

Original Article

Access to Virtual Physician Care among Persons with Dementia in Urban and Rural Areas: A Repeated Cross-Sectional Study

Tomi T. Odugbemi¹, Laura C. MacLagan¹, Zhiyin Li¹, Jun Guan¹, Richard H. Swartz^{1,2,3} , Colleen J. Maxwell^{1,4},
R. Liisa Jaakkimainen^{1,2,5,6} and Susan E. Bronskill^{1,2,5} 

¹ICES, Toronto, Ontario, Canada, ²Sunnybrook Research Institute, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada, ³Department of Medicine (Neurology), Hurvitz Brain Sciences Program, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada, ⁴Schools of Pharmacy and Public Health Sciences, University of Waterloo, Waterloo, Ontario, Canada, ⁵Institute of Health Policy, Management & Evaluation, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada and ⁶Department of Family and Community Medicine, University of Toronto, Toronto, Ontario, Canada

ABSTRACT: Background: During the COVID-19 pandemic, virtual physician visits rapidly increased among community-dwelling older persons living with dementia (PLWD) in Ontario. Rural residents often have less access to medical care compared to their urban counterparts, and it is unclear whether access to virtual care was equitable between PLWD in urban versus rural locations. **Methods:** Using population-based health administrative data and a repeated cross-sectional study design, we identified and described community-dwelling PLWD between March 2020 and August 2022 in Ontario, Canada. Poisson regression was used to calculate rate ratios (RR) and 95% confidence intervals comparing rates of virtual visits between rural and urban PLWD by key physician specialties: family physicians, neurologists and psychiatrists/geriatricians. **Results:** Of 122,751 PLWD in our cohort, 9.2% ($n = 11,304$) resided in rural areas. Rural PLWD were slightly younger compared to their urban counterparts (mean age = 81 vs. 82 years; standardized difference = 0.16). There were no differences across areas by sex or income quintile. In adjusted models, rates of virtual visits were significantly lower for rural compared to urban PLWD across all specialties: family physicians (RR = 0.71 [0.69–0.73]), neurologists (RR = 0.79 [0.75–0.83]) and psychiatrists/geriatricians (RR = 0.72 [0.68–0.76]). **Conclusions:** PLWD in rural areas had significantly lower rates of virtual family physician, neurologist and psychiatrist/geriatrician visits compared to urban dwellers during the study period. This finding raises important issues regarding access to primary and specialist healthcare services for rural PLWD. Future work should explore barriers to care to improve health care access among PLWD in rural communities.

RÉSUMÉ : L'accès aux soins médicaux virtuels chez les personnes atteintes de démence et vivant en milieu urbain ou rural : résultats d'une étude transversale à mesures répétées. Contexte : Durant la pandémie de COVID-19, le nombre de consultations médicales en mode virtuel a connu une croissance rapide chez les personnes âgées, atteintes de démence et vivant dans la communauté, en Ontario. Celles qui demeuraient en milieu rural éprouvaient souvent plus de difficulté à avoir accès aux soins médicaux que celles qui demeuraient en milieu urbain; d'ailleurs, il n'est pas sûr que l'accès aux soins virtuels était équitable entre les deux milieux de vie, urbain et rural, chez les personnes concernées. **Méthode :** C'est à l'aide de données administratives sur la santé, basées sur la population, et d'une étude transversale à mesures répétées que l'équipe a pu cerner, puis décrire le groupe de personnes âgées, atteintes de démence et vivant dans la communauté, entre mars 2020 et août 2022, en Ontario, au Canada. Les ratios de taux (RT) et les intervalles de confiance (IC) à 95 % comparant les taux de consultation virtuelle entre les personnes ciblées vivant en milieu rural et celles demeurant en milieu urbain ont été calculés à l'aide de la régression de Poisson, selon les principales spécialités médicales : médecine familiale, neurologie et psychiatrie ou gériatrie. **Résultats :** Au total, 122 751 personnes âgées, atteintes de démence et vivant dans la communauté composaient la cohorte; de celles-ci, 9,2 % ($n = 11\,304$) demeuraient en milieu rural. Ces dernières, en milieu rural, étaient un peu plus jeunes que les premières, en milieu urbain (âge moyen = 81 ans contre 82 ans; différence normalisée = 0,16). Par contre, il n'y avait aucune différence entre les milieux, quant au sexe ou au quintile de revenu. Toutefois, d'après les modèles rajustés, les taux de consultation virtuelle étaient significativement plus faibles en milieu rural qu'en milieu urbain, et ce, dans toutes les spécialités : médecine familiale (RT = 0,71 [0,69 – 0,73]), neurologie (RT = 0,79 [0,75 – 0,83]) et psychiatrie ou gériatrie (RT = 0,72 [0,68 – 0,76]). **Conclusion :** Les personnes âgées, atteintes de démence et vivant en milieu rural avaient des taux de consultation significativement plus faibles en médecine familiale, en neurologie et en psychiatrie ou en gériatrie que celles établies en milieu urbain, au cours de la période d'étude. Le constat soulève des questions importantes en ce qui concerne l'accès aux services de santé de première ligne et de spécialité en milieu rural, chez les personnes concernées. Aussi faudrait-il se pencher éventuellement sur les obstacles à la prestation de soins afin d'en améliorer l'accès chez les personnes âgées, atteintes de démence et vivant en milieu rural.

Keywords: dementia; geographic variation; health equity; health services research; rural; urban

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Corresponding author: Susan Elisabeth Bronskill; Email: susan.bronskill@ices.on.ca

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Highlights

- During the COVID-19 pandemic, virtual physician visits rapidly increased and then declined among older persons living with dementia (PLWD).
- Rural PLWD were less likely to receive virtual family physician visits compared to urban, highlighting geographic disparities.
- Future research should explore and address barriers to virtual care access among rural PLWD.

Introduction

The rapid uptake and implementation of virtual care in Ontario, Canada, has been regarded as a success of the COVID-19 pandemic response.^{1,2} Despite this, there are concerns virtual care may exacerbate barriers to healthcare already experienced by vulnerable groups such as rural dwellers, older adults, persons with low income, those with disabilities and racialized persons.^{3,4} Such barriers relate to the availability, affordability, access and sustainability of healthcare.³ Barriers to the adoption of virtual care include technological challenges such as digital health literacy, vision and hearing impairment and not having access to the required technology for virtual care.

The COVID-19 pandemic posed unique challenges for persons living with dementia (PLWD) and their caregivers. Restrictions and lockdown measures disrupted routines and increased social isolation and loneliness, all of which have been associated with neuropsychiatric symptoms and behavioral disturbances, thus increasing caregiver burden in this population.^{5,6} PLWD were more likely to suffer severe outcomes when infected with COVID-19,⁷ and some reported a decline in cognitive function.⁶

In Ontario, access to healthcare services was disrupted at the start of the pandemic, resulting in a decline in the use of several health services including emergency department (ED), physician and home care visits.⁸ During this period, a rapid shift to virtual healthcare services occurred to enable continued care access.⁹ This was facilitated by the Ministry of Health introducing temporary fee codes to the health insurance billing structure to allow virtual physician care via telephone calls and videoconferencing as an alternative to in-person visits.^{2,10,11}

Previous research has shown that PLWD in rural/remote areas have lower rates of healthcare utilization including physician visits and home care compared to urban dwellers.^{12,13} We have demonstrated a rapid uptake of virtual care in physician visits among PLWD in Ontario in the first few months of the pandemic;⁸ however, the extent of potential geographic variation has not been explored. We examined the association between rurality and rates of virtual physician care across specialties over time among community-dwelling PLWD in Ontario, Canada.

Methods

Study design, setting and participants

We conducted a population-based repeated cross-sectional study between March 1, 2020, and August 27, 2022, among community-dwelling PLWD aged 66–110 years who were alive and eligible for provincial insurance at the start of each week (index date) in Ontario, Canada. The first COVID-19 case in Ontario was recorded on January 25, 2020; however, community transmission became evident in March 2020. Therefore March 1, 2020, was designated the start of the study period. Ontario is the most populous province in Canada with over 14 million residents, and nearly all residents have universal health coverage for medically

necessary services, including ED visits, physician visits and hospitalizations. We identified PLWD using a validated health administrative database algorithm.¹⁴ Individuals with contact with a nursing home in the 3 months prior to each index date were excluded since persons residing in nursing homes experience different patterns of physician visits and access to care, particularly during the pandemic.

Data sources

We obtained sociodemographic information including age, sex and death date (if applicable) from the Ontario Registered Persons Database. We used the Canadian Institute for Health Information (CIHI) Discharge Abstract Database and National Ambulatory Care Reporting System to obtain information on acute care hospitalizations and ED visits, respectively. We used the Ontario Health Insurance Plan (OHIP) for physician billing information and the Ontario Drug Benefit (ODB) database to identify dispensed medications. To identify and exclude those who were admitted to a nursing home, we used the Continuing Care Reporting System Long-Term Care, ODB and OHIP databases. Information on primary care enrollment models based on primary care provider rostering was obtained using the Client Agency Program Enrolment database. These datasets were linked using unique encoded identifiers and analyzed at ICES. ICES is an independent, nonprofit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze healthcare 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 and does not require review by a Research Ethics Board.

Exposure

The primary exposure was urban versus rural location of residence as of the index date. Rurality was obtained from the Postal Code Conversion File Plus, version 2016, and defined using Statistics Canada's indicator of rural and small-town status based on community size.^{15,16} Rural PLWD were defined as individuals residing in rural communities and small towns (with population size $\leq 10,000$) and municipalities outside the commuting zones of larger urban centers. Urban PLWD, in contrast, were those residing within a census metropolitan area or census agglomeration known as "urban core" as well as those in neighboring municipalities where $\geq 50\%$ of the workforce commute to the urban core.¹⁵

Outcomes

The primary outcomes were visits (total, virtual, in-person) to physicians who regularly provide care for PLWD – family physicians, neurologists and geriatricians/psychiatrists (grouped together for stable estimates due to small counts). Virtual visits were identified using OHIP fee codes for physician visits that indicated telephone or video visits, while in-person visits were identified by fee codes that indicated office or home visits.

Baseline characteristics

Sociodemographic and clinical characteristics such as age, sex, income quintile, Ontario Marginalization Index (ON-Marg) material resources dimension (v2016), medication use and comorbidities were described for community-dwelling PLWD at

the start of the study (March 1, 2020). The neighborhood income quintile is an area-based measure of household income obtained by linking an individual's postal code to census data from Statistics Canada.¹⁷ The ON-Marg material resources dimension represents one facet of marginalization and includes indicators on single-parent households, employment and education, social assistance, low-income and housing.¹⁸

We identified the history and duration of dementia (time from case ascertainment in administrative databases to the start of the study) and the presence of 17 other chronic conditions using validated health administrative algorithms.^{14,19} We identified all medications dispensed where the prescribed duration of use overlapped the start of the study period and categorized them according to subclasses of interest (antipsychotics, antidepressants, benzodiazepines, cholinesterase inhibitors, opioids, angiotensin-converting enzyme inhibitors and angiotensin receptor blockers and total number of medications dispensed (0–4, 5–9 and 10+).

Primary care enrollment models were implemented by the Ontario government in the 2000s to improve primary care delivery.²⁰ We categorized models as capitation (team-based and non-team-based), fee-for-service (FFS) (traditional and enhanced), physicians not in an enrollment model and patients not rostered to a primary care physician. We calculated continuity of primary care using the Usual Provider of Care Index – a ratio of the frequency of visits to a patient's main provider to the frequency of visits to all providers over a 2-year period.²¹ This index was grouped into low (<0.4), medium (0.4–0.8) and high (>0.8) continuity categories.²² Recent registration for health insurance (<10 years prior to the index date) was used as a proxy for immigration. Health system utilization in the previous year including acute care hospitalizations, ED visits, home care visits, family physician, neurologist and geriatrician/psychiatrist visits was also obtained.

Given changes in the nature of the COVID-19 pandemic over time, we divided the 30-month period into 5 subperiods of 26 weeks (~6 months). The subperiods were March 1, 2020, to August 29, 2020 (0–<6 months); August 30, 2020, to February 27, 2021 (6–<12 months); February 28, 2021, to August 28, 2021 (12–<18 months); August 29, 2021, to February 26, 2022 (18–<24 months); and February 27, 2022, to August 27, 2022 (24–30 months).

Statistical Analysis

Demographic and clinical characteristics as of March 1, 2020, were summarized and compared between rural and urban groups using standardized differences, with values greater than 0.1 considered meaningful.²³ In each subperiod, we calculated the proportions of PLWD with at least one visit and the average number of visits among those individuals, for each mode of physician visit (virtual and in-person) and specialty. Weekly rates of physician visits (total, virtual, in-person) per 100 persons were calculated for each specialty comparing urban and rural residents. PLWD were censored at each index date on death, admission to a nursing home or loss of OHIP eligibility, whichever occurred first. Poisson regression models with generalized estimating equations were used to calculate rate ratios (RR) and 95% confidence intervals (CI) comparing physician visit rates by rurality. Models were initially adjusted for age, sex and subperiod (to adjust for changes in visits over time). To achieve a parsimonious model and ensure computational efficiency, we further adjusted for income quintile, primary care enrollment model and history of visits to family

physicians, neurologists, psychiatrists or geriatricians in the previous year. All analyses were conducted using SAS v9.4 (SAS Institute Inc., Cary, NC).

Results

We identified 122,751 community-dwelling PLWD on March 1, 2020, including 111,447 (90.8%) urban and 11,304 (9.2%) rural individuals (Table 1). Those living in rural locations were younger than urban residents (81.1 vs. 82.3 years, SDiff = 0.16), while sex distribution was similar (female 55.8% vs. 58.5%, SDiff = 0.06). We observed differences in the number of chronic conditions, model of primary care, recent health insurance registration, continuity of primary care and healthcare utilization in the previous year by rurality.

At the beginning of the study period, we observed an increase in virtual visits and a decline in in-person visits across all physician specialties and both rural and urban PLWD. This increase was more pronounced in visits to primary care providers compared to other specialties (Figure 1). By the end of the third subperiod (12–<18 months), in-person visits began to rise, eventually surpassing virtual visits. However, urban PLWD consistently had higher virtual visit rates than rural PLWD across specialties (Supplementary Table 2).

Compared to urban PLWD, rural PLWD had significantly lower rates of virtual visits to primary care physicians (RR = 0.71, 95% CI: 0.69–0.73), neurologists (RR = 0.79, 95% CI: 0.75–0.83) and psychiatrists/geriatricians (RR = 0.72, 95% CI: 0.68–0.76) (Table 2). Compared to the first 6 months, virtual visit rates to primary care providers were highest at 6–<12 months (RR = 1.05; 95% CI: 1.03–1.07) and lowest at 24–30 months (RR = 0.70; 95% CI: 0.69–0.71). Similar trends were observed for virtual visits to neurologists (RR = 1.14; 95% CI: 1.11–1.17 at 6–<12 months; RR = 0.73; 95% CI: 0.68–0.78 at 24–30 months) and psychiatrists/geriatricians (RR = 1.14; 95% CI: 1.11–1.17 at 6–<12 months; RR = 0.71; 95% CI: 0.66–0.76 at 24–30 months).

Rates of virtual visits to neurologists and psychiatrists/geriatricians were significantly lower for PLWD aged 75–84 years (RR = 0.92, 95% CI: 0.90–0.94 and RR = 0.72, 95% CI: 0.68–0.76) and even lower for those aged 85+ years (RR = 0.68, 95% CI: 0.64–0.72 and RR = 0.57, 95% CI: 0.54–0.61) compared to those aged 66–74 years (Table 2). There were no significant differences across age for family physician visits (75–84 years (RR = 1.02, 95% CI: 0.95–1.10 and 85+ years RR = 1.05, 95% CI: 0.97–1.14).

Female PLWD had higher rates of virtual visits with psychiatrists/geriatricians than males (RR = 1.12, 95% CI: 1.07–1.16) but lower rates of virtual visits with neurologists (RR = 0.89, 95% CI: 0.88–0.91). For family physicians, rates were not significantly different in females compared to males (RR = 1.03, 95% CI: 0.98–1.08). PLWD in the highest income quintile had higher rates of virtual visits to family physicians and neurologists compared to those in the lowest quintile (RR = 1.06, 95% CI: 1.01–1.11 and RR = 1.15, 95% CI: 1.09–1.21, respectively), but rates were not significantly different for psychiatrist/geriatrician visits (RR = 0.99, 95% CI: 0.95–1.04). Patients enrolled in a capitation-based primary care model had lower rates of virtual visits to family physicians compared to those who were not (RR = 0.60, 95% CI: 0.58–0.62). PLWD who had at least one primary care visit in the past year had significantly higher rates of virtual visits to family physicians (RR = 8.97, 95% CI: 8.67–9.27), neurologists (RR = 29.00, 95% CI: 23.15–36.32) and psychiatrists/geriatricians (RR = 19.49, 95% CI: 17.37–21.88) compared to those who did not.

Table 1. Characteristics of community-dwelling PLWD in Ontario, Canada, as of March 1, 2020, by location of residence

N, % unless otherwise noted	Total N = 122,751	Location of residence		Standardized difference
		Rural N = 11,304	Urban N = 111,447	
Age, years				
Mean (SD)	82.2 (7.6)	81.1 (7.5)	82.3 (7.6)	0.159
Age groups				
66–74 years	22,153 (18.0%)	2,374 (21.0%)	19,779 (17.7%)	0.082
75–84 years	50,544 (41.2%)	5,035 (44.5%)	45,509 (40.8%)	0.075
85+ years	50,054 (40.8%)	3,895 (34.5%)	46,159 (41.4%)	0.144
Sex				
Female	71,469 (58.2%)	6,303 (55.8%)	65,166 (58.5%)	0.055
Income quintile				
1 (Lowest)	27,687 (22.6%)	2,488 (22.0%)	25,199 (22.6%)	0.014
2	27,038 (22.0%)	2,559 (22.6%)	24,479 (22.0%)	0.016
3	23,841 (19.4%)	2,270 (20.1%)	21,571 (19.4%)	0.018
4	21,945 (17.9%)	2,035 (18.0%)	19,910 (17.9%)	0.004
5 (Highest)	22,240 (18.1%)	1,952 (17.3%)	20,288 (18.2%)	0.025
Material resources index*				
1 (Least deprived = ref)	25,690 (20.9%)	1,251 (11.1%)	24,439 (21.9%)	0.296
2	24,538 (20.0%)	2,209 (19.5%)	22,329 (20.0%)	0.012
3	23,480 (19.1%)	2,576 (22.8%)	20,904 (18.8%)	0.099
4	24,713 (20.1%)	2,957 (26.2%)	21,756 (19.5%)	0.159
5 (Most deprived)	23,554 (19.2%)	1,995 (17.6%)	21,559 (19.3%)	0.044
Missing	776 (0.6%)	316 (2.8%)	460 (0.4%)	0.191
Dementia duration, years				
Mean (SD)	4.2 (4.2)	4.0 (4.4)	4.2 (4.2)	0.047
Number of chronic conditions (excluding dementia)				
Mean (SD)	5.2 (2.2)	4.8 (2.2)	5.2 (2.2)	0.17
Counts				
0–1	4,667 (3.8%)	592 (5.2%)	4,075 (3.7%)	0.077
2	8,470 (6.9%)	999 (8.8%)	7,471 (6.7%)	0.08
3	15,217 (12.4%)	1,667 (14.7%)	13,550 (12.2%)	0.076
4	20,520 (16.7%)	1,946 (17.2%)	18,574 (16.7%)	0.015
5 +	73,877 (60.2%)	6,100 (54.0%)	67,777 (60.8%)	0.139
Medication use (overlapping index date)				
Antipsychotics	13,960 (11.4%)	1,161 (10.3%)	12,799 (11.5%)	0.039
Antidepressants	41,951 (34.2%)	4,314 (38.2%)	37,637 (33.8%)	0.092
Benzodiazepines	6,862 (5.6%)	651 (5.8%)	6,211 (5.6%)	0.008
Cholinesterase inhibitors	33,130 (27.0%)	3,084 (27.3%)	30,046 (27.0%)	0.007
Opioids	5,617 (4.6%)	641 (5.7%)	4,976 (4.5%)	0.055
ACE/ARBs †	48,313 (39.4%)	4,406 (39.0%)	43,907 (39.4%)	0.009
Number of medications overlapping index date (unique by drug name)				
0–4	58,824 (47.9%)	5,351 (47.3%)	53,473 (48.0%)	0.013
5–9	49,615 (40.4%)	4,595 (40.6%)	45,020 (40.4%)	0.005
10+	14,312 (11.7%)	1,358 (12.0%)	12,954 (11.6%)	0.012

(Continued)

Table 1. Characteristics of community-dwelling PLWD in Ontario, Canada, as of March 1, 2020, by location of residence (*Continued*)

<i>N</i> , % unless otherwise noted	Total <i>N</i> = 122,751	Location of residence		Standardized difference
		Rural <i>N</i> = 11,304	Urban <i>N</i> = 111,447	
History of primary care health service use				
Model of primary care*				
Capitation	42,058 (34.3%)	2,584 (22.9%)	39,474 (35.4%)	0.279
Enhanced fee-for-service	34,409 (28.0%)	990 (8.8%)	33,419 (30.0%)	0.558
Family health team	35,615 (29.0%)	6,431 (56.9%)	29,184 (26.2%)	0.656
Physician not in a patient enrollment model	6,576 (5.4%)	475 (4.2%)	6,101 (5.5%)	0.059
Other enrollment group	1,031 (0.8%)	254–258 [‡]	773–777 [‡]	0.13
No physician [§]	3,034 (2.5%)	565 (5.0%)	2,469 (2.2%)	0.15
Recent registrant (<10 years)				
Yes	3,076 (2.5%)	124 (1.1%)	2,952 (2.6%)	0.115
Continuity of care (Usual Provider of Care index)				
Mean (SD)	0.8 (0.3)	0.8 (0.3)	0.8 (0.3)	0.108
Low (<0.4)	13,987 (11.4%)	981 (8.7%)	13,006 (11.7%)	0.099
Medium (0.4–<0.8)	30,431 (24.8%)	2,579 (22.8%)	27,852 (25.0%)	0.051
High (≥0.8)	59,557 (48.5%)	5,529 (48.9%)	54,028 (48.5%)	0.009
Missing	18,776 (15.3%)	2,215 (19.6%)	16,561 (14.9%)	0.126
History of health service use in the previous year				
Any acute care hospitalization	29,015 (23.6%)	2,770 (24.5%)	26,245 (23.5%)	0.022
Any emergency department visit	48,521 (39.5%)	5,460 (48.3%)	43,061 (38.6%)	0.196
Any long-stay home care visit	56,692 (46.2%)	4,801 (42.5%)	51,891 (46.6%)	0.082
Any family physician visit	111,180 (90.6%)	9,746 (86.2%)	101,434 (91.0%)	0.152
Any neurologist visit	16,265 (13.3%)	1,002 (8.9%)	15,263 (13.7%)	0.153
Any geriatrician/psychiatrist visit	36,090 (29.4%)	1,886 (16.7%)	34,204 (30.7%)	0.334

Bolded entries represent standardized difference > 0.10.

* Percentages may not sum to 100% due to missing information. † Angiotensin-converting enzyme (ACE) inhibitors and angiotensin-receptor blockers (ARBs), respectively. ‡ Exact cell sizes cannot be reported due to privacy obligations with ICES. § Patient had no core primary care fee codes for 2 years prior to index.

Discussion

In this population-based study of community-dwelling PLWD in Ontario, Canada, we observed lower rates of virtual visits to family physicians, neurologists and geriatrician/psychiatrist physicians among individuals in rural compared to urban areas. During the first few months of the COVID-19 pandemic, rates of virtual visits increased but then declined across all specialties over time. We observed significantly lower rates of virtual care visits to all specialists with increasing age. Female PLWD had higher rates of virtual visits to psychiatrists/geriatricians and lower rates to neurologists compared to men. Those in higher income quintiles had higher rates of virtual visits to family physicians and neurologists, while those in capitation-based primary care models had lower virtual visit rates to family physicians.

Our study highlighted significantly lower rates of virtual visits among PLWD in rural areas. Few studies have compared rates of virtual visits between rural and urban PLWD. However, a study among US veterans that compared the use of telemedicine between urban and rural residents before and during the COVID-19 pandemic observed 36% lower rates of primary care visits and 50% lower rates of mental health integration visits in rural compared to urban residents.²⁴ Similar trends were observed in the general

population in Ontario,^{1,2,25} where rural residents had the lowest rate of virtual primary care visits during the pandemic compared to their urban counterparts. According to Canada Health Infoway, Canadians in rural and remote areas had decreased access to virtual care during the pandemic compared to urban residents.²⁶ Healthcare providers in rural communities have also cited limited internet connectivity, unreliable Wi-Fi and patients' limited access to and knowledge of technology as barriers to providing virtual care.²⁷

For PLWD in Canada, family physicians are usually the first point of contact and play a crucial role in management. In unusual, complex or rapidly progressing cases, family physicians may refer patients to specialists such as neurologists, psychiatrists and geriatricians, who are sparsely distributed across geographic regions and concentrated in urban areas.^{28,29} Virtual care, therefore, provides an opportunity for convenient and accessible dementia care across geographic locations.³⁰ Additionally, it offers several advantages over in-person visits such as ensuring continuity of care; increasing access to timely, convenient medical care; and addressing distance and travel barriers.³¹

Despite these benefits, virtual care may widen existing disparities in access to care. Often, patients who are most likely to benefit from virtual care – such as PLWD – may be the least able

Table 2. Rate ratios for virtual physician visits associated with sociodemographic and clinical characteristics among community-dwelling persons living with dementia in Ontario, Canada, by specialty (2020–2022)

	Fully adjusted rate ratios (95% CI)		
	Primary care	Neurologist	Psychiatrist/geriatrician
Rurality			
Urban (ref)	1.0	1.0	1.0
Rural	0.71 (0.69, 0.73)	0.79 (0.75, 0.83)	0.72 (0.68, 0.76)
Time period			
0–<6 months (ref)	1.0	1.0	1.0
6–<12 months	1.05 (1.03, 1.07)	1.14 (1.11, 1.17)	1.14 (1.11, 1.17)
12–<18 months	1.02 (0.99, 1.05)	1.10 (1.04, 1.17)	1.03 (1.00, 1.07)
18–<24 months	0.81 (0.79, 0.82)	0.88 (0.83, 0.94)	0.88 (0.85, 0.92)
24–30 months	0.70 (0.69, 0.71)	0.73 (0.68, 0.78)	0.71 (0.66, 0.76)
Age group			
66–74 years (ref)	1.0	1.0	1.0
75–84 years	1.02 (0.95, 1.10)	0.92 (0.90, 0.94)	0.72 (0.68, 0.76)
85+ years	1.05 (0.97, 1.14)	0.68 (0.64, 0.72)	0.57 (0.54, 0.61)
Sex			
Male (ref)	1.0	1.0	1.0
Female	1.03 (0.98, 1.08)	0.89 (0.88, 0.91)	1.12 (1.07, 1.16)
Income quintile			
1 (lowest = ref)	1.0	1.0	1.0
2	1.02 (0.99, 1.06)	1.07 (1.01, 1.13)	0.93 (0.90, 0.97)
3	1.02 (0.98, 1.06)	1.01 (0.95, 1.07)	0.94 (0.91, 0.97)
4	1.00 (0.97, 1.03)	1.04 (0.99, 1.09)	0.90 (0.86, 0.94)
5 (highest)	1.06 (1.01, 1.11)	1.15 (1.09, 1.21)	0.99 (0.95, 1.04)
Primary care enrollment model			
Fee-for-service/enhanced fee-for-service/no physician [§] /physician not in primary care enrollment model (ref)	1.0	1.0	1.0
Team-based and non-team-based capitation	0.60 (0.58, 0.62)	0.98 (0.97, 1.00)	0.98 (0.92, 1.03)
History of health service use in the previous year			
Any family physician visit	8.97 (8.67, 9.27)	1.32 (1.22, 1.42)	1.34 (1.26, 1.42)
Any neurologist visit	1.26 (1.23, 1.29)	29.00 (23.15, 36.32)	1.41 (1.31, 1.52)
Any geriatrician/psychiatrist visit	1.15 (1.12, 1.17)	1.02 (1.00, 1.05)	19.49 (17.37, 21.88)

Bolded entries represent standardized difference > 0.10.

[§] Patient had no core primary care fee codes for 2 years prior to index.

to access it.³² Access to virtual care is multifactorial and not only includes the availability of services but also the ability to use services. Therefore, it may depend on individual characteristics like age, income, education level and cognitive status; digital or systemic factors such as local policies and technology access; or previously existing inequities like decreased access to primary and specialist care in remote areas.^{3,32} In older adults, comfort with technology and digital health literacy remains a concern.^{3,33} Older adults with dementia and cognitive impairment may also require caregiver assistance to access virtual care.³³ Those without caregivers, lacking access to computers for videoconferencing or who are frail are more likely to choose phone visits over video visits and therefore have disproportionate access to forms of virtual care.^{34,35} Additional systemic factors, especially in rural areas, further complicate access to virtual care. These communities may

face unique challenges such as a limited healthcare workforce, a lack of necessary infrastructure and inadequate funding and resources, all of which can further contribute to lower rates of virtual care utilization among rural PLWD.³⁶ In particular, the shortage of physicians in rural areas and the high physician turnover lead to low continuity of care for rural PLWD,³⁷ which may lead to difficulties accessing virtual care with a patient's own physician. Previous research has demonstrated that virtual visits with a physician outside a patient's enrolling group lead to increased risks of subsequent ED visits.³⁸ Rural family physicians have also highlighted difficulties communicating with new patients virtually (e.g., difficulty building relationships, accessing health records, understanding and evaluating the health literacy of patients), reinforcing that virtual care is most effective when supported in an existing physician–patient relationship.³⁶

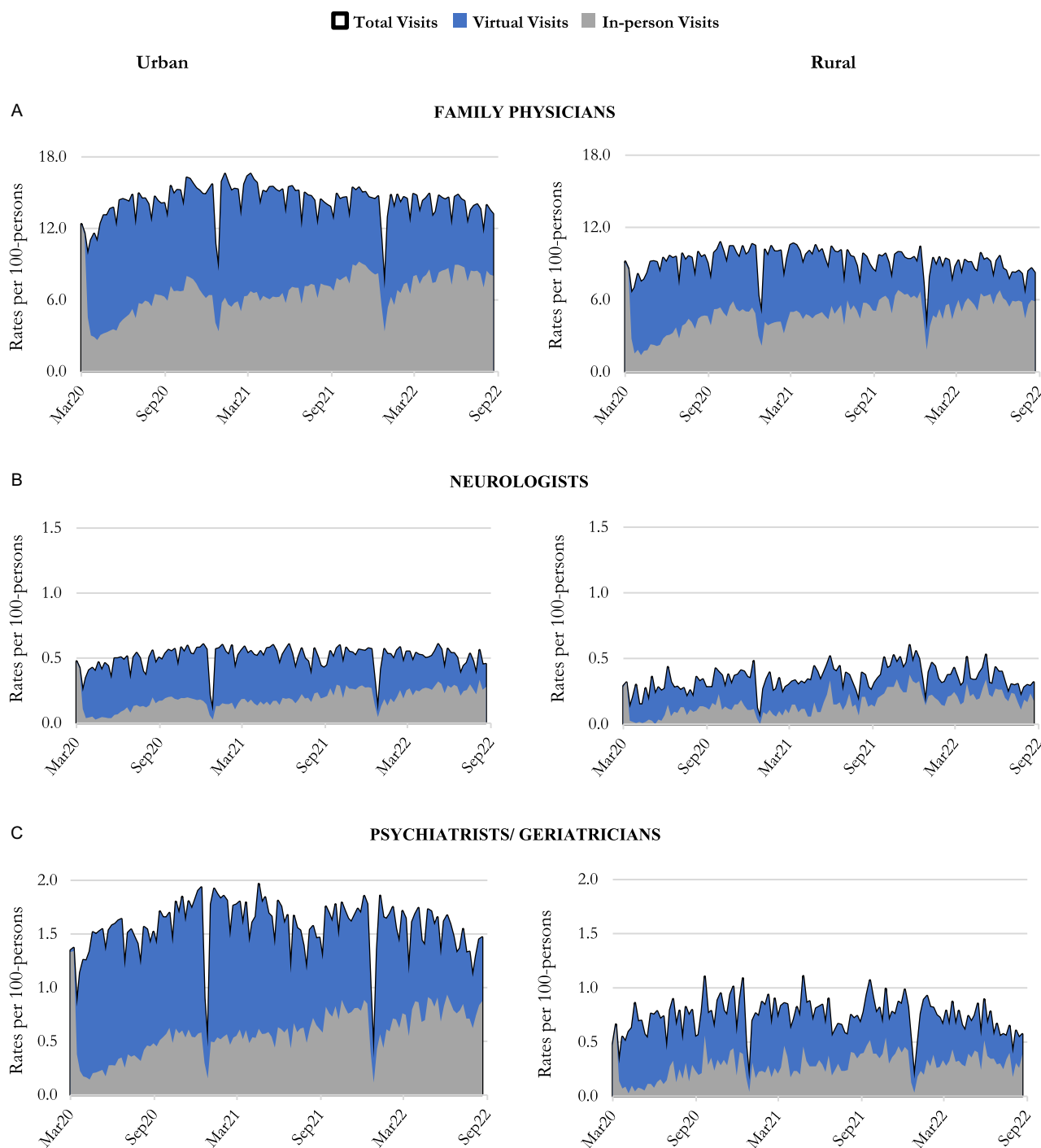


Figure 1. Weekly rates of physician visits among older adults living with dementia in Ontario, Canada, by location of residence and physician specialty (2020–2022).

Few studies have noted the gradual decline in virtual visits after its rapid uptake in the early months of the pandemic.³⁹ Canada Health Infoway reports that the proportion of virtual visits for non-COVID-related reasons decreased from 54% in April 2020 to 30% in March 2022 across Canada.⁴⁰ In Ontario, a gradual return to in-person visits has been observed; as of December 1, 2022, the virtual primary care fee codes introduced in March 2020 are no longer billable,^{41–43} and remaining billing codes for virtual care are limited, further reducing the provision of virtual care services. Given the importance of virtual care in improving healthcare

access, consideration for reinstating these virtual primary care fee codes would ensure that it remains a viable option for rural PLWD.

In our study, older females living with dementia were more likely to virtually visit psychiatrists or geriatricians and less likely to visit neurologists compared to men. Virtual visits to family physicians did not show significant differences. Other studies in Ontario observed that rates of virtual visits to family physicians were significantly higher in women compared to men both before and during the pandemic.¹ This is expected as women are more likely to seek primary care.⁴⁴ Older age was also associated with

significantly lower rates of virtual visits to specialists in our study. The consensus on the association between age and virtual care visits in the literature is mixed.^{2,45} Bhatia et al. found that older adults had higher overall virtual physician visits during the pandemic in Ontario compared to younger adults.² However, a CIHI report found that older adults had the fewest virtual visits.⁴⁵ These varying results may be due to the different time periods in which these studies were conducted during the COVID-19 pandemic and the unique circumstances of PLWD.

PLWD residing in the highest income neighborhoods were more likely to receive virtual care from family physicians and neurologists. Similarly, a study in Ontario noted an increase in the proportion of virtual visits to primary care providers with increasing income quintiles during the pandemic.¹ CIHI also reported a slight increase in virtual visits with increasing income quintiles.⁴⁵ Disparities may be related to the ability to afford devices such as smartphones and laptop computers or high-speed internet connections for virtual care access.^{32,45}

Rates of virtual visits to family physicians were significantly lower for patients in capitation-based enrollment models compared to those who were not. A study in Ontario found that between February and October 2021, family physicians who provided the most virtual visits practiced outside a patient enrollment model, particularly FFS models, compared to those in enrollment models (capitation, family health teams and family health groups).⁴⁶

Limitations

To our knowledge, this study is one of few capturing the geographic variations in virtual visits by physician specialties among community-dwelling PLWD over time in Ontario. We used a population-based approach with health administrative datasets to observe virtual physician visits across different physician specialties. Despite these strengths, there are limitations. The definition and ascertainment of dementia used in this study, although validated in a primary care sample, are not a clinical diagnosis, and there is the potential for misclassification. Further, the case ascertainment algorithm for physician visits requires multiple encounters, which may be more difficult for rural PLWD to achieve, particularly during the pandemic, possibly influencing the incidence rates of dementia during the study period. We could not distinguish between modalities of virtual care such as telephone calls and videoconferencing or adjust for individual levels of education. As is a common limitation of administrative data, we also could not examine reasons for the geographic variation in visit rates or the extent, appropriateness or quality of care provided during these visits.

Conclusions and implications

The pandemic highlighted challenges faced by older PLWD in accessing virtual care, particularly in rural areas. Our findings demonstrate that although virtual physician visits for both rural and urban PLWD increased at the start of the pandemic, quickly surpassing in-person visits, rural PLWD received lower rates of virtual care from family physicians, neurologists and geriatricians/psychiatrists.³² While virtual care can be a convenient and efficient method to deliver timely care,^{4,47} considerations of equitable access to care and its role in building a sustainable healthcare ecosystem are crucial. Sustainable systems and services are needed to reduce barriers to virtual care for underserved groups. Policymakers, healthcare providers and other stakeholders should consider

policies and interventions to close the gap in access to virtual care between rural and urban residents while improving its long-term sustainability. Such policies might include support for rural healthcare providers, enhanced virtual care infrastructure in rural areas, incentivizing reimbursements for virtual services and promoting the retention of physicians practicing in rural settings. Future research should further explore the barriers to accessing virtual care particularly for rural PLWD, evaluate the quality of virtual visits compared to in-person visits and examine outcomes for PLWD in rural and urban areas.

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Author contributions. TO: Contributed to the study design, provided input on results, drafted and formatted the manuscript.

LM: Contributed to the study design, result interpretation, manuscript drafting, editing and reviewing.

ZL: Conducted statistical and data analysis and manuscript review.

JG: Supervised statistical and data analysis, determined appropriate techniques for data analysis, interpreted results.

RS: Contributed to the study design, provided input on results, reviewed the manuscript.

CM: Contributed to the study design, provided input on results, reviewed the manuscript.

LJ: Contributed to the study design, provided input on results, reviewed the manuscript.

SB: Conceptualized the research idea and study design, contributed to manuscript drafting editing and reviewing, supervised the entire research project, ensured all aspects were conducted properly.

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