RESEARCH PAPER

Co-Locating Older Retirement Home Residents: Uncovering an Under-Researched Population via Postal Code

Localisation des résidents de maisons de retraite : découvrir une population sous-étudiée grâce au code postal

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Abstract

Background: Retirement home residents represent a growing proportion of older Ontarians who cannot be identified within existing administrative databases.

Objective: This article aims to develop an approach for determining, from an individual's postal code, their likelihood of residing in a retirement home.

Methods: We identified 748 licensed retirement homes in Ontario as of June 1, 2018, from a public registry. We developed a two-step evaluation and verification process to determine the probability (*certain*, *likely* or *unlikely*) of identifying a retirement home, as opposed to other dwellings, within a postal code.

Results: We identified 274 (36.7%) retirement homes within a postal code *certain* to indicate that a person was residing in a retirement home, 200 (26.7%) for which it was *likely* and 274 (36.7%) for which it was *unlikely*. Postal codes that were *certain* and *likely* identified retirement homes with a capacity for 59,920 residents (79.9% of total provincial retirement home capacity).

Conclusion: It is feasible to identify a substantive cohort of retirement home residents using postal code data in settings where street address is unavailable for linkage to administrative databases.

Résumé

Contexte : Les résidents des maisons de retraite représentent un segment croissant du nombre d'aînés en Ontario qui ne peuvent être identifiés avec les bases de données administratives actuelles.

Objectif : Cet article vise à développer une approche pour déterminer, à partir du code postal d'une personne, sa probabilité de résider dans une maison de retraite.

Méthode : Nous avons repéré, grâce à un registre public, 748 maisons de retraite titulaires d'un permis en Ontario en date du 1er juin 2018. Nous avons élaboré un processus d'évaluation et de vérification en deux étapes afin de déterminer la probabilité (certaine, probable ou improbable) d'identifier une maison de retraite, par opposition à d'autres types de logement, dans la zone d'un code postal.

Résultats : Nous avons repéré 274 (36,7 %) maisons de retraite dans la zone d'un code postal où il est certain qu'une personne réside dans une maison de retraite, 200 (26,7 %) où cela est probable et 274 (36,7 %) où cela est improbable. Les codes postaux qualifiés de certains ou probables permettaient d'identifier des maisons de retraite pouvant accueillir 59 920 résidents (79,9 % de la capacité totale des maisons de retraite dans la province).

Conclusion : Il est possible d'identifier une cohorte importante de résidents de maisons de retraite grâce au code postal dans les milieux où l'adresse municipale n'est pas disponible pour le couplage aux bases de données administratives.

Background and Objective

It is well recognized that the health of people living in a shared place of residence may be interdependent (Christakis and Allison 2006). A shared place of residence, also known

as co-location, can be a valuable tool for health services research to understand how social determinants and the built environment can shape health, and to support health system capacity planning. Co-location has proven useful for studying relationships between married or cohabiting couples, parents and their children, and family caregivers and their care recipients (Christakis and Allison 2006; Kjaer et al. 2014; Moriarty et al. 2015; Smits et al. 2010). Within the existing administrative databases in Ontario, Canada (and other Canadian and international jurisdictions), there can be challenges to co-locating individuals due to the methods through which data are collected, linked and protected; these include the current unavailability of individuals' registered street addresses.

Health systems' administrative data are generated whenever an individual has an encounter with the healthcare system (Cadarette and Wong 2015). While these data are generally collected for administrative and billing purposes, they are frequently leveraged for health services research (Cadarette and Wong 2015). The Canadian healthcare system includes universal access to a publicly funded provincial health insurance program that covers medically necessary physician services, diagnostic testing services and ambulatory and hospital care; in the province of Ontario, children and older adults receive additional coverage for prescription medications. Services that are not directly tied to the provision of healthcare, such as accommodation, are frequently privatized and are therefore not captured in health administrative data (Palley et al. 2011). Consequently, health services researchers and policy makers must turn to creative solutions to identify recipients of supportive care and services not covered by public funding; these include the co-location of individuals residing in privately funded retirement homes (also known as residential care or assisted living facilities; Sloane et al. 2003; Statistics Canada 2017).

In Ontario, roughly 92% of individuals live in private households, while the remaining 8% live in collective dwellings, including provincially financed long-term care (LTC) facilities and privately financed retirement homes (Milan et al. 2014). Whereas LTC facilities place a greater focus on medical care, provide 24-hour supervision of their residents and provide the majority of institutional end-of-life care to older adults, retirement homes tend to provide limited supportive care and services to assist with activities of daily living while allowing residents to maintain independence in the community (National Institute on Aging 2017; Roblin et al. 2019). While retirement homes have become an increasingly common place of residence for older adults in Ontario when they can no longer support themselves independently, there is currently limited information on the public health system use of retirement home residents at a population level (Poss et al. 2017, 2019). Retirement homes have been regulated in Ontario since 2010, when the government passed the *Retirement Homes Act 2010*, granting the Retirement Homes Regulatory Authority (RHRA) of Ontario the authority to license homes in the province (Government of Ontario 2010). The licensing of retirement homes in Ontario resulted in the development of a public registry of homes available through the RHRA of Ontario website and presents an opportunity to co-locate retirement home residents via shared address information (RHRA of Ontario 2018).

The purpose of this pilot study was to develop an approach identifying privately funded retirement homes with geographically unique postal codes in order to support capacity planning for provincial health services. Limited evidence from a single jurisdiction in Ontario highlights how – compared to older adults in private residences – retirement home residents have higher proportions of dementia and moderate cognitive impairment, less support from family and friend caregivers, higher rates of depression and loneliness as well as more private personal care and nursing services (Poss et al. 2017, 2019). Evidence from other jurisdictions, including Alberta, has focused on publicly funded assisted living facilities and demonstrated that residents in these facilities have high rates of LTC placement, acute care utilization and antipsychotic use (Hogan et al. 2014; Maxwell et al. 2013, 2015; Stock et al. 2017).

Despite an increasing number of older adults turning to retirement homes for residential care, the sociodemographic and clinical characteristics of retirement home residents and the ways in which they access and interact with the healthcare system is still largely undescribed. To comprehensively study the unique healthcare system needs and services of retirement home residents, it is necessary to generate a population-based cohort that can be linked to the existing health administrative databases. The coronavirus disease (COVID-19) pandemic has accelerated the need for population-based research on retirement home residents, with large outbreaks occurring in retirement home settings (Roxby et al. 2020; Zimmerman et al. 2020). This pilot study determines the probability of identifying a retirement home resident by using six-digit postal code information alone.

Methods

Data sources

We identified all 748 licensed retirement homes in the province of Ontario as of June 1, 2018, from the public registry available through the RHRA of Ontario website (RHRA of Ontario 2018). Information was collected from the public registry on geographic location (including postal code), resident capacity and service provision.

Using postal codes to co-locate individuals

Postal codes and map-based technologies were used to co-locate individuals, a methodology that has been used in previous health services research to geospatially map population distributions and data (Ray et al. 2008; Romanski et al. 2015). To co-locate individuals within a retirement residence using postal codes, we had to be reasonably certain that the facility postal code was not substantially shared with other residences. In some instances, a postal code was unique to a given address. In other cases, postal codes were shared by multiple addresses within a region, making it difficult to ascertain whether individuals within a postal code belonged to any one particular residence; the multiple addresses included commercial buildings that were non-residential and multiplexes that were private residences housing multiple individuals.

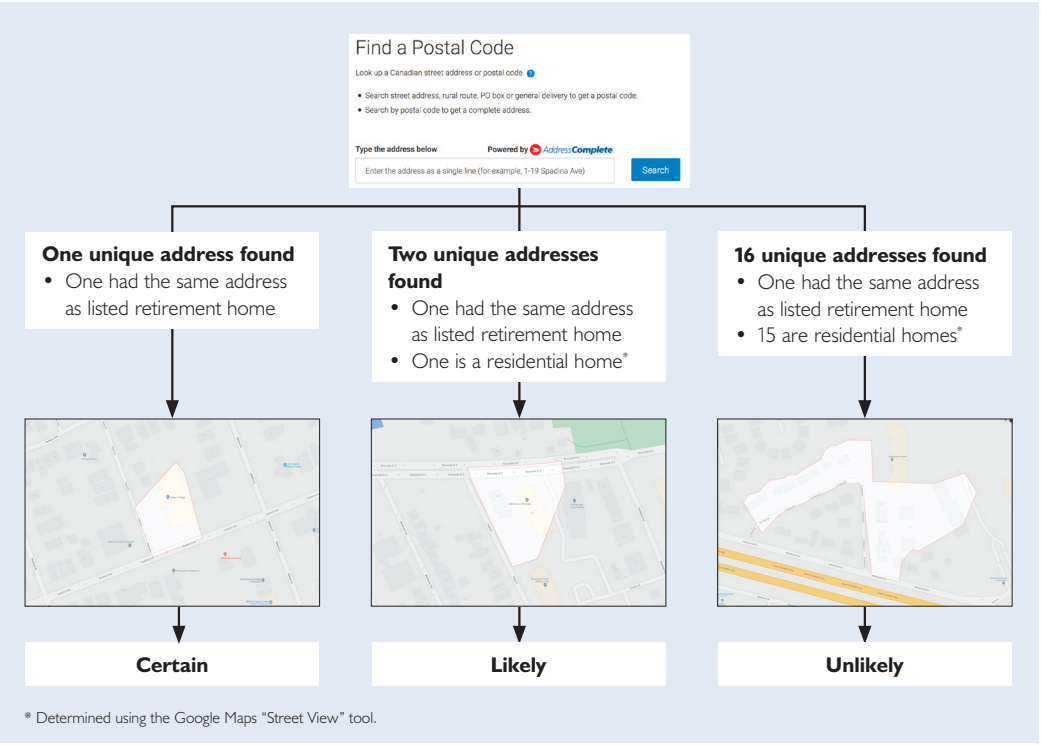
Outcomes

We developed a screening method to determine the probability (*certain*, *likely* or *unlikely*) of identifying a retirement home resident using postal code information alone. Because we anticipated linking the cohort of *certain* and *likely* retirement home postal codes to administrative databases, these categories were combined, and publicly available licensing data were used to compare the characteristics of *certain* and *likely* facilities to those of the facilities with *unlikely* postal codes. Publicly available licensing data were used to provide context on the resident capacity, location (urban or rural) and service provision of retirement homes.

Analysis: Two-stage approach

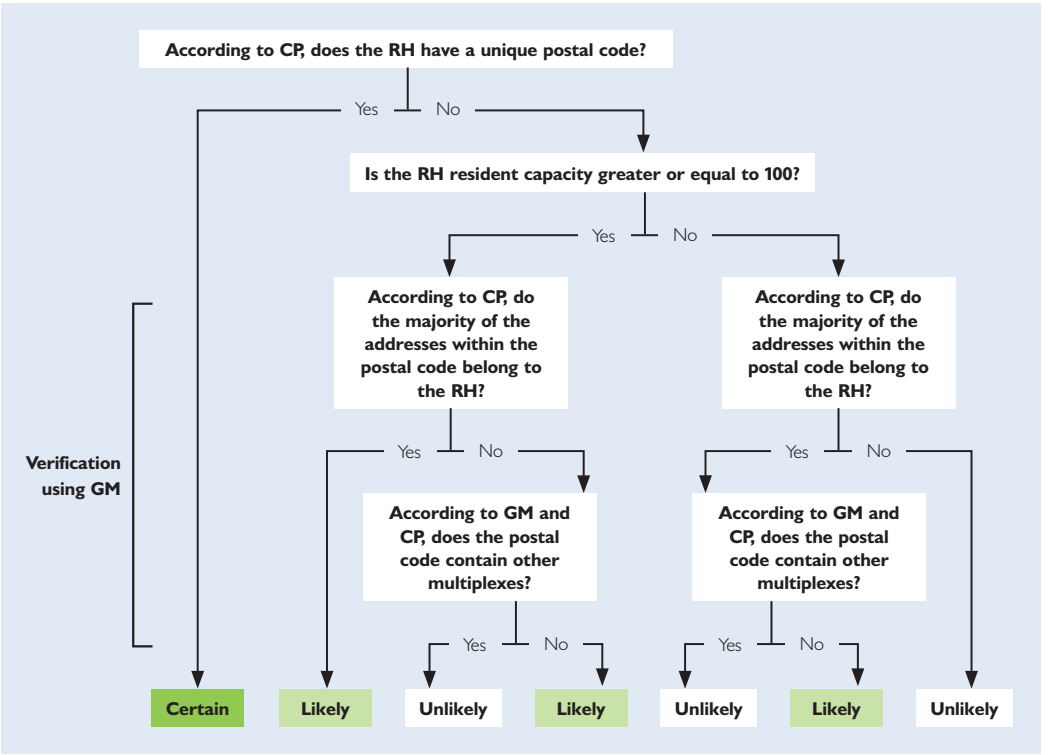
To determine whether retirement home addresses shared a postal code with other non-retirement home addresses, we developed a two-step verification process (Figure 1). First, we inputted postal codes from the RHRA of Ontario public registry into the online Canada Post (n.d.) "Find a Postal Code" tool (RHRA of Ontario 2018). Canada Post is the primary postal operator in Canada, and their publicly available "Find a Postal Code" tool enables users to search by a postal code and returns a complete list of street addresses that share that postal code. Postal codes were classified as unique to a retirement home only when Canada Post displayed one street address per postal code.

FIGURE 1. Examples of how postal codes were classified using Canada Post's "Find a Postal Code" tool and then Google Maps' Satellite and Street View tools



Second, if a retirement home postal code shared multiple addresses, the postal code was investigated using Google Maps Satellite and Street View technology (Google n.d.). Inputting postal codes into Google Maps provides the user with a visual and spatial representation of the estimated geographic area captured by a postal code; Google Maps has excellent validity and reliability for virtual measures of geoprocessing (Silva et al. 2015). Using this technology, we developed a standardized algorithm to differentiate between postal codes that were *likely* and *unlikely* to be uniquely attached to retirement homes. If a retirement home capacity was large (>100 residents), and the majority (>50%) of addresses sharing a given postal code belonged to retirement home residents while accounting for the presence of other residential multiplexes, the home would be classified as *likely* (because it was assumed that the majority of individuals with that postal code were residents of the retirement home). If the retirement home capacity was small (<100 residents), and the majority (>50%) of addresses sharing a given postal code belonged to other residential addresses or multiplexes, the postal code would be classified as *unlikely* to uniquely belong to retirement home residents (because it was assumed that the majority of residents with that postal code were not retirement home residents). The resulting algorithm for classifying retirement home postal codes is illustrated in Figure 2. Two reviewers (Hana Brath and Sanghun J. Kim)

FIGURE 2. Flowchart algorithm for classifying postal codes: unique, likely unique or unlikely unique



Notes: CP = Canada Post; RH = Retirement Home; GM = Google Maps

independently assessed postal codes and classified them as *likely* and *unlikely* unique to retirement homes. Discrepancies between the two reviewers in classifying the postal codes were resolved through consultations and discussions with a third reviewer (Nathan M. Stall).

After classifying retirement home postal codes based on the likelihood of identifying a retirement home resident using postal code information, we compared facilities with *certain* and *likely* postal codes to those with *unlikely* postal codes. Retirement homes were compared, for context, on the basis of resident capacity, rurality and service provision to facilitate future research and planning opportunities.

Results

After screening the 748 licensed retirement homes listed in the RHRA of Ontario public registry as of June 1, 2018, 274 (36.7%) postal codes were categorized as *certain*, 200 (26.7%) as *likely* and 274 (36.7%) as *unlikely* to uniquely belong to a retirement home (Table 1). See Appendix Tables A1–A3 for the full list of retirement home names and postal codes (available online at longwoods.com/content/26352).

Retirement home capacities

Retirement homes with *certain* and *likely* postal codes had a capacity for 59,920 residents, which represents 79.9% of Ontario's retirement home collective resident capacity. The full sample of the 748 retirement homes had a median resident capacity of 87 (interquartile range [IQR] = 50–140) residents, whereas the 474 *certain* and *likely* retirement homes had a higher median resident capacity of 115 (IQR = 77–159.25) residents.

Retirement home locations

Retirement homes classified as *certain* and *likely* were all located in either urban or suburban areas, while a high proportion of *unlikely* homes were located in rural areas (43.8%).

Discussion

This study presents a feasible screening method to co-locate retirement home residents by postal code in Ontario, Canada. In the absence of more specific address location information, we were able to identify 474 *certain* and *likely* retirement homes based on their postal codes, which accounted for a population of 59,920 retirement home residents, or 79.9% of total provincial capacity.

While retirement homes have been licensed by the RHRA of Ontario since 2010, there is little published information on the collective characteristics of retirement homes, despite the collection of information from individual facilities required for licensing. The absence of this information and related quality metrics likely results from the fact that retirement homes are not publicly funded; this contrasts with LTC facilities, which are part of the province's healthcare system and publicly funded on a cost-shared basis with residents (Ontario Long Term Care Association 2018). Licensing data indicate that the 748 retirement homes

in Ontario have a capacity for over 75,000 residents (with a median resident capacity of 87 residents [IQR = 50–140]), and the majority provide supportive care with some instrumental and basic activities of daily living, including bathing, personal hygiene, ambulation, meal preparation and medication management. Interestingly, nearly one-third (31.6%) of all homes have no direct access to physician services, and the minority of homes assist with feeding (37.3%) and have dementia care programs (16.8%).

An algorithm to determine the probability (*certain*, *likely* or *unlikely*) of identifying a retirement home resident using postal code information at the facility level represents an important tool that can be used in other jurisdictions where direct linkage of health administrative databases to street address is not available. This algorithm's output will allow health service researchers and policy makers in Ontario to identify individuals as residing in specific retirement homes, facilitating linkages to administrative databases. In the province of Ontario, linkages permit the capture of all medically necessary physician services, ambulatory and hospital care and prescription medications that are covered under a publicly funded provincial health insurance program. These linkages will allow researchers to describe the sociodemographic and clinical characteristics of retirement home residents, investigate their specific healthcare needs and service utilization and describe their changing health status and residence over time. In particular, research questions of interest include the inappropriate use of acute care services and medications, the way in which retirement home residents access physician services and transition through residential care settings as well as variations in the care of retirement home residents by both region and facility.

Indeed, retirement home residents are a potentially vulnerable population who have received little attention to date. Relatedly, the identification of LTC residents in health administrative databases in Ontario has permitted the undertaking of a large body of important research that has advanced the understanding of this population and improved health outcomes, something that could be similarly translated to future studies among retirement homes. Most recently, the COVID-19 pandemic has revealed the extreme vulnerability of congregate care including retirement homes, and the ability to effectively identify and link retirement homes residents to existing health administrative databases could facilitate timely analysis of COVID-19 outcomes (Roxby et al. 2020, Zimmerman et al. 2020).

There are important health policy implications that stem from improving our understanding of which older adults reside in retirement homes and how these individuals use the health system. Emerging evidence suggests that the characteristics and needs of retirement home residents may be very different from those of other community-dwelling individuals, and perhaps closer to those of LTC residents (Poss et al. 2017, 2019; Roblin 2017). In particular, the ongoing demand and waiting lists for beds in provincially funded LTC homes can overflow into other residential care settings, including private retirement homes; despite this, retirement homes are still largely perceived as serving the needs of more independent older adults (Roblin et al. 2019). As the characteristics of retirement home residents and the services provided in these facilities increasingly become similar to those of nursing homes,

experts in healthcare policy have advocated for a more careful consideration of how retirement homes are funded, regulated and incorporated into planning for the provision of LTC in Canada (National Institute on Aging 2019; Roblin 2017; Roblin et al. 2019; Sinha 2012).

Any new healthcare policy involving retirement homes will rely, in part, on robust population-based health services research with the capability of linking retirement home residents. Currently, health services research in Ontario relying on administrative claims data can only differentiate between LTC-dwelling older adults and community-dwelling older adults; the latter category includes both individuals living in their own homes and those living in retirement homes. The methodology developed and reported in our study presents an opportunity to both uncover the under-researched population of retirement home residents using postal code and support the evaluation of a much-needed healthcare policy related to the residential care sector.

Limitations

We must also acknowledge some limitations to this study. Our reliance on postal code data for future linkage to health administrative databases meant that it was not possible to include all the 748 Ontario retirement homes in our cohort. We created a cohort of 474 retirement homes with *certain* and *likely* postal codes, resulting in the exclusion of 274 homes with *unlikely* postal codes. These excluded retirement homes that shared postal codes with multiple addresses, mainly because they had smaller residential capacities and were located in rural areas. While we were able to create a cohort with a capacity for 59,920 *certain* and *likely* retirement home residents (representing 79.9% of Ontario's retirement home collective resident capacity), the retirement homes in our cohort exist disproportionately in urban and suburban areas, reflecting the challenges faced by residents of rural settings in accessing health services data (Lavoie et al. 2016). An ideal solution to this issue would be to link retirement homes to individuals by street address. However, at present, many research-ready administrative databases in Canada do not include street address. This is due, in part, to the highly identifiable nature of street address data and the need for appropriate privacy protections. More broadly, research on retirement home settings might best be accomplished by multi-method approaches using a variety of data sources. For example, supplementing the health administrative data with health survey methods would potentially mitigate the exclusion of data from retirement home residents of rural settings and help identify other health and social service needs incompletely captured by administrative data.

Another limitation of our study is the lack of validation work, including the calculation of interrater agreement between reviewers as well as the determination of sensitivity and specificity of cut-offs used, which could help determine the accuracy of our classification (*certain*, *likely* or *unlikely*) of identifying a retirement home resident using postal code information at the facility level. In particular, we acknowledge the real possibility that postal codes classified as *likely* unique to a retirement home may capture a proportion of individuals who are not actually retirement home residents.

There are some potential approaches to validation that could help overcome the aforementioned limitations. One method would involve linking the subset of Ontario residents receiving publicly funded home care who have registered addresses containing *certain* and *likely* postal codes to health administrative databases, notably the RAI-Home Care database (Poss et al. 2017). The RAI-Home Care database is a standardized, reliable, valid and comprehensive clinical assessment system designed for home care, the use of which has been mandated in Ontario for all long-stay home care clients (≥60 days) since 2002 (Landi et al. 2000; Morris et al. 1997; Poss et al. 2017). The RAI-Home Care tool contains a mandatory data entry field (Section CC, Item 5) about the place of living, which could be used to investigate the proportion of individuals (who would all have registered addresses with *certain* and *likely* postal codes belonging to retirement homes) classified as living in a retirement home. An alternate approach would be using probabilistic record linkage methodology, whereby a wider range of potential identifiers could be used to identify likely retirement home residents in administrative databases (Sayers et al. 2016). These variables could include age more than 65 years (especially because this is one of the criteria used to define a retirement home in Ontario) or identifying individuals who receive primary care services from a physician known to serve a specific retirement home (the latter identifier would involve contacting each retirement home to help identify the physician; Government of Ontario 2010).

Conclusion

In Ontario – Canada's most populous province – a substantial proportion of older adults lives in 748 licensed retirement homes that have a combined capacity for 75,020 residents. While retirement home residents represent a growing subpopulation of older Ontarians, there is very limited information about their health and well-being because of the inability to link them to large administrative databases. Furthermore, because retirement homes are not publicly funded, there is little published information on the characteristics of these facilities and the care services available to residents. This study presents a novel method to co-locate Ontario retirement home residents in health administrative databases using postal code information at the facility level. The creation of this retirement home cohort will create data to best support the health needs of aging communities.

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Conflict of Interests

The authors have no financial relationships with any organizations that might have an

interest in the study and have no other relationships or activities that could appear to have influenced the study.

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