.04-1.34)**
Clinical Severity Scales						
ISE (1-2)	0.95 (0.91-1.00)	0.95 (0.92-0.97)	**0.78 (0.64-0.94)**	0.94 (0.91-0.97)	**0.64 (0.63-0.66)**	**0.73 (0.64-0.83)**
ISE (3-4)	0.96 (0.92-1.01)	0.94 (0.91-0.97)	**0.65 (0.54-0.79)**	**0.88 (0.85-0.91)**	**0.43 (0.42-0.45)**	**0.58 (0.50-0.66)**
ISE (5-6)	0.96 (0.91-1.01)	**0.89 (0.86-0.92)**	**0.47 (0.37-0.58)**	**0.84 (0.81-0.86)**	**0.30 (0.29-0.31)**	**0.48 (0.40-0.56)**
CHESS (1-2)	0.91 (0.88-0.93)	0.94 (0.93-0.96)	0.89 (0.79-0.99)	1.09 (1.07-1.11)	**1.76 (1.72-1.80)**	1.02 (0.93-1.12)
CHESS 3+	**0.87 (0.82-0.92)**	**0.85 (0.82-0.88)**	**1.46 (1.19-1.79)**	**1.33 (1.29-1.38)**	**6.31 (6.12-6.50)**	**1.54 (1.31-1.81)**
ADLH (1-2)	**0.80 (0.74-0.85)**	**0.86 (0.82-0.90)**	**0.56 (0.44-0.70)**	1.00 (0.94-1.06)	0.96 (0.84-1.09)	**0.78 (0.62-0.98)**
ADLH 3+	**0.76 (0.71-0.81)**	**0.85 (0.81-0.89)**	**0.35 (0.28-0.43)**	**1.10 (1.04-1.16)**	**2.43 (2.16-2.74)**	**0.48 (0.38-0.60)**
CPS (1-2)	**0.76 (0.72-0.80)**	**0.88 (0.85-0.92)**	**0.71 (0.59-0.86)**	**0.86 (0.83-0.89)**	0.90 (0.85-0.96)	**0.68 (0.57-0.83)**
CPS (3-4)	**0.63 (0.60-0.66)**	**0.86 (0.83-0.90)**	**0.45 (0.37-0.56)**	**0.74 (0.71-0.77)**	1.08 (1.02-1.14)	**0.53 (0.44-0.65)**
CPS (5-6)	**0.75 (0.71-0.80)**	1.06 (1.01-1.11)	**0.43 (0.33-0.55)**	**0.65 (0.62-0.68)**	**1.84 (1.73-1.96)**	**0.53 (0.43-0.67)**

Pain Scale 1-2	**0.75 (0.73-0.77)**	**0.79 (0.78-0.80)**	1.03 (0.92-1.15)	0.98 (1.00-1.00)	**1.14 (1.12-1.17)**	0.97 (0.89-1.06)
Pain Scale 3	**0.66 (0.61-0.72)**	**0.64 (0.61-0.68)**	**1.54 (1.20-1.98)**	1.03 (0.98-1.08)	**1.58 (1.51-1.66)**	**1.15 (0.92-1.45)**
ABS 1-4	**0.62 (0.60-0.63)**	**0.80 (0.79-0.82)**	0.93 (0.82-1.05)	0.91 (0.90-0.93)	0.95 (0.93-0.97)	0.09 (0.83-1.03)
ABS 5+	**0.37 (0.35-0.39)**	**0.58 (0.57-0.59)**	**0.66 (0.55-0.80)**	**0.89 (0.87-0.92)**	**0.81 (0.79-0.84)**	**1.19 (1.04-1.36)**
MCC 1-2	1.01 (0.97-1.06)	0.99 (0.95-1.02)	1.02 (0.84-1.24)	**1.29 (1.24-1.33)**	**1.29 (1.23-1.35)**	1.01 (0.84-1.21)
MCC 3+	0.97 (0.92-1.03)	0.93 (0.89-0.97)	**1.33 (1.05-1.69)**	**1.67 (1.59-1.72)**	**1.87 (1.77-1.97)**	0.89 (0.71-1.11)
Mood and Behaviour Patterns and Psychological Well-Being Items						
Conflict	**0.66 (0.64-0.68)**	**0.74 (0.72-0.76)**	0.97 (0.86-1.11)	**0.89 (0.87-0.91)**	**0.77 (0.75-0.79)**	1.09 (0.99-1.2)
Poor Sleep	**0.70 (0.68-0.73)**	**0.71 (0.70-0.73)**	**0.83 (0.72-0.97)**	**0.88 (0.86-0.90)**	0.99 (0.97-1.01)	1.08 (0.97-1.2)
Health Diagnoses						
Anxiety	**0.81 (0.78-0.84)**	**0.82 (0.80-0.84)**	0.93 (0.79-1.08)	**0.88 (0.86-0.90)**	0.90 (0.87-0.92)	0.92 (0.81-1.04)
ADRD	0.90 (0.88-0.93)	1.01 (0.99-1.03)	**0.69 (0.61-0.79)**	**0.71 (0.70-0.73)**	**0.70 (0.68-0.72)**	0.89 (0.79-1.01)
Bipolar Disorder	1.06 (0.97-1.16)	0.98 (0.92-1.04)	0.99 (0.68-1.42)	**1.14 (1.08-1.20)**	1.00 (0.92-1.09)	1.25 (0.96-1.62)
Depression	0.98 (0.95-1.01)	0.96 (0.95-0.98)	0.97 (0.86-1.10)	0.96 (0.94-0.98)	1.02 (1.00-1.04)	0.91 (0.82-1.00)
Facility Attributes						
Province AB	1.07 (1.03-1.11)	1.08 (1.06-1.11)	1.01 (0.86-1.20)	**0.43 (0.42-0.44)**	0.94 (0.91-0.97)	**2.20 (1.97-2.47)**
Province BC	**1.81 (1.75-1.88)**	**1.15 (1.12-1.18)**	0.89 (0.74-1.08)	**0.40 (0.39-0.42)**	**1.36 (1.31-1.40)**	**1.36 (1.17-1.58)**
Urban	**1.19 (1.15-1.24)**	**1.12 (1.09-1.15)**	1.07 (0.92-1.24)	**1.38 (1.35-1.42)**	0.99 (0.96-1.02)	0.91 (0.81-1.02)
Facility Size L	**0.86 (0.78-0.96)**	**0.85 (0.79-0.92)**	0.77 (0.50-1.19)	**1.64 (1.48-1.83)**	**0.86 (0.79-0.93)**	**0.57 (0.43-0.75)**
Facility Size M	**0.88 (0.79-0.98)**	0.92 (0.86-0.99)	0.87 (0.57-1.34)	**1.49 (1.34-1.65)**	0.95 (0.87-1.03)	**0.87 (0.67-1.13)**

Table C.5: Adjusted odds of transition to other DRS and Absorbing states From a State of No Mood Disturbance Among Long-term Care Residents 2010-2019, Canada N=314,042 (Recreation Therapy Days Variable as a Continuous Variable)

	MILD MOOD DISTURBANCE	MODERATE/SEVERE MOOD DISTURBANCE	HOME	HOSPITAL	DEATH	OTHER
Demography						
Female	1.03 (1.02-1.05)	**1.22 (1.20-1.25)**	0.90 (0.84-0.97)	**0.65 (0.64-0.66)**	**0.79 (0.78-0.81)**	**0.74 (0.68-0.80)**
Married	1.02 (1.00-1.03)	1.03 (1.01-1.06)	**1.49 (1.37-1.61)**	**0.89 (0.88-0.91)**	0.95 (0.92-0.97)	1.10 (0.99-1.22)
Age 75-84	1.02 (1.00-1.05)	1.09 (1.05-1.12)	**0.64 (0.58-0.70)**	**1.10 (1.07-1.12)**	**1.34 (1.29-1.39)**	**0.83 (0.74-0.92)**
Age 85-94	1.03 (1.00-1.05)	**1.17 (1.13-1.21)**	**0.39 (0.35-0.43)**	1.01 (0.99-1.04)	**1.84 (1.78-1.91)**	**0.76 (0.68-0.85)**
Age 95+	1.01 (0.98-1.05)	**1.19 (1.14-1.25)**	**0.33 (0.28-0.40)**	**0.83 (0.80-0.86)**	**2.53 (2.42-2.65)**	**0.67 (0.56-0.81)**
Treatment						
Physician Visit	0.94 (0.93-0.96)	0.97 (0.95-0.99)	**1.32 (1.21-1.43)**	**1.19 (1.18-1.21)**	1.07 (1.05-1.10)	1.44 (1.32-1.58)
Psychological Therapy Days	1.00 (0.94-1.07)	0.90 (0.81-0.99)	**0.76 (0.51-1.13)**	**0.82 (0.77-0.89)**	**0.73 (0.64-0.82)**	0.97 (0.65-1.45)
Recreation Therapy Days	1.01 (1.00-1.02)	1.04 (1.03-1.05)	0.97 (0.93-1.02)	0.99 (0.98-1.00)	0.98 (0.97-0.99)	0.97 (0.93-1.01)
Number of Medications	1.00 (1.00-1.01)	1.01 (1.01-1.02)	1.00 (0.99-1.00)	1.05 (1.04-1.05)	1.01 (1.01-1.01)	1.01 (1.00-1.02)
Anxiolytic	**1.12 (1.09-1.15)**	**1.27 (1.23-1.32)**	1.12 (0.99-1.26)	1.08 (1.05-1.11)	1.09 (1.05-1.14)	1.15 (1.00-1.32)
Antidepressant	**1.12 (1.10-1.14)**	**1.16 (1.14-1.19)**	**0.75 (0.69-0.82)**	**0.88 (0.87-0.90)**	0.99 (0.96-1.01)	0.96 (0.88-1.05)
Antipsychotic	**1.19 (1.17-1.21)**	**1.31 (1.28-1.35)**	**0.86 (0.77-0.95)**	1.05 (1.03-1.07)	**0.86 (0.84-0.89)**	**1.18 (1.06-1.30)**
Hypnotic	1.04 (1.01-1.07)	**1.10 (1.06-1.15)**	1.06 (0.93-1.21)	0.96 (0.94-0.99)	1.03 (0.99-1.06)	1.12 (1.00-1.27)
Clinical Severity Scales						
ISE (1-2)	1.03 (0.99-1.06)	1.07 (1.01-1.12)	**0.71 (0.60-0.84)**	0.92 (0.89-0.95)	**0.65 (0.63-0.67)**	**0.80 (0.68-0.95)**
ISE (3-4)	1.01 (0.98-1.05)	1.03 (0.98-1.08)	**0.62 (0.52-0.73)**	**0.79 (0.76-0.81)**	**0.42 (0.41-0.44)**	**0.62 (0.52-0.73)**
ISE (5-6)	1.00 (0.97-1.04)	1.01 (0.95-1.06)	**0.53 (0.45-0.63)**	**0.74 (0.72-0.77)**	**0.29 (0.28-0.30)**	**0.59 (0.49-0.71)**
CHESS (1-2)	**1.10 (1.08-1.12)**	**1.14 (1.11-1.16)**	0.93 (0.86-1.01)	**1.16 (1.14-1.18)**	**2.12 (2.08-2.16)**	**1.14 (1.05-1.24)**
CHESS 3+	**1.12 (1.07-1.19)**	**1.27 (1.18-1.37)**	**1.54 (1.20-1.97)**	**1.43 (1.37-1.50)**	**10.43 (10.03-10.84)**	**2.59 (2.11-3.18)**
ADLH (1-2)	1.09 (1.05-1.12)	1.09 (1.04-1.15)	0.88 (0.78-0.99)	1.07 (1.03-1.10)	**1.21 (1.12-1.31)**	**0.84 (0.73-0.96)**
ADLH 3+	1.05 (1.01-1.08)	1.02 (0.98-1.07)	**0.58 (0.51-0.65)**	**1.26 (1.22-1.30)**	**2.79 (2.59-3.01)**	**0.51 (0.44-0.58)**
CPS (1-2)	**1.17 (1.14-1.20)**	**1.25 (1.21-1.30)**	**0.65 (0.59-0.71)**	0.97 (0.95-0.99)	1.04 (1.00-1.09)	**0.80 (0.72-0.89)**
CPS (3-4)	**1.29 (1.25-1.32)**	**1.29 (1.24-1.34)**	**0.48 (0.43-0.53)**	0.95 (0.92-0.97)	**1.42 (1.36-1.48)**	**0.63 (0.55-0.71)**
CPS (5-6)	1.03 (1.00-1.07)	**0.72 (0.69-0.76)**	**0.39 (0.33-0.46)**	**0.83 (0.80-0.85)**	**2.55 (2.44-2.68)**	**0.58 (0.49-0.70)**

Pain Scale (1-2)	**1.23 (1.21-1.25)**	**1.51 (1.48-1.55)**	**1.32 (1.22-1.42)**	**1.13 (1.11-1.15)**	**1.24 (1.21-1.27)**	**1.30 (1.20-1.41)**
Pain Scale 3	**1.58 (1.46-1.70)**	**2.29 (2.08-2.52)**	**1.52 (1.09-2.12)**	**1.53 (1.43-1.65)**	**2.03 (1.86-2.23)**	**2.10 (1.54-2.88)**
ABS (1-4)	**1.56 (1.53-1.58)**	**1.71 (1.67-1.75)**	1.00 (0.90-1.11)	**1.11 (1.09-1.13)**	**1.13 (1.10-1.16)**	**1.24 (1.12-1.38)**
ABS 5+	**1.81 (1.72-1.91)**	**2.21 (2.06-2.38)**	0.73 (0.47-1.12)	**1.29 (1.22-1.37)**	0.96 (0.89-1.03)	**1.99 (1.49-2.65)**
MCC (1-2)	1.08 (1.05-1.11)	1.08 (1.04-1.12)	**0.84 (0.76-0.93)**	**1.27 (1.24-1.31)**	**1.28 (1.23-1.34)**	1.00 (0.89-1.13)
MCC 3+	**1.11 (1.08-1.15)**	**1.16 (1.11-1.22)**	0.89 (0.77-1.03)	**1.73 (1.67-1.78)**	**1.93 (1.84-2.03)**	1.14 (0.97-1.35)
Mood and Behaviour Patterns and Psychological Well-Being Items						
Conflict	**1.41 (1.36-1.45)**	**1.82 (1.75-1.89)**	**1.19 (1.01-1.40)**	1.06 (1.03-1.10)	0.93 (0.88-0.98)	1.13 (0.95-1.34)
Poor Sleep	**1.62 (1.49-1.76)**	**1.58 (1.40-1.77)**	1.37 (0.81-2.33)	**1.14 (1.04-1.26)**	1.10 (0.97-1.25)	0.87 (0.48-1.59)
Health Diagnoses						
Anxiety	1.08 (1.06-1.11)	**1.25 (1.21-1.30)**	0.83 (0.71-0.96)	**0.85 (0.83-0.87)**	1.01 (0.97-1.05)	0.88 (0.75-1.03)
ADRD	1.07 (1.05-1.08)	1.03 (1.00-1.05)	**0.68 (0.62-0.74)**	**0.78 (0.76-0.79)**	**0.84 (0.82-0.86)**	**0.80 (0.73-0.88)**
Bipolar Disorder	0.97 (0.92-1.03)	0.98 (0.90-1.06)	0.82 (0.61-1.10)	0.97 (0.92-1.03)	1.00 (0.91-1.10)	1.19 (0.91-1.57)
Depression	1.01 (0.99-1.03)	1.04 (1.01-1.06)	0.93 (0.85-1.02)	0.97 (0.95-0.98)	1.09 (1.06-1.11)	1.01 (0.92-1.12)
Facility Attributes						
Province AB	**1.28 (1.25-1.31)**	**1.23 (1.19-1.27)**	**0.87 (0.77-0.98)**	**0.32 (0.31-0.33)**	**1.14 (1.10-1.17)**	**3.18 (2.88-3.51)**
Province BC	**0.66 (0.65-0.68)**	**0.51 (0.50-0.53)**	**0.41 (0.36-0.45)**	**0.25 (0.25-0.26)**	**1.12 (1.09-1.15)**	1.01 (0.90-1.12)
Urban	**0.83 (0.81-0.85)**	**0.78 (0.76-0.81)**	1.07 (0.94-1.21)	**1.30 (1.27-1.34)**	0.95 (0.92-0.98)	0.88 (0.78-1.00)
Facility Size L	**0.83 (0.78-0.88)**	**0.86 (0.78-0.94)**	**0.75 (0.54-1.04)**	**1.27 (1.15-1.40)**	**0.85 (0.76-0.93)**	0.80 (0.60-1.07)
Facility Size M	0.95 (0.89-1.02)	0.96 (0.88-1.06)	**0.71 (0.51-0.98)**	**1.16 (1.05-1.28)**	0.96 (0.87-1.06)	1.02 (0.77-1.35)

Table C.6: Adjusted odds of transition to other DRS and Absorbing states From a State of Mild Mood Disturbance Among Long-Term Care Residents 2010-2019, Canada N=314,042 (Recreation Therapy Days Variable as a Continuous Variable)

	No Mood Disturbance	Moderate/Severe Mood Disturbance	HOME	HOSPITAL	DEATH	OTHER
Demography						
Female	1.01 (0.99-1.02)	**1.19 (1.17-1.21)**	0.90 (0.82-1.00)	**0.63 (0.62-0.64)**	**0.75 (0.74-0.77)**	**0.74 (0.67-0.81)**
Married	0.97 (0.94-0.99)	1.05 (1.02-1.07)	**0.63 (0.56-0.71)**	1.08 (1.05-1.10)	**1.38 (1.33-1.44)**	**0.80 (0.71-0.91)**
Age 75-84	0.96 (0.94-0.99)	**1.12 (1.09-1.14)**	**0.49 (0.43-0.56)**	0.99 (0.97-1.02)	**1.90 (1.83-1.98)**	**0.66 (0.58-0.75)**
Age 85-94	0.98 (0.94-1.02)	**1.16 (1.11-1.20)**	**0.35 (0.27-0.46)**	**0.77 (0.74-0.81)**	**2.58 (2.45-2.71)**	**0.56 (0.44-0.71)**
Age 95+	1.07 (1.05-1.10)	**1.07 (1.05-1.09)**	**1.66 (1.48-1.85)**	0.92 (0.90-0.94)	0.95 (0.92-0.97)	**1.25 (1.11-1.40)**
Treatment						
Physician Visit	0.97 (0.96-0.99)	0.97 (0.95-0.98)	**1.23 (1.10-1.37)**	**1.18 (1.16-1.21)**	1.09 (1.07-1.12)	**1.34 (1.20-1.49)**
Psychological Therapy Days	**0.86 (0.80-0.93)**	0.98 (0.91-1.05)	0.88 (0.56-1.38)	0.90 (0.83-0.96)	**0.71 (0.63-0.80)**	1.14 (0.77-1.68)
Recreation Therapy Days	1.00 (0.99-1.00)	1.03 (1.02-1.04)	**0.88 (0.82-0.94)**	0.97 (0.96-0.98)	0.98 (0.97-1.00)	1.02 (0.98-1.06)
Number of Medications	1.00 (1.00-1.00)	1.01 (1.01-1.01)	0.99 (0.98-1.00)	1.05 (1.04-1.05)	1.01 (1.01-1.01)	1.00 (0.98-1.01)
Anxiolytic	0.91 (0.89-0.93)	**1.12 (1.09-1.15)**	1.11 (0.95-1.29)	1.01 (0.98-1.04)	1.07 (1.03-1.11)	**1.25 (1.09-1.43)**
Antidepressant	1.02 (1.00-1.04)	1.05 (1.04-1.07)	**0.88 (0.79-0.97)**	**0.87 (0.86-0.89)**	0.94 (0.92-0.96)	0.97 (0.88-1.07)
Antipsychotic	0.92 (0.90-0.93)	**1.11 (1.09-1.13)**	**0.85 (0.75-0.95)**	0.97 (0.95-0.99)	**0.84 (0.82-0.86)**	1.10 (0.99-1.22)
Hypnotic	0.95 (0.92-0.98)	1.03 (1.00-1.06)	1.06 (0.89-1.25)	0.91 (0.88-0.94)	0.97 (0.93-1.00)	1.09 (0.95-1.26)
Clinical Severity Scales						
ISE (1-2)	1.01 (0.98-1.04)	1.09 (1.05-1.12)	0.88 (0.72-1.07)	0.92 (0.90-0.96)	**0.67 (0.65-0.69)**	**0.73 (0.62-0.85)**
ISE (3-4)	1.07 (1.04-1.11)	**1.14 (1.11-1.18)**	**0.75 (0.62-0.92)**	**0.85 (0.82-0.88)**	**0.46 (0.45-0.48)**	**0.64 (0.55-0.76)**
ISE (5-6)	1.05 (1.01-1.08)	**1.12 (1.09-1.17)**	**0.62 (0.50-0.76)**	**0.80 (0.77-0.83)**	**0.32 (0.30-0.33)**	**0.57 (0.47-0.68)**
CHESS (1-2)	0.99 (0.97-1.01)	1.03 (1.02-1.05)	0.93 (0.84-1.03)	**1.10 (1.09-1.12)**	**1.92 (1.88-1.97)**	1.01 (0.92-1.11)
CHESS 3+	**0.88 (0.84-0.92)**	0.97 (0.93-1.01)	**1.50 (1.19-1.89)**	**1.25 (1.20-1.30)**	**7.69 (7.42-7.97)**	**1.70 (1.39-2.07)**
ADLH (1-2)	**0.88 (0.84-0.92)**	1.08 (1.03-1.13)	**0.75 (0.62-0.91)**	1.04 (0.98-1.09)	1.05 (0.94-1.17)	0.88 (0.73-1.07)
ADLH 3+	**0.87 (0.83-0.90)**	0.99 (0.95-1.04)	**0.46 (0.38-0.56)**	**1.16 (1.10-1.21)**	**2.49 (2.25-2.77)**	**0.50 (0.41-0.61)**
CPS (1-2)	**0.82 (0.79-0.85)**	1.06 (1.02-1.10)	**0.63 (0.54-0.72)**	**0.86 (0.84-0.89)**	0.94 (0.89-0.99)	**0.74 (0.64-0.87)**
CPS (3-4)	**0.71 (0.69-0.74)**	1.00 (0.96-1.03)	**0.39 (0.33-0.46)**	**0.76 (0.73-0.78)**	**1.19 (1.12-1.26)**	**0.55 (0.46-0.65)**
CPS (5-6)	**0.74 (0.71-0.77)**	**0.69 (0.67-0.72)**	**0.34 (0.27-0.42)**	**0.63 (0.60-0.65)**	**2.01 (1.89-2.13)**	**0.49 (0.40-0.61)**

Pain Scale (1-2)	**0.88 (0.87-0.90)**	**1.21 (1.19-1.23)**	**1.21 (1.10-1.34)**	1.08 (1.06-1.10)	**1.25 (1.22-1.28)**	**1.18 (1.08-1.30)**
Pain Scale 3	**0.80 (0.74-0.86)**	**1.38 (1.29-1.47)**	**1.48 (1.06-2.07)**	**1.22 (1.14-1.31)**	**1.83 (1.70-1.97)**	1.32 (0.94-1.84)
ABS (1-4)	**0.80 (0.79-0.81)**	**1.18 (1.16-1.20)**	0.92 (0.82-1.02)	0.99 (0.97-1.01)	1.00 (0.98-1.02)	**1.12 (1.01-1.23)**
ABS 5+	**0.59 (0.57-0.61)**	**1.25 (1.21-1.29)**	**0.65 (0.50-0.84)**	0.99 (0.96-1.02)	**0.81 (0.77-0.84)**	**1.51 (1.27-1.80)**
MCC (1-2)	0.94 (0.91-0.97)	1.00 (0.97-1.04)	0.95 (0.80-1.12)	**1.23 (1.19-1.27)**	**1.19 (1.13-1.25)**	0.91 (0.78-1.07)
MCC 3+	0.94 (0.90-0.97)	1.05 (1.01-1.09)	1.18 (0.96-1.46)	**1.63 (1.57-1.70)**	**1.77 (1.67-1.87)**	1.04 (0.85-1.28)
Mood and Behaviour Patterns and Psychological Well-Being Items						
Conflict	**0.83 (0.81-0.85)**	**1.30 (1.27-1.34)**	0.93 (0.79-1.09)	0.98 (0.95-1.01)	**0.85 (0.82-0.88**)	1.04 (0.91-1.20)
Poor Sleep	**0.80 (0.77-0.83)**	**1.16 (1.12-1.21)**	1.06 (0.83-1.35)	0.98 (0.94-1.02)	0.92 (0.88-0.97)	1.09 (0.89-1.33)
Health Diagnoses						
Anxiety	1.00 (0.98-1.03)	**1.17 (1.14-1.20)**	0.91 (0.77-1.08)	**0.89 (0.87-0.92)**	1.01 (0.98-1.05)	1.02 (0.87-1.19)
ADRD	0.98 (0.96-1.00)	1.02 (1.00-1.05)	**0.72 (0.64-0.81)**	**0.76 (0.74-0.77)**	**0.76 (0.74-0.78)**	**0.75 (0.67-0.84)**
Bipolar Disorder	1.04 (0.97-1.11)	1.07 (1.01-1.14)	1.02 (0.72-1.45)	1.09 (1.02-1.16)	0.96 (0.87-1.06)	0.92 (0.66-1.30)
Depression	0.99 (0.97-1.01)	1.01 (0.99-1.02)	**0.86 (0.76-0.97)**	0.97 (0.95-0.99)	1.07 (1.04-1.10)	**0.87 (0.78-0.97)**
Facility Attributes						
Province AB	1.01 (0.99-1.03)	0.99 (0.97-1.02)	1.01 (0.88-1.17)	**0.35 (0.34-0.36)**	1.00 (0.97-1.03)	**2.38 (2.13-2.67)**
Province BC	**1.33 (1.30-1.36)**	**0.69 (0.67-0.71)**	**0.55 (0.46-0.65)**	**0.31 (0.30-0.32)**	**1.28 (1.24-1.32)**	**1.37 (1.19-1.56)**
Urban	1.05 (1.03-1.08)	**0.86 (0.84-0.88)**	1.12 (0.96-1.30)	**1.42 (1.38-1.46)**	0.93 (0.90-0.96)	**0.83 (0.73-0.94)**
Facility Size L	0.96 (0.89-1.03)	0.95 (0.89-1.02)	1.34 (0.79-2.26)	**1.40 (1.26-1.55)**	**0.83 (0.76-0.91)**	**0.67 (0.50-0.90)**
Facility Size M	0.95 (0.88-1.02)	1.03 (0.96-1.11)	1.41 (0.84-2.38)	**1.26 (1.13-1.40)**	0.96 (0.87-1.05)	0.93 (0.70-1.24)

Table C.7: Adjusted odds of transition to other DRS and Absorbing states From a State of Moderate/Severe Mood Disturbance Among Long-term Care Residents 2010-2019, Canada N=314,042 (Recreation Therapy Days Variable as a Continuous Variable)

	NO MOOD DISTURBANCE	MILD MOOD DISTURBANCE	HOME	HOSPITAL	DEATH	OTHER
Demography						
Female	**0.81 (0.78-0.83)**	**0.81 (0.79-0.82)**	**0.73 (0.65-0.82)**	**0.58 (0.57-0.59)**	**0.65 (0.64-0.67)**	**0.59 (0.54-0.65)**
Married	0.95 (0.91-0.98)	0.95 (0.92-0.97)	**0.69 (0.59-0.79)**	0.96 (0.94-0.99)	**1.37 (1.32-1.42)**	0.87 (0.78-0.99)
Age 75-84	**0.89 (0.86-0.93)**	0.90 (0.87-0.92)	**0.53 (0.46-0.62)**	**0.83 (0.81-0.86)**	**1.95 (1.88-2.02)**	**0.63 (0.56-0.72)**
Age 85-94	**0.88 (0.83-0.93)**	**0.87 (0.84-0.91)**	**0.54 (0.42-0.70)**	**0.63 (0.60-0.66)**	**2.61 (2.49-2.74)**	**0.54 (0.43-0.69)**
Age 95+	1.00 (0.97-1.03)	1.00 (0.98-1.02)	**1.57 (1.39-1.78)**	**0.86 (0.84-0.87)**	**0.88 (0.86-0.91)**	**1.19 (1.06-1.33)**
Treatment						
Physician Visit	1.04 (1.02-1.07)	1.03 (1.01-1.05)	**1.33 (1.17-1.51)**	**1.18 (1.16-1.20)**	**1.13 (1.10-1.15)**	**1.47 (1.32-1.64)**
Psychological Therapy Days	**0.62 (0.55-0.69)**	**0.69 (0.64-0.73)**	1.05 (0.72-1.54)	**0.88 (0.83-0.94)**	**0.68 (0.62-0.74)**	0.95 (0.67-1.34)
Recreation Therapy Days	1.00 (0.99-1.01)	0.98 (0.97-0.99)	0.91 (0.85-0.97)	0.96 (0.95-0.97)	0.97 (0.96-0.98)	0.96 (0.92-1.01)
Number of Medications	1.00 (0.99-1.00)	0.99 (0.99-1.00)	0.98 (0.97-1.00)	1.04 (1.04-1.05)	1.01 (1.01-1.02)	1.00 (0.99-1.01)
Anxiolytic	**0.86 (0.83-0.90)**	**0.88 (0.86-0.90)**	1.14 (0.99-1.32)	1.01 (0.99-1.03)	1.05 (1.02-1.08)	**1.29 (1.16-1.44)**
Antidepressant	0.97 (0.94-0.99)	1.01 (1.00-1.03)	**0.79 (0.71-0.89)**	**0.84 (0.83-0.86)**	0.97 (0.95-0.99)	**0.89 (0.81-0.98)**
Antipsychotic	**0.88 (0.85-0.90)**	0.94 (0.92-0.96)	0.91 (0.81-1.03)	0.93 (0.92-0.95)	**0.88 (0.86-0.90)**	**1.27 (1.16-1.40)**
Hypnotic	0.96 (0.92-1.00)	0.95 (0.93-0.98)	1.02 (0.85-1.22)	1.01 (0.98-1.04)	0.95 (0.91-0.98)	**1.18 (1.04-1.34)**
Clinical Severity Scales						
ISE (1-2)	0.95 (0.91-1.00)	0.95 (0.92-0.97)	**0.78 (0.64-0.94)**	0.94 (0.91-0.97)	**0.64 (0.63-0.66)**	**0.73 (0.64-0.83)**
ISE (3-4)	0.96 (0.92-1.01)	0.94 (0.91-0.97)	**0.65 (0.54-0.79)**	**0.88 (0.85-0.91)**	**0.43 (0.42-0.45)**	**0.58 (0.50-0.66)**
ISE (5-6)	0.96 (0.91-1.01)	**0.89 (0.86-0.92)**	**0.47 (0.38-0.59)**	**0.84 (0.81-0.87)**	**0.30 (0.29-0.32)**	**0.48 (0.40-0.56)**
CHESS (1-2)	0.91 (0.88-0.93)	0.94 (0.93-0.96)	0.89 (0.79-0.99)	1.09 (1.07-1.11)	**1.76 (1.72-1.80)**	1.02 (0.93-1.12)
CHESS 3+	**0.87 (0.82-0.92)**	**0.85 (0.82-0.89)**	**1.46 (1.20-1.79)**	**1.33 (1.29-1.38)**	**6.31 (6.12-6.50)**	**1.54 (1.31-1.81)**
ADLH (1-2)	**0.80 (0.74-0.85)**	**0.86 (0.82-0.90)**	**0.56 (0.44-0.70)**	1.00 (0.94-1.06)	0.96 (0.84-1.09)	**0.78 (0.62-0.98)**
ADLH 3+	**0.76 (0.71-0.81)**	**0.85 (0.81-0.89)**	**0.35 (0.28-0.43)**	**1.10 (1.04-1.16)**	**2.43 (2.16-2.74)**	**0.48 (0.38-0.60)**
CPS (1-2)	**0.76 (0.72-0.80)**	**0.88 (0.85-0.92)**	**0.71 (0.59-0.86)**	**0.86 (0.83-0.89)**	0.90 (0.85-0.96)	**0.68 (0.57-0.83)**
CPS (3-4)	**0.63 (0.60-0.66)**	**0.86 (0.83-0.90)**	**0.45 (0.37-0.56)**	**0.74 (0.71-0.77)**	**1.08 (1.02-1.14)**	**0.53 (0.44-0.65)**
CPS (5-6)	**0.75 (0.71-0.80)**	1.06 (1.01-1.11)	**0.43 (0.33-0.56)**	**0.65 (0.62-0.68)**	**1.84 (1.73-1.96)**	**0.53 (0.43-0.67)**

Pain Scale (1-2)	**0.75 (0.73-0.77)**	**0.79 (0.78-0.80)**	1.02 (0.92-1.14)	0.98 (0.97-1.00)	**1.14 (1.12-1.17)**	0.97 (0.89-1.06)
Pain Scale 3	**0.66 (0.61-0.72)**	**0.64 (0.61-0.68)**	**1.54 (1.19-1.98)**	1.03 (0.98-1.08)	**1.58 (1.51-1.66)**	1.15 (0.92-1.45)
ABS (1-4)	**0.62 (0.60-0.63)**	**0.80 (0.79-0.82)**	0.93 (0.82-1.04)	0.91 (0.90-0.93)	0.95 (0.93-0.97)	0.93 (0.83-1.03)
ABS 5+	**0.37 (0.35-0.39)**	**0.58 (0.57-0.59)**	**0.66 (0.55-0.79)**	**0.89 (0.87-0.92)**	**0.81 (0.79-0.84)**	**1.19 (1.04-1.36)**
MCC (1-2)	1.01 (0.97-1.06)	0.99 (0.95-1.02)	1.02 (0.84-1.24)	**1.29 (1.24-1.33)**	**1.29 (1.23-1.35)**	1.01 (0.84-1.21)
MCC 3+	0.97 (0.92-1.03)	0.93 (0.89-0.96)	**1.33 (1.05-1.68)**	**1.65 (1.59-1.72)**	**1.87 (1.77-1.97)**	0.89 (0.71-1.11)
Mood and Behaviour Patterns and Psychological Well-Being Items						
Conflict	**0.66 (0.64-0.68)**	**0.74 (0.72-0.75)**	0.97 (0.86-1.11)	**0.89 (0.87-0.91)**	**0.77 (0.75-0.79)**	1.09 (0.98-1.20)
Poor Sleep	**0.70 (0.68-0.73)**	**0.71 (0.70-0.73)**	**0.83 (0.72-0.97)**	**0.88 (0.86-0.90)**	0.99 (0.97-1.01)	1.08 (0.97-1.20)
Health Diagnoses						
Anxiety	**0.81 (0.78-0.84)**	**0.82 (0.80-0.84)**	0.92 (0.79-1.08)	**0.88 (0.86-0.90)**	0.90 (0.87-0.92)	0.92 (0.81-1.04)
ADRD	0.90 (0.88-0.93)	1.01 (0.99-1.03)	**0.69 (0.61-0.80)**	**0.71 (0.70-0.73)**	**0.70 (0.68-0.72)**	0.89 (0.79-1.01)
Bipolar Disorder	1.06 (0.97-1.16)	0.98 (0.92-1.04)	0.98 (0.68-1.42)	**1.14 (1.08-1.20)**	1.00 (0.92-1.09)	1.25 (0.96-1.62)
Depression	0.98 (0.95-1.01)	0.96 (0.95-0.98)	0.97 (0.86-1.09)	0.96 (0.94-0.97)	1.02 (1.00-1.04)	0.90 (0.82-1.00)
Facility Attributes						
Province AB	1.07 (1.03-1.11)	1.08 (1.05-1.10)	1.01 (0.86-1.19)	**0.43 (0.41-0.44)**	0.94 (0.91-0.97)	**2.18 (1.95-2.43)**
Province BC	**1.81 (1.75-1.88)**	**1.15 (1.12-1.18)**	0.90 (0.74-1.09)	**0.40 (0.39-0.42)**	**1.36 (1.31-1.41)**	**1.36 (1.17-1.58)**
Urban	**1.19 (1.15-1.24)**	**1.12 (1.09-1.15)**	1.07 (0.92-1.24)	**1.38 (1.35-1.42)**	0.99 (0.96-1.01)	0.91 (0.81-1.02)
Facility Size L	**0.86 (0.78-0.96)**	**0.85 (0.79-0.91)**	0.76 (0.49-1.18)	**1.64 (1.47-1.82)**	**0.85 (0.79-0.93)**	**0.57 (0.43-0.75)**
Facility Size M	**0.88 (0.79-0.98)**	0.92 (0.86-0.99)	0.86 (0.56-1.32)	**1.48 (1.33-1.65)**	0.94 (0.87-1.03)	0.87 (0.67-1.13)

Table C.8: Ninety Day Transition Rates (Table %) to Different Care Settings and Mortality by DRS Score and Day of Stay at Start of Assessment Period Among Long-term Care Residents 2010-2019, Canada N=314,042

Status at End of 90-Day Follow-Up	**Assessment Period**							
	First Year				**Second Year**	**Third Year**	**Fourth Year**	**Fifth Year**
	First Quarter	**Second Quarter**	**Third Quarter**	**Fourth Quarter**				
DRS=0								
Discharged home	0.9	0.3	0.2	0.2	0.1	0.1	0.1	0.1
Hospitalized (no death)	5.9	4.1	3.8	3.6	3.4	3.1	3.0	3.0
Died in hospital	1.3	1.4	1.2	1.2	1.1	1.0	1.0	1.1
Died in LTC home	7.7	5.0	4.8	4.8	5.0	6.4	7.3	8.1
Discharged other setting	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Remain in LTC home	32.9	28.2	28.1	28.2	28.4	27.1	27.3	28.0
DRS = 1-2								
Discharged home	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Hospitalized (no death)	3.4	3.1	2.9	2.8	2.7	2.5	2.2	2.1
Died in hospital	1.0	1.1	1.0	0.9	0.9	0.8	0.8	0.8
Died in LTC home	4.5	4.7	4.6	4.7	5.0	6.2	7.0	7.2
Discharged other setting	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Remain in LTC home	17.9	20.5	21.1	21.3	21.4	21.1	21.0	21.1
DRS = 3+								
Discharged home	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Hospitalized (no death)	2.9	3.3	3.1	3.0	2.8	2.5	2.3	2.0
Died in hospital	0.8	1.0	1.0	0.9	0.9	0.8	0.7	0.7
Died in LTC home	3.8	5.6	5.6	5.6	5.9	7.0	7.0	6.7
Discharged other setting	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1
Remain in LTC home	15.0	20.7	21.7	22.2	22.1	21.1	20.1	18.7

Table C.9: Total Sojourn Time in Each Mood State Before Transitioning to Absorbing States **(Months)** Among Long-term Care Residents, Canada

	DRS 0	**DRS 1-2**	**DRS 3+**
Initial state of DRS 0	7.8	2.4	1.8
Initial state of DRS 1-2	2.7	6.6	2.7
Initial state of DRS 3+	1.8	2.4	7.8

Appendix D (Chapter 5; Manuscript 4)

Table D.10: Total Sojourn Time in Each Mood State Before Transitioning to Absorbing States **(Months)** During COVID-19 Among Long-term Care Residents, Canada

	COVID-19 Wave 1			**COVID-19 Wave 2**		
	DRS 0	**DRS 1-2**	**DRS 3+**	**DRS 0**	**DRS 1-2**	**DRS 3+**
Initial DRS 0	8.1	2.4	1.8	8.1	2.4	1.8
Initial DRS 1-2	3	6.3	2.7	3	6.3	2.4
Initial DRS 3+	2.1	2.4	7.5	2.1	2.4	7.2