SUBSTITUTION EFFECT OF ASSISTED LIVING SERVICES

EXAMINING THE SUBSTITUTION EFFECT OF ASSISTED LIVING SERVICES IN RETIREMENT HOMES IN ONTARIO, CANADA

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Lay Abstract

This thesis examined whether retirement homes are a substitute for long-term care in Ontario, Canada. The first study created the first population-level cohort of residents of retirement homes and compared their health service use to other older adult populations. Residents of retirement homes had the highest rates of hospital-based care compared to the other older adult populations. The second study investigated the characteristics of retirement homes that provided a dementia care program. The homes that provided a dementia care program offered an array of care services. The third study investigated whether residents of retirement homes who lived with dementia and resided in a retirement home with a dementia care program transitioned more slowly to a long-term care home. Residents of retirement homes who had access to a dementia care program transitioned much slower to a long-term care home. Retirement homes may be a substitute to long-term care.

Abstract

Retirement homes provide assisted living services in a residential setting to support independent living. Retirement homes predominately operate on a private, for-profit business model, and these homes are privately financed through out-of-pocket payments by residents and/or their caregivers. This thesis examines whether retirement homes are a substitute congregate care setting to long-term care in Ontario, Canada. The first study created the first population-level cohort of residents of retirement homes with health system administrative data in 2018 and compared the health service rates of residents of retirement homes relative to other older adult populations (i.e., residents of long-term care homes, home care recipients who lived in the community, and community-dwelling older adults). This study found that residents of retirement homes were a unique older adult population with the highest relative rates of hospital-based care. The second study examined the facility-level characteristics of retirement homes that provided a dementia care program in 2018. This study found that these retirement homes offered an array of care services and were fundamentally different from those that did not. The third study investigated whether residents of retirement homes who were newly diagnosed with dementia and resided in a retirement home with a dementia care program had a lower rate of transition to a long-term care home from 2014 to 2019. This study found that residents of retirement homes who had access to a dementia care program in their retirement home had a significantly lower rate of transition to a long-term care home. The findings from these three studies suggest retirement homes may be a substitute congregate care home for a long-term care home in Ontario, Canada. These findings inform health system planning, national dementia care strategies, and policies that address housing, health, and social care needs of older adults.

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Table of Contents

List of Figures and Tables

Chapter 1

Chapter 2

Appendix

List of Abbreviations

CCRS – Continuing Care Reporting System

CHA – Canada Health Act

CI – Confidence Interval

DAD – Discharge Abstract Database

HCD – Home Care Database

HR – Hazard Ratio

LHIN – Local Health Integration Network

MOH – Ontario Ministry of Health

MLTC – Ontario Ministry of Long-Term Care

NACRS – National Ambulatory Care Reporting System

OCR – Ontario Cancer Registry

OHIP – Ontario Health Insurance Plan

OR – Odds Ratio

PCCF+ – Postal Code Conversion File

PHIPA – Ontario Personal Health Information and Protection Act

PR – Prevalence Ratio

RAIHC – Resident Assessment Instrument-Home Care

RAI-MDS 2.0 – Resident Assessment Instrument-Minimum Data Set 2.0

RECORD – Reporting of Studies Conducted using Observational Routinely-Collected Health Data

RHRA – Retirement Homes Regulatory Authority

RPDB – Registered Persons Database

Declaration of Academic Achievement

This thesis contains an introductory chapter (Chapter 1), three original research studies (Chapters 2, 3, and 4), and a discussion chapter (Chapter 5). Chapters 2, 3, and 4 were co-authored and I am the lead author on each of these studies. I was responsible for conceptualizing and designing these studies, conducting the statistical analyses, and writing the manuscripts. I consulted with my supervisor (Dr. Andrew P. Costa), committee members (Drs. Julia Abelson and Jean-Éric Tarride), and my co-authors (Dr. Susan E. Bronskill, Dr. Paula A. Rochon, Dr. Iwona A. Bielska, Dr. Jeffrey W. Poss, Dr. Nathan M. Stall, Ahmad Rahim, Richard Perez, Michael A. Campitelli, and Glenda Babe) regarding study design, data collection, analyses, and health policy implications.

Chapter 1: Introduction

This thesis presents three original studies on retirement homes and residents of retirement homes in Ontario, Canada that span from 2014 to 2019. This chapter highlights the importance of aging populations for health care systems and provides an overview of the health care system in Canada, with an emphasis on the home and long-term care[1] sector in Ontario. The chapter also defines the retirement home and assisted living sector in Ontario and other jurisdictions and presents the three original studies that comprise the thesis.

Importance of Aging Populations for Health Care Systems

Aging populations have more chronic health conditions and complex care needs. A pressing issue for many health care systems is the establishment and implementation of systems of care that address the evolving and intersecting needs of adults aged 65 years and older, including their caregivers (1–3). The older adult population is one of the fastest growing segments of society (1,4), yet many jurisdictions are struggling to adapt systems and services to meet the growing demand for care among this population (5,6).

Overview of the Health Care System in Canada

Canada provides universal, publicly financed health insurance to its citizens (7–9). Canada is a federalist nation of 10 provinces and three territories, and so there are 13 distinct health care systems in Canada (10). The *Canada Health Act* (CHA) was implemented in 1984

[1] Long-term care homes are referred to as "nursing homes" in other jurisdictions, such as the United States. The term "nursing home" is used to refer to a long-term care home in the studies contained in this thesis.

and has the objective to facilitate reasonable access to health care, independent of ability to pay (7,10).

The CHA contains provisions that each province or territory must meet in order to receive funds for health care from the federal government through the Canada Health Transfer (7,8,10). The CHA has five principles: 1) Public Administration (i.e., provincial health insurance plans are administered by a public entity); 2) Comprehensiveness (i.e., provincial health insurance plans insure medically necessary hospital and physician services); 3) Universality (i.e., provincial health insurance plans cover all insured health services on uniform terms to all insured persons); 4) Accessibility (i.e., provincial health insurance plans provide reasonable access to medically necessary hospital and physician services, independent of ability to pay); and 5) Portability (i.e., provincial health insurance plans are accepted in different provinces or territories in Canada and provides health insurance coverage internationally, albeit with limits) (7,8,10). The federal government may reduce the amount of funding to a province or territory if the province or territory is not compliant with the principles of the CHA (7,10).

The CHA provides first-dollar insurance coverage for medically necessarily hospital and physician services (8,11). The CHA defines long-term care, adult residential care, home care, and ambulatory care services as extended care services, and these services are not subject to the terms of the CHA (i.e., publicly paid) (8). The decision to include some or all the extended care services under the provincial plan rests with each province and territory. As such, coverage for these services differs between provinces and territories, and Canadians who require these services may be responsible for paying some or all the fees associated with them (8).

Home and Long-Term Care in Ontario

Close to 300,000 individuals in Ontario receive publicly funded home care services in a given year (12). Home care services are covered under the universal health insurance plan in Ontario, and the receipt of these services is based on need. Need is assessed and established by a care coordinator at one of the 14 local health integration networks (LHINs) (13). For those who do not qualify for publicly funded home care, privately paid home care services can be purchased from corporate providers in their community (14). Home care services provide recipients access to nursing care, rehabilitation (e.g., physiotherapy, speech language pathology, occupational therapy, social work, etc.), and personal support workers to assist with bathing, dressing, and other activities of daily living. Among those who qualify for publicly funded home care, the care is not unlimited (15). Home care recipients or their family and friend caregivers may purchase additional home care services from a corporate provider in their community to meet their needs and preferences for care. Home care recipients live independently in their home.

If an individual can no longer live independently in their home, their options for care under the universal health insurance plan in Ontario are limited to transitioning to a long-term care home, which provides 24-hour nursing care and residents are institutionalized. There are lengthy waiting lists (median: 180 days) for a bed in a long-term care home, and long-term care homes in Ontario operate at 100% capacity (16,17). Similar to home care, the waiting list is based on need (18). Applicants select their top three preferred long-term care homes in the LHIN of their choice; they may apply to more than one LHIN, depending if they wish to relocate to be closer to family or friends (18).

Beds in long-term care homes are heavily subsidized by the provincial government (19). Residents of long-term care homes who cannot afford to pay the basic rate for a shared room (i.e., $1,891 per month) can apply for a government subsidy based on their net income and federal and provincial benefits to cover a portion of, or the entire amount, of the basic rate. Semi-private and private rooms are not eligible for the government subsidy (20).

Aging Population Demographics and Increasing Care Needs in Ontario

There are 2,594,358 older adults who reside in Ontario in 2020, and an additional 2,034,762 older adults will be over the age of 65 years by 2030 (21), which is a 78% increase. The Canadian Institute for Health Information reports that the demand for home care services and a bed in a long-term care home continues to exceed the supply (22). Expanding access to a variety of care services and settings to support the diverse housing, health, and social care needs older adults over their life course is a pressing issue for policymakers to inform resource allocation and facilitate equitable access to medically necessary care (23).

Retirement Homes and Assisted Living

Retirement homes are private residences primarily for older adults (24). Retirement homes provide assisted living services to support independent living (e.g., assistance with activities of daily living, etc.), and these homes are marketed to provide a retirement community of older adults and a lifestyle to meet their housing, health, and social needs (15,25).

Differences Between Retirement Homes and Long-Term Care Homes

Retirement homes and long-term care homes are congregate care homes for older adults. Nearly 20% of retirement homes in Ontario are co-located with a long-term care home (Table 1). Despite these commonalities, there are fundamental differences between retirement homes and long-term care homes in Ontario. Retirement homes are differently legislated from long-term care homes (i.e., *Retirement Homes Act, 2010* versus *Long-Term Care Homes Act, 2007*) (19,24,26). Many retirement homes provide nursing care; however, residents of retirement homes do not require access to 24-hour nursing care, whereas residents of long-term care homes do (15,19). Retirement homes are private residences primarily for older adults who are 65 years of age and older, whereas residents of long-term care homes are institutionalized and there are no minimum age requirements (24). Residency in a retirement home is paid out of pocket by residents and/or their caregiver partners (15,19,27); conversely, there is a government subsidy for low net-income individuals who are residents of a long-term care home in Ontario (20). Almost all retirement homes operate in a private, for-profit business model, whereas the long-term care home sector may also include not-for-profit and municipally run homes (19). The retirement home sector in Ontario is regulated by an independent, not-for-profit regulator, whereas long-term care homes are inspected by the provincial government (i.e., Ministry of Long-Term Care) for compliance with the legislative operating requirements (19).

Retirement Homes in Ontario

Retirement homes in Ontario were regulated in 2011 (19,28). Reports of abuse and neglect among residents of retirement homes led to the implementation of the *Retirement*

Homes Act, 2010 and the creation of an independent, not-for-profit regulator, the Retirement Homes Regulatory Authority (RHRA) (19,28). The RHRA functions in a manner similar to a health professions regulatory college (e.g., College of Physicians and Surgeons of Ontario, etc.); the ultimate objective of the RHRA is to protect residents of retirement homes from harm, abuse, and neglect, including financial harms (29).

In 2012, the RHRA began collecting historical licensee data on retirement homes, and the sector housed more than 40,000 older adults (28). In 2018, the RHRA licensed 757 retirement homes, which housed over 75,000 older adults (30). The retirement home sector nearly doubled its capacity to support the health, social, and housing needs of older adults in Ontario in a six-year period (Table 1). More than 90% of all licensed retirement homes in 2012 and 2018 offered nursing services, assistance with bathing, provided meals, and administered medications. There was a 2.5-fold increase in the number of chain retirement homes (i.e., 34.2% in 2012 versus 47.3% in 2018). The rapid growth and capacity of the retirement home sector to house and care for older adults underscores the importance of understanding the needs of those who reside in retirement homes.

Retirement homes that offer a comprehensive array of care services may function as a substitute congregate care setting for older adults who would ordinarily be cared for in a long-term care home. Retirement homes may provide niche care to support older adults who do not require 24-hour nursing care, but who may require additional support and care to live independently, in Ontario. Retirement homes are an important link in the gradient of care services for older adults (Figure 1). These homes provide a transition from autonomous, independent living to supportive, independent living in a community of older adults. Given the capacity of the retirement home sector in Ontario and the typology of services provided

in these homes, retirement homes naturally fit between home care and long-term care. Retirement homes provide additional in-home supports (e.g., on-site health care providers, etc.) that are not typically delivered in the context of home care, and residents of retirement homes are not institutionalized as they would be in a long-term care home.

There are many similarities between the assisted living sector in the United States and retirement homes in Ontario. In the United States, the assisted living markets are rapidly growing in response to the health and housing needs of older adults who have low needs for care (31–33). Assisted living facilities in the United States are also regulated at the state-level (34,35), and the array of care services in assisted living facilities are similar to retirement homes in Ontario (27). The supply of beds in assisted living facilities is not regulated, as demand dictates supply in this privately financed market (19,27). Out-of-pocket payments are also the primary mode of financing the assisted living sector (36,37), but Medicaid – a federal-state program for low-income older adults – payments account for more than 40% of the financing of the sector (33). The availability and access of Medicaid to support low-income older adults access residency and care is a key distinction between the sector in Ontario and the United States.

Retirement Homes in Other Jurisdictions

The use of the term "retirement home" is not ubiquitous in Canada and the United States to describe the assisted living sector. Retirement homes are also referred to as "assisted living facilities",[2] "supportive housing or living", "seniors' housing", "elder homes",

[2] Taxonomy used most often to describe retirement homes in the United States.

"residential care", and "personal care homes" (Table 2) (27). It is important to note that the use of one or more of these terms may refer to a long-term care home (i.e., nursing home), rather than to retirement home, depending on the jurisdiction. While retirement homes are primarily for older adults who are 65 years of age and older, some jurisdictions do not have stringent age requirements for residency in these congregate care homes.

As per Table 2, the inconsistent taxonomy in Canada for delineating the retirement home and assisted living sector is problematic for making inter-provincial comparisons on the housing health, and social needs of older adults. As the sector is privately financed through out-of-pocket payments (13,19,27), there are no consistent individual-level assessments that are periodically conducted on residents of retirement homes, compared to, for example, the Resident Assessment Instrument-Minimum Data Set 2.0 (RAI-MDS 2.0) that is conducted on residents of long-term care homes (15). This lack of individual-level data on residents of retirement homes underscores a notable challenge to fulsomely investigate the sector and understand the needs of older adults who live in these homes. International reviews of the Canadian health care system acknowledge the existence of the retirement home and assisted living sector alongside the tax subsidized long-term care sector; however, these reviews do not provide any additional information on the contribution of the sector to supporting older adults, which is likely attributed to the absence of standardized assessments specific to these homes (9,13).

The Yukon, Northwest Territories, and Prince Edward Island do not distinguish retirement homes from long-term care homes; prospective residents complete an application and undergo an approval process before moving into one of these homes (38–40). Prospective residents of retirement homes in Newfoundland and Labrador must apply and

obtain approval from their local or regional health authority to move into the retirement home (41). Receiving such approval does not exist in other provinces, as retirement homes are predominantly financed through private payments; the supply and demand for a bed in a retirement home is driven by, and responsive to, local markets, rather than coordinated through local or regional health authorities. Nunavut provides coverage for retirement homes (i.e., Elder Homes) under the provincial health insurance plan; however, there are only two homes in the province that can house 16 older adults (42).

Ontario is the only province that has an independent, not-for-profit, self-funded regulator of retirement homes (29). British Columbia, Quebec, New Brunswick, and Newfoundland and Labrador have a registry of retirement homes available on their respective webpages (41,43–45). Ontario and Quebec do not have a subsidy for low-income older adults who qualify to offset the cost of room, board, and care services in retirement homes. Provincial government ministries in each province, except Ontario, conduct inspections of retirement homes (46–49), which is similar to the regime in place for long-term care homes in Ontario.

The Canadian Mortgage and Housing Corporation's Seniors Housing Survey provides median fees paid per month for standard care (i.e., less than 90 minutes of care per day) and heavy care (i.e., more than 90 minutes of care per day – potentially attributed to Alzheimer's, dementia, and/or reduced mobility issues) in retirement homes throughout Canada (50,51). This survey is census that captures all seniors' residences in Canada, and it has been completed annually since 2009; the full survey methodology is available elsewhere (51). The median fees for standard care per month in 2021 ranged from $1,873 to $3,845 (Table 3). Ontario had the highest fees ($3,845), followed by Nova Scotia ($3,404) and

Alberta ($3,292). The median fees for heavy care per month in 2021 ranged from $3,566 to $6,726. British Columbia had the highest fees ($6,726), followed by Ontario ($5,336) and Alberta ($5,064). These estimates would change, and potentially increase, based on an older adults' needs for care (e.g., dementia, etc.) and other preferences (50).

Thesis Objectives

The objective of this sandwich thesis is to examine whether retirement homes that provide assisted living services are a substitute congregate care setting for a long-term care home in Ontario, Canada. The studies in this thesis are secondary analyses of health system administrative data.

Chapter 2 creates the first population-level cohort of residents of retirement homes in Ontario by linking postal codes of licensed retirement homes to eligible Ontarians and examines their health service rates relative to other older adult populations (i.e., residents of long-term care homes, home care recipients who lived in the community, and community-dwelling older adults). This population-based, retrospective cohort study used individual-level data in 2018 and found residents of retirement homes had the highest rates of hospital-based care (i.e., emergency department visits, hospitalizations, and alternate levels of care [ALC] days) relative to other older adult populations. The residents of retirement homes cohort was used in Chapters 3 and 4.

Chapter 3 examines whether retirement homes that provide a dementia care program are different from those that do not in Ontario. This population-level, cross-sectional study used home-level data on all licensed retirement homes in 2018 and found retirement homes that offered a dementia care program were more prevalent in retirement homes that could

house many residents and provided an array of care services. This study was published in BMC Geriatrics.

Chapter 4 examines whether residents of retirement homes who receive a new dementia diagnosis and reside in retirement homes that offers a dementia care program transition later to a long-term care home. This population-based, retrospective cohort study used individual-level data on residents of retirement homes from 2014 to 2019 and found residents of retirement homes who had access to a dementia care program had a 40% lower rate of transition to a long-term care home. This study was published in the Journal of the American Medical Directors Association.

Chapter 5 summarizes the findings from the three original studies, discusses the contributions of the thesis, strengths and limitations, and opportunities for future research. Retirement homes support aging in place, particularly among those who live with dementia and have access to a dementia care program. The growth and expansion of the retirement home and assisted living sector affirms its important role in addressing the varied needs for housing, health, and social care among older adults.

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Table 1. Descriptive Characteristics of Licensed Retirement Homes in 2012 and 2018

	2012	**2018**
Licensed Retirement Homes, *n*	383	757
Facility Characteristics, *n* (%)		
Resident Capacity, median (IQR)	96 (65 to 114)	87 (50 to 140)
Number of Suites, median (IQR)	77 (55 to 113)	71 (42 to 115)
Part of a Corporate-Owned Chain	142 (37.1)	358 (47.3)
Residential Home	13 (3.4)	80 (10.6)
Co-located With a Long-Term Care Home	68 (17.8)	134 (17.7)
Regulated Care Services, *n* (%)		
Assistance with Bathing	371 (96.9)	722 (95.4)
Assistance with Hygiene	336 (87.7)	672 (88.8)
Assistance with Ambulation	331 (86.4)	651 (86.0)
Assistance with Feeding	107 (27.9)	285 (37.6)
Assistance with Dressing	307 (80.2)	670 (88.5)
Continence Care	299 (80.2)	596 (78.7)
Skin and Wound Care	93 (24.3)	165 (21.8)
Dementia Care	62 (16.2)	126 (16.6)
Provision of Meals	383 (100.0)	751 to 757 (99.2 to 100.0) *
Administration of Medications	377 to 383 (98.4 to 100.0) *	751 to 757 (99.2 to 100.0) *
Pharmacist Services	336 (87.7)	664 (87.7)
Nursing Services	370 (96.6)	714 (94.3)
Medical Services	243 (63.4)	519 (68.6)

Abbreviations: IQR, Interquartile Range

* Small cell sizes (i.e., where six or fewer retirement homes do not have a characteristic) are suppressed due to privacy restrictions at ICES

Figure 1. Continuum of Care Services for Older Adults in Ontario

Table 2. Comparison of Retirement Homes in Different Provinces

Province/Territory	Taxonomy	Legislation	Independent Regulator	Payment	Median Rent per Month	
					Standard Care	Heavy Care
British Columbia	Assisted living or retirement homes	*Community Care and Assisted Living Act* and *Continuing Care Fees Regulation*	No. Provincial Assisted Living Registry (Registrar appointed by Minister)	Private pay and publicly subsidized	$3,228	$6,726
Yukon (5 LTC homes, includes retirement homes)		*Health Act*	No.	Private pay	$1,217 (LTC fees)	
Alberta	Designative Supportive Living 3	*Supportive Living Accommodation Licensing Act*	No. Licensed by province and inspected annually	Private pay. Some low-income affordable spaces (Seniors lodges) with government co-pay	$3,292	$5,064
Northwest Territories (9 LTC, includes retirement homes)	Supportive Living	*Hospital Insurance and Health and Social Services Administration Act*	No.	Private pay	$844 (LTC fees)	
Saskatchewan	Personal care homes	*The Personal Care Homes Act*	No. Monitored and licensed and inspected by Ministry of Health	Private pay. Personal Care Home Benefit available to low-income older	$3,090	$4,538

Table 2. Comparison of Retirement Homes in Different Provinces

Province/Territory	Taxonomy	Legislation	Independent Regulator	Payment	Median Rent per Month	
					Standard Care	Heavy Care
				adults who qualify		
Manitoba	Supportive housing for seniors; Independent Senior's housing; Independent Living & Assisted Living	*The Elderly and Infirm Persons' Housing Act*	No. Inspections completed by Ministry	Private pay. Some government subsidy	$2,842	$4,474 [1]
Ontario	Retirement Homes	*Retirement Homes Act, 2010*	Yes. Retirement Homes Regulatory Authority	Private pay	$3,845	$5,336
Nunavut (2 homes, 8-bed capacity per home)	Elder Homes (>= 55 years of age)	*Hospital Insurance and Health and Social Services Administration Act*	No	Provincial health insurance plan coverage	$0	$0
Quebec	Résidence pour Personnes Âgées	*Loi sur les services de santé et les services sociaux*	No. Provincially inspected and certified. Provincial register of homes	Private pay	$1,873	$3,566

Table 2. Comparison of Retirement Homes in Different Provinces

Province/Territory	Taxonomy	Legislation	Independent Regulator	Payment	Median Rent per Month	
					Standard Care	Heavy Care
New Brunswick	Special care homes (>= 19 years of age)	*Family Services Act*	No. Inspected by fire marshal and public health. Provincial register	Private pay. Eligible post financial assessment for subsidy	$2,679	NA [2]
Nova Scotia	Residential care facilities	*Homes for Special Care Act*	No. Licensing inspections twice annually by Department of Health and Wellness	Private pay. Financial support for those who qualify	$3,404	NA [2]
Prince Edward Island (9 LTC homes)		*Community Care Facilities and Nursing Homes Act*	No.	Private pay. Low-income subsidy for long-term care	$2,767	NA [2]
Newfoundland & Labrador	Personal care homes; Protective Community Residences (specifically for dementia – operated by health authority)	*Personal Care Homes Regulations* under the *Health and Community Services Act, 2000*	No. Licensed by regional health authority. List of homes provided as PDF document on website	Private pay. Financial assessment to determine if eligible to receive subsidy	$2,375	NA [2]

Abbreviations: LTC, Long-Term Care; NA, Not Available

[1] The Canadian Mortgage and Housing Corporation's Manitoba data tables had suppressed the total value for confidentiality/statistical reliability. The median rent for heavy care in a space with two or more bedrooms is reported.

Table 2. Comparison of Retirement Homes in Different Provinces

Province/Territory	Taxonomy	Legislation	Independent Regulator	Payment	Median Rent per Month	
					Standard Care	Heavy Care

[2] Heavy care rates were not reported in the Canadian Mortgage and Housing Corporation's Atlantic region data tables.

Chapter 2: Examining Health Service Rates Among Residents of Retirement Homes and Other Older Adult Populations

Preface

This chapter presents the creation of a new population-level cohort of residents of retirement homes and compares their health services rates to other older adult populations (i.e., home care recipients living in the community, residents of long-term care homes, and community-dwelling older adults). Doing so substantiates the extent to which residents of retirement homes are a similar or distinct population from residents of long-term care homes, and examining their health service use relative to other older adult populations positions these older adults as potentially residing in a retirement home as a substitute for a long-term care home.

I was responsible for the conceptualization, design, and statistical analysis plan for the study in collaboration with Dr. Costa. I was responsible for the acquisition of the data along with Ahmad Rahim, Glenda Babe, and Dr. Costa. Ahmad Rahim and Glenda Babe were responsible for conducting the statistical analyses according to plan I conceptualized. I was responsible for writing the manuscript. All authors contributed important intellectual content to the manuscript, and all authors read and approved the final version.

Examining Health Service Rates Among Residents of Retirement Homes and Other Older Adult Populations in Ontario, Canada: A Population-Based Cohort Study

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Abstract

Background: There are no standardized reporting systems or assessments specific to residents of retirement homes in North America. As such, little is known about these older adults as a distinct population. We created a new population-level cohort of residents of retirement homes and examined their health service rates relative to other older adult populations.

Methods: We conducted a population-based retrospective cohort study in Ontario, Canada in 2018. The postal codes of all licensed retirement homes (n = 757) were classified and linked to individual-level health system administrative data to derive a cohort of residents of retirement homes. A generalized linear model with a gamma distribution and log link function was used to model rates of emergency department visits, hospitalizations, alternate levels of care (ALC) days, primary care visits, and specialist physician visits.

Results: Residents of retirement homes comprised two percent of the older adult population in Ontario (n = 54,773; 2.3%). After adjustment for relevant characteristics, residents of retirement homes had 10 times the rate of emergency department visits (Relative Rate [RR] 10.02, 95% Confidence Interval [CI] 9.83 to 10.21), 20 times the rate of hospitalizations (RR

20.43, 95% CI 20.08 to 20.78), and 44 times the rate ALC days (RR 43.91, 95% CI 43.28 to 44.54) compared to community-dwelling older adults.

Interpretation: Residents of retirement homes are a distinct older adult population with high rates of hospital-based care. Our findings contribute to policy debates about the provision of health care in privately operated congregate care settings for older adults.

Keywords: Retirement Homes; Assisted Living; Long-Term Care; Home Care; Older Adults

Introduction

Retirement homes are private, congregate living environments that deliver supportive care to adults who are 65 years of age and older (1,2). Retirement homes are often marketed to provide a lifestyle and community, and these homes provide a range of assisted living care services (e.g., meals, administration of medication, nursing services, etc.) on a cost recovery basis (2). These homes predominately operate on a private, for-profit business model, and the room, board, and services are purchased by residents and/or their family or friend caregivers (1,2).

Retirement homes are referred to as assisted living facilities in other North American jurisdictions. The legislative and regulatory operating requirements for these homes vary (3); Ontario is the only jurisdiction to regulate and license retirement homes through an independent, not-for-profit regulator (i.e., Retirement Homes Regulatory Authority [RHRA]) (2). There are more than 700 licensed retirement homes in Ontario that can house over 70,000 older adults, which is comparable to the number of beds in the long-term care home sector (1,2,4). Unlike long-term care homes where the validated Resident Assessment Instrument Minimum Data Set (RAI-MDS) is used, there are no standardized assessments specific to residents of retirement homes (5). The absence of standardized assessments that are periodically conducted on residents of retirement homes, coupled with the privately financed nature of the sector, presents unique challenges to identify these older adults using health system administrative data and understand their health service use relative to other older adult populations.

While there is a body of research describing the assisted living sector and residents of assisted living facilities in the United States (6–12), the Canadian literature requires a more in-

depth investigation. Canadian studies have investigated transitions to a long-term care home, risk of hospitalization among those who live with dementia, and events and health conditions associated with the transition to a congregate care setting for older adults (13–17), To date, no population- or provincial-level cohort of residents of retirement homes in Canada has been created to define the retirement home and assisted living sector, describe the characteristics and health service use of older adults who purchase these services, and position the sector in the gradient of care services and housing needs for older adults. In this study, we create a new population-level cohort of residents of retirement homes and examine their health service rates relative to other older adult populations (i.e., residents of long-term care homes, home care recipients in the community, and community-dwelling older adults) in Ontario, Canada.

Methods

Study Design and Setting

We conducted a population-based retrospective cohort study using linked, individual-level health system administrative data in 2018 in Ontario, Canada at ICES. ICES is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement. The use of the data in this project is authorized under section 45 of Ontario's *Personal Health Information Protection Act* (PHIPA) and does not require review by a Research Ethics Board. We followed the REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement guideline (Supplemental Table 1) (18).

Data

The RHRA shared their public register of licensed retirement homes, which contains historical data on the license of the home, resident and suite capacities, provision of regulated care services, and full postal address. There were 757 licensed retirement homes in 2018 (Supplemental Table 2). We verified and visualized the postal code of each licensed retirement home through a variety of sources (i.e., Canada Post, Statistics Canada, and Google Maps). Building off research that examined the feasibility of using postal codes to identify residents of retirement homes (19), we used a modified taxonomy to classify the postal code of each licensed retirement home as unique, or not unique, to the retirement home. We imported the RHRA's public register and our classified postal code data on licensed retirement homes to ICES. The health system administrative datasets used are listed and described in Supplemental Table 3. These datasets were linked using unique encoded identifiers and analyzed at ICES.

Identification of Residents of Retirement Homes

We identified adults who were 65 years of age of and older and had a postal code that ever matched to a licensed retirement home with a unique postal code classification in 2018 (Figure 1). There were substantially more adults who were 65 years of age and older and had a postal code that matched to a licensed retirement home with a not unique postal code classification than beds in licensed retirement homes. We limited our identification of residents of retirement homes with not unique postal codes to those who received home care services in a retirement home, as the receipt of home care services specified whether the services were provided in a retirement home. We defined the index date as when the adults' postal code matched to the postal code of a licensed retirement home; we terminated follow-

up when the adult transitioned to a long-term care home, complex continuing care facility, or died.

We excluded adults who were institutionalized in a long-term care home that was co-located with a retirement home and adults who resided in a long-term care home for more than half of 2018 (i.e., six months plus one day) (n = 15,626). Adults who resided in a continuing care facility for the whole year in 2018 were excluded (n = 57). We also excluded adults who received shift nursing in retirement homes (n = 168), as these individuals were temporarily housed in the retirement home through convalescent government programs, and so these individuals were not true residents of retirement homes. We excluded duplicate adults who moved from one retirement home to another during the year (n = 807). According to the RHRA's register, there were 75,822 beds in all licensed retirement homes in 2018, and our approach identified a cohort of 54,733 residents of retirement homes (n = 54,733; 72.2%).

Identification of Other Older Adult Populations

For comparison purposes, we identified residents of long-term care homes, older adults who received home care services in the community, and community-dwelling adults who were 65 years of age and older in 2018. Residents of long-term care homes were identified by their inclusion in the Continuing Care Reporting System (n = 96,528). Adults who received home care services in their community were differentiated from residents of retirement homes by their postal code that never matched to a postal code associated with a licensed retirement home (n = 290,245). Community-dwelling adults were defined as those who were 65 years of age and older and never met any of the above criteria (n = 1,967,612). We defined the index date as when the adult met the criteria to be categorized as one of the

mutually exclusive older adult populations in 2018; we terminated follow-up when the adult met the criteria to be categorized as a different older adult population or died.

Measures

The outcomes of interest were annual rates of emergency department visits, hospitalizations, alternate levels of care (ALC) days, primary care visits, and specialist physician visits. These rates were standardized at the level of the individual (i.e., from index to end of follow-up). Emergency department visits were defined as any care received in an emergency department. Hospitalizations were defined as any hospitalization. ALC days were obtained from the Discharge Abstract Database.

Primary care visits among residents of retirement homes, home care recipients in the community, and community-dwelling older adults were defined as any billing by a family or community medicine physician to the universal health insurance plan where the location of the visit occurred in an office, home, or via the telephone. Primary care visits among residents of long-term care homes were similarly defined in accordance with the Monthly Management System and included a long-term care home as the visit location. Specialist physician visits were defined as any physician billing whose speciality was not family or community medicine to the universal health insurance plan. All individuals could only have one primary care and/or specialist physician visit per physician per day.

Sociodemographic (i.e., age and sex) and community characteristics (i.e., urban location, neighborhood income quintile, Ontario Marginalization Index) were obtained at the index date. Clinical comorbidities were also obtained at the index date from physician-diagnosed billing codes to the universal health insurance plan in Ontario, ICD-9 or ICD-10 diagnosis codes, and validated ICES-derived cohorts (20–27).

Statistical Analysis

Counts and proportions were calculated for categorical sociodemographic, community, and clinical variables; means and standard deviations were calculated for continuous, normally distributed sociodemographic variables, and medians and interquartile ranges were calculated for continuous, not normally distributed sociodemographic variables. A generalized linear model with a gamma distribution and log link function was used to model the standardized health service rates among the different older adult populations, and community-dwelling older adults were used as the reference population. The gamma distribution and log link function is appropriate to model dispersed rates and/or costs in dollars (28). Crude and adjusted relative rates and 95% confidence intervals were calculated from exponentiated beta coefficients. All statistical tests were two-tailed, and the level of statistical significance was $P < .05$. Variance inflation factors were calculated to assess for multicollinearity. A sex-stratified subgroup analysis was conducted. Dataset processing and statistical analyses were conducted in SAS Enterprise 9.4 (Cary, NC, USA).

Results

Residents of retirement homes comprised two percent of adults aged 65 and older in Ontario in 2018 (n = 54,773; 2.3%). More than two thirds of residents of retirement homes were female (n = 37,768; 69.0%), and residents of retirement homes had a mean age of 87.7 years (Table 1). Hypertension (n = 47,212; 86.2%), osteoarthritis (n = 36,978; 67.5%), mood disorders (n = 35,000; 63.9%) and dementia (n = 20,651; 37.7%) were the most prevalent clinical comorbidities among residents of retirement homes. More than 90% of all residents of retirement homes resided in urban communities (n = 50,650; 92.5%).

The crude and sex-stratified health service rates are described in Supplemental Table 4. After adjustment for sociodemographic characteristics and clinical comorbidities at index, residents of retirement homes had 10 times the rate of emergency department visits (Relative Rate [RR] 10.02, 95% Confidence Interval [CI], 9.83 to 10.21), 20 times the rate of hospitalizations (RR 20.43, 95% CI 20.08 to 20.78), 44 times the rate of ALC days (RR 43.91, 95% CI 43.28 to 44.54), and nearly twice the rate of primary care (RR 1.99, 95% CI 1.97 to 2.02) and specialist physician visits (RR 1.62, 95% CI 1.59 to 1.65), compared to community-dwelling older adults (Table 2). Male residents of retirement homes had higher rates of emergency department visits, hospitalizations, and ALC days than female residents of retirement homes, but similar rates of primary care and specialist physician visits (Table 3). Adjusted beta coefficients and standard errors are available in Supplementary Tables 5 and 6.

Interpretation

Residents of retirement homes had the highest rates of emergency department visits, hospitalizations, and ALC days relative to the other older adult populations in Ontario, Canada in 2018. These older adults purchase health care services from their retirement home to support independent living, yet we found they consume more publicly funded hospital-based care and have lower rates of primary care and specialist physician visits. Our findings contribute to on-going policy debates about privately financed and delivered health care, and the provision of health care in privately operated congregate care settings for older adults, in jurisdictions that provide universal health insurance to its citizens (29,30).

The variation in legislative and operating requirements for retirement homes has been shown to affect rates of hospital-based use among these residents (31,32). Previous

studies found residents of retirement homes have substantially higher rates of emergency department visits and hospitalizations compared to community-dwelling older adults and residents of long-term care homes (11,33). Our findings align with the literature and may suggest residents of retirement homes have higher needs for care compared to other older adult populations.

Residents of retirement homes had the highest rates of ALC days relative to the other older adult populations in our study, which suggests the needs of some residents may exceed the capacity of their home to provide the level and scope of care needed. Moreover, some of these residents may not be able to afford additional care from their retirement home, as rates for heavy care in Ontario can exceed $6,000 per month (34). Nearly half of the residents of retirement homes lived in middle- and low-income neighborhoods. The costs for heavy care are likely out of reach for many of these older adults (35–37), which underscores the need for equitable policies that support health and housing for older adults.

Residents of retirement homes had lower rates of primary care and specialist physician visits relative to home care recipients who lived in the community. Residents of long-term care homes receive primary care through the Monthly Management System, but no similar model exists for retirement homes. Our findings suggest the implementation and expansion of similar medical models of care in retirement homes may be an important intervention to promote continuity of care and reduce rates of hospital-based care among this population.

Retirement home and assisted living markets in North America are rapidly expanding to accommodate the varying preferences of older adults for housing, health, and social care (2,5–7,35,38). The growth and availability of beds in retirement homes and assisted living

facilities outpaces that of long-term care homes (2,38), and this growth is likely attributed to fewer legislative and regulatory requirements than long-term care homes. The increased supply of retirement homes may suggest that retirement homes are a substitute for a long-term care home (7,38), which suggests that retirement homes are an important link in the continuum of care settings for older adults and should be subject to similar regulatory oversight.

There are limitations to our study. We conducted a secondary analysis of health system administrative data; as such, there is the possibility of misclassification bias and residual confounding could influence our results and interpretation. We were unable to identify residents of retirement homes who did not receive home care services in licensed retirement homes with not unique postal codes. We were also unable to determine the occupancy of each retirement home, as the RHRA does not require operators to disclose this statistic as a condition for licensing (2). As the occupancy of each retirement home is unknown, the size of our cohort of residents of retirement homes may reflect the actual population size.

Residents of retirement home are a unique older adult population in Ontario, Canada. Future research should examine with more granularity the reasons why residents of retirement homes visited emergency departments and/or were hospitalized to understand their needs for hospital-based care that may not be met in their retirement home.

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Figure 1. Creation of the Residents of Retirement Homes Cohort in 2018 (*n* = 54,773)

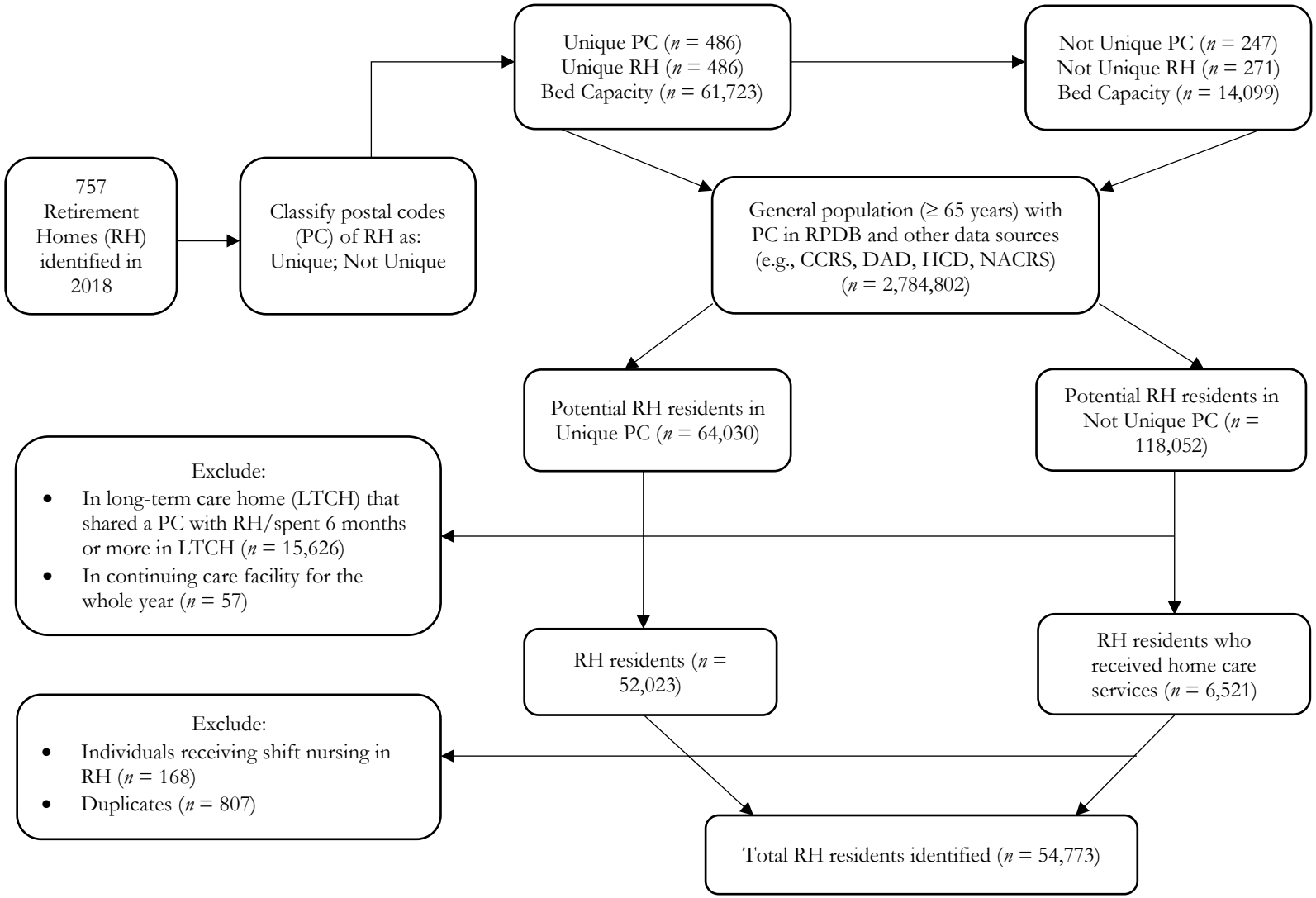

Table 1. Sociodemographic Characteristics and Clinical Comorbidities Among Residents of Retirement Homes, Residents of Long-Term Care Homes, Home Care Recipients in the Community, and Community-Dwelling Older Adults in 2018 (*n* = 2,419,158)

	Residents of Retirement Homes	**Residents of Long-Term Care Homes**	**Home Care Recipients in the Community**	**Community-Dwelling Older Adults**
n (%)	54,773 (2.3)	96,528 (4.0)	290,245 (12.0)	1,967,612 (81.6)
Demographic Characteristics, *n* (%)				
Age, mean (SD)	87.7 (7.21)	85.3 (8.22)	79.3 (8.41)	73.8 (6.68)
Female	37,768 (69.0)	66,097 (68.5)	163,216 (56.2)	1,046,805 (53.2)
Clinical Comorbidities, *n* (%)				
Asthma	8,334 (15.2)	13,903 (14.4)	52,169 (18.0)	250,749 (12.7)
Cancer	14,557 (26.6)	19,578 (20.3)	93,550 (32.2)	316,863 (16.1)
Cardiac Arrhythmias	19,723 (36.0)	28,585 (29.6)	90,111 (31.0)	320,234 (16.3)
Cerebrovascular Accident	11,796 (21.5)	26,781 (27.7)	51,683 (17.8)	109,713 (5.6)
Chronic Coronary Disease	23,210 (42.4)	39,091 (40.5)	119,603 (41.2)	494,772 (25.1)
Chronic Obstructive Pulmonary Disease	17,486 (31.9)	31,033 (32.1)	97,929 (33.7)	370,765 (18.8)
Congestive Heart Failure	16,063 (29.3)	25,119 (26.0)	73,498 (25.3)	130,132 (6.6)
Dementia	20,651 (37.7)	76,485 (79.2)	52,952 (18.2)	51,372 (2.6)
Diabetes	17,097 (31.2)	36,513 (37.8)	119,516 (41.2)	566,716 (28.8)
Hypertension	47,212 (86.2)	80,882 (83.8)	240,470 (82.9)	1,317,840 (67.0)
Mood Disorders	35,000 (63.9)	66,365 (68.8)	168,785 (58.2)	951,562 (48.4)
Myocardial Infarction	6,542 (11.9)	10,554 (10.9)	35,141 (12.1)	116,275 (5.9)
Osteoarthritis	36,978 (67.5)	65,335 (67.7)	169,423 (58.4)	794,611 (40.4)
Osteoporosis	8,334 (15.2)	13,903 (14.4)	49,938 (16.9)	261,113 (13.3)
Other Mental Health	16,097 (29.4)	34,350 (35.6)	94,282 (32.5)	475,043 (24.1)
Renal Disease	8,236 (15.0)	13,487 (14.0)	50,374 (17.4)	118,137 (6.0)
Rheumatoid Arthritis	2,091 (3.8)	3,261 (3.4)	12,639 (4.4)	46,713 (2.4)

Table 1. Sociodemographic Characteristics and Clinical Comorbidities Among Residents of Retirement Homes, Residents of Long-Term Care Homes, Home Care Recipients in the Community, and Community-Dwelling Older Adults in 2018 (*n* = 2,419,158)

	Residents of Retirement Homes	**Residents of Long-Term Care Homes**	**Home Care Recipients in the Community**	**Community-Dwelling Older Adults**
Community Characteristics, *n* (%)				
Urban Location	50,650 (92.5)	83,171 (86.2)	253,336 (87.3)	1,712,634 (87.0)
Neighborhood Income Quintile				
1 (Least)	13,037 (23.8)	28,683 (29.7)	72,124 (24.9)	370,961 (18.9)
2	12,685 (23.2)	21,047 (21.8)	64,141 (22.1)	405,261 (20.6)
3	10,405 (19.0)	16,892 (17.5)	56,242 (19.4)	396,048 (20.1)
4	10,409 (19.0)	15,936 (16.5)	48,907 (16.9)	378,654 (19.2)
5 (Highest)	7,639 (13.9)	13,291 (13.8)	48,093 (16.6)	412,074 (20.9)
Missing	598 (1.1)	679 (0.7)	728 (0.3)	4,614 (0.2)
Ontario Marginalization Index Summary Score, median (IQR)	3 (3 to 4)	4 (3 to 4)	3 (3 to 4)	3 (3 to 4)

Abbreviations: IQR, Interquartile Range; SD, Standard Deviation

Table 2. Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

	Crude Relative Rates (95% CI)					**Adjusted Relative Rates (95% CI)** [1]				
	ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**	**ED Visits**	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Residents of Retirement Homes	12.63 (12.23 to 13.04) *	33.40 (31.65 to 35.25) *	166.40 (152.51 to 181.56) *	2.29 (2.26 to 2.32) *	1.62 (1.57 to 1.69) *	10.02 (9.83 to 10.21) *	20.43 (20.08 to 20.78) *	43.91 (43.28 to 44.54) *	1.99 (1.97 to 2.02) *	1.62 (1.59 to 1.65) *
Residents of Long-Term Care Homes	4.90 (4.72 to 5.09) *	11.82 (11.12 to 12.58) *	75.53 (69.09 to 82.57) *	13.69 (13.55 to 13.82) *	0.76 (0.73 to 0.80) *	3.76 (3.70 to 3.82) *	7.37 (7.27 to 7.48) *	29.19 (28.87 to 29.52) *	13.30 (13.15 to 13.45) *	0.87 (0.86 to 0.89) *
Home Care Recipients in the Community	10.58 (10.36 to 10.80) *	18.60 (17.81 to 19.43) *	72.04 (66.32 to 78.25) *	2.27 (2.26 to 2.28) *	3.68 (3.63 to 3.73) *	8.89 (8.81 to 8.96) *	11.97 (11.88 to 12.06) *	27.49 (27.31 to 27.68) *	2.03 (2.01 to 2.04) *	3.15 (3.12 to 3.17) *
Community-Dwelling Older Adults	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)

Abbreviations: ALC, Alternate Levels of Care; CI, Confidence Interval; ED, Emergency Department; Ref, Reference

[1]Adjusted for all sociodemographic characteristics and clinical comorbidities in Table 1

* $P < .001$

Table 3. Sex-Stratified Subgroup Analysis of Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

		Crude Relative Rates (95% CI)					**Adjusted Relative Rates (95% CI)** [1]				
		ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**	**ED Visits**	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Males (*n* = 1,094,635)	Residents of Retirement Homes	15.57 (15.08 to 16.07) *	35.69 (34.63 to 36.78) *	148.40 (144.46 to 152.44) *	2.48 (2.42 to 2.54) *	1.90 (1.84 to 1.95) *	12.15 (11.76 to 12.56) *	22.30 (21.63 to 22.99) *	51.07 (49.81 to 52.37) *	2.03 (1.98 to 2.07) *	1.64 (1.60 to 1.69) *
	Residents of Long-Term Care Homes	6.32 (6.17 to 6.47) *	12.97 (12.68 to 13.27) *	83.60 (81.92 to 85.31) *	14.67 (14.42 to 14.93) *	0.87 (0.85 to 0.89) *	4.88 (4.75 to 5.01) *	8.77 (8.56 to 9.00) *	58.72 (57.56 to 59.89) *	13.61 (13.34 to 13.88) *	0.86 (0.84 to 0.88) *
	Home Care Recipients in the Community	12.89 (12.73 to 13.04) *	19.05 (18.83 to 19.27) *	60.19 (59.57 to 60.82) *	2.54 (2.51 to 2.56) *	4.03 (3.99 to 4.08) *	11.19 (11.06 to 11.33) *	13.45 (13.29 to 13.60) *	31.77 (31.46 to 32.09) *	2.25 (2.23 to 2.27) *	3.35 (3.32 to 3.39) *
	Community-Dwelling Older Adults	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Females (*n* = 1,313,038)	Residents of Retirement Homes	11.11 (10.87 to 11.36) *	30.92 (30.30 to 31.54) *	120.23 (118.08 to 122.41) *	2.18 (2.15 to 2.22) *	1.52 (1.49 to 1.55) *	8.89 (8.69 to 9.10) *	19.38 (18.98 to 19.78) *	40.09 (39.39 to 40.80) *	2.00 (1.96 to 2.03) *	1.66 (1.62 to 1.69) *

Table 3. Sex-Stratified Subgroup Analysis of Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

	Crude Relative Rates (95% CI)					**Adjusted Relative Rates (95% CI)** [1]				
	ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**	**ED Visits**	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Residents of Long-Term Care Homes	4.19 (4.12 to 4.26) *	10.78 (10.62 to 10.95) *	45.62 (45.00 to 46.26) *	13.09 (12.93 to 13.24) *	0.73 (0.72 to 0.74) *	3.17 (3.11 to 3.24) *	6.61 (6.50 to 6.73) *	15.26 (15.05 to 15.48) *	13.31 (13.12 to 13.50) *	0.92 (0.90 to 0.93) *
Home Care Recipients in the Community	8.61 (8.51 to 8.70) *	16.19 (16.03 to 16.36) *	50.41 (49.94 to 50.87) *	2.07 (2.05 to 2.08) *	3.40 (3.36 to 3.43) *	7.17 (7.09 to 7.25) *	10.82 (10.71 to 10.93) *	24.02 (23.80 to 24.23) *	1.86 (1.85 to 1.88) *	3.01 (2.98 to 3.04) *
Community-Dwelling Older Adults	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)

Abbreviations: ALC, Alternate Levels of Care; CI, Confidence Interval; ED, Emergency Department; Ref, Reference

[1]Adjusted for all sociodemographic characteristics and clinical comorbidities in Table 1

* $P < .001$

Supplementary Material

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and Abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	p. 1,2	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	p. 1,2
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	p. 3,4		

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Objectives	3	State specific objectives, including any prespecified hypotheses	p. 4		
Methods					
Study Design	4	Present key elements of study design early in the paper	p. 4		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	p. 4		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the	p. 5,6	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed	p. 5,6,16

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	p. 6,7	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	p. 6,7

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	p. 6,7		
Bias	9	Describe any efforts to address potential sources of bias			
Study size	10	Explain how the study size was arrived at			
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	p. 6,7		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine	p. 7-8		

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	p. 6

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	p. 6
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	p. 8, 24	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	p. 8, 24

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	p. 8, 15-19		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of	p. 8-9		

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	p. 8-9		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	p. 8-9		

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Discussion					
Key results	18	Summarise key results with reference to study objectives	p. 10		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	p. 12	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	p. 12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	p. 10,11		
Generalisability	21	Discuss the generalisability (external validity) of the study results	p. 10,11		
Other Information					

Supplemental Table 1. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	p. 1		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	p. 2

Supplemental Table 2. Characteristics of Licensed Retirement Homes in 2018 (*n* = 757)

Characteristic	***n* (%)**
Urban	632 (83.5)
Facility Capacity, median (IQR)	87 (50 to 140)
Suites Capacity, median (IQR)	71 (42 to 115)
Chain Facility	358 (47.3)
Residential Home	80 (10.6)
Co-Located with a Long-Term Care Home	134 (17.7)
Care Services	
Assistance with Bathing	722 (95.4)
Assistance with Hygiene	672 (88.8)
Assistance with Ambulation	651 (86.0)
Assistance with Feeding	285 (37.6)
Assistance with Dressing	670 (88.5)
Continence Care	596 (78.7)
Skin and Wound Care	165 (21.8)
Dementia Care	126 (16.6)
Provision of Meals	751 to 757 (99.2 to 100.0)*
Administration of Medications	751 to 757 (99.2 to 100.0)*
Pharmacist Services	664 (87.7)
Nursing Services	714 (94.3)
Medical Services	519 (68.6)

Abbreviations: IQR, Interquartile Range

* Small cell sizes (i.e., where six or fewer retirement homes do not have a characteristic) are suppressed due to privacy restrictions at ICES

Supplemental Table 3. Descriptions of the Health System Administrative Databases

Database	Description
Client Agency Program Enrolment Data (CAPE)	Contains enrolment data on individuals in Ontario who are eligible for coverage under the universal health insurance plan in the province and enrolled or rostered to a health care program with a specific practitioner or group.
Continuing Care Reporting System (CCRS)	Contains person-level data (i.e., clinical, demographic) in nursing homes in Canada using the validated Resident Assessment Instrument Minimum Data Set (RAI-MDS) version 2.0. Complete assessments are conducted when people are admitted to the nursing home, every year thereafter, and after any significant change in the person's health by a health care provider.
Corporate Provider Database (CPDB)	Contains information on physician and allied health care practitioners (i.e., demographic characteristics, practice location, billing status and specialty) and/or groups (i.e., hospital groups and affiliated institutions, geographic location, group affiliation and composition) that are eligible to receive payments under the universal health insurance plan in Ontario.
Discharge Abstract Database (DAD)	Contains person-level data (i.e., demographic, administrative, diagnoses, procedures) for all admissions to acute care hospitals. The DAD is compiled and maintained by the Canadian Institute for Health Information.
Home Care Database (HCD)	Contains person-level data (i.e., social, clinical) for publicly funded home care services in Ontario, including types and volume of service provision.
National Ambulatory Care Reporting System (NACRS)	Contains person-level data (i.e., demographic, administrative, diagnoses, procedures) for all patient visits to ambulatory care centres in hospitals and communities (i.e., emergency departments, day surgery units, hemodialysis units, cancer care clinics). The NACRS is compiled and maintained by the Canadian Institute for Health Information.
Ontario Health Insurance Plan (OHIP) Database	Contains physician billings claims data among physicians who are remunerated by fee-for-service for outpatient visits. It also contains "shadow billings" for physicians who are remunerated through alternate payment schemes.
Ontario Marginalization Index (ONMARG)	Contains geographic, Census-based indices that quantity the extent of marginalization in communities in Ontario. There are four dimensions: residential instability, material deprivation, dependency, and ethnic concentration.
Postal Code Conversion File (PCCF+)	Specialized macro containing geographic identifiers based on Census data. This macro is based on 2016 Census information, identifies communities with less than 10,000 residents as rural, and includes related data from Canada Post Corporation.

Supplemental Table 3. Descriptions of the Health System Administrative Databases

Database	Description
Registered Persons Database (RPDP)	Contains demographic information (i.e., sex, age, date of birth, date of death for deceased individuals, area of residence, including postal code) and establishes eligibility for publicly funded universal health insurance in Ontario.

Supplemental Table 4. Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

		ED Visits [1]	**Hospitalizations** [1]	**ALC Days** [1]	**Primary Care Visits** [1]	**Specialist Physician Visits** [1]
Total (*n* = 2,419,158)	Crude Rate	0.0001 (0.0001 to 0.029231)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0576923 (0.0192308 to 0.0961538)	0.0192308 (0.001 to 0.576923)
	Residents of Retirement Homes	0.019337 (0.0001 to 0.07)	0.0001 (0.0001 to 0.0216049)	0.0001 (0.0001 to 0.0001)	0.0769231 (0.0192308 to 0.1573034)	0.0192308 (0.0001 to 0.0576923)
	Residents of Long-Term Care Homes	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.2307692 (0.2178988 to 0.2763158)	0.0001 (0.0001 to 0.0001)
	Home Care Recipients in the Community	0.0001 (0.0001 to 0.0551181)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0514706 (0.0001 to 0.1555556)	0.0269231 (0.0001 to 0.1609195)
	Community-Dwelling Older Adults	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0384615 (0.0192308 to 0.0961538)	0.0192308 (0.0001 to 0.0384615)
Males (*n* = 1,094,635)	Crude Rate	0.0001 (0.0001 to 0.0192308)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0393258 (0.0192308 to 0.0961538)	0.0192308 (0.0001 to 0.0576923)
	Residents of Retirement Homes	0.0233333 (0.0001 to 0.0823529)	0.0001 (0.0001 to 0.0290456)	0.0001 (0.0001 to 0.0001)	0.0769231 (0.0192308 to 0.1655405)	0.0192308 (0.0001 to 0.0769231)
	Residents of Long-Term Care Homes	0.0001 (0.0001 to 0.0191208)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.2307692 (0.2115385 to 0.2884615)	0.0001 (0.0001 to 0.0192308)

Supplemental Table 4. Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

		ED Visits [1]	**Hospitalizations** [1]	**ALC Days** [1]	**Primary Care Visits** [1]	**Specialist Physician Visits** [1]
	Home Care Recipients in the Community	0.0001 (0.0001 to 0.0707071)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0492958 (0.0001 to 0.168)	0.0384615 (0.0001 to 0.1891892)
	Community-Dwelling Older Adults	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0384615 (0.0192308 to 0.0769231)	0.0192308 (0.0001 to 0.0576923)
Females (*n* = 1,313,038)	Crude Rate	0.0001 (0.0001 to 0.0192308)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0576923 (0.0192308 to 0.1153846)	0.0192308 (0.0001 to 0.0576923)
	Residents of Retirement Homes	0.0192308 (0.0001 to 0.0644172)	0.0001 (0.0001 to 0.0196629)	0.0001 (0.0001 to 0.0001)	0.0769231 (0.0192308 to 0.1538462)	0.0001 (0.0001 to 0.0576923)
	Residents of Long-Term Care Homes	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.2307692 (0.2210526 to 0.2705314)	0.0001 (0.0001 to 0.0001)
	Home Care Recipients in the Community	0.0001 (0.0001 to 0.0384615)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0532319 (0.0001 to 0.15)	0.0192308 (0.0001 to 014)
	Community-Dwelling Older Adults	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0001 (0.0001 to 0.0001)	0.0576923 (0.0192308 to 0.0961538)	0.0192308 (0.0001 to 0.0384615)

Abbreviations: ALC, Alternate Levels of Care; ED, Emergency Department

[1] Medians and Interquartile Ranges are presented

Supplemental Table 5. Adjusted Beta Coefficients (Standard Errors) from Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

	ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Demographic Characteristics					
Age	0.002 (0.000) *	0.001 (0.000) *	0.034 (0.000) *	-0.002 (0.000) *	-0.018 (0.000) *
Sex					
Male	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Female	-0.026 (0.003) *	-0.163 (0.003) *	-0.092 (0.002) *	-0.023 (0.002) *	-0.100 (0.003) *
Clinical Comorbidities					
Asthma	0.159 (0.004) *	0.089 (0.004) *	-0.115 (0.003) *	0.160 (0.003) *	0.131 (0.004) *
Cancer	0.238 (0.004) *	0.694 (0.003) *	0.645 (0.003) *	0.178 (0.003) *	0.222 (0.003) *
Cardiac Arrhythmias	0.301 (0.004) *	0.335 (0.003) *	0.138 (0.003) *	0.119 (0.003) *	0.052 (0.005) *
Cerebrovascular Accident	0.251 (0.005) *	0.525 (0.005) *	1.080 (0.004) *	0.005 (0.004)	0.052 (0.005) *
Chronic Coronary Disease	0.188 (0.003) *	0.238 (0.003) *	-0.108 (0.003) *	0.064 (0.002) *	0.158 (0.003) *
Chronic Obstructive Pulmonary Disease	0.267 (0.003) *	0.329 (0.003) *	0.256 (0.003) *	0.079 (0.003) *	0.054 (0.003) *
Congestive Heart Failure	0.254 (0.005) *	0.630 (0.004) *	0.787 (0.004) *	0.001 (0.004)	0.072 (0.005) *
Dementia	-0.107 (0.006) *	0.007 (0.005)	1.083 (0.004) *	-0.138 (0.004) *	-0.237 (0.005) *
Diabetes	0.060 (0.003) *	0.079 (0.003) *	0.124 (0.002) *	0.215 (0.002) *	0.075 (0.003) *
Hypertension	0.134 (0.003) *	0.238 (0.003) *	0.088 (0.003) *	0.298 (0.002) *	0.132 (0.003) *
Mood Disorders	0.203 (0.003) *	0.023 (0.003) *	0.126 (0.002) *	0.222 (0.002) *	0.192 (0.003) *
Myocardial Infarction	0.207 (0.006) *	0.473 (0.005) *	0.302 (0.004) *	-0.030 (0.004) *	-0.005 (0.005)
Osteoarthritis	0.155 (0.003) *	0.326 (0.003) *	-0.140 (0.002) *	0.212 (0.002) *	0.287 (0.003) *
Osteoporosis	0.003 (0.004)	-0.062 (0.004) *	0.150 (0.003) *	0.174 (0.003) *	0.191 (0.004) *
Other Mental Health	0.165 (0.003) *	0.122 (0.003) *	0.397 (0.003) *	0.161 (0.002) *	0.228 (0.003) *
Renal Disease	0.223 (0.005) *	0.440 (0.005) *	0.665 (0.004) *	0.056 (0.004) *	0.475 (0.005) *
Rheumatoid Arthritis	0.166 (0.008) *	0.196 (0.008) *	0.307 (0.007) *	0.056 (0.006) *	0.301 (0.008) *

Supplemental Table 5. Adjusted Beta Coefficients (Standard Errors) from Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

	ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Community Characteristics					
Location					
Rural	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Urban	-0.532 (0.004) *	-0.126 (0.004) *	-0.152 (0.003) *	0.289 (0.003) *	0.243 (0.004) *
Neighborhood Income Quintile					
1 (Least)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
2	-0.084 (0.004) *	-0.040 (0.004) *	-0.289 (0.003) *	0.032 (0.003) *	0.081 (0.004) *
3	-0.121 (0.005) *	-0.069 (0.004) *	-0.422 (0.004) *	0.050 (0.003) *	0.124 (0.004) *
4	-0.168 (0.005) *	-0.071 (0.005) *	-0.419 (0.004) *	0.062 (0.004) *	0.167 (0.005) *
5 (Highest)	-0.226 (0.005) *	-0.065 (0.005) *	-0.447 (0.004) *	0.053 (0.004) *	0.257 (0.005) *
Ontario Marginalization Index Summary Score	-0.043 (0.002) *	-0.042 (0.002) *	-0.009 (0.002) *	0.033 (0.002) *	0.062 (0.002) *
Constant	-5.016 (0.017) *	-7.243 (0.016) *	-10.781 (0.013) *	-3.694 (0.013) *	-3.364 (0.016) *

Abbreviations: ALC, Alternate Levels of Care; ED, Emergency Department

* $P < .001$

Supplemental Table 6. Sex-Stratified Subgroup Analysis Adjusted Beta Coefficients (Standard Errors) from Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

		ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Males	**Demographic Characteristics**					
	Age	0.003 (0.000) *	0.002 (0.000) *	0.038 (0.000) *	0.002 (0.000) *	-0.011 (0.000) *
	Clinical Comorbidities					
	Asthma	0.156 (0.007) *	0.080 (0.006) *	-0.044 (0.005) *	0.181 (0.005) *	0.129 (0.006) *
	Cancer	0.251 (0.005) *	0.677 (0.005) *	0.635 (0.004) *	0.164 (0.004) *	0.744 (0.005) *
	Cardiac Arrhythmias	0.282 (0.005) *	0.341 (0.005) *	0.004 (0.004)	0.105 (0.004) *	0.216 (0.005) *
	Cerebrovascular Accident	0.233 (0.007) *	0.491 (0.006) *	1.208 (0.005) *	-0.008 (0.005)	0.036 (0.006) *
	Chronic Coronary Disease	0.190 (0.005) *	0.283 (0.004) *	-0.171 (0.004) *	0.071 (0.004) *	0.186 (0.004) *
	Chronic Obstructive Pulmonary Disease	0.270 (0.005) *	0.312 (0.005) *	0.208 (0.004) *	0.092 (0.004) *	0.048 (0.005) *
	Congestive Heart Failure	0.256 (0.007) *	0.584 (0.006) *	0.829 (0.005) *	-0.013 (0.005) **	0.083 (0.006) *
	Dementia	-0.081 (0.009) *	0.015 (0.008)	1.214 (0.006) *	-0.122 (0.007) *	-0.169 (0.008) *
	Diabetes	0.046 (0.004) *	0.064 (0.004) *	0.097 (0.003) *	0.248 (0.003) *	0.086 (0.004) *
	Hypertension	0.104 (0.005) *	0.215 (0.004) *	0.031 (0.004) *	0.316 (0.003) *	0.158 (0.004) *
	Mood Disorders	0.173 (0.004) *	0.026 (0.004) *	0.175 (0.003) *	0.211 (0.003) *	0.168 (0.004) *
	Myocardial Infarction	0.189 (0.007) *	0.410 (0.007) *	0.180 (0.006) *	-0.035 (0.005) *	-0.026 (0.007) *

Supplemental Table 6. Sex-Stratified Subgroup Analysis Adjusted Beta Coefficients (Standard Errors) from Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

		ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
	Osteoarthritis	0.163 (0.004) *	0.297 (0.04) *	-0.136 (0.003) *	0.209 (0.003) *	0.272 (0.004) *
	Osteoporosis	0.004 (0.010)	-0.002 (0.010)	0.309 (0.008) *	0.190 (0.008) *	0.209 (0.009) *
	Other Mental Health	0.156 (0.005) *	0.116 (0.004) *	0.324 (0.004) *	0.152 (0.003) *	0.222 (0.004) *
	Renal Disease	0.195 (0.007) *	0.407 (0.007) *	0.761 (0.006) *	0.052 (0.005) *	0.490 (0.006) *
	Rheumatoid Arthritis	0.175 (0.015) *	0.187 (0.014) *	-0.109 (0.012) *	0.052 (0.001) *	0.305 (0.014) *
	Community Characteristics					
	Location					
	Rural	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Urban	-0.531 (0.006) *	-0.094 (0.006) *	-0.011 (0.005)	0.302 (0.004) *	0.235 (0.005) *
	Neighborhood Income Quintile					
	1 (Least)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	2	-0.105 (0.007) *	-0.068 (0.006) *	-0.446 (0.005) *	0.034 (0.005) *	0.077 (0.006) *
	3	-0.129 (0.007) *	-0.094 (0.007) *	-0.516 (0.005) *	0.047 (0.005) *	0.121 (0.006) *
	4	-0.187 (0.008) *	-0.099 (0.007) *	-0.502 (0.006) *	0.058 (0.006) *	0.162 (0.007) *
	5 (Highest)	-0.245 (0.008) *	-0.074 (0.007) *	-0.524 (0.006) *	0.046 (0.006) *	0.247 (0.007) *
	Ontario Marginalization Index Summary Score	-0.040 (0.003) *	-0.019 (0.003) *	-0.029 (0.002) *	0.031 (0.003) *	0.051 (0.003) *
	Constant	-5.121 (0.026) *	-7.395 (0.024) *	-11.058 (0.018) *	-4.049 (0.019) *	-3.857 (0.024) *
Females	**Demographic Characteristics**					

Supplemental Table 6. Sex-Stratified Subgroup Analysis Adjusted Beta Coefficients (Standard Errors) from Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

	ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
Age	0.001 (0.000) *	0.000 (0.000)	0.029 (0.000) *	-0.005 (0.000) *	-0.022 (0.000) *
Clinical Comorbidities					
Asthma	0.157 (0.005) *	0.092 (0.005) *	-0.173 (0.004) *	0.148 (0.004) *	0.130 (0.005) *
Cancer	0.223 (0.005) *	0.710 (0.005) *	0.679 (0.004) *	0.180 (0.004) *	0.675 (0.005) *
Cardiac Arrhythmias	0.315 (0.005) *	0.332 (0.005) *	0.266 (0.004) *	0.128 (0.004) *	0.222 (0.005) *
Cerebrovascular Accident	0.267 (0.007) *	0.566 (0.006) *	0.971 (0.005) *	0.014 (0.005)	0.063 (0.007) *
Chronic Coronary Disease	0.192 (0.005) *	0.201 (0.004) *	-0.041 (0.004) *	0.055 (0.003) *	0.128 (0.004) *
Chronic Obstructive Pulmonary Disease	0.264 (0.005) *	0.344 (0.004) *	0.331 (0.004) *	0.064 (0.003) *	0.055 (0.004) *
Congestive Heart Failure	0.260 (0.007) *	0.672 (0.006) *	0.750 (0.005) *	0.016 (0.005)	0.061 (0.006) *
Dementia	-0.119 (0.008) *	0.001 (0.007)	1.095 (0.005) *	-0.146 (0.005) *	-0.285 (0.007) *
Diabetes	0.074 (0.004) *	0.094 (0.004) *	0.128 (0.003) *	0.184 (0.003) *	0.066 (0.004) *
Hypertension	0.162 (0.004) *	0.257 (0.004) *	0.189 (0.003) *	0.290 (0.003) *	0.117 (0.004) *
Mood Disorders	0.224 (0.004) *	0.017 (0.004) *	0.102 (0.003) *	0.228 (0.003) *	0.207 (0.004) *
Myocardial Infarction	0.244 (0.009) *	0.565 (0.008) *	0.553 (0.007) *	-0.030 (0.007) *	0.012 (0.008)
Osteoarthritis	0.149 (0.004) *	0.351 (0.003) *	-0.133 (0.003) *	0.217 (0.003) *	0.299 (0.004) *
Osteoporosis	0.006 (0.004)	-0.067 (0.004) *	0.108 (0.003) *	0.172 (0.003) *	0.191 (0.004) *

Supplemental Table 6. Sex-Stratified Subgroup Analysis Adjusted Beta Coefficients (Standard Errors) from Annual, Standardized Health Service Rates Among Residents of Retirement Homes, Residents of Long-Term Care Homes, and Home Care Recipients in the Community in 2018

		ED Visits	**Hospitalizations**	**ALC Days**	**Primary Care Visits**	**Specialist Physician Visits**
	Other Mental Health	0.178 (0.005) *	0.128 (0.004) *	0.348 (0.004) *	0.171 (0.003) *	0.233 (0.004) *
	Renal Disease	0.250 (0.007) *	0.470 (0.007) *	0.599 (0.006) *	0.050 (0.005) *	0.448 (0.007) *
	Rheumatoid Arthritis	0.166 (0.010) *	0.201 (0.009) *	0.501 (0.008) *	0.058 (0.007) *	0.297 (0.009) *
	Community Characteristics					
	Location					
	Rural	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Urban	-0.534 (0.006) *	-0.153 (0.005) *	-0.203 (0.005) *	0.276 (0.004) *	0.250 (0.005) *
	Neighborhood Income Quintile					
	1 (Least)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	2	-0.066 (0.006) *	-0.015 (0.005)	-0.130 (0.005) *	0.030 (0.004) *	0.082 (0.005) *
	3	-0.117 (0.006) *	-0.049 (0.006) *	-0.328 (0.005) *	0.051 (0.005) *	0.123 (0.006) *
	4	-0.151 (0.007) *	-0.044 (0.006) *	-0.328 (0.005) *	0.063 (0.005) *	0.167 (0.007) *
	5 (Highest)	-0.211 (0.007) *	-0.057 (0.007) *	-0.358 (0.006) *	0.056 (0.005) *	0.261 (0.007) *
	Ontario Marginalization Index Summary Score	-0.046 (0.003) *	-0.062 (0.003) *	-0.001 (0.002)	0.035 (0.002) *	0.070 (0.003) *
	Constant	-4.999 (0.023) *	-7.294 (0.021) *	-10.640 (0.017) *	-3.468 (0.017) *	-3.109 (0.022) *

Abbreviations: ALC, Alternate Levels of Care; ED, Emergency Department

* $P < .001$

Chapter 3: Characteristics of Retirement Homes Associated with the Provision of a Dementia Care Program

Preface

This chapter identifies the characteristics of retirement homes that are associated with the provision of a dementia care program. This chapter identifies how retirement homes that provide specialized care for dementia resemble long-term care homes. Identifying how retirement homes are similar and dissimilar from long-term care homes provides insight into how the retirement home and assisted living sector is a substitute congregate care home for older adults in Ontario, Canada.

I was responsible for designing the study in conjunction with my supervisor, Dr. Andrew P. Costa. I acquired the data in conjunction with Ahmad Rahim and Dr. Costa. I was responsible for the cleaning the data, conducting the statistical analyses, and writing the manuscript. All other authors critically read the manuscript and contributed important intellectual content. All authors read and approved the final manuscript

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Do Assisted Living Facilities That Offer a Dementia Care Program Differ from Those That Do Not? A Population-Level Cross-Sectional Study in Ontario, Canada

Abstract

Background: Many residents of assisted living facilities live with dementia, but little is known about the characteristics of assisted living facilities that provide specialized care for older adults who live with dementia. In this study, we identify the characteristics of assisted living facilities that offer a dementia care program, compared to those that do not offer such a program.

Methods: We conducted a population-level cross-sectional study on all licensed assisted living facilities in Ontario, Canada in 2018 (n = 738). Facility-level characteristics (e.g., resident and suite capacities, etc.) and the provision of the other 12 provincially regulated care services (e.g., pharmacist and medical services, skin and wound care, etc.) attributed to assisted living facilities were examined. Multivariable Poisson regression with robust standard errors was used to model the characteristics of assisted living facilities associated with the provision of a dementia care program.

Results: There were 123 assisted living facilities that offered a dementia care program (16.7% versus 83.3% no dementia care). Nearly half of these facilities had a resident capacity exceeding 140 older adults (44.7% versus 21.6% no dementia care) and more than 115 suites (46.3% versus 20.8% no dementia care). All assisted living facilities that offered a dementia care program also offered nursing services, meals, assistance with bathing and hygiene, and administered medications. After adjustment for facility characteristics and other provincially regulated care services, the prevalence of a dementia care program was nearly three times

greater in assisted living facilities that offered assistance with feeding (Prevalence Ratio [PR] 2.91, 95% Confidence Interval [CI] 1.98 to 4.29), and almost twice as great among assisted living facilities that offered medical services (PR 1.78, 95% CI 1.00 to 3.17), compared to those that did not.

Conclusions: A dementia care program was more prevalent in assisted living facilities that housed many older adults, had many suites, and offered at least five of the other 12 regulated care services. Our findings deepen the understanding of specialized care for dementia in assisted living facilities.

Keywords: Assisted Living Facilities; Retirement Homes; Dementia Care; Canada

Introduction

Dementia affects more than half of all residents who reside in assisted living facilities (1–3). Older adults who live with dementia are more likely to experience injuries requiring acute care, be diagnosed with pneumonia, and encounter difficulties with eating (4,5). Care for dementia is expensive and a widely cited reason for older adults requiring placement in a nursing home (6–9). Specialized care for older adults who live with dementia, such as a dementia care program, has demonstrated reductions in acute health service use and transitions to a nursing home (8,10).

Assisted living facilities provide congregate care in a residential setting to support independent living (11,12), and assisted living facilities are referred to as retirement homes in Ontario, Canada. Assisted living facilities and retirement homes in the United States and Canada are regulated at the state- or provincial-level (12–14). Ontario is the only jurisdiction that regulates the sector through an independent, not-for-profit regulator (i.e., Retirement Homes Regulatory Authority [RHRA]) (15). All licensed assisted living facilities in Ontario must provide, at a minimum, any two of the 13 provincially regulated care services to six or more older adults (16). The assisted living and retirement home sector in Ontario has a resident capacity equivalent to that of its nursing home sector (i.e., more than 70,000 older adults) (15), yet population-level studies of the sector pales in comparison to the nursing home sector. Unlike nursing homes, residency in a retirement home is exclusively financed through private, out-of-pocket payments by residents and/or their family caregivers (15,17,18).

Much of the literature on dementia care in assisted living facilities addresses health service use among residents who live with dementia, managing staff, and state-level

regulations for dementia care (1,14,19–21). Studies that explicitly investigate the characteristics of assisted living facilities or retirement homes that provide specialized care for dementia (i.e., a dementia care program), and how these characteristics compare to those that do not, has not received sufficient attention. The findings from such studies are important for identifying case mix and examining scope and breadth of care for older adults with complex care needs. A growing proportion of residents of assisted living facilities live with dementia (22), and improving the understanding of dementia care programs in assisted living facilities contributes to informing the sector, community-based dementia care, and national dementia care strategies.

In this study, we identify the characteristics of licensed assisted living facilities that offer a dementia care program compared to assisted living facilities that do not offer such a program in Ontario, Canada. As a dementia care program is the least prevalent regulated care service offered in assisted living facilities in Ontario, we hypothesize assisted living facilities that offer a dementia care program have an array of care services to support aging in place among residents. Our hypothesis is supported by other studies that investigated enhanced programming and special care units for dementia in assisted living facilities (23,24).

Methods

Study Design and Setting

We conducted a population-level cross-sectional study in Ontario, Canada at ICES. ICES is an independent, non-profit research institute funded by an annual grant from the Ontario Ministry of Health (MOH) and the Ministry of Long-Term Care (MLTC). As a prescribed entity under Ontario's privacy legislation, ICES is authorized to collect and use

health care data for the purposes of health system analysis, evaluation, and decision support. Secure access to these data is governed by policies and procedures that are approved by the Information and Privacy Commissioner of Ontario. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement guideline was followed (Supplemental Table 3) (25).

Data and Study Population

A list of all licensed assisted living facilities in Ontario in 2018 was obtained from the public register of the RHRA and imported to ICES (n = 757). The postal code of each assisted living facility was linked to Statistics Canada's Postal Code Conversion file, which is a specialized macro for use with health system administrative datasets containing postal codes. This macro is based on 2016 Census information, flags communities with a population less than 10,000 individuals as rural, and includes related data from Canada Post Corporation (26). These datasets were linked using unique encoded identifiers and analyzed at ICES. Nineteen assisted living facilities (n = 19) were removed from the analysis because of missing facility-level and postal code data.

Exposures

The exposures of interest are facility-level characteristics (i.e., urban location, resident capacity, total suites, chain facility, residential home status, and co-location with a nursing home) and the other 12 provincially regulated care services offered in an assisted living facility (i.e., assistance with bathing, hygiene, ambulation, feeding, and dressing; continence care; skin and wound care; provision of meals; administration of medications; pharmacist, nursing, and medical services) (Supplemental Table 1).

Outcome

The primary outcome is whether the assisted living facility offered a dementia care program. Dementia care programs in assisted living facilities in Ontario are regulated to include communication strategies, mental stimulation activities, health and wellness monitoring and promotion, and identification of triggers for responsive behaviours (27). These programs must also be supervised by a regulated health care professional (e.g., registered nurse, physician, etc.), align with current evidence and best practices for dementia care, and be evaluated annually (27).

Statistical Analysis

Counts, percentages, and standardized differences were calculated to describe the facility-level and care service characteristics of assisted living facilities that offered, and did not offer, a dementia care program. Multivariable Poisson regression with robust standard errors was used to model unadjusted and adjusted estimates with 95% confidence intervals to identify the characteristics of assisted living facilities associated with the provision of a dementia care program (28). Tests were two-tailed, and the level of statistical significance was set at $\alpha = 0.05$. The deviance goodness-of-fit test was calculated to assess whether the Poisson regression model was appropriate. Variance inflation factors were calculated to assess for multicollinearity. Dataset processing was conducted in SAS Enterprise 9.4 (Cary, NC, USA) and statistical analyses were conducted in Stata MP 16.1 (College Station, TX, USA).

Results

There were 738 licensed assisted living facilities in Ontario in 2018 ($n = 738$). Of these, 123 offered a dementia care program (16.7% versus 83.3% no dementia care program),

and almost all were located in an urban area (92.7% versus 82.6% no dementia care program) (Table 1). Nearly half of these assisted living facilities had a resident capacity of 140 or more (44.7% versus 21.6% no dementia care program) and had more than 115 suites (46.3% versus 20.8% no dementia care program). All assisted living facilities that offered a dementia care program also provided nursing services, meals, assistance with bathing and hygiene, and administered medications (n = 123). In addition, very few (i.e., six or fewer) assisted living facilities that offered a dementia care program did not offer assistance with ambulation and dressing, pharmacist services, and continence care. Many of the standardized differences between assisted living facilities that offered a dementia care program and those that did not exceeded 10%, which indicated that assisted living facilities that offered a dementia care program were systematically different from those that did not.

Assistance with bathing and hygiene, provision of meals, administration of medications, and nursing services were removed from the adjusted model because of collinearity, and there was no evidence of multicollinearity in the adjusted model (i.e., variance inflation factors equal to or greater than a value of 10). The deviance goodness-of-fit statistic was not statistically significant. After adjustment for facility characteristics and regulated care services, the prevalence of a dementia care program was almost three times greater in assisted living facilities with 115 or more suites (Prevalence Ratio [PR] 2.78, 95% Confidence Interval [CI] 1.09 to 7.07) compared to assisted living facilities with 41 or fewer suites (Table 2). The prevalence of a dementia care program was nearly three times greater in assisted living facilities that offered assistance with feeding (PR 2.91, 95% CI 1.98 to 4.29), and the prevalence of a dementia care program was almost twice as great in assisted living facilities that offered medical services (PR 1.78, 95% CI 1.00 to 3.17), compared to assisted

living facilities that did not offer these care services. The prevalence of a dementia care program was substantially greater in assisted living facilities that offered continence care (PR 13.51, 95% CI 1.64 to 111.67) compared to assisted living facilities that did not offer this care service.

Discussion

Assisted living facilities that offered a dementia care program were systematically different from those that did not offer such a program. Specifically, assisted living facilities in Ontario that offered a dementia program had large resident capacities, many suites, and offered, at a minimum, nursing services, meals, assistance with bathing and hygiene, and administered medications. The prevalence of a dementia care program in an assisted living facility was greater in assisted living facilities where assistance with feeding, medical services, and continence care were also offered.

More than 90% of assisted living facilities that offered a dementia care program were located in urban communities. Consistent with existing literature, this finding raises important equity considerations for older adults who live with dementia in assisted living facilities located in rural and remote regions (29). Rural assisted living facilities house fewer older adults and are more likely to have deficiencies in care provision than urban ones, including challenges with retaining appropriate care staff and resources to meet the needs of residents (30). The use of videoconferencing and other information technology resources to offer dementia care should be considered to improve access to care for older adults who live with dementia in rural and remote areas (31).

Most assisted living facilities that offered a dementia care program had capacity for more than 140 older adults and had more than 115 suites. Current practices for designing settings specifically for older adults who live with dementia emphasize larger spaces that are not characteristic of institutionalized congregate care (32), and the presence and statistically significant association of many suites in assisted living facilities that offer a dementia care program aligns with the literature. In addition, this may indicate that many assisted living facilities that offer a dementia care program are large complexes, likely attributed to chains.

Given the challenges that older adults who live with dementia face with respect to eating (5), it is expected that assistance with feeding would be a prevalent care service offered alongside a dementia care program in an assisted living facility. Moreover, the complex and intersecting care needs of older adults who live with dementia, which includes polypharmacy (33), underscores the need for on-going medical care. As such, the prevalence of medical services in assisted living facilities that offer a dementia care program is also expected. There was a greater proportion of assisted living facilities that offered skin and wound care among assisted living facilities that offered a dementia care program compared to those that did not. However, there was no statistically significant association with this care service and the provision of a dementia care program in the adjusted model. This finding raises important safety considerations, as residents of assisted living facilities who live with advanced dementia may be bed-bound or have mobility issues that can contribute to the development of pressure ulcers (34).

As the assisted living sector is privately financed in Ontario, our study makes an important contribution to the literature to define the sector by modeling facility-level characteristics associated with the provision of a dementia care program. Our findings are

relevant to clinicians and policymakers actively considering dementia care options in communities to support older adults who live with dementia and their caregivers. Family caregivers and consumers of assisted living services will also be interested in our findings to inform their decisions for housing and congregate care.

In North America, the regulatory requirements for assisted living facilities vary between all states and provinces (34). In all other provinces and territories in Canada, assisted living facilities are periodically inspected by the government for compliance with the legislative and regulatory requirements in their jurisdiction. The assisted living sector has substantially grown over the past decade in response to the varying health and social needs and preferences of older adults for care and housing (11,17,18,34). Understanding the characteristics of assisted living facilities that offer a dementia care program informs national dementia care strategies to support older adults to age in place and reduce the demand for a bed in a nursing home associated with advanced dementia (35).

With respect to limitations, the fees charged by assisted living facilities for room and board and care services each month could not be included in the adjusted model. This is due, in part, to the inability to retrieve this information from existing administrative health system data. Moreover, these fees are not publicly available on the websites of assisted living facilities, through their member associations, or available to the RHRA through regulatory reporting requirements. In addition, variables related to staff training, type, and ratios were unavailable, as there are no regulatory reporting requirements of these to the RHRA as a condition for licensing. Another limitation is that our study is descriptive; as such, no causal or temporal claims can be made about the associations between the facility-level characteristics of assisted living facilities and the provision of a dementia care program. As

with all secondary analyses of data, the data used in our study are susceptible to misclassification bias.

Conclusions

Our study identified and compared facility-level characteristics of licensed assisted living facilities that offered a dementia care program to those that did not in Ontario, Canada in 2018. Assisted living facilities that offered a dementia care program housed more older adults and provided more care services. Future research might consider investigating the underlying differences in populations between residents of these facilities and their health outcomes attributed to care services offered in assisted living facilities. In addition, research that examines the quality of dementia care programs and the attributes of these programs is warranted.

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Table 1. Descriptive Characteristics of Licensed Assisted Living Facilities in 2018 (*n* = 738)

	Dementia Care Program		**Standardized Difference**
	Yes	**No**	
n (%)	123 (16.7)	615 (83.3)	
Facility Characteristics, *n* (%)			
Urban Location	114 (92.7)	508 (82.6)	0.309
Facility Capacity			0.583
6 to 49	24 (19.5)	155 (25.2)	
50 to 86	14 (11.4)	171 (27.8)	
87 to 139	30 (24.4)	156 (25.4)	
140+	55 (44.7)	133 (21.6)	
Total Suites			0.615
6 to 41	20 (16.3)	163 (26.5)	
42 to 70	16 (13.0)	168 (27.3)	
71 to 114	30 (24.4)	156 (25.4)	
115+	57 (46.3)	128 (20.8)	
Chain Status	74 (60.2)	281 (45.7)	0.293
Residential Home	8 (6.5)	71 (11.5)	0.176
Co-Located with Nursing Home	19 (15.4)	112 (18.2)	0.073
Care Services, *n* (%)			
Assistance with Bathing	123 (100.0)	581 (94.5)	0.342
Assistance with Hygiene	123 (100.0)	531 (86.3)	0.562
Assistance with Ambulation	117 to 123 (95.1 to 100.0) †	517 (84.1)	0.480
Assistance with Feeding	89 (72.4)	185 (30.1)	0.933
Assistance with Dressing	117 to 123 (95.1 to 100.0) †	532 (86.5)	0.507
Continence Care	117 to 123 (95.1 to 100.0) †	457 (74.3)	0.788
Skin and Wound Care	47 (38.2)	113 (18.4)	0.451
Provision of Meals	123 (100.0)	609 to 615 (99.0 to 100.0) †	0.057
Administration of Medications	123 (100.0)	609 to 615 (99.0 to 100.0) †	0.114
Pharmacist Services	117 to 123 (95.1 to 100.0) †	535 (87.0)	0.287
Nursing Services	123 (100.0)	574 (93.3)	0.377
Medical Services	107 (87.0)	401 (65.2)	0.528

† Small cell sizes (i.e., where six or fewer assisted living facilities have, or do not have, a characteristic) are suppressed due to privacy restrictions at ICES.

Table 2. Associations with the Provision of a Dementia Care Program in Licensed Assisted Living Facilities

	Unadjusted PR (95% CI)	**Adjusted PR (95% CI) †**
Facility Characteristics		
Urban	2.26 (1.23 to 4.52) **	1.15 (0.61 to 2.17)
Facility Capacity		
6 to 49	1.00 (Reference)	1.00 (Reference)
50 to 86	0.56 (0.30 to 1.06)	0.34 (0.18 to 0.66) **
87 to 139	1.20 (0.73 to 1.98)	0.43 (0.20 to 0.93) *
140+	2.18 (1.41 to 3.37) ***	0.59 (0.25 to 1.42)
Total Suites		
6 to 41	1.00 (Reference)	1.00 (Reference)
42 to 70	0.80 (0.43 to 1.49)	1.40 (0.73 to 2.70)
71 to 114	1.48 (0.87 to 2.50)	2.28 (1.02 to 5.11) *
115+	2.82 (1.77 to 4.50) ***	2.78 (1.09 to 7.07) *
Chain Status	1.63 (1.17 to 2.27) **	1.21 (0.88 to 1.67)
Residential Home	0.58 (0.29 to 1.14)	0.75 (0.35 to 1.61)
Co-Located with a Nursing Home	0.85 (0.54 to 1.33)	1.21 (0.78 to 1.87)
Care Services		
Assistance with Ambulation	6.34 (2.05 to 19.57) **	0.96 (0.34 to 2.75)
Assistance with Feeding	4.43 (3.07 to 6.39) ***	2.91 (1.98 to 4.29) ***
Assistance with Dressing	15.67 (2.22 to 110.82) **	2.24 (0.26 to 18.96)
Continence Care	33.50 (4.71 to 238.20) ***	13.51 (1.64 to 111.67) *
Skin and Wound Care	2.23 (1.62 to 3.07) ***	1.18 (0.85 to 1.63)
Pharmacist Services	2.57 (1.17 to 5.66) *	0.91 (0.38 to 2.21)
Medical Services	3.03 (1.83 to 5.00) ***	1.78 (1.00 to 3.17) *

Abbreviations: PR, Prevalence Ratio; CI, Confidence Interval

†Adjusted for all variables in the table

* $P < .05$; ** $P < .01$; *** $P < .001$

Supplementary Material

Supplemental Table 1. Detailed Descriptions of Exposures

Variable	Description
Urban	Based on the PCCF flag, which is a specialized macro for use with health system administrative datasets containing postal codes. This macro is based on 2016 Census information, flags communities with a population less than 10,000 individuals as rural, and it includes related data from Canada Post Corporation.
Facility Capacity	Resident capacity of the assisted living facilities. This variable was transformed into quartiles for ease of interpretation.
Total Suites	Number of suites in the assisted living facility. This variable was transformed into quartiles for ease of interpretation.
Chain Status	Binary variable specifying whether the assisted living facility is part of a chain. Chains are defined as two or more assisted living facilities owned and operated by the same entity.
Residential Home	Binary variable specifying whether the assisted living facility is a residential home. Residential homes are not facilities and are located in residential areas.
Co-Located with a Nursing Home	Binary variable specifying whether the assisted living facility is co-located with a nursing home in the same building or land site.
Assistance with Bathing	Binary variable specifying whether the assisted living facility provides bathing respecting privacy and preferences.
Assistance with Hygiene	Binary variable specifying whether the assisted living facility provides grooming, oral care, foot care, and care for fingernails.
Assistance with Ambulation	Binary variable specifying whether the assisted living facility provides assistance with mobility devices and transferring and positioning techniques.
Assistance with Feeding	Binary variable specifying whether the assisted living facility provides assistance to residents to eat and drink safely, including assistance inserting and removing dentures.
Assistance with Dressing	Binary variable specifying whether the assisted living facility provides assistance with dressing, consistent with time of day and weather conditions.
Continence Care	Binary variable specifying whether the assisted living facility provides continence products and measures to prevent constipation.
Skin and Wound Care	Binary variable specifying whether the assisted living facility provides interventions and routine care to maintain the integrity of the resident's skin, prevent wounds and infections, and other preventive measures (e.g., physiotherapy, etc.).

Supplemental Table 1. Detailed Descriptions of Exposures

Variable	Description
Provision of Meals	Binary variable specifying whether the assisted living facility provides meals supporting good nutrition standards, food service workers, and individualized meals, if required.
Administration of Medications	Binary variable specifying whether the assisted living facility stores medications and has regulated health professionals providing medication to residents consistent with their needs and care plans.
Pharmacist Services	Binary variable specifying whether the assisted living facility provides services from a pharmacist regulated by the Ontario College of Pharmacists.
Nursing Services	Binary variable specifying whether the assisted living facility provides services from a nurse regulated by the Ontario College of Nurses.
Medical Services	Binary variable specifying whether the assisted living facility provides services from a physician regulated by the Ontario College of Physicians and Surgeons.

Detailed descriptions of the care services are found in O. Reg. 166/11: GENERAL under *Retirement Homes Act, 2010, S.O. 2010, c. 11.* Available at: https://www.ontario.ca/laws/regulation/110166#BK47

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and Abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	p. 1,2	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	p. 1,2
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	p. 3,4		
Objectives	3	State specific objectives, including any prespecified hypotheses	p. 4		
Methods					

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Study Design	4	Present key elements of study design early in the paper	p. 4		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	p. 4		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods	p. 5	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.	p. 5

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	p. 5	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	p. 5
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).	p. 5		

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		Describe comparability of assessment methods if there is more than one group			
Bias	9	Describe any efforts to address potential sources of bias	p. 5		
Study size	10	Explain how the study size was arrived at	p. 5,6		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	p. 5,6		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed	p. 5,6		

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		(d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	p. 5
Linkage		..		RECORD 12.3: State whether the study included person-level,	p. 5

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
				institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	p. 6,7	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	p. 6,7
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders	p. 6,7		

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		(b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)			
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	p. 6		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95%	p. 7,8		

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period			
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	N/A		
Discussion					
Key results	18	Summarise key results with reference to study objectives	p. 9		
Limitations	19	Discuss limitations of the study, taking into account sources of	p. 11	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer	p. 11

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		potential bias or imprecision. Discuss both direction and magnitude of any potential bias		the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	p. 9-11		
Generalisability	21	Discuss the generalisability (external validity) of the study results	p. 9-11		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which	p. 13		

Supplemental Table 2. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		the present article is based			
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	p. 12

Chapter 4: Transitions to a Long-Term Care Home Among Residents of Retirement Homes who had Access to a Dementia Care Program

Preface

This chapter builds on Chapter 2 by determining whether residents of retirement homes who had access to a dementia care program in their retirement home and were newly diagnosed with dementia had a lower rate of transition to a long-term care home. This chapter demonstrates how residents of retirement homes who live with dementia and have access to a dementia care program in their retirement home age in place and do not transition as quickly to a long-term care home compared to those without access to such a program. These findings support the argument that, among residents of retirement homes who live with dementia and have access to specialized care for dementia, retirement homes are a substitute congregate care setting for a long-term care home in Ontario, Canada.

I was responsible for the study design in consultation with Andrew P. Costa. I was also responsible for acquiring the data with Ahmad Rahim and Andrew P. Costa. I was solely responsible for the data cleaning, statistical analyses, and drafting the manuscript. All other authors critically read the manuscript and contributed important intellectual content to it. All authors read and approved the final version of the manuscript for publication.

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Association Between Dementia Care Programs in Assisted Living Facilities and Transitions to Nursing Homes in Ontario, Canada: A Population-Based Cohort Study

Abstract

Objective: We investigate whether older adults who were newly diagnosed with dementia (severity unspecified) and resided in an assisted living facility that offered a dementia care program had a lower rate of transition to a nursing home, compared to those who resided in an assisted living facility without such a program.

Design: Population-based retrospective cohort study.

Setting and Participants: Linked, person-level health system administrative data on older adults who were newly diagnosed with dementia and resided in an assisted living facility in Ontario, Canada from 2014 to 2019 (n = 977).

Methods: Access to a dementia care program in an assisted living facility (n = 57) was examined. Multivariable Cox proportional hazards regression with robust standard errors clustered on the assisted living facility was used to model the time to transition to a nursing home from the new dementia diagnosis.

Results: There were 11.8 transitions to a nursing home per 100 person-years among older adults who resided in an assisted living facility with a dementia care program, compared to 20.5 transitions to a nursing home per 100 person-years among older adults who resided in an assisted living facility without a dementia care program. After adjustment for relevant characteristics at baseline, older adults who resided in an assisted living facility with a dementia care program had a 40% lower rate of transition to a nursing home (Hazard Ratio

0.60, 95% Confidence Interval 0.44 to 0.81), compared to those in an assisted living facility without such a program at any point during the follow-up period.

Conclusions and Implications: The rate of transition to a nursing home was significantly lower among older adults who resided in an assisted living facility that offered a dementia care program. These findings support the expansion of dementia care programs in assisted living facilities.

Keywords: Dementia Care; Assisted Living Facilities; Retirement Homes; Nursing Homes; Long-Term Care

Introduction

More than 400,000 older Canadians live with dementia (1). Older adults who live with dementia have increased acute care health service use attributed to injuries and/or accidents, and dementia has adverse impacts on family or friend caregivers (2,3). Care for dementia is costly and a frequently cited reason for older adults transitioning to a nursing home (4–7). Dementia care programs in assisted living facilities are an example of a specialized care program for older adults living with dementia (8,9). These programs may reduce or offset the demand for a bed in a nursing home by reducing caregiver distress and the behavioral symptoms associated with dementia (6,10). Currently, the demand for a bed in a nursing home in Canada exceeds the supply (11,12). Given this, understanding how dementia care programs affect transitions to a nursing home is an important question for policymakers who are grappling with strategies to support older adults who live with dementia in community settings while additional capacity is built in the nursing home sector.

Dementia care programs are designed to support people living with dementia, and these programs can also include support and assistance for family or friend caregivers (13,14). Dementia care programs can also support the triple aim in health care of improving patient experience, improving population health, and reducing health care expenditures (6,13,15). As such, identifying and evaluating the outcomes attributed to these programs contributes to informing health policies designed to strengthen systems of care for older adults. Previous studies of dementia care programs in assisted living facilities investigated staffing and time considerations for activities of daily living care and sleep patterns among older adults receiving such a program (8,9,16). However, the association between offering a

dementia care program in an assisted living facility and subsequent transitions in care represents a gap in the literature.

Assisted living facilities, which are referred to as retirement homes in Ontario, Canada, are private residences that provide congregate care to support independent living for older adults (17–19). The scope of service provision in these facilities ranges from independent, congregate living, to more intensive, supportive care similar to what is provided in a nursing home (9,11). They are also similar to assisted living facilities in the United States, as they are regulated at the state- or provincial-level (18–20). In Ontario, assisted living facilities are exclusively paid for out-of-pocket by residents and are regulated under separate legislation from nursing homes (11).

In this study, we investigate whether older adults who were newly diagnosed with dementia and resided in an assisted living facility that offered a dementia care program had a lower rate of transition to a nursing home compared to those who did not have such a program in their assisted living facility during the 2014 to 2019 period. We hypothesize that older adults who received a new dementia diagnosis and resided in an assisted living facility that offered a dementia care program would have a lower rate of transition to a nursing home. Our hypothesis is supported by studies that investigated community-based dementia care programs and determined that these programs were associated with reduced transitions to a nursing home (6,10,21).

Methods

Study Design and Setting

We conducted a population-based retrospective cohort study using linked, person-level health system administrative data in Ontario, Canada at ICES. ICES is an independent, non-profit research institute funded by an annual grant from the Ontario Ministry of Health (MOH) and the Ministry of Long-Term Care (MLTC). As a prescribed entity under Ontario's privacy legislation, ICES is authorized to collect and use health care data for the purposes of health system analysis, evaluation, and decision support. Secure access to these data is governed by policies and procedures that are approved by the Information and Privacy Commissioner of Ontario. The use of the data in this project is authorized under section 45 of Ontario's *Personal Health Information Protection Act* (PHIPA) and does not require review by a Research Ethics Board. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement guideline was followed (Supplemental Table 5) (22).

Data

The following health system administrative datasets were used: Residents of Retirement Homes Cohort; Registered Persons Database; Continuing Care Reporting System; Ontario Cancer Registry; National Ambulatory Care Reporting System; Discharge Abstract Database; Home Care Database; Ontario Health Insurance Plan database; and Postal Code Conversion File (Supplemental Table 1). These datasets were linked using unique encoded identifiers and analyzed at ICES.

Study Population

The creation of the population-level cohort of older adults who reside in assisted living facilities (i.e., Residents of Retirement Homes Cohort) is based on postal code linkage of older adults who are eligible for universal health insurance coverage to licensed assisted

living facilities in Ontario. A validated algorithm for identifying older adults who were newly diagnosed with dementia from January 1, 2014 to December 31, 2015 was used to establish the index event date among older adults who resided in assisted living facilities (n = 1,687) (23). This algorithm is based on physician billing codes to the universal health insurance plan and dispensed prescriptions for cholinesterase inhibitors (23). The algorithm requires three or more physician billing claims with a dementia diagnosis at least 30 days apart over a two-year period; or one or more hospitalizations or same day surgeries where a dementia diagnosis was recorded; or one or more dispensed prescription claims for a cholinesterase inhibitor (23). The algorithm has a sensitivity of 79%, specificity of 99%, and positive predictive value of 80% (23).

Older adults who resided in an assisted living facility and ever had a previous admission to a nursing home were excluded (n = 561), and older adults who had a short stay transition (i.e., less than 90 days) to a nursing home from their assisted living facility during the follow-up period were excluded (n = 62). Older adults who resided in assisted living facilities where two different facilities shared the same postal code, but only one facility offered a dementia care program, were also excluded (n = 38). There were 49 older adults with missing postal code and/or assisted living facility-level data who were removed from the analysis (n = 49). The remaining older adults were followed until they transitioned to a nursing home from their assisted living facility. Older adults were censored if they did not transition to a nursing home by December 31, 2019; died; moved out of the assisted living facility; or moved to an assisted living facility without a dementia care program from an assisted living facility with a dementia care program during the follow-up period (Figure 1).

Exposure

The main exposure of interest was whether the assisted living facility in which an older adult who lived with dementia resided offered a dementia care program. In Ontario, dementia care programs in assisted living facilities are regulated to include mental stimulation activities, safety monitoring, promoting quality of life and wellness, communication strategies, and behavioral trigger identification (24). These programs must also align with current evidence and prevailing practices, be supervised by a regulated health professional (e.g., registered nurse, physician, etc.), and be evaluated at least once per year (24). Dementia care programs in assisted living are supportive in nature and do not include enhanced access to specialized neurocognitive medical care. They are not a closed medical model with a specialized physician, which is often the case in nursing homes.

Outcome

The primary outcome was whether an older adult had an indefinite or long-stay (i.e., greater than 90 days) transition to a nursing home from their assisted living facility during the follow-up period. The time to the transition to a nursing home from the index event date was measured in years.

Covariates

The literature was used to inform the selection of covariates (4,25–27). Demographic characteristics at baseline were obtained from the Registered Persons database (i.e., age, sex, and neighborhood income). Health conditions (i.e., asthma, cancer, cardiac arrhythmia, cerebrovascular accident, chronic coronary syndrome, chronic obstructive pulmonary disease, congestive heart failure, diabetes, hypertension, inflammatory bowel disease, mood disorders, myocardial infarction, osteoarthritis, osteoporosis, other mental health, renal disease, and rheumatoid arthritis) at baseline were identified using the Ontario Cancer

Registry; billing codes from the Ontario Health Insurance Plan database, National Ambulatory Care Reporting System, and Discharge Abstract Database; and validated algorithms (23,28–34). Publicly funded home care service use at baseline was included from the Home Care database, as residency in an assisted living facility does not preclude a person from receiving these services under the universal health insurance plan in Ontario. Characteristics of assisted living facilities (e.g., urban location, resident capacity, all regulated care services provided in assisted living facilities, etc.) were included from the Residents of Retirement Homes Cohort and Postal Code Conversion File (Supplementary Table 1).

Statistical Analysis

Counts, proportions, and standardized differences for categorical variables describing the person-level characteristics were calculated at baseline (35). The incidence density rate, ratio, and difference were calculated. Mantel-Haenszel sex-stratified incidence rate ratios per predictor variable were calculated to determine whether sex was an effect modifier using the test of homogeneity, as dementia disproportionately affects women and more than half of the residents in assisted living facilities in Ontario are women. Kaplan-Meier survival curves illustrating survival probabilities were graphed and the log-rank test for equality of survivor functions was calculated. Sample size was calculated using at least 10 events per predictor variable ($n \geq 300$) (36,37). Multivariable Cox proportional hazards regression with robust standard errors clustered on the assisted living facility was used to model unadjusted and adjusted estimates with 95% confidence intervals. Tests were two-tailed, and the level of statistical significance was set at $\alpha = 0.05$. The proportional hazards assumption was tested to verify that it was not violated. The variance-covariance matrix of the predictor variable beta coefficients as a correlation matrix was examined to assess for multicollinearity. Dataset

processing was conducted in SAS Enterprise 9.4 (Cary, NC, USA) and statistical analyses were conducted in Stata MP 16.1 (College Station, TX, USA).

Results

There were 977 older adults who were newly diagnosed with dementia from January 1, 2014 to December 31, 2015 and resided in 353 unique assisted living facilities. Fifty-seven (16.1%) of these assisted living facilities offered a dementia care program. Many of the person-level demographic, health conditions, and publicly funded home care service use characteristics were similar (i.e., standardized differences less than 0.10) between residents who were newly diagnosed with dementia and resided in assisted living facilities that did, and did not, offer a dementia care program at baseline (Table 1).

There were 451 transitions to a nursing home during 2,433.63 person-years of follow-up (Incidence Density Rate 18.5 per 100 person-years, 95% Confidence Interval [CI] 16.9 to 20.3). There were 11.8 transitions to a nursing home (95% CI 9.3 to 15.0) per 100 person-years among older adults who resided in an assisted living facility with a dementia care program, compared to 20.5 transitions to a nursing home (95% CI 18.6 to 22.7) per 100 person-years among older adults who resided in an assisted living facility without a dementia care program (Incidence Density Ratio 0.58, 95% CI 0.44 to 0.75). There were 8.7 fewer transitions to a nursing home per 100 person-years that could be attributed to a dementia care program in an assisted living facility (Incidence Density Difference -8.7, 95% CI -5.2 to -12.2). Figure 2 illustrates the Kaplan-Meier survival probabilities among older adults who received a new dementia diagnosis and resided in an assisted living facility with a dementia

care program compared to those without such a program. The log-rank test for equality of survivor functions was statistically significant ($\chi^2 = 19.60$, $df = 1$; $P < .001$).

There was no evidence of multicollinearity (i.e., greater than 0.75 correlation between predictor variable beta coefficients), and sex did not modify the effect of any predictor variable included in the adjusted model (i.e., statistically significant test of homogeneity between sex-stratified rate ratios). The proportional hazards assumption was not violated. After adjustment for demographic characteristics, health conditions, and publicly funded home care service use at baseline, older adults who received a new dementia diagnosis and resided in an assisted living facility with a dementia care program had a 40% lower rate of transition to a nursing home (Hazard Ratio [HR] 0.60, 95% CI 0.44 to 0.81), compared to those without such a program at any point during the follow-up period (Table 2). Greater age was associated with an increased rate of transition to a nursing home. Older adults who resided in an assisted living facility between the ages of 85 to 94 had an increased rate of transition to a nursing home (HR 2.77, 95% CI 1.43 to 5.34), compared to those between the ages of 65 to 74 at any point during the follow-up period. Osteoarthritis (HR 1.44, 95% CI 1.05 to 1.96) and receipt of home care service use on a long-stay basis (HR 1.39, 95% CI 1.15 to 1.66) were associated with increased rates of transitions to a nursing home at any point during the follow-up period.

Discussion

Older adults who were newly diagnosed with dementia and resided in an assisted living facility with a dementia care program in Ontario, Canada had nearly half the rate of transition to a nursing home compared to those without such a program in their assisted

living facility. This finding has service provision and policy implications for how assisted living facilities provide specialized care for dementia to support the growing proportion of older adults who develop and live with dementia. In addition, policymakers who are investigating different strategies for reducing the demand for a bed in a nursing home among older adults who live with dementia may consider different regulatory and/or legislative levers regarding the scaling up of such programs in their jurisdictions.

Assisted living markets in the United States and Canada have experienced substantial growth in the past few decades (11,17,38,39), and the evolution of this sector can be partly attributed to the market responses for congregate care to support the health needs of older adults in response to the deficit of available beds in nursing homes. Our findings highlight different strategies to support older adults who live with dementia in the community without further straining existing resources in nursing homes. As older adults who resided in assisted living facilities with a dementia care program had fewer transitions to a nursing home, these assisted living facilities might have been a substitute congregate care environment for older adults who lived with dementia and were waiting for a bed in a nursing home (39).

A quarter of the older adults who resided in an assisted living facility with a dementia care program had the highest neighborhood income quintile compared to 12.5% of older adults who did not have such a program in their assisted living facility. Conversely, a quarter of the older adults who resided in an assisted living facility without a dementia care program had the lowest neighborhood income quintile compared to 16.3% of older adults who did have such a program in their assisted living facility. This underscores important equity considerations with respect to access to dementia care and ability to pay, as higher socioeconomic status is well-established to contribute to favorable health outcomes. Almost

half of all residents in assisted living facilities in Ontario, including other jurisdictions in the United States, live with dementia (40–42), and the protective association between a dementia care program and a transition to a nursing home indicates that there may be value for operators of assisted living facilities to consider broader implementation these programs for older adults who live with dementia.

Assisted living facilities that offer a dementia care program in Ontario, Canada are different from those that do not (43). These facilities are larger, offer more care services, and are more likely to be located in urban areas (43). Assistance with feeding and medical services were more prevalent in assisted living facilities that offered a dementia care program (43), but these and other regulated care services were not statistically significant in our analyses (Supplemental Tables 2 and 3). This finding indicates that there is a protective association attributed to a dementia care program in an assisted living facility, rather than to the other regulated care services that provide support for activities of daily living.

Older age, osteoarthritis, and the receipt of long-stay home care services were associated with increased rates of transition to a nursing home after multivariable regression adjustment. These person-level characteristics are aligned with the literature describing older adults who reside in a nursing home (44,45). Furthermore, older adults who receive publicly funded home care services on a long-stay basis have increased morbidity and needs for care. Osteoarthritis is noted in the literature among home care clients to negatively impact health-related quality of life (46), which would contribute to an increased rate of transition to a nursing home.

Our study makes an important contribution because much of the literature related to dementia in assisted living facilities examines prevalence of dementia among residents

(40,47), quality of life among residents living with dementia (48), and medication use and non-pharmacologic interventions to address agitation and aggression in residents living with dementia (49–53). Our study addresses a gap in the literature and investigates the temporal sequence among older adults who were newly diagnosed with dementia, resided in assisted living facilities, and transitioned to a nursing home. Second, almost all measured person-level demographic, health conditions, and publicly funded home care use characteristics between older adults who received a new dementia diagnosis and resided in assisted living facilities with and without a dementia care program had small, standardized differences at baseline. Third, our study extends the understanding of dementia care in assisted living facilities.

With respect to limitations, the data used in our study could not discern whether an older adult who resided in the assisted living facility paid to receive the dementia care program; the data only specified that a dementia care program existed in the assisted living facility. Furthermore, there may be variation in the attributes of a dementia care program offered between assisted living facilities, such as between chains and independent operators. These attributes are unknown and could not be included in our analysis. We could not determine the severity of the dementia diagnosis at the index event date. The validated algorithm used physician billing codes, which do not differentiate stages and severity of the dementia diagnosis (23). Our study is observational and used health system administrative data for secondary purposes. Given this, there is the potential for misclassification bias, as these data were not collected for research purposes, and residual confounding could also influence the results.

Conclusions and Implications

Older adults who were newly diagnosed with dementia and resided in an assisted living facility with a dementia care program had almost half the rate of transition to a nursing home compared to those who did not have such a program in their assisted living facility. The findings in our study support the expansion such programs in assisted living facilities to care for older adults living with dementia. Given the consistency in estimates of dementia care programs in our study and in other jurisdictions (6,10), future research should conduct randomized control trials on a dementia care program.

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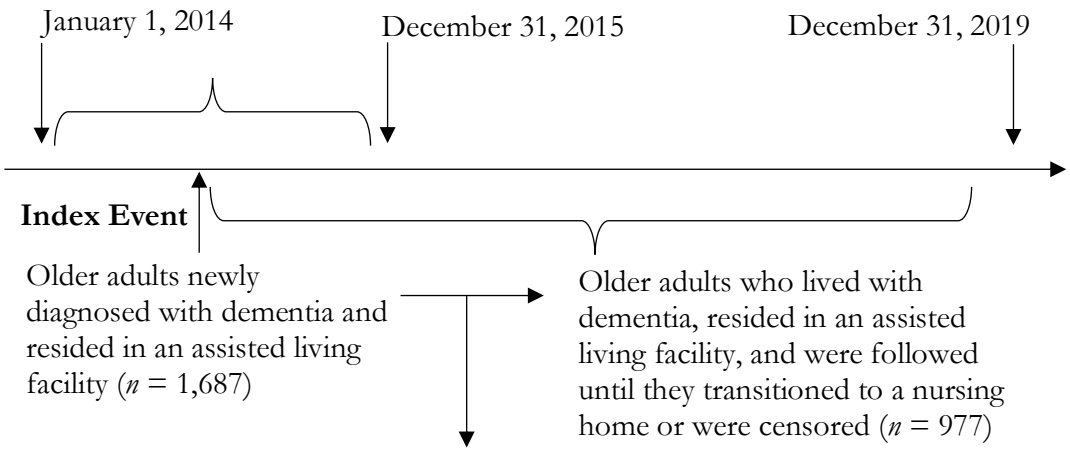
Figure 1. Creation of the Population-Based Sample



Excluded:

- Older adults who ever had a previous admission to a nursing home (*n* = 561)
- Older adults who had a short stay transition (i.e., less than 90 days) to a nursing home during the follow-up period (*n* = 62)
- Older adults who resided in two different assisted living facilities that shared the same postal code, but only one offered a dementia care program (*n* = 38)
- Older adults with missing postal code and/or assisted living facility-level data (*n* = 49)

Table 1. Demographic, Health Status, and Publicly Funded Home Care Service Characteristics of Residents of Assisted Living Facilities at Baseline (*n* = 977)

	Dementia Care Program		**Standardized Difference**
	Yes	**No**	
n (%)	203 (20.8)	774 (79.2)	
Transitions to a Nursing Home, *n* (%)	66 (32.5)	385 (49.7)	
Person-Years of Follow-Up	558.94	1,874.69	
Demographic Characteristics, *n* (%)			
Female	152 (74.9)	579 (74.8)	0.002
Age			0.133
65-74	1 to 6 (0.5 to 3.0) †	24 (3.1)	
75-84	37 (18.2)	150 (19.4)	
85-94	131 (64.5)	523 (67.6)	
95+	29 (14.3)	77 (9.9)	
Neighborhood Income			0.366
1 (Lowest Quintile)	33 (16.3)	193 (24.9)	
2	50 (24.6)	181 (23.4)	
3	32 (15.8)	133 (17.2)	
4	37 (18.2)	170 (22.0)	
5 (Highest Quintile)	51 (25.1)	97 (12.5)	
Health Conditions, *n* (%)			
Asthma	34 (16.7)	122 (15.8)	0.027
Cancer	54 (26.6)	177 (22.9)	0.087
Cardiac Arrhythmia	64 (31.5)	268 (34.6)	0.066
Cerebrovascular Accident	50 (24.6)	151 (19.5)	0.124
Chronic Coronary Syndrome	88 (43.3)	345 (44.6)	0.025
Chronic Obstructive Pulmonary Disease	57 (28.1)	246 (31.8)	0.081
Congestive Heart Failure	48 (23.6)	174 (22.5)	0.028
Diabetes	60 (29.6)	201 (26.0)	0.080
Hypertension	169 (83.3)	671 (86.7)	0.096
Inflammatory Bowel Disease	1 to 6 (0.5 to 3.0) †	9 (1.2)	0.074
Mood Disorders	139 (68.5)	499 (64.5)	0.085
Myocardial Infarction	19 (9.4)	101 (13.0)	0.117
Osteoarthritis	170 (83.7)	671 (86.7)	0.083
Osteoporosis	58 (28.6)	200 (25.8)	0.061
Other Mental Health	69 (34.0)	249 (32.2)	0.039
Renal Disease	37 (18.2)	135 (17.4)	0.020
Rheumatoid Arthritis	10 (4.9)	18 (2.3)	0.140
Publicly Funded Home Care, *n* (%)			0.105

Table 1. Demographic, Health Status, and Publicly Funded Home Care Service Characteristics of Residents of Assisted Living Facilities at Baseline (*n* = 977)

	Dementia Care Program		**Standardized Difference**
	Yes	**No**	
n (%)	203 (20.8)	774 (79.2)	
None	125 (61.6)	444 (57.4)	
Short-Stay Client	8 (3.9)	25 (3.2)	
Long-Stay Client	70 (34.5)	305 (39.4)	

† Small cell sizes (i.e., where six or fewer individuals have, or do not have, a characteristic) are suppressed due to privacy restrictions at ICES.

Figure 2. Kaplan Meier Survival Curves of Dementia Care Programs in Assisted Living Facilities and Transitions to Nursing Homes

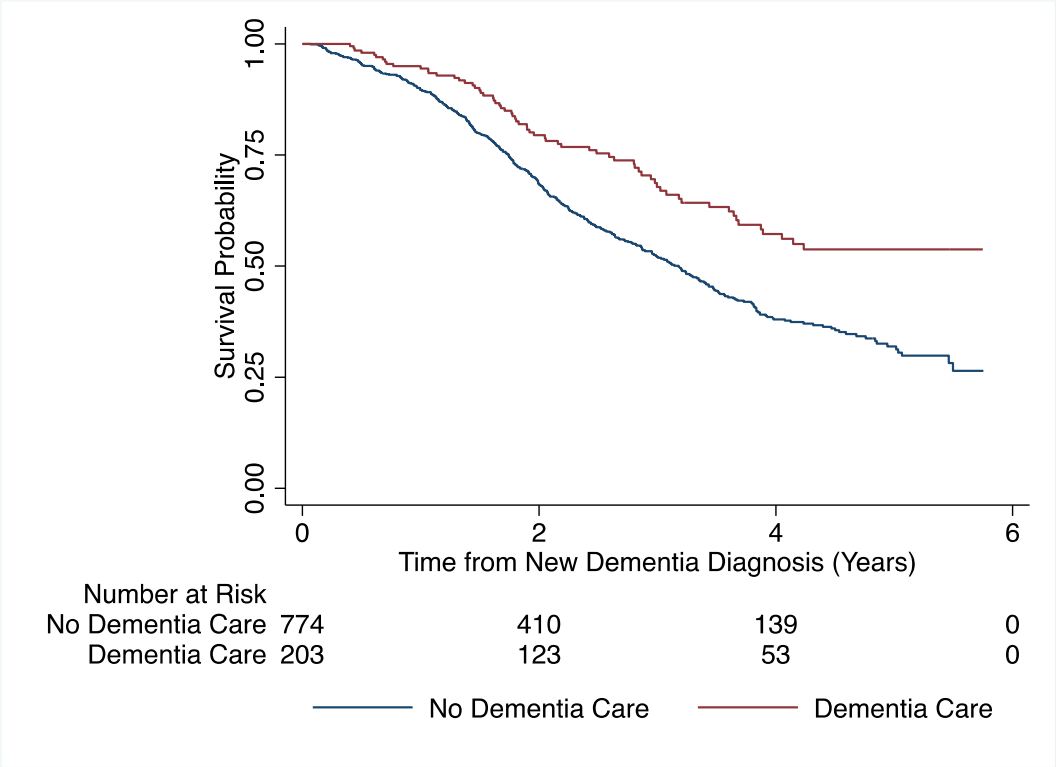


Table 2. Cox Proportional Hazards Model Assessing Demographic, Health Status, and Publicly Funded Home Care Service Characteristics Associated with a Long-Stay Transition to a Nursing Home

	Unadjusted HR (95% CI)	**Adjusted HR (95% CI) †**
Dementia Care Program	0.56 (0.41 to 0.76) ***	0.60 (0.44 to 0.81) ***
Demographic Characteristics		
Female	0.96 (0.78 to 1.18)	0.94 (0.75 to 1.18)
Age		
65-74	1.00 (Reference)	1.00 (Reference)
75-84	1.85 (0.97 to 3.55)	2.21 (1.12 to 4.35) *
85-94	2.49 (1.32 to 4.69) **	2.77 (1.43 to 5.34) **
95+	2.36 (1.18 to 4.74) *	2.97 (1.42 to 6.20) **
Neighborhood Income		
1 (Lowest Quintile)	1.00 (Reference)	1.00 (Reference)
2	0.93 (0.69 to 1.25)	0.97 (0.73 to 1.29)
3	1.04 (0.79 to 1.37)	1.02 (0.76 to 1.36)
4	0.87 (0.65 to 1.17)	0.87 (0.64 to 1.19)
5 (Highest Quintile)	0.67 (0.46 to 0.96) *	0.74 (0.53 to 1.02)
Health Conditions		
Asthma	0.80 (0.61 to 1.05)	0.77 (0.57 to 1.04)
Cancer	0.92 (0.73 to 1.15)	0.84 (0.67 to 1.07)
Cardiac Arrhythmia	1.24 (1.03 to 1.50) *	1.20 (0.96 to 1.50)
Cerebrovascular Accident	0.99 (0.80 to 1.24)	0.97 (0.76 to 1.24)
Chronic Coronary Syndrome	1.11 (0.92 to 1.33)	1.05 (0.84 to 1.30)
Chronic Obstructive Pulmonary Disease	0.99 (0.80 to 1.22)	0.96 (0.75 to 1.22)
Congestive Heart Failure	1.27 (1.01 to 1.61) *	1.05 (0.80 to 1.38)
Diabetes	1.18 (0.95 to 1.46)	1.16 (0.94 to 1.45)
Hypertension	1.31 (1.00 to 1.71)	1.15 (0.86 to 1.52)
Inflammatory Bowel Disease	1.25 (0.48 to 3.24)	1.12 (0.43 to 2.93)
Mood Disorders	0.87 (0.73 to 1.05)	0.82 (0.68 to 0.99) *
Myocardial Infarction	1.08 (0.83 to 1.40)	0.94 (0.70 to 1.27)
Osteoarthritis	1.39 (1.05 to 1.84) *	1.44 (1.05 to 1.96) *
Osteoporosis	1.01 (0.83 to 1.24)	1.06 (0.86 to 1.31)
Other Mental Health	1.01 (0.83 to 1.23)	0.99 (0.81 to 1.22)
Renal Disease	1.27 (0.99 to 1.62)	1.21 (0.93 to 1.57)
Rheumatoid Arthritis	0.70 (0.39 to 1.23)	0.72 (0.43 to 1.22)
Publicly Funded Home Care		
None	1.00 (Reference)	1.00 (Reference)
Short-Stay Client	0.83 (0.45 to 1.52)	0.98 (0.53 to 1.78)
Long-Stay Client	1.42 (1.20 to 1.69) ***	1.39 (1.15 to 1.66) ***

Abbreviations: HR, Hazard Ratio; 95% CI, 95% Confidence Interval

† Adjusted for all variables in the table.

* $P < .05$; ** $P < .01$; *** $P < .001$

Supplementary Material

Supplemental Table 1. Databases Used to Construct Population-Based Sample

Database	Description
Continuing Care Reporting System (CCRS)	Contains person-level data (i.e., clinical, demographic) in nursing homes in Canada using the validated Resident Assessment Instrument Minimum Data Set (RAI-MDS) version 2.0. Complete assessments are conducted when people are admitted to the nursing home, every year thereafter, and after any significant change in the person's health by a health care provider.
Discharge Abstract Database (DAD)	Contains person-level data (i.e., demographic, administrative, diagnoses, procedures) for all admissions to acute care hospitals. The DAD is compiled and maintained by the Canadian Institute for Health Information.
Home Care Database (HCD)	Contains person-level data (i.e., social, clinical) for publicly funded home care services in Ontario, including types and volume of service provision.
National Ambulatory Care Reporting System (NACRS)	Contains person-level data (i.e., demographic, administrative, diagnoses, procedures) for all patient visits to ambulatory care centres in hospitals and communities (i.e., emergency departments, day surgery units, hemodialysis units, cancer care clinics). The NACRS is compiled and maintained by the Canadian Institute for Health Information.
Ontario Cancer Registry (OCR)	Contains person-level demographics and data on incident cancer diagnoses and deaths.
Ontario Health Insurance Plan (OHIP) Database	Contains physician billings claims data among physicians who are remunerated by fee-for-service for outpatient visits. It also contains "shadow billings" for physicians who are remunerated through alternate payment schemes.
Postal Code Conversion File (PCCF+)	Specialized macro containing geographic identifiers based on census data.
Registered Persons Database (RPDP)	Contains demographic information (i.e., sex, age, date of birth, date of death for deceased individuals, area of residence, including postal code) and establishes eligibility for publicly funded universal health insurance in Ontario.
Residents of Retirement Homes Cohort	Identifies residents of assisted living facilities in Ontario, including characteristics of assisted living facilities (i.e., resident capacity, total suites, residential home, chain status, co-located with a nursing home, and the 13 provincially regulated care services – assistance bathing, assistance with hygiene, assistance with ambulation, assistance with feeding, assistance with dressing, continence care, skin and wound care, dementia care,

Supplemental Table 1. Databases Used to Construct Population-Based Sample

Database	Description
	provision of meal, administration of medication, pharmacist services, nursing services, and medical services)

Supplemental Table 2. Facility and Care Service Characteristics of Residents of Assisted Living Facilities at Baseline (*n* = 977)

	Dementia Care Program		**Standardized Difference**
	Yes	**No**	
n (%)	203 (20.8)	774 (79.2)	
Facility Characteristics, *n* (%)			
Urban	197 to 203 (97.0 to 100.0)†	708 (91.5)	0.328
Chain Facility	83 (40.9)	356 (46.0)	0.103
Residential Home	0	11 (1.4)	0.170
Co-Located with a Nursing Home	33 (16.3)	119 (15.4)	0.024
Resident Capacity			0.739
7-86	13 (6.4)	220 (28.4)	
87-128	46 (22.7)	202 (26.1)	
129-180	51 (25.1)	195 (25.2)	
181+	93 (45.8)	157 (20.3)	
Suites Capacity			0.918
7-73	16 (7.9)	223 (28.8)	
74-105	24 (11.8)	224 (28.9)	
106-138	59 (29.1)	182 (23.5)	
139+	104 (51.2)	145 (18.7)	
Care Services, *n* (%)			
Assistance with Bathing	203 (100.0)	752 (97.2)	0.242
Assistance with Hygiene	203 (100.0)	706 (91.2)	0.439
Assistance with Ambulation	197 to 203 (97.0 to 100.0)†	698 (90.2)	0.338
Assistance with Feeding	128 (63.1)	169 (21.8)	0.918
Assistance with Dressing	203 (100.0)	673 (87.0)	0.548
Continence Care	203 (100.0)	595 (76.9)	0.778
Skin and Wound Care	65 (32.0)	133 (17.2)	0.349
Provision of Meals	203 (100.0)	774 (100.0)	0.000
Administration of Medications	203 (100.0)	768 to 774 (99.2 to 100.0)†	0.051
Pharmacist Services	191 (94.1)	717 (92.6)	0.058
Nursing Services	203 (100.0)	763 (98.6)	0.170
Medical Services	177 (87.2)	572 (73.9)	0.340

† Small cell sizes (i.e., where six or fewer individuals have, or do not have, a characteristic) are suppressed due to privacy restrictions at ICES.

Supplemental Table 3. Cox Proportional Hazards Model Assessing Facility and Care Service Characteristics Associated with a Long-Stay Transition to a Nursing Home

	Unadjusted HR (95% CI)	**Adjusted HR (95% CI)** [*]	**Adjusted HR (95% CI)** [†]
Dementia Care Program	0.56 (0.41 to 0.76) [‖]	0.69 (0.49 to 0.95) [‡]	--
Facility Characteristics, *n* (%)			
Urban	0.71 (0.54 to 1.01)	0.83 (0.55 to 1.25)	0.82 (0.56 to 1.19)
Chain Facility	1.14 (0.93 to 1.41)	1.15 (0.92 to 1.44)	1.16 (0.94 to 1.43)
Residential Home	1.11 (0.38 to 3.31)	0.72 (0.21 to 2.44)	0.72 (0.25 to 2.10)
Co-Located with a Nursing Home	1.03 (0.80 to 1.34)	0.90 (0.68 to 1.19)	0.89 (0.67 to 1.19)
Resident Capacity			
7-86	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
87-128	0.69 (0.54 to 0.88) [§]	0.77 (0.54 to 1.08)	0.75 (0.51 to 1.10)
129-180	0.80 (0.61 to 1.06)	1.13 (0.71 to 1.78)	1.14 (0.71 to 1.82)
181+	0.58 (0.43 to 0.79) [‖]	1.09 (0.60 to 1.99)	1.08 (0.61 to 1.92)
Suites Capacity			
7-73	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
74-105	0.83 (0.65 to 1.05)	0.96 (0.69 to 1.31)	0.95 (0.66 to 1.36)
106-138	0.76 (0.57 to 1.01)	0.71 (0.46 to 1.10)	0.66 (0.42 to 1.05)
139+	0.54 (0.40 to 0.73) [‖]	0.57 (0.32 to 1.02)	0.51 (0.29 to 0.90) [‡]
Care Services, *n* (%)			
Assistance with Bathing	0.58 (0.39 to 0.87) [§]	0.69 (0.42 to 1.12)	0.67 (0.36 to 1.28)
Assistance with Hygiene	0.64 (0.45 to 0.91) [‡]	0.71 (0.36 to 1.40)	0.75 (0.41 to 1.37)
Assistance with Ambulation	0.84 (0.57 to 1.23)	1.33 (0.67 to 2.63)	1.34 (0.81 to 2.23)
Assistance with Feeding	0.82 (0.65 to 1.05)	1.11 (0.87 to 1.42)	1.02 (0.80 to 1.29)
Assistance with Dressing	0.74 (0.57 to 0.95) [‡]	0.95 (0.63 to 1.43)	0.89 (0.58 to 1.38)
Continence Care	0.78 (0.61 to 1.01)	1.02 (0.72 to 1.44)	0.99 (0.71 to 1.36)
Skin and Wound Care	0.74 (0.56 to 0.97) [‡]	0.78 (0.59 to 1.04)	0.78 (0.59 to 1.02)
Pharmacist Services	0.96 (0.62 to 1.47)	0.96 (0.62 to 1.48)	0.95 (0.61 to 1.45)
Nursing Services	1.06 (0.48 to 2.37)	1.12 (0.46 to 2.72)	1.07 (0.36 to 3.11)
Medical Services	0.86 (0.69 to 1.09)	0.95 (0.74 to 1.21)	0.93 (0.73 to 1.20)

Abbreviations: HR, Hazard Ratio; 95% CI, 95% Confidence Interval

[*] Adjusted for all variables in the table.

[†] Adjusted for all variables in the table, except dementia care program.

[‡] $P < .05$; [§] $P < .01$; [‖] $P < .001$

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and Abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	p. 1, 3	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	p. 1, 3
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	p. 4		
Objectives	3	State specific objectives, including any prespecified hypotheses	p. 5		
Methods					

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Study Design	4	Present key elements of study design early in the paper	p. 5		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	p. 5		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods	p. 6-7	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.	p. 6-7

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case		RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	p. 7-8,23	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	p. 7-8, 23
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).	p. 7-8, 23		

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		Describe comparability of assessment methods if there is more than one group			
Bias	9	Describe any efforts to address potential sources of bias	p. 8		
Study size	10	Explain how the study size was arrived at	p. 8		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	p. 7, 8		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed	p. 8,9		

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		(d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	p. 6,7
Linkage		..		RECORD 12.3: State whether the study included person-level,	p. 6,7

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
				institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	p. 9,19	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	p. 9
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders	p. 9, 19		

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		(b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)			
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	p. 9		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95%	p. 9,10		

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period			
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	p. 25		
Discussion					
Key results	18	Summarise key results with reference to study objectives	p. 10,11		
Limitations	19	Discuss limitations of the study, taking into account sources of		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer	p. 12,13

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		potential bias or imprecision. Discuss both direction and magnitude of any potential bias		the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	p. 11,12		
Generalisability	21	Discuss the generalisability (external validity) of the study results			p. 11,12
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which			p. 1

Supplemental Table 4. RECORD Checklist

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
		the present article is based			
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	p. 1,2

Chapter 5: Discussion

This chapter summarizes the findings from the three original studies contained in this thesis. The chapter expands upon the contributions of the thesis to the provision of care in retirement homes and long-term care reform. The strengths and limitations of the thesis are discussed, and the chapter concludes with opportunities for future research in the retirement home and assisted living sector.

Principal Findings

This thesis examined whether retirement homes that provide assisted living services are a substitute congregate care setting for a long-term care home in Ontario, Canada using secondary analyses of health system administrative data. The first study created a novel population-level cohort of residents of retirement homes in 2018 and compared their health service rates to other older adult populations (i.e., residents of long-term care homes, home care recipients who lived in the community, and community-dwelling older adults). This study found residents of retirement homes had unique health service rates, and residents of retirement homes consumed the most hospital-based care.

The second study examined whether retirement homes that provided a dementia care program were different from those that did not in Ontario in 2018. This study found the provision of a dementia care program was the least prevalent provincially regulated care service among retirement homes, and the homes that did offer a dementia care program housed many older adults, had many suites, and offered five or more care services to support aging in place. These findings provide a population-level overview of the privately financed retirement home and assisted living sector that plays an important role in housing and caring

for older adults who live with dementia. The third study examined whether residents of retirement homes who were newly diagnosed with dementia and resided in a retirement home with a dementia care program had a lower rate of transition to a long-term care home compared to residents of retirement homes without this care service from 2014 to 2019. This study found residents of retirement homes who had access to a dementia care program had a 40% lower rate of transition to a long-term care home. This finding demonstrates that, among those who live with dementia, retirement homes support aging in place.

The findings from these three studies show that residents of retirement homes are a distinct older adult population. Some retirement homes provide a level of care that supports aging in place, and, among residents who live with dementia and have access to a dementia care program, residency in these homes can reduce the demand for a bed in a long-term care home potentially associated with advanced dementia. The findings from these three studies suggest retirement homes may be a substitute congregate care setting for a long-term care home in Ontario, Canada. These findings inform health system planning, national dementia care strategies, and policies that address housing, health, and social care needs of older adults.

Contributions of the Thesis

There is a paucity of research on retirement homes in Ontario and a small body of literature on assisted living in Canada (1–4). This thesis adds to a body of literature that describes the expansion and importance of the retirement home and assisted living sector in North America for housing, health, and social care of older adults (5–11). Retirement homes and assisted living facilities are subject to fewer regulations compared to long-term care homes (12,13). In many long-term care homes, medical care provided by physicians is a

fundamental component of the model of care (14,15). However, as retirement homes are private residences, the model of care varies and is established by the operator of the retirement home, including the scope of service provision available to purchase by residents (16). Moreover, the regulated role of physicians in retirement homes and assisted living facilities substantially varies between jurisdictions (16), and the thesis adds to the literature that calls for increased regulation and oversight of retirement homes and assisted living facilities to care for the varied needs among residents in these homes (12,16). In addition, the findings of increased rates of health service use, particularly emergency department visits, among residents of retirement homes aligns with the findings from other jurisdictions (4,17,18). To better understand how this phenomenon occurs, regulators of the sector and operators of retirement homes should consider the creation and implementation of standardized assessments for residents, similar to the RAI-MDS, to examine changes in the health status of residents and ensure the appropriate management of resident needs.

Nearly half of residents of retirement homes in Ontario also received publicly funded home care services (19–21). Other studies that investigated home care use among residents of retirement homes found these older adults had fewer informal care supports and higher needs for nursing care, but shorter visits and lower expenditures (19–21). The provision of third-party home care services plays an important, and growing, role in assisted living facilities, and many residents of assisted living facilities in the United States receive home care services (22–24). The trend of third-party home care service provision, in addition to the assisted living services provided by retirement homes, further demonstrates how retirement homes may be a substitute for a long-term care home. The scope, frequency, and intensity of service provision from the retirement home and third-party home care providers suggests

that residents of retirement homes may receive a quantity of care that approaches 24-hour nursing care among those who reside in long-term care homes. This is additional evidence to support the thesis that retirement homes may be a substitute to a long-term care home.

The privately financed nature of the retirement home and assisted living sector in Canada and the United States underscores important policy issues with respect to ability and willingness to pay (22,24–27). This thesis found retirement homes that offered more care were in higher income neighborhoods, which suggests that older adults who are willing and can pay for residency and care in a retirement home have differential access to care. This finding is consistent with studies from the United States describing where assisted living facilities are often located (28,29). Differential access to ostensibly medically necessary care among vulnerable or frail older adults in retirement homes is a contentious political issue for Canadian federal and provincial policymakers, as many Canadians believe access to health care is a fundamental right of their citizenship (30). Differential access is also an important equity issue, as low- and middle-income older adults may have limited options for care and may rely on strained long-term care homes (10,31). As Ontario has no low net-income support for retirement homes, provincial policymakers should consider various financing and cost-sharing options that enable access for those who can no longer live independently, but do not necessarily require access to 24-hour nursing care.

Previous research found that there was increased satisfaction with retirement homes compared to long-term care homes (32). The largest difference in satisfaction was found with respect to the environment of the congregate care home (32). Many retirement homes that offered a dementia care program were larger and had many suites, and this was likely attributed to the fact that care settings for older adults who live with dementia should appear

more home-like and less like an institutionalized care home (33). Ensuring that retirement homes and assisted living facilities retain a home-like setting to support aging in place and distinguish them from an institutionalized long-term care home also contributes to retirement homes being a substitute for long-term care.

The growth and expansion of the retirement home and assisted living sector reduces strain on the long-term care sector that operates at 100% capacity in Ontario (31). The median waiting period for a bed in a long-term care home in 2019/20 was nearly six months for those who lived in the community and three months for those who were in hospital (31). In the case of residents of retirement homes who live with dementia and have access to a dementia care program in their home, retirement homes play an important role in reducing the demand for long-term care that may be associated with advanced dementia. Promoting the value of retirement homes for reducing the demand for a bed in a long-term care home should be an important strategy for policymakers who are seeking ways to increase health system capacity for older adults and the long-term care sector.

Dementia affects more than half of all older adults who live in a congregate care setting (5,6,34,35). The literature describing specialized care for dementia in congregate care homes is heterogenous (6,36,37), and the volume of literature from the United States far exceeds that of Canada. Advanced dementia is a frequently cited reason for placement in a long-term care home (3,38–40). Understanding dementia among residents of retirement homes and the specialized care provided to older adults who live with dementia in these homes provides insight into whether retirement homes in Ontario, Canada are a substitute congregate care home for long-term care.

Canada's national dementia care strategy is multi-pronged, and it includes support for research that investigates improved approaches and therapies to support quality of life among those who live with dementia and their caregiver partners (41). Expanding and promoting access to dementia care programs in retirement homes aligns with the goal of the national dementia care strategy to ensure evidence-based approaches are known to those who live with dementia and their caregivers (41).

The COVID-19 pandemic has increased conversations about how long-term care should be structured in Canada and the United States (42). Long-term care does not solely encompass nursing homes(42); retirement homes are largely absent from the conversation, as evidenced within *Ontario's Long-Term Care COVID-19 Commission Final Report* – there are 14 occurrences where retirement homes are mentioned in the 426-page report (43). The studies contained in this thesis demonstrate that retirement homes and assisted living facilities are an important link in the continuum of care services for older adults, including congregate care homes. As policy conversations about the financing and funding and quality of care provided in long-term care homes continue, retirement homes should be a part of the conversation (26,44).

Strengths and Limitations

With respect to strengths, this thesis provides a population-level view of the retirement home sector in Ontario over a five-year period in the only jurisdiction that has regulated the sector in North America. This thesis is the first to quantitatively examine the retirement home sector and its residents in detail in Ontario, Canada. In addition, the thesis is the first to examine dementia care programs in retirement homes in Canada, and it makes

an important contribution for identifying options for congregate care for those who live with dementia other than placement in a long-term care home. Given the similarities with respect to financing and service delivery between the assisted living facilities in the United States and Ontario, the findings from these studies are generalizable. The population-based analytic approach using health system administrative data is valuable for policymaking because individuals are followed without risk of attrition, and recall bias is minimized by using data that represents individual encounters with the health care system.

The approach to classify the postal codes of retirement homes and link this data to existing health system administrative datasets is novel. Other jurisdictions with registers of retirement homes or assisted living facilities may consider replicating our approach to create their own population-level cohort. In the absence of standardized assessments that are periodically conducted on residents of retirement homes and compiled provincially or nationally, there are limited opportunities to examine the health service use and health status of residents of retirement homes and compare them to other older adult populations. Furthermore, the creation of other population-level cohorts of residents of retirement homes aids in describing the privately financed and expanding sector in the context of jurisdictions that provide universal health insurance to its citizens.

Despite these strengths, there are limitations. The thesis is comprised of secondary analyses of health system administrative data, which has the potential for misclassification biases, as these data were not collected for research purposes. Additional variables at the level of the retirement home (e.g., fees, occupancy, staffing, etc.) could not be included in the analyses. The RHRA does not require these variables as a condition for licensing, nor are operators of retirement homes required to publicly disclose this information on their

websites or to their professional associations. The three studies contained in the thesis are observational, and residual confounding may affect the results.

Future Research

Building on this thesis, future research should examine the preferences of older adults for housing, health, and social care, and how their preferences evolve, conditional upon their needs for care and the preferences of their caregiver partners. Given that residents of retirement homes had low rates of primary care and specialist physician visits, an investigation into the medical models of care in retirement homes is warranted. Investigating the preferences of residents and medical models of care in retirement homes would be very beneficial for identifying quality of care metrics for the sector that can be implemented by policymakers or regulators. The development and implementation of these metrics could also support cross-jurisdictional comparisons to strengthen systems of care for older adults.

There is also the need to take stock of the specific dementia care program attributes, including the skillsets of those who deliver the program, between independent operators and chain retirement homes. Examining the specific dementia care program attributes in retirement homes and whether certain attributes are more efficacious than others at reducing the behavioural symptoms associated with dementia is another area of future research arising from the thesis. There is also value to investigate the extent that caregiver partners provide financial assistance to a resident of a retirement home, including whether these caregivers experience distress.

Conclusion

This thesis determined that retirement homes may be a substitute congregate care home for a long-term care home in Ontario, Canada. The retirement home and assisted living sector will continue to expand and play an important role in supporting the heterogenous needs and preferences of older adults for housing, health, and social care. Future research should examine how the preferences of older adults for congregate care evolve, conditional upon their needs. Health system leaders and policymakers should consider how the preferences and needs of older adults inform health system capacity planning and resource allocation.

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Appendix

Appendix Table 1. Codes Used to Classify Exposures, Outcomes, Confounders, and Effect Modifiers in Chapter 2, 3, and 4

Variable	Database	Variable
Long-Stay Transition to a Nursing Home	CCRS	ADMDATE, Q1C
Female	NACRS, HCD, SEX	SEX
Age	RPDB	BDATE
Neighborhood Income	RPDB	INQUINT
Asthma	OHIP, ASTHMA	DXCODE 493
Cancer	OHIP, OCR	DXCODES 140-239
Cardiac Arrhythmia	OHIP, DAD	DXCODES 426, 427 dx10 'I48.0' 'I48.1' dx '427.3'
Cerebrovascular Accident	OHIP, DAD	DXCODES 432, 436 dx10code 'I60' 'I64' dxcode '430' '431' '432' '434' '436'
Chronic Coronary Syndrome	OHIP, DAD	DXCODES 412, 413 dx10code 'I20' 'I22' 'I23' 'I24' 'I25' dxcode '411' '412' '413' '414'
Chronic Obstructive Pulmonary Disease	OHIP, COPD	DXCODES 491, 492, 496
Congestive Heart Failure	OHIP, CHF	DXCODES 428
Dementia	OHIP, DEMENTIA	DXCODE 290
Diabetes	OHIP, ODD	DXCODES 250
Hypertension	OHIP, HYPER	DXCODES 401, 402
Inflammatory Bowel Disease	OHIP	DXCODES 555, 556
Mood Disorders	OHIP, DAD	DXCODES 300, 309, 296, 311 dx10 'F30' 'F31' 'F32' 'F33' 'F34' 'F38' 'F39' 'F40' 'F41' 'F42' 'F43.1' 'F43.2' 'F43.8' 'F44' 'F45.0' 'F45.1' 'F45.2' 'F48' 'F53.0' 'F68.0' 'F93.0' 'F99' dx '296' '300' '309' '311'
Myocardial Infarction	OHIP, DAD	DXCODE 410 dx10 'I21' 'I22' dx '410'
Osteoarthritis	OHIP, DAD	DXCODE 715 dx10code 'I60' 'I64' dxcode '430' '431' '432' '434' '436'
Osteoporosis	OHIP, DAD	DXCODE 733

Appendix Table 1. Codes Used to Classify Exposures, Outcomes, Confounders, and Effect Modifiers in Chapter 2, 3, and 4

Variable	Database	Variable
		dx10 'M15' 'M16' 'M17' 'M18' 'M19' dx '715'
Other Mental Health	OHIP, DAD	DXCODES 291, 292, 303, 304, 305, 296, 295, 301, 302, 297, 298, 306, 307, 319 dx10 'F04' 'F050' 'F058' 'F059' 'F060' 'F061' 'F062' 'F063' 'F064' 'F07' 'F08' 'F10' 'F11' 'F12' 'F13' 'F14' 'F15' 'F16' 'F17' 'F18' 'F19' 'F20' 'F21' 'F22' 'F23' 'F24' 'F25' 'F26' 'F27' 'F28"F29' 'F340' 'F35' 'F36' 'F37' 'F430' 'F439' 'F453' 'F454' 'F458' 'F36' 'F47' 'F49' 'F50' 'F51' 'F52' 'F531' 'F538' 'F539' 'F54"F55' 'F56' 'F57' 'F58' 'F59' 'F60' 'F61' 'F62' 'F63' 'F64' 'F65' 'F66"F67' 'F681' 'F688' 'F69' 'F70' 'F71' 'F72' 'F72' 'F74' 'F75' 'F76"F77' 'F78' 'F79' 'F80' 'F81' 'F82' 'F83' 'F84' 'F85' 'F86' 'F87' 'F88"F89' 'F90' 'F91' 'F92' 'F931' 'F932' 'F933' 'F928' 'F939' 'F94' 'F95' 'F96' 'F97' 'F98' dx '291' '292' '295' '297' '298' '299' '301' '302' '303' '304' '305' '306' '307' '313"314' '315' '319'
Renal Disease	OHIP, DAD	DXCODES 403, 585, 585 dx10 'N17' 'N18' 'N19' 'T82.4' 'Z49.2' 'Z99.2' dx '403' '404' '584' '585"586' 'v451'
Rheumatoid Arthritis	OHIP, ORAD	DXCODE 714
Home Care Client	HCD	SRCD 91, 92, 93, 94
Ontario Marginalization Index Summary Score	ONMARG	
Emergency Department Visits	NACRS	Low-acuity visits were defined as those triaged (Triage=4,5) as nonurgent at ED registration - Potentially preventable visits were defined as those for any ambulatory care sensitive condition. Condition ICD-10-CA: -Angina pectoris I20 I2382 I240 I248 I249. Exclude cases with surgical procedure (CCI procedure: 1, 2, 5) - Asthma J45 -Cellulitis L03. Exclude cases with surgical procedures (CCI: 1, 2, 5)

Appendix Table 1. Codes Used to Classify Exposures, Outcomes, Confounders, and Effect Modifiers in Chapter 2, 3, and 4

Variable	Database	Variable
		-Chronic obstructive pulmonary disease J41–J44 J47 J20 (only when "other diagnosis" of J41–J44, J47 is present) J12–J16, J18 (only when "other diagnosis" of J41–J44, J47 is present) -Congestive heart failure I50 J81. Exclude cases with surgical procedures (CCI: 1IJ50, 1HZ85, 1IH76, 1HB53, 1HD53, 1HZ53, 1HB55, 1HD55, 1HZ55, 1HB54, 1HD54) -Dehydration E86 - Diabetes mellitus E101 E106, E107 E109 E110, E111 E116, E117 E119 E130, E131 E136, E137 E139 E140, E141 E146, E147 E149 -Gastroenteritis K52 -Grand mal seizure disorders G40 G41 - Hypertension I100 I101 I11, Exclude cases with surgical procedures (CCI: 1IJ50, 1HZ85, 1IJ76, 1HB53, 1HD53, 1HZ53, 1HB55, 1HD55, 1HZ55, 1HB54, 1HD54) -Hypoglycemia E162 -Kidney or urinary tract infection N10 N151 N11 N136 N390 -Pneumonia J12–J16 J18 -Severe ear, nose, or throat infection J02, J03 J312 -Other: ED visits that are not defined as potentially preventable or/and low acuity ED visits.
Hospitalizations	DAD	-Elective hospitalization= admission category (admcat) in "Elective" -Urgent hospitalization=admission category(admcate) in "Urgent" -Other hospitalization admission= admission category (admcat) not in 'Elective","Urgent" -Acute length of stay: use the 'ACUTELOS" in DAD.
Alternate Levels of Care Days	DAD	ALCLOS
Primary Care Visits	OHIP, CPDB	OHIP billings with any "O", "H", or "P" billing from either a FP/GP (specialty in

Appendix Table 1. Codes Used to Classify Exposures, Outcomes, Confounders, and Effect Modifiers in Chapter 2, 3, and 4

Variable	Database	Variable
		"00","05) or Community Medicine physician. Max 1 per individual per
Specialist Physician Visits	OHIP, CPDB	OHIP billings with any "O", "H", or "P" billing from specialist physician (i.e. specialty not in "00","05") . Max 1 per individual per physician per day
Death	RPDB	Death Date in 2018
Urban	PCCF	PCTYPE
Chain Facility	Residents of Retirement Homes Cohort	chain
Residential Home	Residents of Retirement Homes Cohort	residential_home
Co-Located with a Nursing Home	Residents of Retirement Homes Cohort	co_located_ltc
Resident Capacity	Residents of Retirement Homes Cohort	resident_capacity
Suites Capacity	Residents of Retirement Homes Cohort	suites_capacity
Assistance with Bathing	Residents of Retirement Homes Cohort	CS_Assistance_Bathing
Assistance with Hygiene	Residents of Retirement Homes Cohort	CS_Assistance_Hygiene
Assistance with Ambulation	Residents of Retirement Homes Cohort	CS_Assistance_Ambulation

Appendix Table 1. Codes Used to Classify Exposures, Outcomes, Confounders, and Effect Modifiers in Chapter 2, 3, and 4

Variable	Database	Variable
Assistance with Feeding	Residents of Retirement Homes Cohort	CS_Assistance_Feeding
Assistance with Dressing	Residents of Retirement Homes Cohort	CS_Assistance_Dressing
Dementia Care Program	Residents of Retirement Homes Cohort	CS_Dementia_Care_Program
Continence Care	Residents of Retirement Homes Cohort	CS_Continence_Care
Skin and Wound Care	Residents of Retirement Homes Cohort	CS_Skin_Wound_Care
Pharmacist Services	Residents of Retirement Homes Cohort	CS_Pharmacist_Services
Nursing Services	Residents of Retirement Homes Cohort	CS_Nuring_Services
Medical Services	Residents of Retirement Homes Cohort	CS_Medical_Services

Appendix Table 2. Reprint Permission for Chapter 3

Thursday, August 12, 2021 at 21:34:10 Eastern Daylight Time

Subject: Re: Reprint permission request for PhD thesis - Ticket ID [#5769362]
Date: Wednesday, August 11, 2021 at 12:09:16 Eastern Daylight Time
From: Open Research Support <orsupport@springernature.com>
To: Manis, Derek <manisd@mcmaster.ca>

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> On Wed, 11 Aug at 4:38 PM , Derek Manis <manisd@mcmaster.ca> wrote:
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>
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>
> Manis DR, Rahim A, Poss JW, Bielska IA, Bronskill SE, Tarride JÉ, Abelson J, Costa AP. Do assisted living facilities that offer a dementia care program differ from those that do not? A population-level cross-sectional study in

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Derek Manis

--
Derek R. Manis, MHSc
PhD Candidate, Centre for Health Economics and Policy Analysis &
Department of Health Research Methods, Evidence, and Impact
Research Associate, Big Data & Geriatric Models of Care
PhD Trainee, ICES
McMaster University
1280 Main St W, CRL-201, Hamilton, ON L8S 4K1
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Thursday, August 12, 2021 at 21:35:03 Eastern Daylight Time

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Manis DR, Rahim A, Poss JW, Bielska IA, Bronskill SE, Tarride JÉ, Abelson J, Costa AP. Association between dementia care programs in assisted living facilities and transitions to nursing homes in Ontario, Canada: a population-based cohort study. J Am Med Dir Assoc. 2021 Aug 2;S1525-8610(21)00640-X. doi:10.1016/j.jamda.2021.07.002. Epub

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Derek Manis

--
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