RESEARCH PAPER

Rural–Urban Differences in Healthcare Use in Persons With Dementia Between 2000 and 2019: A Quebec Population-Based Study

Différences entre régions rurales et urbaines dans l'utilisation des soins de santé chez les personnes atteintes de démence entre 2000 et 2019 : une étude québécoise axée sur la population

GENEVIÈVE ARSENAULT-LAPIERRE, PhD
Researcher
Centre for Research and Expertise in Social Gerontology
Montreal, QC

CLAIRE GODARD-SEBILLOTTE, MD, PhD
Junior Scientist
Research Institute
McGill University Health Centre
Assistant Professor
Department of Medicine
Division of Geriatrics
McGill University
Montreal, QC

TAMMY BUI, MSc
Research Assistant
Lady Davis Institute for Medical Research
Jewish General Hospital
Montreal, QC

NADIA SOURIAL, PhD
Assistant Professor
Department of Health Management,
Evaluation and Policy
School of Public Health
University of Montreal
Montreal, QC

LOUIS ROCHETTE, MSc
Statistician
Institut national de santé publique du Québec
Quebec City, QC

VICTORIA MASSAMBA, PhD (c)
Scientific Advisor
Institut national de santé publique du Québec
Quebec City, QC

CAROLINE SIROIS, BPharm, PhD
Professor
Faculté de pharmacie
Université Laval
Quebec City, QC

JULIE KOSTENIUK, PhD
Assistant Professor
Canadian Centre for Rural and Agricultural Health
University of Saskatchewan
Saskatoon, SK

DEBRA MORGAN, PhD
Professor
Chair in Rural Health Delivery
Canadian Centre for Rural and Agricultural Health
University of Saskatchewan
Saskatoon, SK

Rural–Urban Differences in Healthcare Use in Persons With Dementia Between 2000 and 2019

AMÉLIE QUESNEL-VALLÉE, PHD
Inaugural Chair and Professor
Department of Equity Ethics and Policy
(Jointly Appointed in the Department of Sociology)
McGill University
Montreal, QC

ISABELLE VEDEL, MD, PHD
Associate Professor
Department of Family Medicine
McGill University
Montreal, QC

Abstract

Background: Rural persons with dementia face medical services gaps. This study compares the health service utilization of rural and urban community-dwelling individuals with incident dementia.

Methods: This study used a repeated annual cross-sectional cohort design spanning a period from 2000 to 2019 analyzing age-adjusted rates for 20 indicators of service use and mortality one year after diagnosis in Quebec administrative databases.

Results: Of 237,259 persons, 20.1% were rural. Most rural persons had more emergency department visits and hospitalizations, shorter stays, less alternate level of care and fewer family physicians' and cognition specialists' visits. All groups had similar long-term care and mortality rates.

Conclusion: Policy implications of these disparities are discussed.

Résumé

Contexte : Les personnes qui vivent en milieu rurales atteintes de démence font face à des lacunes dans les services médicaux. Cette étude compare l'utilisation des services de santé entre les personnes atteintes de démence dans les collectivités rurales et celles des collectivités urbaines.

Méthodes : Cette étude emploie un plan de cohortes transversales annuelles répétées pour la période allant de 2000 à 2019 et analyse les taux ajustés selon l'âge de 20 indicateurs d'utilisation des services et de mortalité un an après le diagnostic dans les bases de données administratives du Québec.

Résultats : Parmi 237 259 personnes, 20,1% vivaient en milieu rural. La plupart des personnes en milieu rural ont eu plus de visites à l'urgence et d'hospitalisations, des séjours plus courts, moins de soins de niveau différent et moins de visites de médecins de famille ou de spécialistes de la cognition. Tous les groupes avaient des taux de soins de longue durée et de mortalité similaires.

Conclusion : Les répercussions politiques de ces disparités sont discutées.

Introduction

Dementia is an increasing public health concern that continues to grow due to the aging population (WHO 2023). Persons with dementia (PWDs) are high users of health services, requiring tailored medical services. Compared to older persons without dementia, PWDs visit emergency departments (EDs) and hospitals more frequently (Bronskill et al. 2020), receive more potentially inappropriate medications (Maltais et al. 2022) and have higher mortality rates (Prince et al. 2012).

The variable availability of health services across regions may impact the provision of adequate care to PWDs, with rural areas facing challenges due to limited access to specialized and primary care services (Casey et al. 2001). Consequently, rural PWDs encounter more barriers to healthcare than urban PWDs (Sibley and Weiner 2011).

Existing literature highlights disparities in healthcare use between rural and urban PWDs. Our systematic review (Arsenault-Lapierre et al. 2023) reveals that in comparison to urban PWDs, rural PWDs have higher mortality rates and more hospitalizations with shorter stays but are less likely to consult specialists. However, these findings may be confounded by the limited scope of most of the studies that were included, capturing only a few years of data and one or two care indicators (i.e., visits to the family physicians, visits to specialists, ED visits, hospitalization, etc.) (Arsenault-Lapierre et al. 2023). In addition, diverse definitions of rurality in the original studies hinder cross-jurisdictional comparisons (Arsenault-Lapierre et al. 2023). Functional measures accounting for the social and economic influence of large urban centres on the surrounding regions may offer a more nuanced approach suitable in the health provision context (du Plessis et al. 2002; Hart et al. 2005; Nelson et al. 2021). More importantly, existing studies have looked at PWDs at various stages of the disease. Around the time of diagnosis, PWDs tend to use (appropriately or inappropriately) health services more than at any other stage of the disease (National Academies of Sciences, Engineering and Medicine et al. 2018; Sivananthan and McGrail 2016).

Understanding the scope of service use by rural and urban PWDs across multiple indicators throughout the continuum of care is necessary for decision makers to plan more equitable health services. This study aims to compare healthcare service use between rural and urban community-dwelling persons with incident dementia in Quebec between 2000 and 2019.

Methods

Setting

Quebec is Canada's second largest province and home to 1.5 million adults aged 65 years and over (Institut de la statistique du Québec 2023). Over the course of the past two decades, Canadian dementia guidelines (Gauthier et al. 2012; Ismail et al. 2020) and federal and provincial healthcare reforms and policies, such as the Canadian dementia strategy (PHAC 2019) and the Quebec Alzheimer Plan (Bergman et al. 2009), have shaped the capacity of primary care to detect, diagnose and manage dementia, whereas other countries have based their dementia strategy in specialist care (Arsenault-Lapierre et al. 2020). Since 2009, the province introduced the Quebec Alzheimer Plan (Bergman et al. 2009) in two phases: first, in 2014, a pilot phase was launched in 42 interdisciplinary primary care teams, followed by an extension phase in 2016 to the whole province (Arsenault-Lapierre et al. 2020;

Guillette et al. 2021; Vedel et al. 2019). The data included in this study span these population changes and pivotal health policies and reforms.

Design and data source

We conducted an annual repeated cohort study from 2000 to 2019. We extracted data from the linked population-based administrative databases from the Québec Integrated Chronic Disease Surveillance System at Institut national de santé publique du Québec. These databases include services provided by the publicly funded universal healthcare system (health insurance registry, hospitalizations, fee-for-service physician claims and drug services) and mortality rates. These databases are linked to individual-level demographics for 99% of the Quebec population, except for the drug services databases, which cover 90% of older adults aged 65 years or more (Blais et al. 2014). Therefore, these databases offer an opportunity to study geographical differences in healthcare service use and mortality at a near population-based level.

Population

We included all community-dwelling older adults aged 65 years and over with incident diagnosis of dementia occurring between April 1 and March 31 for each cohort year. Dementia diagnosis was identified through a validated algorithm, developed in Ontario from the ICES database and adopted by the Public Health Agency of Canada (Appendix 1, available online at www.longwoods.com/content/27281). It has high specificity (99.1%) and sensitivity (79.3%) (Jaakkimainen et al. 2016). With this algorithm, a dementia diagnosis is defined by one of the following criteria: (a) one hospitalization with a dementia code, (b) three or more physician visits with a dementia code and (c) a dementia-specific drug, whichever occurred first. We focused on the incident dementia population as the needs and healthcare use at this time are frequently high and tend to be more homogeneous than in the prevalent population (Sivananthan and McGrail 2016). We determined the community-dwelling status by the absence of evidence in the linked health administrative databases of living in or waiting for admission to a long-term care facility (Godard-Sebillotte et al. 2019). More details are provided in Appendix 2 (available online at www.longwoods.com/content/27281). Individuals with missing postal codes were excluded from analyses.

We used an area-level equity stratification linking an individual's residential postal code to a statistical area classification (SAC) type (CIHI 2018a). This stratification with SAC types, developed by Statistics Canada, provides a functional stratification – i.e., rather than being based only on the size of the population, the degree of social and economic influence that the census metropolitan areas and census agglomerations have on regions outside of census metropolitan areas and census agglomerations is considered (du Plessis et al. 2001).

The most urban group is SAC type 1 that corresponds to census metropolitan areas. SAC types 2 and 3 correspond to census agglomerations (Appendix 3, available online at www.longwoods.com/content/27281); SAC type 4 corresponds to a census area with strong metropolitan influence; SAC type 5 corresponds to a census area with moderate metropolitan influence; and the most rural groups are SAC types 6 and 7 that correspond to a census area with weak or null metropolitan influence. Finally, there is SAC type 8 that refers to territories outside of census agglomerations. There are no data for SAC type 8 as they fall outside each provincial jurisdiction, including Quebec (Statistics Canada 2022). As routinely done by researchers and surveillance specialists, we grouped SAC types 2 and 3, as well as SAC types 6 and 7, to keep the number of categories small and the number of persons within each category large enough to draw meaningful conclusions and reduce noise (Institut national de santé publique du Québec 2019; Vanasse et al. 2010). We used the last issue of the Postal Code Conversion File Plus (a SAS [statistical software suite] control program), to assign the SAC type based on postal codes. This program uses population-weighted random allocation for postal codes that link to more than one geographical area. The distribution of this product is shared between Statistics Canada and Canada Post Corporation.

Outcomes

We selected 20 indicators grounded in a validated Quality of Dementia Care Framework (Sourial et al. 2022) that spans the continuum of care (ambulatory care, acute care and pharmacological care). The operational definitions of all indicators used are provided in Appendices 4 and 5 (available online at www.longwoods.com/content/27281). We measured all indicators during the year following the diagnosis, until death or admission to long-term care and thus expressed as person-year rates.

We grouped four indicators into *ambulatory care*: visits to a primary care physician, continuity of ambulatory care (using the Usual Provider Continuity index, which describes the proportion of visits to the regular physician out of all visits), diagnosis of dementia in primary care and visits to a cognition specialist.

We grouped four indicators into *general acute care*: at least one ED visit, ED visits, at least one hospitalization and days hospitalized.

We grouped four indicators into *potentially avoidable acute care*: at least one hospitalization for an ambulatory care sensitive condition (ACSC) (Feng et al. 2014) relative to the aging/dementia population, 30-day readmissions, at least one hospitalization with alternate level of care (ALC) and months in ALC. ALC is also referred to as delayed discharge.

We grouped three indicators into *dementia-specific pharmacological care*: cholinesterase inhibitor prescriptions, memantine prescriptions and dementia medication prescribed in primary care (cholinesterase inhibitor and/or memantine).

We grouped three indicators into *potentially inappropriate pharmacological care*: benzodiazepine, antipsychotic and antidepressant prescriptions. Some of these medications are considered potentially inappropriate for PWDs by Canadian dementia care guidelines (Gauthier et al. 2012; Ismail et al. 2020). Not all antidepressants are inappropriate; however, information on different classes of antidepressants was not accessible. This limitation is discussed in the interpretation of our results.

We used one indicator for *long-term care* (long-term care admission) and one indicator for *mortality*.

Analysis

Indicators were summarized as rates adjusted for person-time (until death, admission to long-term care or end of the cohort year). Indicators were adjusted for age using direct standardization with the distribution of the 2011 Canada census as the reference population (Anderson and Rosengerb 1998).

We performed descriptive analyses of the baseline characteristics (mean age and standard deviation and percentage of women) of each group based on SAC type. To assess the geographical differences, we stratified age-standardized person-year rates for all indicators over the 20 cohort years using SAC types. These stratified rates were then graphed (one per indicator) and visually analyzed. A visual analysis allowed for determining differences without over-relying on statistical tests as any small difference would have been statistically significant due to quasi-population-level data (Faber and Fonseca 2014). The presence or absence of geographical differences was determined by iterative rounds of collective consensus with 10 experts, including health services researchers and clinicians (public health physicians, nurses, pharmacists, geriatricians and epidemiologists). This methodology was used in a previous study with similar design and methods (Sourial et al. 2020).

Results

Between 2000 and 2019, we present results for 257,919 incidents of PWDs (see Table 1 for socio-demographic characteristics). Of these, 65.7% lived in the most urban area (SAC type 1), 14.2% lived in other urban areas (SAC types 2 and 3), 5.3% lived in a rural area with strong metropolitan influence (SAC type 4), 10.8% lived in a rural area with a moderate metropolitan influence (SAC type 5) and 4.0% lived in the most rural areas (SAC types 6 and 7). In each subsequently more rural geographical location group, the mean age decreased slightly (from 81.4 years old on average in the most urban group to 80.9 years old on average in the most rural group) as the proportion of women decreased (from 63.6% in the most urban group to 59.5% in the most rural group). There was minimal missing information (0.2%) due to lack of postal code.

In terms of *ambulatory care*, between 2000 and 2019 we observed that the most rural group (SAC types 6 and 7) had the lowest rates of visits to a family physician of all groups (Figure 1). For example, the most urban group had more visits to family physicians compared with the most rural group, 17 out of the 19 cohort-years and up to 1.7 visits per person-year. A table of the differences between each group for each indicator is presented in Appendix 6 (available online at www.longwoods.com/content/27281). We observed that the most urban group (SAC type 1) had higher rates of visits to cognition specialists (i.e., compared with the most rural group, the most urban group had more visits to cognition specialists, up to one visit per person-year), lower rates of dementia diagnosis in primary care (the most rural group

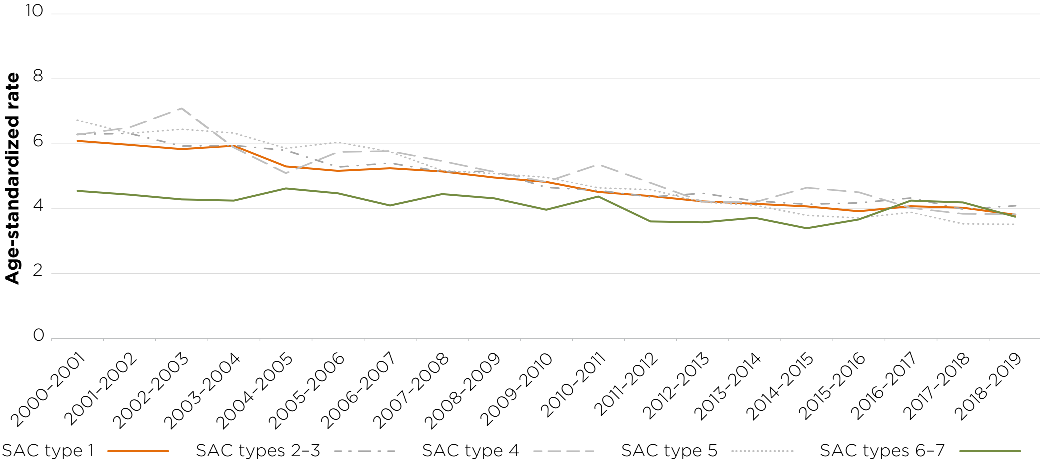
TABLE 1. Description of persons with a newly identified diagnosis of dementia per geographical location

SAC type	*N*	Percentage (%)	Mean age	% of women
SAC type 1 (most urban)	169,351	65.7	81.4	63.6
SAC types 2 and 3	36,689	14.2	81.3	62.9
SAC type 4	13,700	5.3	80.6	55.8
SAC type 5	27,759	10.8	81.1	59.2
SAC types 6 and 7 (most rural)	10,420	4.0	80.9	59.5
Missing postal code	393	0.2		

SAC = Statistical Area Classification.
The cumulative number (*N*) and relative proportion (%) of persons with newly identified dementia between 2000 and 2019, their mean age (in years) and the percentage (%) of women per SAC type.
The most urban group is SAC type 1, which corresponds to census metropolitan areas; SAC types 2 and 3, correspond to census agglomerations; SAC type 4 corresponds to a census area with strong metropolitan influence; SAC type 5 corresponds to a census area with moderate metropolitan influence; and the most rural/remote groups are SAC types 6 and 7, which correspond to a census area with weak or null metropolitan influence. The number and relative proportion of persons for whom the postal code is missing is also given.

had more diagnosis in primary care for the entire cohort-years, and this difference was up to 21.1 person-year, compared with the most urban group) and lower continuity of ambulatory care compared with the other groups. Due to a technical issue, the identification numbers of the physicians were not saved in the prescription drugs database during the year 2011–2012; therefore, it was not possible to determine if the dementia diagnosis was in primary care for that cohort. Data for that year and the indicator are thus missing. The figures for these indicators are available in Appendix 7 (available online at www.longwoods.com/content/27281).

FIGURE 1. Age-standardized rates (per person-year) of the number of visits to a family physician

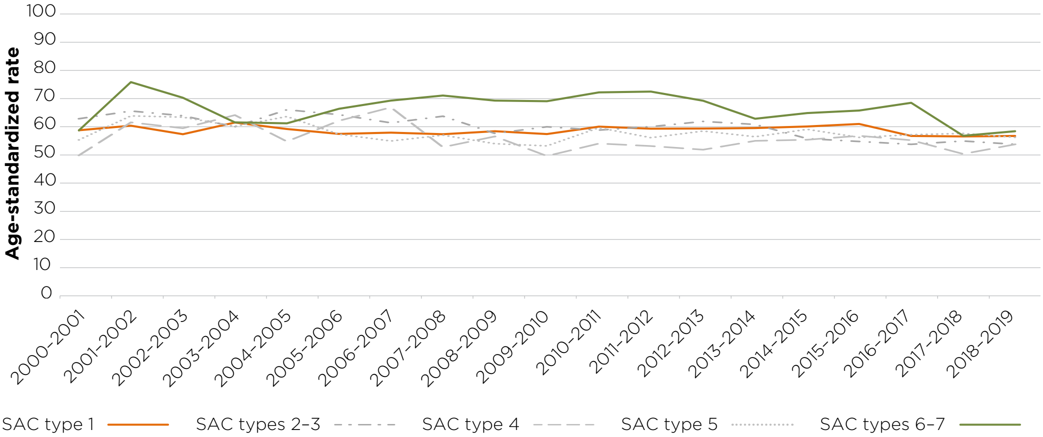


SAC = Statistical Area Classification. SAC type 1 is the most urban group, which corresponds to census metropolitan areas; SAC types 2 and 3 correspond to census agglomerations; SAC type 4 corresponds to a census area with strong metropolitan influence; SAC type 5 corresponds to a census area with moderate metropolitan influence; and the most rural groups, SAC types 6 and 7, correspond to a census area with weak or null metropolitan influence.
Operational definitions are available in Appendix 3. Other figures of age-standardized rate for ambulatory care indicators are presented in Appendix 7.

In terms of *acute care*, between 2000 and 2019 we observed that the most rural group (SAC types 6 and 7) had the highest rates of ED visits (Figure 2) and hospitalizations

(Appendix 7) but the shortest length of stays of all groups (Appendix 7). For example, compared with the most urban group, the most rural group had more ED visits, 18 years out of 19, up to 15.5 person-year and more hospitalization, 17 years out of 19, up to 17.0 person-year. The most urban group had more days of hospitalization, 18 years out of 19 and up to 24 per person-year, compared with the most rural group.

FIGURE 2. Age-standardized rates (per 100 person-year) of at least one ED visit

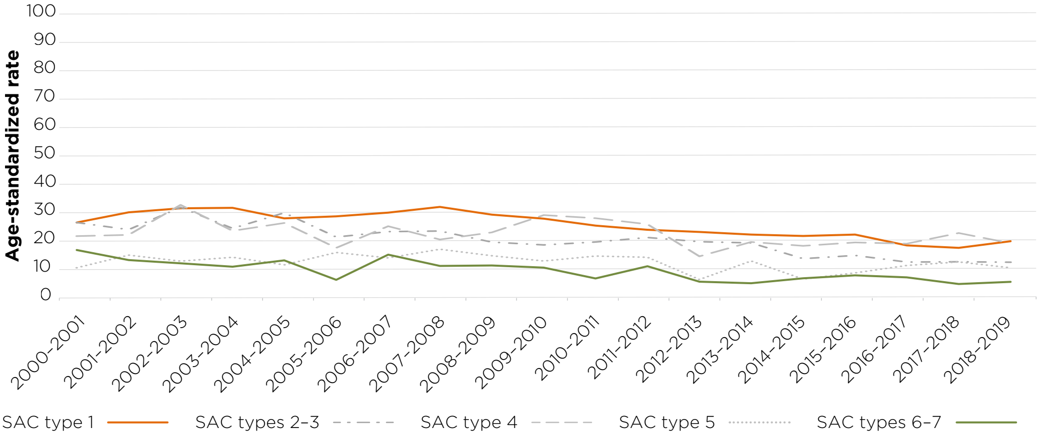


ALC = alternate level of care; SAC = Statistical Area Classification. For further details on each SAC type, refer to Figure 1 footnote (p. 84).
Complete operational definitions are available in Appendix 3. Other figures of age-standardized rate for acute care indicators are presented in Appendix 7.

In terms of *potentially avoidable acute care*, between 2000 and 2019 the most rural group (SAC types 6 and 7) had the lowest rate of hospitalizations with ALC (or delayed discharge) (Figure 3) but highest rates of 30-day readmissions of all groups (Appendix 7). For example, the most urban group had more hospitalizations with ALC for all cohort years, and up to 22.4 person-year, compared with the most rural group; and the most rural group had more 30-day readmissions, 18 out of 19 cohort-years, up to 22.6 person-year, compared with the most urban group. Due to the already low rate of hospitalization, with ensuing large variations between each cohort, the results were inconclusive for the rates of number of months in ALC or hospitalization for an age-related condition that could have been treated in primary care (Appendix 7). Of note, approximately 45% of each group were hospitalized each year.

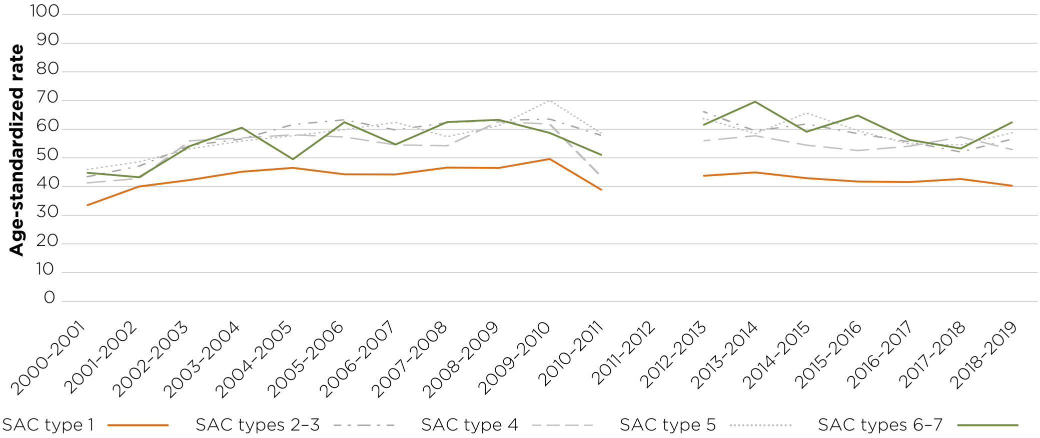
In terms of *dementia-specific pharmacological treatments*, we observed no differences between the groups in the rates of cholinesterase inhibitors or memantine between 2000 and 2019 (Appendix 7). However, the most urban group (SAC type 1) had the lowest rates of dementia medications prescribed in primary care (Figure 4). For example, compared with the most urban group, the most rural group had more prescriptions in primary care for all cohort years, up to 24.6 person-year. Due to a technical issue in the prescription drugs database, the identification numbers of the physicians were not saved during the year 2011–2012; therefore, it was not possible to determine who prescribed the dementia-specific medication for that cohort. Data for that year and the indicator are thus missing.

FIGURE 3. Age-standardized rates (per 100 person-year) of at least one hospitalization with ALC (or delayed discharge)



ALC = alternate level of care; SAC = Statistical Area Classification. For further details on each SAC type, refer to Figure 1 footnote (p. 84).
Complete operational definitions are available in Appendix 3. Other figures of age-standardized rate for potentially avoidable acute care indicators are presented in Appendix 7.

FIGURE 4. Age-standardized rates (per 100 person-year) of dementia prescriptions (cholinesterase inhibitors or memantine) prescribed in primary care

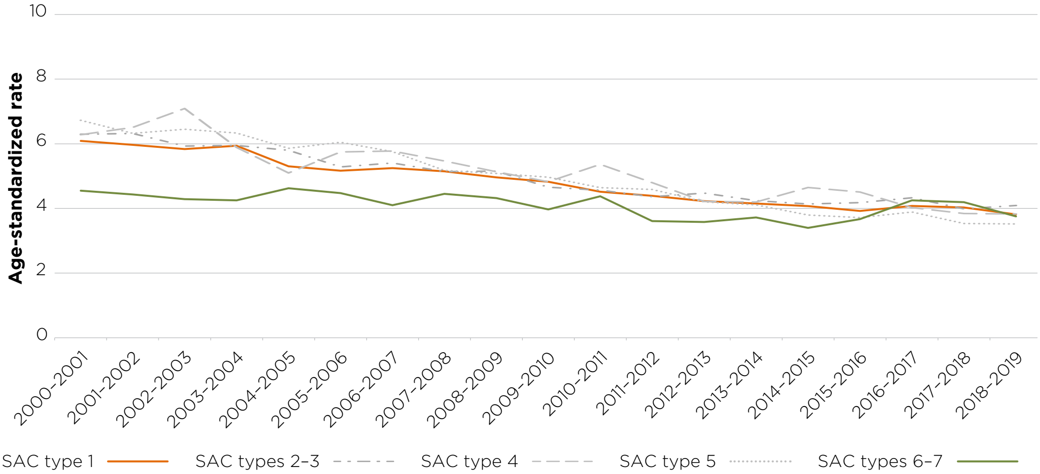


SAC = Statistical Area Classification. For further details on each SAC type, refer to Figure 1 footnote (p. 84).
Complete operational definitions are available in Appendix 3. Missing data for the year 2011–2012 are due to a technical issue in the prescription drugs database. Other figures of age-standardized rate for dementia-specific medications indicators are presented in Appendix 7.

In terms of *potentially inappropriate pharmacological treatments*, between 2000 and 2019 we observed no differences between the groups for rates of antipsychotic and antidepressant prescriptions (Appendix 7), but the most rural group (SAC types 6 and 7) had the highest rates of benzodiazepine prescriptions (Figure 5). For example, compared with the most urban group, the most rural group had higher rates of benzodiazepine prescriptions, 19 years out of 19 and up to 17.7 person-year.

Finally, during the two-decade period, we observed no differences between the groups in rates of *long-term care* or *mortality* (Appendix 7).

FIGURE 5. Age-standardized rates (100 per person-year) of benzodiazepine prescriptions



SAC = Statistical Area Classification. For further details on each SAC type, refer to Figure 1 footnote (p. 84). Complete operational definitions are available in Appendix 3. Other figures of age-standardized rate for potentially inappropriate indicators are presented in Appendix 7.

Discussion

We observed differences in the use of health services for incident PWDs living in rural and urban communities in Quebec. Despite no differences in long-term care admissions and mortality rates, disparities emerged in ambulatory care, acute care and pharmacological care.

In our study, PWDs from the most rural group had the lowest rates of visits to family physicians and cognition specialists as well as higher continuity of care. This aligns with prior studies (Crouch et al. 2019; Koller et al. 2010) but not all (Forbes et al. 2006; Koller et al. 2010). Conflicting results may stem from our focus on incident cases, portraying PWDs in earlier disease stages. Nevertheless, limited resources in rural areas likely contribute to our findings (Charlton et al. 2015; Fédération médicale étudiante du Québec 2020; Gauthier et al. 2009).

We found that rural PWDs had higher rates of ED visits, possibly linked to the practice of rural family physicians in Quebec who often practise in both primary care clinics and the ED (Fleet et al. 2015). Thus, rural family physicians in Quebec may auto-refer patients to the ED for follow-up. Investigating the impact of this practice is essential for future research.

We found higher hospitalizations in rural PWDs, which aligns with existing literature (Forbes et al. 2006). Increased accidents (Smith et al. 2008) and comorbidity (Weeks et al. 2004) in the general rural population may contribute to higher use of acute care services. The shorter length of stay in the rural PWDs of this study may be influenced by the long travel distances; rural PWDs may be hospitalized more often but for shorter periods to spare them long and sometimes unsafe commutes (Martinez et al. 2004), especially when several consultations or tests are required. The limited availability of dementia-related support services in rural areas, including day programs and respite services for both PWDs and caregivers (Bayly et al. 2020), may also contribute to these findings (Martinez et al. 2004).

The most rural PWDs in our study had higher 30-day readmission rates and lower rates of hospitalizations with ALCs (or delayed discharge). Variability in coding preferences and even the availability of hospital beds (Ravaghi et al. 2020) warrant further investigation before conclusion. Due to the low hospitalization rates in each group, we could not determine differences in the length of stay for hospitalizations with ALCs or the rates of hospitalizations with sensitive care conditions for the aging or dementia population. Moreover, there is not enough literature for more detailed comparisons, indicating the need for additional research.

We found no group difference in dementia-specific prescription rates. However, we found lower dementia-specific prescription initiation rates in rural primary care settings. Canadian dementia guidelines (Gauthier et al. 2012; Ismail et al. 2020) and Quebec Alzheimer Plan (Bergman et al. 2009) do support the management of dementia in primary care, across the continuum of care, as opposed to other countries that have based their dementia strategy in specialist care (Arsenault-Lapierre et al. 2020). Nuanced comparisons are limited due to insufficient literature that considers the locus of prescription, emphasizing the need for further research.

We observed no group differences in antidepressant and antipsychotic prescriptions, contradicting previous literature (Bohlken et al. 2015; Sivananthan et al. 2015). This may be due to our focus on incident cases or due to different healthcare insurance systems. Selecting incident cases reduces the inclusion of advanced disease stages explaining the disparity. Rural–urban distinctions may become more pronounced in later disease stages. In addition, rural–urban differences in potentially inappropriate medications have been shown in the general older population in Quebec (Gosselin et al. 2020) and may reflect practice effects. Rural physicians may have limited exposure to new knowledge and fewer chances to consult with geriatricians to manage behavioural and psychological symptoms of dementia.

Finally, we found no group differences in mortality and long-term care admissions, contradicting previous literature, which found higher mortality (Singh and Siahpush 2014) and long-term care admission rates (Crouch et al. 2019) in rural PWDs.

Policy implications

The findings of this study have several policy implications that warrant attention from various stakeholders, including healthcare providers, policy makers, clinicians and professional organizations. Some of our results suggest that services offered in rural settings are of better quality, as they align with the Quebec Alzheimer Plan recommendations (i.e., higher rates of dementia diagnosis in primary care, higher rates of anti-dementia medication prescribed in primary care and higher continuity of care, with the same mortality rates). However, the sheer lack of resources in rural settings needs to be considered carefully. Importantly, PWDs in rural areas, in our study and globally, still have limited access to family physicians and specialists. The perpetual movement of the physician workforce, caused by measures put in place by the Quebec government to promote a better distribution of medical services across the province in rural and especially remote areas (Fédération médicale étudiante du Québec 2020) means that individual access varies abruptly as people come and go (Gauthier et al. 2009). Governmental incentive measures and professional organizations need to align and formalize interprofessional collaborations to improve access to primary care. Through structuring elements that allow a patient's affiliation to a clinic rather than a physician and that expand the scope of practice of these interdisciplinary resources, the impact of resource instability could be mitigated, a broader range of primary care needs could be supported and rural communities' dependence on distant resources could be reduced (Gauthier et al. 2009). This is especially relevant for the dementia care policy in Canada, which relies on interdisciplinary care (Bergman et al. 2009; PHAC 2019). Another solution would be to invest and support in virtual care, which has been demonstrated as useful in rural areas (Iyer et al. 2024).

The higher utilization of acute care services of rural PWDs in our study underscores the significance of strategic investments in health and social services in rural settings to better support PWDs and their care partners at home and avoid caregiver burden, which can lead to ED visits or hospitalizations not medically needed. Decision makers, managers, clinicians and community organizations could pursue several avenues to decrease ED visits and hospitalizations. First, home services and other community services are especially relevant to dementia care (Morgan et al. 2002). Supporting primary care partnerships with community services, such as Alzheimer societies, has been explored in rural Ontario as well as in Saskatchewan, where half of the population lives outside metropolitan areas (Government of Saskatchewan n.d.). These services have strategically located First Link resource centres in smaller communities and adapted a range of services to be accessible virtually to rural communities, including support groups, education sessions, socialization programs and a telephone helpline (Alzheimer Society of Saskatchewan 2021). In addition, decision makers should support the development of hospital-at-home schemes (Leff and Montalto 2004) in rural settings as an alternative to in-patient care when hospitalizations are medically required. Hospital-at-home schemes could also decrease the travel burden for PWDs and care partners.

Finally, to address the higher rates of benzodiazepine prescriptions in rural settings, medical associations, continuing education providers and academic institutions could develop and implement educational programs focusing on pharmacological dementia care, especially in rural areas. Ensuring that healthcare providers are well-informed about the latest dementia management guidelines, or initiatives such as Choosing Wisely, can lead to improved diagnosis, treatment and overall care outcomes. These recommendations should be addressed in dementia care policies, such as the Canadian dementia strategy and provincial Alzheimer's plans, with precise action plans aiming at reducing these rural–urban inequities.

Limitations

Our study has limitations to consider. First, it is a descriptive study, precluding causal inferences. Rather, it provides a comprehensive (20 indicators over 20 years across the care continuum) observational portrait of rural–urban health service use differences in incident dementia cases. Second, measurement of rurality using area-level indicators – like SAC type – though widely used, may be imprecise at the individual levels, particularly in large rural territories and rapidly changing urban areas (CIHI 2018b). However, this measure helps assess how urban centres affect nearby areas.

Third, our analysis – based on administrative databases – may underestimate medical visits, especially in rural settings where salaried physicians (Bosco and Oandasan 2016) and non-physician professionals (Forbes et al. 2006) are common. However, administrative databases allow us to measure the use of health services by the vast majority (90%) of PWDs in Quebec (Blais et al. 2014). The dementia diagnosis algorithm used (Jaakkimainen et al. 2016) excludes specific subtypes of dementia, such as Lewy body dementia, potentially biasing health service use patterns.

Additional research is necessary to grasp the extent of rural–urban disparities in health service utilization among PWDs. Future studies should encompass all subtypes for a more precise representation of the studied population. In addition, exploring other questions in future research mandates the scrutiny of normalcy assumptions, especially given the typically smaller size of the rural groups compared with urban ones. Finally, consideration of how rurality intersects with socio-economic status and sex in PWDs' health service use is essential as these multi-dimensional determinants may overlap and impact health service utilization.

Conclusion

This study reveals important similitudes and differences in health service use between rural and urban community-dwelling PWDs in Quebec. Ignoring geographical disparities may exacerbate health inequity. By providing an estimation of the scope of the differences in health service use in rural and urban regions, this research could guide decision makers involved in implementing Alzheimer's plans to develop more equitable health policies.

Ethics Approval

This study is part of the continuous chronic disease surveillance mandate granted to the Institut national de santé publique du Québec by the provincial Minister of Health and Social Services and approved by the provincial Ethics Committee of Public Health, allowing surveillance activities without participant consent. In addition, it was approved by the McGill Faculty of Medicine Institutional Review Board (A10-B66-19A).

Availability of Data and Materials

The data that support the findings of this study are available from the Institut national de santé publique du Québec but restrictions apply to the availability of these data, which were used under licence for the current study and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission of the Institut national de santé publique du Québec.

Funding

This work was funded by the Quebec Research Network on Aging (Réseau québécois de recherche sur le vieillissement) and the Canadian Consortium on Neurodegeneration in Aging (CCNA) (2019–2024) (CNA-137794). The CCNA is supported by a grant from the Canadian Institutes of Health Research with funding from several partners. The publication of this work was supported by Fonds de recherche du Québec – Société et Culture soutien aux infrastructures de recherche – Centre de recherche et d'expertise en gérontologie sociale. The funding bodies had no role in the study design, data collection, analysis and interpretation.

Acknowledgment

We would like to extend our gratitude to Juliette Champoux-Pellegrin, who produced the graphs that guided our iterative consensus process, and Sabrina Bujo-Nagji and Alexandra Lemay-Compagnat, who helped with grammar editing and reference management. We would like to thank Rachel Mackey as well for her guidance on rurality measurement.

Correspondence may be directed to Geneviève Arsenault-Lapierre by e-mail at genevieve.arsenault-lapierre@mail.mcgill.ca.

References

Alzheimer Society of Saskatchewan. 2021. *Staying Connected: Annual Report 2020–2021*. Retrieved July 2023. <https://alzheimer.ca/sk/sites/sk/files/documents/Annual%20Report%202020%202021_0.pdf>.

Anderson, R.N. and H.M. Rosengerb. 1998, October 7. *Age Standardization of Death Rates; Implementation of the Year 2000 Standard*. Centers for Disease Control, National Center for Health Statistics. Retrieved July 2023. <https://stacks.cdc.gov/view/cdc/13357>.

Arsenault-Lapierre, G., T.X. Bui, M. Le Berre, H. Bergman and I. Vedel. 2023. Rural and Urban Differences in Quality of Dementia Care of Persons With Dementia and Caregivers Across All Domains: A Systematic Review. *BMC Health Services Research* 23(1): 102. doi:10.1186/s12913-023-09100-8.

Arsenault-Lapierre, G., C. Godard-Sebillotte, N. Sourial, Y. Couturier, P. Bouchard, L.R. Rozo et al. 2020. Le Plan Alzheimer québécois, un plan basé sur les soins primaires. *Santé Publique* 32(4): 375–80. doi:10.3917/spub.204.0375.

Bayly, M., D. Morgan, A.F. Chow, J. Kosteniuk and V. Elliot. 2020. Dementia-Related Education and Support Service Availability, Accessibility, and Use in Rural Areas: Barriers and Solutions. *Canadian Journal on Aging* 39(4): 545–85. doi:10.1017/S0714980819000564.

Bergman, H., M. Arcand, C. Bureau, H. Chertkow, F. Ducharme, Y. Joanette et al. 2009, May. *Report of the Committee of Experts for the Development of an Action Plan on Alzheimer's Disease and Related Disorders: Meeting the Challenge of Alzheimer's Disease and Related Disorders*. Retrieved July 2023. <https://www.mcgill.ca/geriatrics/files/geriatrics/alzheimer_report.pdf>.

Blais, C., S. Jean, C. Sirois, L. Rochette, C. Plante, I. Larocque et al. 2014. Quebec Integrated Chronic Disease Surveillance System (QICDSS), an Innovative Approach. *Chronic Diseases and Injuries in Canada* 34(4): 226–35. doi:10.24095/hpcdp.34.4.06.

Bohlken, J., M. Schulz, M.A. Rapp and J. Bätzing-Feigenbaum. 2015. Pharmacotherapy of Dementia in Germany: Results From a Nationwide Claims Database. *European Neuropsychopharmacology* 25(12): 2333–38. doi:10.1016/j.euroneuro.2015.09.014.

Bosco, C. and I. Oandasan. 2016, January. *Review of Family Medicine Within Rural and Remote Canada: Education, Practice, and Policy*. College of Family Physicians of Canada. Retrieved March 22, 2024. <https://www.cfpc.ca/CFPC/media/Resources/Rural-Practice/ARFM_BackgroundPaper_Eng_WEB_FINAL.pdf>.

Bronskill, S.E., L.C. Maclagan, J.D. Walker, J. Guan, X. Wang, R. Ng et al. 2020. Trajectories of Health System Use and Survival for Community-Dwelling Persons With Dementia: A Cohort Study. *BMJ Open* 10(7): e037485. doi:10.1136/bmjopen-2020-037485.

Canadian Institute for Health Information (CIHI). 2018a, April. *In Pursuit of Health Equity: Defining Stratifiers for Measuring Health Inequality – A Focus on Age, Sex, Gender, Income, Education and Geographic Location*. Retrieved July 2023. <https://www.cihi.ca/sites/default/files/document/defining-stratifiers-measuring-health-inequalities-2018-en-web.pdf>.

Canadian Institute for Health Information (CIHI). 2018b. *Measuring Health Inequalities: A Toolkit: Area-Level Equity Stratifiers Using PCCF and PCCF+*. Retrieved July 2023. <https://www.cihi.ca/sites/default/files/document/toolkit-area-level-measurement-pccf-en.pdf>.

Casey, M.M., K. Thiede Call and J.M. Klingner. 2001. Are Rural Residents Less Likely to Obtain Recommended Preventive Healthcare Services? *American Journal of Preventive Medicine* 21(3): 182–88. doi:10.1016/S0749-3797(01)00349-X.

Charlton, M., J. Schlichting, C. Chioreso, M. Ward and P. Vikas. 2015. Challenges of Rural Cancer Care in the United States. *Oncology* 29(9): 633–40.

Crouch, E., J.C. Probst, K. Bennett and J.M. Eberth. 2019. Differences in Medicare Utilization and Expenditures in the Last Six Months of Life Among Patients With and Without Alzheimer's Disease and Related Disorders. *Journal of Palliative Medicine* 22(2): 126–31. doi:10.1089/jpm.2018.0147.

du Plessis, V., R. Beshiri, R.D. Bollman and H. Clemenson. 2001, November. Definitions of "Rural." *Rural and Small Town Canada Analysis Bulletin* 3(3). Catalogue no. 21-006-XIE. Statistics Canada. Retrieved March 22, 2024. <https://publications.gc.ca/collections/collection_2014/statcan/CS21-601-61-eng.pdf>.

du Plessis, V., R. Beshiri, R.D. Bollman and H. Clemenson. 2002, December. Definitions of "Rural." *Agricultural and Rural Working Paper Series* No. 61. Catalogue no. 21-601-MIE — No. 061. Statistics Canada. Retrieved March 22, 2024. <https://publications.gc.ca/collections/collection_2014/statcan/CS21-601-61-eng.pdf>.

Faber, J. and L.M. Fonseca. 2014. How Sample Size Influences Research Outcomes. *Dental Press Journal of Orthodontics* 19(4): 27–29. doi:10.1590/2176-9451.19.4.027-029.ebo.

Fédération médicale étudiante du Québec. 2020. *Amener la relève médicale à nos régions : comment valoriser la pratique de la médecine en région au Québec*. Rédigé dans le cadre de la Journée d'Action politique 2020. Retrieved February 7, 2023. <https://fmeq.ca/wp-content/uploads/2020/11/Memoire_regions.pdf>.

Feng, Z., L.A. Coots, Y. Kaganova and J.M. Wiener. 2014. Hospital and ED Use Among Medicare Beneficiaries With Dementia Varies by Setting and Proximity to Death. *Health Affairs* 33(4): 683–90. doi:10.1377/hlthaff.2013.1179.

Fleet, R., J. Poitras, P. Archambault, F.K. Tounkara, J.-M. Chauny, M. Ouimet et al. 2015. Portrait of Rural Emergency Departments in Québec and Utilization of the Provincial Emergency Department Management Guide: Cross Sectional Survey. *BMC Health Services Research* 15: 572. doi:10.1186/s12913-015-1242-0.

Forbes, D.A., D. Morgan and B.L. Janzen. 2006. Rural and Urban Canadians With Dementia: Use of Health Care Services. *Canadian Journal on Aging / La Revue canadienne du vieillissement* 25(3): 321–30. doi:10.1353/cja.2007.0003.

Gauthier, J., J. Haggerty, P. Lamarche, J.-F. Lévesque, D. Morin, R. Pineault et al. 2009, October. *Entre adaptabilité et fragilité : les conditions d'accès aux services de santé des communautés rurales et éloignées*. Institut national de santé publique du Québec. Retrieved July 2023. <https://www.inspq.qc.ca/sites/default/files/publications/1014_conditionsaccesservsantecommunrurales.pdf>.

Gauthier, S., C. Patterson, H. Chertkow, M. Gordon, N. Herrmann, K. Rockwood et al. 2012. Recommendations of the 4th Canadian Consensus Conference on the Diagnosis and Treatment of Dementia (CCCDTD4). *Canadian Geriatrics Journal* 15(4): 120–26. doi:10.5770/cgj.15.49.

Godard-Sebillotte, C., N. Sourial, M. Hardouin, L. Rochette, E. Pelletier, P. Gamache et al. 2019. Development of Two Hierarchical Algorithms Identifying the 65+ Community Dwelling Population in the Provincial Administrative Database in Quebec [Paper presented at the CAHSPR Annual Conference, 2019, May 27, Halifax, NS].

Gosselin, E., M. Simard, M. Dubé and C. Sirois. 2020. *Portrait de la polypharmacie chez les aînés québécois entre 2000 et 2016*. Institut national de santé publique du Québec. Retrieved March 22, 2024. <https://www.inspq.qc.ca/sites/default/files/publications/2679_portrait_polypharmacie_aines_quebecois.pdf>.

Government of British Columbia. 2024. Diagnostic Code Descriptions (ICD-9). Retrieved March 22, 2024. <https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/msp/physicians/diagnostic-code-descriptions-icd-9>.

Government of Saskatchewan. n.d. 2021 Census of Population: Population by Community. In "Demography, Census Reports and Statistics." Retrieved March 22, 2024. <https://www.saskatchewan.ca/government/government-data/bureau-of-statistics/population-and-census>.

Guillette, M., Y. Couturier, I. Vedel and H. Bergman. 2021. *The Quebec Alzheimer Plan: Sharing the Experience of Its Implementation to Strengthen Primary Care: Policy Brief*. McGill Department of Family Medicine, Healthcare Excellence Canada and Université de Sherbrooke. Retrieved March 22, 2024. <https://www.healthcareexcellence.ca/media/0p1jhwug/final-2-policy-brief-format-court_en-final-ua.pdf>.

Hart, L.G., E.H. Larson and D.M. Lishner. 2005. Rural Definitions for Health Policy and Research. *American Journal of Public Health* 95(7): 1149–55. doi:10.2105/ajph.2004.042432.

Institut national de santé publique du Québec. 2019. Milieux ruraux et urbains : Quelles différences de santé au Québec? Retrieved March 22, 2024. <https://www.inspq.qc.ca/santescope/milieux-ruraux-urbains>.

Institut de la statistique du Québec. 2023, May 18. Portrait of Seniors in Québec. Retrieved March 22, 2024. <https://statistique.quebec.ca/en/communique/portrait-of-seniors-in-quebec>.

Ismail, Z., S.E. Black, R. Camicioli, H. Chertkow, N. Herrmann, R. Laforce Jr. et al. 2020. Recommendations of the 5th Canadian Consensus Conference on the Diagnosis and Treatment of Dementia. *Alzheimer's and Dementia* 16(8): 1182–95. doi:10.1002/alz.12105.

Iyer, S., P. Mehta, C.E. Gould, S. Gara, M.-F. B. Brodrick and J.L. Tenover. 2024. Dementia "E"-Consults for Behavioral and Psychological Symptoms of Dementia: Improving Access to Specialty Dementia Care for Rural Veterans. *Clinical Gerontologist* 47(1): 90–97. doi:10.1080/07317115.2023.2177574.

Jaakkimainen, R.L., S.E. Bronskill, M.C. Tierney, N. Herrmann, D. Green, J. Young et al. 2016. Identification of Physician-Diagnosed Alzheimer's Disease and Related Dementias in Population-Based Administrative Data: A Validation Study Using Family Physicians' Electronic Medical Records. *Journal of Alzheimer's Disease* 54(1): 337–49. doi:10.3233/jad-160105.

Koller, D., M. Eisele, H. Kaduszkiewicz, G. Schön, S. Steinmann, B. Wiese et al. 2010. Ambulatory Health Services Utilization in Patients with Dementia – Is There an Urban-Rural Difference? *International Journal of Health Geographics* 9: 59. doi:10.1186/1476-072X-9-59.

Leff, B. and M. Montalto. 2004. Home Hospital-Toward a Tighter Definition. *Journal of the American Geriatrics Society* 52(12): 2141. doi:10.1111/j.1532-5415.2004.52579_1.x.

Maltais, A., M. Simard, I. Vedel and C. Sirois. 2022. Changes in Polypharmacy and Psychotropic Medication Use After Diagnosis of Major Neurocognitive Disorders: A Population-Based Study in Québec, Canada. *Alzheimer Disease and Associated Disorders* 36(3): 222–29. doi:10.1097/wad.0000000000000513.

Martinez, J., R. Pampalon, D. Hamel and G. Raymond. 2004, January 2004. *Does Living in Rural Communities Rather Than Cities Really Make a Difference in People's Health and Wellness?"* Institut national de santé publique du Québec. Retrieved July 6, 2022. <https://www.inspq.qc.ca/es/node/2296>.

Morgan, D.G., K.M. Semchuk, N.J. Stewart and C. D'Arcy. 2002. Rural Families Caring for a Relative With Dementia: Barriers to Use of Formal Services. *Social Science and Medicine* 55(7): 1129–42. doi:10.1016/S0277-9536(01)00255-6.

National Academies of Sciences, Engineering and Medicine; Health and Medicine Division; Board on Health Care Services; Committee on Health Care Utilization and Adults With Disabilities. 2018. Factors That Affect Health-Care Utilization. In *Health-Care Utilization as a Proxy in Disability Determination* (pp. 21–38). National Academies Press.

Nelson, K.S., T.D. Nguyen, N.A. Brownstein, D. Garcia, H.C. Walker, J.T. Watson et al. 2021. Definitions, Measures, and Uses of Rurality: A Systematic Review of the Empirical and Quantitative Literature. *Journal of Rural Studies* 82: 351–65. doi:10.1016/j.jrurstud.2021.01.035.

Prince, M., D. Acosta, C.P. Ferri, M. Guerra, Y. Huang, J.J. Llibre Rodriguez et al. 2012. Dementia Incidence and Mortality in Middle-Income Countries, and Associations With Indicators of Cognitive Reserve: A 10/66 Dementia Research Group Population-Based Cohort Study. *Lancet* 380(9836): 50–58. doi:10.1016/S0140-6736(12)60399-7.

Public Health Agency of Canada (PHAC). 2019, June 17. *A Dementia Strategy for Canada: Together We Aspire*. Retrieved March 22, 2024. <https://www.canada.ca/content/dam/phac-aspc/images/services/publications/diseases-conditions/dementia-strategy/National%20Dementia%20Strategy_ENG.pdf>.

Ravaghi, H., S. Alidoost, R. Mannion and V.D. Bélorgeot. 2020. Models and Methods for Determining the Optimal Number of Beds in Hospitals and Regions: A Systematic Scoping Review. *BMC Health Services Research* 20(1): 186. doi:10.1186/s12913-020-5023-z.

Sibley, L.M. and J.P. Weiner. 2011. An Evaluation of Access to Health Care Services Along the Rural-Urban Continuum in Canada. *BMC Health Services Research* 11(1): 20. doi:10.1186/1472-6963-11-20.

Singh, G.K. and M. Siahpush. 2014. Widening Rural-Urban Disparities in All-Cause Mortality and Mortality From Major Causes of Death in the USA, 1969–2009. *Journal of Urban Health* 91(2): 272–92. doi:10.1007/s11524-013-9847-2.

Sivananthan, S.N., M.R. Lavergne and K.M. McGrail. 2015. Caring for Dementia: A Population-Based Study Examining Variations in Guideline-Consistent Medical Care. *Alzheimer's and Dementia* 11(8): 906–16. doi:10.1016/j.jalz.2015.02.008.

Sivananthan, S.N. and K.M. McGrail. 2016. Diagnosis and Disruption: Population-Level Analysis Identifying Points of Care at Which Transitions Are Highest for People With Dementia and Factors That Contribute to Them. *Journal of the American Geriatrics Society* 64(3): 569–77. doi:10.1111/jgs.14033.

Smith, K.B., J.S. Humphreys and M.G.A. Wilson. 2008. Addressing the Health Disadvantage of Rural Populations: How Does Epidemiological Evidence Inform Rural Health Policies and Research? *Australian Journal of Rural Health* 16(2): 56–66. doi:10.1111/j.1440-1584.2008.00953.x.

Sourial, N., C. Godard-Sebillotte, S.E. Bronskill, G. Hacker and I. Vedel. 2022. Quality Indicator Framework for Primary Care of Patients With Dementia. *Canadian Family Physician* 68(9): e270–78. doi:10.46747/cfp.6809e270.

Sourial, N., I. Vedel, C. Godard-Sebillotte, J. Etches, G. Arsenault-Lapierre and S.E. Bronskill. 2020. Sex Differences in Dementia Primary Care Performance and Health Service Use: A Population-Based Study. *Journal of the American Geriatrics Society* 68(5): 1056–63. doi:10.1111/jgs.16347.

Statistics Canada. 2022. Table 98-10-0016-01 Population and Dwelling Counts by the Statistical Area Classification. Retrieved March 22, 2024. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=9810001601>.

Vanasse, A., J. Courteau, A. Cohen, M.G. Orzanco and C. Drouin. 2010. Rural-Urban Disparities in the Management and Health Issues of Chronic Diseases in Quebec (Canada) in the Early 2000s. *Rural and Remote Health* 10: 1548. doi:10.22605/RRH1548.

Vedel, I., N. Sourial, G. Arsenault-Lapierre, C. Godard-Sebillotte and H. Bergman. 2019. Impact of the Quebec Alzheimer Plan on the Detection and Management of Alzheimer Disease and Other Neurocognitive Disorders in Primary Health Care: A Retrospective Study. *CMAJ Open* 7(2): E391–98. doi:10.9778/cmajo.20190053.

Weeks, W.B., L.E. Kazis, Y. Shen, Z. Cong, X.S. Ren, D. Miller et al. 2004. Differences in Health-Related Quality of Life in Rural and Urban Veterans. *American Journal of Public Health* 94(10): 1762–67. doi:10.2105/ajph.94.10.1762.

World Health Organization (WHO). 1992. The lCD-10 Classification of Mental and Behavioural Disorders. Retrieved March 22, 2024. <https://cdn.who.int/media/docs/default-source/classification/other-classifications/9241544228_eng.pdf?sfvrsn=933a13d3_1&download=true>.

World Health Organization (WHO). 2023, March 15. Dementia Fact Sheet. Retrieved March 22, 2024. <https://www.who.int/news-room/fact-sheets/detail/dementia>.