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Research

Visits to the emergency department by community-dwelling people with dementia during the first 2 waves of the COVID-19 pandemic in Ontario: a repeated cross-sectional analysis

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Abstract

Background: Community-dwelling people with dementia have been affected by COVID-19 pandemic health risks and control measures that resulted in worsened access to health care and service cancellation. One critical access point in health systems is the emergency department. We aimed to determine the change in weekly rates of visits to the emergency department of community-dwelling people with dementia in Ontario during the first 2 waves of the COVID-19 pandemic compared with historical patterns.

Methods: We conducted a population-based repeated cross-sectional study and used health administrative databases to compare rates of visits to the emergency department among community-dwelling people with dementia who were aged 40 years and older in Ontario during the first 2 waves of the COVID-19 pandemic (March 2020–February 2021) with the rates of a historical period (March 2019–February 2020). Weekly rates of visits to the emergency department were evaluated overall, by urgency and by chapter from the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*. We used Poisson models to compare pandemic and historical rates at the week of the lowest rate during the pandemic period and the latest week.

Results: We observed large immediate declines in rates of visits to the emergency department during the COVID-19 pandemic (rate ratio [RR] 0.50, 95% confidence interval [CI] 0.47–0.53), which remained below historical levels by the end of the second wave (RR 0.88, 95% CI 0.83–0.92). Rates of both nonurgent (RR 0.33, 95% CI 0.28–0.39) and urgent (RR 0.51, 95% CI 0.48–0.55) visits to the emergency department also declined and remained low (RR 0.68, 95% CI 0.59–0.79, RR 0.91, 95% CI 0.86–0.96), respectively. Visits for injuries, and circulatory, respiratory and musculoskeletal diseases declined and remained below historical levels.

Interpretation: Prolonged reductions in visits to the emergency department among people with dementia during the first 2 pandemic waves raise concerns about patients who delay seeking acute care services. Understanding the long-term effects of these reductions requires further research.

People with dementia are susceptible to adverse events associated with disruptions in health care and social supports caused by the COVID-19 pandemic.[1–3] Before the pandemic, research had shown that care fragmentation and lower continuity of care were associated with increased risks of visits to the emergency department by people with dementia.[4] People with dementia frequently visit the emergency department for care, often to address concerns such as injuries, behavioural changes and other symptoms of dementia, adverse drug reactions and for caregiver reassurance. Although many physicians shifted to virtual care provision during the COVID-19 pandemic to enable continuity of care, people with dementia faced challenges accessing such care, including lack of access to technology or a support person to assist them.[5,6] In addition, there are concerns that the social isolation and cancellation of health and social services that resulted from pandemic restrictions have worsened behavioural and psychological symptoms for people with dementia, which may necessitate appropriate access to in-person health care services.[1]

The emergency department is an important care setting for persons with dementia;[7] however, there are little data regarding changes in rates of visits to the emergency department among people with dementia during the COVID-19

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pandemic. Studies across several jurisdictions have noted large declines in visits to emergency departments by the general population during the pandemic,[8–13] including for both urgent and nonurgent visits. Lower rates of visits to the emergency department for urgent conditions are concerning because they may result from people who avoid or delay seeking necessary care, or from barriers to care, which may lead to exacerbations of chronic conditions and increased risks of longer-term complications. Describing changes in the rates of visits to the emergency department during the pandemic by urgency and diagnoses among people with dementia will aid in understanding the initial effect of the pandemic and longer-term implications for patterns of use of health systems and outcomes in this vulnerable population. Therefore, we aimed to determine the change in weekly rates of visits to the emergency department of community-dwelling people with dementia in Ontario, by urgency and diagnosis, during the first 2 waves of the COVID-19 pandemic compared with historical patterns.

Methods

Study design

We conducted a repeated cross-sectional study using linked population-based health administrative databases in Ontario. We followed the Reporting of Studies Conducted Using Observational Routinely-Collected Data (RECORD) guideline.[14]

Data sources

We obtained data on visits to the emergency department from the Canadian Institute for Health Information's National Ambulatory Care Reporting System Database, which captures records for all visits in Ontario. We used the Ontario Registered Persons Database to obtain demographic information (e.g., age, sex and date of death, if applicable) and eligibility for health insurance. Details of other administrative databases used in this study can be found in Appendix 1, Table S1, available at www.cmajopen.ca/content/10/3/E610/suppl/DC1. These data sets were linked using unique encoded identifiers and analyzed at ICES, an independent, nonprofit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement

Study population

We identified community-dwelling people with Alzheimer disease and related dementias (dementia) in Ontario who were aged 40–110 years and who were eligible for provincial health insurance at the start of each week (index date). We excluded people who were not residents of Ontario and those with invalid death dates. We also excluded those who did not have contact with the Ontario health system in the 5 years before the index date to ensure we identified people who had active use of the provincial health plan. We identified people who resided in long-term care homes at each weekly index date using an established algorithm[15] and excluded them, as they are likely to have different patterns of emergency department use compared with community-dwelling older adults.

We used data from the week of Mar. 1, 2020, to the week of Feb. 21, 2021, to define the first 2 waves of the COVID-19 pandemic in Ontario (pandemic period). We used data from the week of Mar. 3, 2019, to the week of Feb. 23, 2020, to define the historical period. Data for the cohort were extracted in September 2021.

We identified a patient's dementia status using a validated health administrative data algorithm that requires at least 1 hospital admission for dementia, at least 3 physician visits for dementia within 2 years (at least 30 d apart) or at least 1 prescription for a cholinesterase inhibitor. This algorithm has been shown to have a sensitivity of 79.3% and a specificity of 99.1% for the detection of dementia when validated against a primary care electronic medical record reference standard.[16]

We measured patient characteristics including age, sex, rural residence, neighbourhood income quintile and time since case ascertainment using health administrative databases as of the date of the visit to the emergency department. We defined rural residence as having a Rurality Index for Ontario value greater than 40. We defined neighbourhood income quintiles using postal code linkage to Statistics Canada Census data (2016; https://www150.statcan.gc.ca/n1/pub/92-154-g/92-154-g2017001-eng.htm). For people with more than 1 visit to the emergency department during the pandemic or historical period, we analyzed individual characteristics as of the date of the first emergency department visit in each period. History of 16 common chronic conditions, likely to be associated with the need for care in the emergency department, was assessed using health administrative data algorithms. We defined a history of chronic conditions, according to Mondor and colleagues,[20] as including acute myocardial infarction (AMI), osteoarthritis, rheumatoid arthritis, asthma, cancer, cardiac arrhythmia, heart failure, chronic obstructive pulmonary disease, coronary syndrome (excluding AMI), dementia, diabetes, hypertension, mood, anxiety, depression and other nonpsychotic disorders, other mental illnesses, osteoporosis, renal failure and stroke (excluding transient ischemic attack).

Outcomes

We evaluated emergency department visits (including visits by people who were later admitted to hospital) overall and also stratified by urgency and diagnostic groupings. We defined urgency using the Canadian Triage and Acuity Scale (CTAS) (1–3, urgent/emergent; 4–5, less urgent/nonurgent).[17] We evaluated diagnoses using the diagnosis code listed as the "main problem," which represents the most clinically important reason for the patient's visit.[18] We defined diagnostic groupings using the Canadian version of the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (ICD-10-CA) chapter headings, which cluster related diagnoses and conditions. Specific diagnosis codes, within chapter headings, were also evaluated separately. We were interested in ICD-10-CA codes

that occurred more commonly for people with dementia[7,19] (e.g., fall-related and nonfall-related injuries, dementia or delirium, adverse drug reactions and urinary tract infections; see Appendix 1, Table S2 for ICD-10-CA codes).

Statistical analysis

We compared sociodemographic and clinical characteristics of people with dementia who presented to the emergency department at least once during the historical and pandemic periods using standardized differences, with differences less than 0.10 indicating imbalance. Among people with at least 1 emergency department visit, we calculated the mean (standard deviation [SD]) and median (interquartile range [IQR]) number of emergency department visits during each period. We calculated weekly rates of emergency department visits per 100 people.

We used Poisson models to estimate rate ratios (RRs) and 95% confidence intervals (CIs), comparing rates of emergency department visits at the week of the lowest rate during the pandemic period and the latest week during the pandemic period with equivalent weekly rates during the historical period. The latest weekly rate is as of the week of Feb. 21, 2021 (pandemic period) and the week of Feb. 23, 2020 (historical period). The models included a single predictor variable for the period (pandemic v. historical) and an offset term for number of people with dementia alive and living in the community at the start of each week. We conducted all analyses using SAS 9.4 (SAS Institute Inc.).

Ethics approval

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.

Results

We identified 58 852 unique people with dementia who visited the emergency department during the pandemic period and 67 611 unique people who visited the emergency department during the historical period (Figure 1, Table 1). We found that people with dementia who visited the emergency department during the pandemic showed characteristics similar to those presenting during the historical period (mean age 81.4 v. 81.3 yr, standardized difference [Std. Diff.] < 0.01; 56.8% v. 57.4% female, Std. Diff. 0.01). Both groups had a high but similar prevalence of multiple chronic conditions (5 or more chronic conditions: 77.6% v. 75.7%, Std. Diff. 0.04). People who presented to the emergency department during the pandemic were more likely to be admitted to an inpatient facility (35.1% v. 29.7%, Std. Diff. 0.12). People with dementia who visited the emergency department during the pandemic also were likely to experience repeated emergency department visits compared with the historical period (3 or more visits: 24.9% v. 29.0%, Std. Diff. 0.09).

The rate of visits to the emergency department during the first week of the pandemic period (week of Mar. 1, 2020)

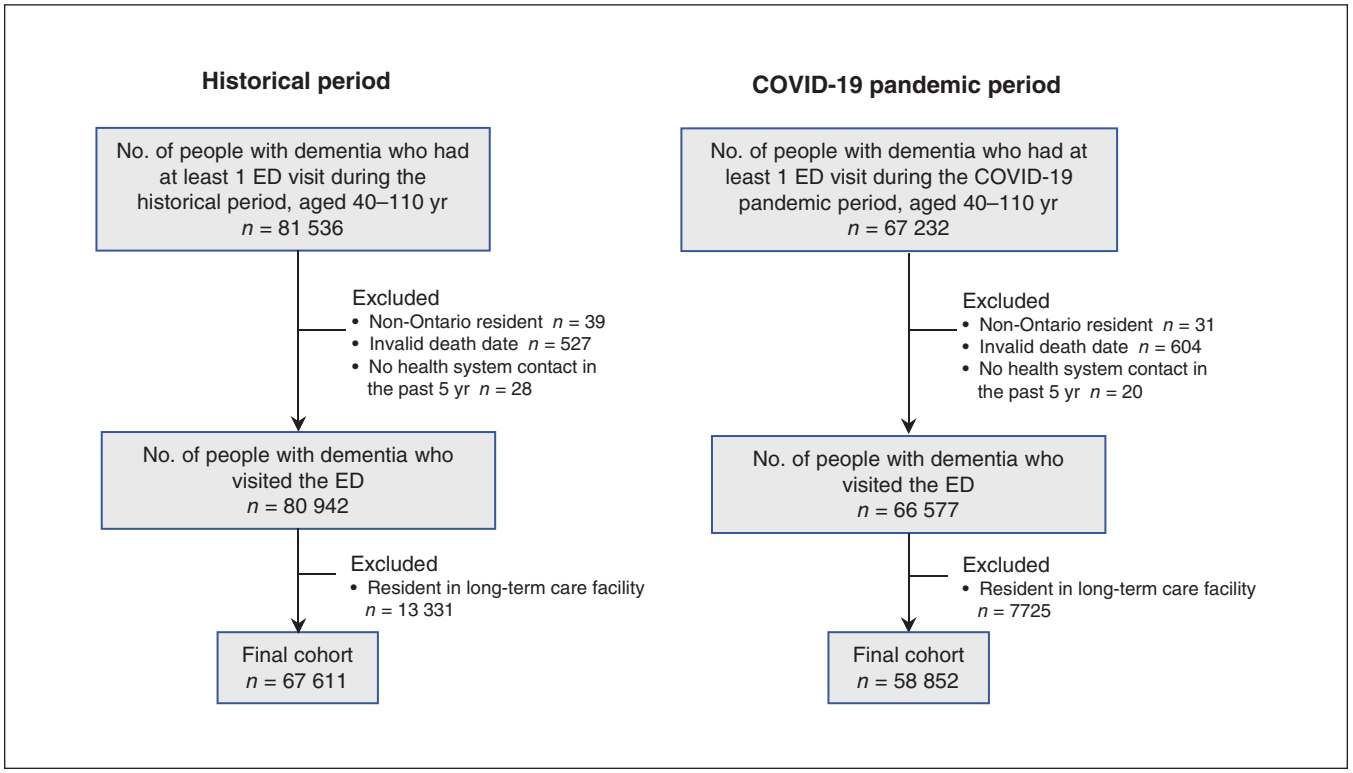

Figure 1: Flow diagram showing selection of the population of community-dwelling people with dementia who visited the emergency department during the COVID-19 pandemic and historical periods in Ontario. We defined the pandemic period as the week of Mar. 1, 2020, to the week of Feb. 21, 2021. We defined the historical period as the week of Mar. 3, 2019, to the week of Feb. 23, 2020. Note: ED = emergency department.

Table 1 (part 1 of 2): Characteristics of community-dwelling people with dementia who had at least 1 visit to the emergency department in Ontario, by COVID-19 pandemic and historical periods (2019–2021)

Characteristic	No. (%) of people with dementia*		Standardized difference
	Historical period† *n* = 67 611	Pandemic period† *n* = 58 852	
Age, yr			
Mean ± SD	81.3 ± 9.7	81.4 ± 9.7	< 0.01
40–64	4219 (6.2)	3741 (6.4)	0.01
65–74	9980 (14.8)	8676 (14.7)	< 0.01
75–84	24 728 (36.6)	21 421 (36.4)	< 0.01
≥ 85	28 684 (42.4)	25 014 (42.5)	< 0.01
Sex, female	38 819 (57.4)	33 439 (56.8)	0.01
Rural residence‡	7082 (10.5)	6288 (10.7)	0.01
Income quintile§			
1 (lowest)	16 368 (24.2)	14 061 (23.9)	0.01
2	14 808 (21.9)	13 011 (22.1)	0.01
3	13 191 (19.5)	11 457 (19.5)	< 0.01
4	11 620 (17.2)	10 198 (17.3)	< 0.01
5 (highest)	11 244 (16.6)	9791 (16.6)	0
Time since dementia case ascertainment, yr; mean ± SD	4.1 ± 4.1	4.3 ± 4.2	0.04
No. of ED visits during the relevant period (includes the first ED visit)			
Mean ± SD	2.3 ± 2.9	2.1 ± 3.3	0.06
Median (IQR)	2 (1–3)	1 (1–2)	0.10
1	31 895 (47.2)	30 253 (51.4)	0.09
2	16 132 (23.9)	13 929 (23.7)	0.01
≥ 3	19 584 (29.0)	14 670 (24.9)	0.09
Time in ED, h			
Mean ± SD	9.6 ± 12.2	9.2 ± 10.7	0.03
Median (IQR)	6 (3–10)	6 (3–10)	0.03
Discharge disposition			
Discharged home or to place of residence	37 930 (56.1)	30 366 (51.6)	0.09
Admitted to inpatient facility	20 084 (29.7)	20 653 (35.1)	0.12
Transferred to another health care facility	1394 (2.1)	1292 (2.2)	0.01
Transferred to a congregate living facility	6576 (9.7)	5681 (9.7)	< 0.01
Left ED	1595 (2.4)	822 (1.4)	0.07
Died	32 (0.0)	38 (0.1)	0.01
No. of chronic conditions at time of visit¶			
Mean ± SD	6.1 ± 2.8	6.3 ± 2.7	0.06
Median (IQR)	6 (5–8)	6 (5–8)	0.04
0–1	5067 (7.5)	3147 (5.3)	0.09
2	1329 (2.0)	1203 (2.0)	0.01
3	3475 (5.1)	3077 (5.2)	< 0.01
4	6553 (9.7)	5777 (9.8)	< 0.01
≥ 5	51 187 (75.7)	45 648 (77.6)	0.04

Table 1 (part 2 of 2): Characteristics of community-dwelling people with dementia who had at least 1 visit to the emergency department in Ontario, by COVID-19 pandemic and historical periods (2019–2021)

Characteristic	No. (%) of people with dementia*		Standardized difference
	Historical period† *n* = 67 611	Pandemic period† *n* = 58 852	
History of specific chronic conditions			
AMI	5305 (7.8)	4778 (8.1)	0.01
Osteoarthritis	49 007 (72.5)	43 870 (74.5)	0.05
Rheumatoid arthritis	2293 (3.4)	2076 (3.5)	0.01
Asthma	11 487 (17.0)	10 332 (17.6)	0.02
Cancer	39 136 (57.9)	35 287 (60.0)	0.04
Cardiac arrhythmia	15 673 (23.2)	13 727 (23.3)	< 0.01
Heart failure	13 629 (20.2)	12 092 (20.5)	0.01
Chronic obstructive pulmonary disease	10 181 (15.1)	8778 (14.9)	< 0.01
Coronary syndrome (excluding AMI)	23 983 (35.5)	20 784 (35.3)	< 0.01
Diabetes	23 918 (35.4)	21 468 (36.5)	0.02
Hypertension	51 564 (76.3)	45 728 (77.7)	0.03
Mood, anxiety, depression and other nonpsychotic disorders	42 952 (63.5)	38 261 (65.0)	0.03
Other mental illnesses	26 498 (39.2)	24 437 (41.5)	0.05
Osteoporosis	12 256 (18.1)	10 827 (18.4)	0.01
Renal failure	13 205 (19.5)	12 387 (21.0)	0.04
Stroke (excluding transient ischemic attack)	10 330 (15.3)	8976 (15.3)	< 0.01

Note: AMI = acute myocardial infarction, ED = emergency department, IQR = interquartile range, SD = standard deviation.
*Unless indicated otherwise.
†Historical period: week of Mar. 3, 2019, to the week of Feb. 23, 2020. COVID-19 pandemic period: week of Mar. 1, 2020, to the week of Feb. 21, 2021. For people who visited the ED more than once in a given period, characteristics shown are as of the first visit in each period.
‡We defined rural residence as having a Rurality Index for Ontario value greater than 40.
§We defined neighbourhood income quintiles using postal code linkage to Statistics Canada Census data (2016; https://www150.statcan.gc.ca/n1/pub/92-154-g/92-154-g2017001-eng.htm).
¶We used Mondor et al.[20] to define a history of chronic conditions. Eligible conditions included AMI, osteoarthritis, rheumatoid arthritis, asthma, cancer, cardiac arrhythmia, heart failure, chronic obstructive pulmonary disease, coronary syndrome (excluding AMI), dementia, diabetes, hypertension, mood, anxiety, depression and other nonpsychotic disorders, other mental illnesses, osteoporosis, renal failure and stroke (excluding transient ischemic attack).

was 2.17 per 100 people, which declined to 1.20 visits per 100 people at the week of the lowest rate (week of Mar. 29, 2020) (Figure 2, Table 2). We observed a 50% decline in visit rates at the week of the lowest rate (RR 0.50, 95% CI 0.47–0.53) (Table 3). These rates increased over time but remained 12% below historical levels by the end of the second wave (RR 0.88, 95% CI 0.83–0.92).

Rates by urgency

We found that the rates for emergency department visits for nonurgent and urgent conditions fell by as much as 67% (RR 0.33, 95% CI 0.28–0.39) and 49% (RR 0.51, 95% CI 0.48–0.55), respectively, compared with rates before the pandemic. Although we observed rebounds in visit rates for both nonurgent and urgent visits over time, by the end of the study period, rates remained significantly below historical levels (RR 0.68, 95% CI 0.59–0.79, RR 0.91, 95% CI 0.86–0.96), respectively.

Rates by diagnostic grouping

We noted the highest rates of emergency department visits for the following ICD-10-CA diagnostic groupings: signs, symptoms, and abnormal clinical and laboratory findings, injuries and poisoning, and circulatory and respiratory diseases (Figure 3). Together, these chapter headings accounted for 60% of all the visits to the emergency department by people with dementia. Rates of visits for these diagnostic groupings declined and failed to return to historical levels by the end of the study period (Table 3). Rates of visits to the emergency department for musculoskeletal diseases, genitourinary diseases, mental and behavioural disorders, and digestive and nervous system diseases initially declined but returned to historical levels by the end of the study period.

Rates by dementia-associated conditions

We observed large immediate declines in visits to the emergency department for dementia, delirium, signs and symptoms

involving cognition, and adverse drug reactions, but all rebounded to historical levels by the end of the study period (Table 3). Rates of visits for cardiac diseases (i.e., AMI, stroke and heart failure) declined and remained below historical levels by the end of the study period (RR 0.58, 95% CI 0.44–0.78). Rates of influenza, pneumonia and chronic lower respiratory infections declined and remained 41% below historical levels (RR 0.59, 95% CI 0.45–0.77).

Interpretation

During the first 2 waves of the COVID-19 pandemic, we observed large and rapid declines in weekly rates of visits to the emergency department among community-dwelling people with dementia. Rates for both urgent and nonurgent conditions declined and did not return to historical levels by the end of the second wave. Rates of visits to the emergency department for key diagnostic groupings, including injuries, and circulatory, genitourinary and respiratory diseases, also declined and remained below historical levels by the end of the second wave, whereas rates of visits for mental and behavioural disorders declined initially but rebounded to historical levels. Our findings highlight that by the end of the second wave, use of the emergency department among people with dementia had not returned to prepandemic levels and raise concerns regarding the receipt of timely care for urgent and acute conditions.

The size of decline in visits to the emergency department that we observed was similar to that previously found in adults (40%–65%) in the general population in Canada[8–10] and the United States.[11–13] Declines in rates of visits are likely due to a constellation of factors including both a reluctance to present to the emergency department (e.g., fear of infection as well as policies preventing care partners from accompanying persons with dementia into the emergency department) and a potentially decreased need for emergency department care during the pandemic (e.g., fewer injuries owing to lower levels of activity, lower levels of other circulating viruses). Although our findings are not surprising given what is known about the pandemic, the sequelae of decreased access are just now emerging, and it is helpful to characterize the size of the issue in people with dementia.

Although few studies have evaluated visits to the emergency department by urgency during the pandemic, we found similar declines in visits for both urgent and nonurgent conditions.[21,22] Lower rates of visits for nonurgent conditions may represent conditions that were treated at home or by other health care providers (either in person or virtually). Sustained periods of decline in nonurgent visits may be a positive finding and reflect the provincial expansion of the provision of virtual care. Related work from our group has documented the rapid shift to virtual family physician care among people with dementia during the COVID-19 pandemic.[23] Although virtual care provides benefits to patients with dementia including convenience, there are challenges with conducting cognitive assessments virtually that may necessitate in-person care.[5] It is difficult to determine to what extent visits to the emergency department may have been avoided by seeking virtual care from primary care and other providers.[24] A 2020 study involving community-dwelling people with dementia and their caregivers who were recruited from an activity day centre for older adults

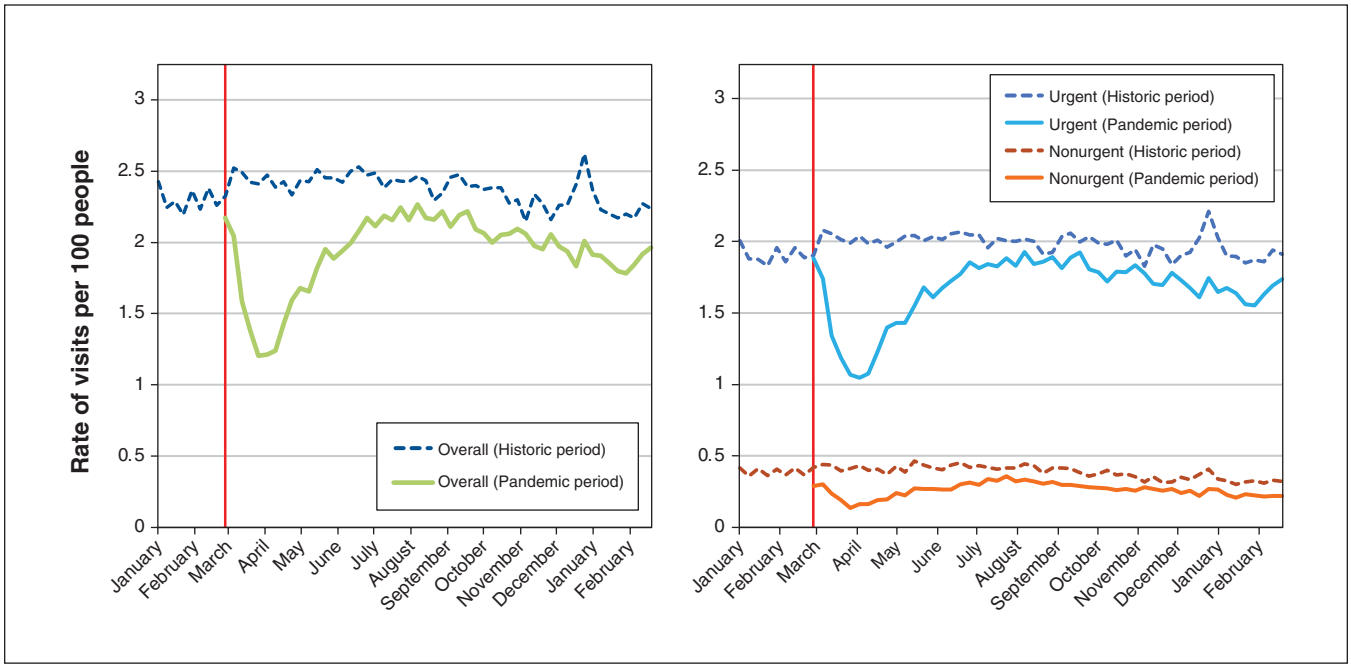

Figure 2: Weekly rates of visits to the emergency department overall and by urgency among community-dwelling people with dementia during the historical and COVID-19 pandemic periods in Ontario. We defined the pandemic period as the week of Mar. 1, 2020, to the week of Feb. 21, 2021. We defined the historical period as the week of Mar. 3, 2019, to the week of Feb. 23, 2020. Note: The red line represents the beginning of the first COVID-19 pandemic wave in Ontario.

Table 2: Rates of visits to the emergency department among community-dwelling people with dementia during the COVID-19 pandemic and historical period* in Ontario, by urgency and chapter from the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (2019–2021)

	Weekly rate of visits per 100 people			
	Lowest rate*		Latest week*	
Reason for visit	Historical period	Pandemic period	Historical period	Pandemic period
Overall	2.41	1.20	2.24	1.96
Urgency				
Nonurgent	0.41	0.14	0.32	0.22
Urgent	2.04	1.05	1.91	1.74
ICD-10-CA chapter				
Infections	0.07	0.03	0.06	0.05
Neoplasms	0.009	0.002	0.009	0.005
Blood diseases	0.02	0.01	0.03	0.01
Endocrine diseases	0.06	0.02	0.05	0.06
Mental and behavioural disorders	0.16	0.07	0.13	0.13
Dementia†	0.06	0.02	0.05	0.06
Delirium	0.04	0.02	0.05	0.04
Nervous system diseases	0.04	0.01	0.04	0.04
Eye diseases	0.01	0.005	0.02	0.02
Ear diseases	0.01	0.002	0.008	0.008
Circulatory diseases	0.16	0.08	0.16	0.12
Cardiac diseases (AMI, stroke and heart failure)	0.08	0.04	0.09	0.06
Respiratory diseases	0.12	0.08	0.14	0.09
Influenza, pneumonia and chronic lower respiratory infections	0.08	0.05	0.11	0.06
COPD	0.05	0.02	0.04	0.03
Digestive diseases	0.13	0.05	0.12	0.11
Skin diseases	0.05	0.02	0.05	0.04
Musculoskeletal diseases	0.14	0.04	0.11	0.09
Genitourinary diseases	0.12	0.07	0.15	0.13
Kidney or urinary tract infection	0.11	0.04	0.11	0.09
Signs, symptoms, and abnormal clinical and laboratory findings	0.63	0.29	0.57	0.49
Signs and symptoms involving cognition	0.08	0.04	0.09	0.08
Injuries and poisoning	0.42	0.20	0.41	0.35
Fall-related injuries	0.28	0.16	0.30	0.25
Nonfall-related injuries	0.06	0.02	0.06	0.05
Factors influencing health status	0.08	0.05	0.07	0.08
Other				
Adverse drug reactions	0.02	0.006	0.01	0.01

Note: AMI = acute myocardial infarction, COPD = chronic obstructive pulmonary disease, ICD-10-CA = Canadian version of the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*.
*The week of the lowest rate is the lowest rate during the pandemic period (week of Mar. 1, 2020, to week of Feb. 21, 2021). Rates for equivalent weeks in the historical period (week of Mar. 3, 2019, to week of Feb. 23, 2020) are also shown. The latest weekly rate is as of the week of Feb. 21, 2021 (pandemic period) and the week of Feb. 23, 2020 (historical period).
†Dementia codes include F00–F03, G30.

Table 3: Rate ratios for visits to the emergency department among community-dwelling people with dementia in the COVID-19 pandemic period and the historical period in Ontario, by urgency and chapter from the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (2019–2021)

Reason for visit	RR (95% CI)	
	At lowest weekly rate during pandemic period*	At latest week during pandemic period*
Overall	0.50 (0.47–0.53)	0.88 (0.83–0.92)
Urgency		
Nonurgent	0.33 (0.28–0.39)	0.68 (0.59–0.79)
Urgent	0.51 (0.48–0.55)	0.91 (0.86–0.96)
ICD-10-CA chapter		
Infections	0.38 (0.25–0.56)	0.84 (0.61–1.16)
Neoplasms	0.17 (0.04–0.74)	0.51 (0.19–1.37)
Blood diseases	0.69 (0.36–1.31)	0.48 (0.28–0.82)
Endocrine diseases	0.35 (0.22–0.54)	1.05 (0.76–1.46)
Mental and behavioural disorders	0.44 (0.34–0.56)	1.05 (0.85–1.30)
Dementia†	0.40 (0.27–0.60)	1.30 (0.93–1.81)
Delirium	0.49 (0.30–0.79)	0.91 (0.64–1.31)
Nervous system diseases	0.36 (0.21–0.60)	1.01 (0.69–1.48)
Eye diseases	0.38 (0.15–0.96)	0.94 (0.53–1.68)
Ear diseases	0.11 (0.03–0.48)	1.03 (0.44–2.37)
Circulatory diseases	0.51 (0.41–0.65)	0.74 (0.60–0.91)
Cardiac diseases (acute myocardial infarction, stroke and heart failure)	0.52 (0.38–0.72)	0.58 (0.44–0.78)
Respiratory diseases	0.41 (0.33–0.53)	0.64 (0.51–0.80)
Influenza, pneumonia, and chronic lower respiratory infections	0.38 (0.28–0.50)	0.59 (0.45–0.77)
COPD	0.33 (0.20–0.56)	0.76 (0.49–1.18)
Digestive diseases	0.39 (0.30–0.52)	0.90 (0.71–1.13)
Skin diseases	0.35 (0.22–0.55)	0.86 (0.60–1.24)
Musculoskeletal diseases	0.29 (0.22–0.40)	0.81 (0.64–1.03)
Genitourinary diseases	0.56 (0.43–0.72)	0.88 (0.72–1.08)
Kidney or urinary tract infection	0.36 (0.26–0.50)	0.83 (0.65–1.06)
Signs, symptoms and abnormal clinical and laboratory findings	0.46 (0.41–0.52)	0.86 (0.77–0.95)
Signs and symptoms involving cognition	0.45 (0.32–0.63)	0.83 (0.63–1.08)
Injuries and poisoning	0.48 (0.41–0.55)	0.86 (0.76–0.97)
Fall-related injuries	0.56 (0.47–0.66)	0.85 (0.73–0.98)
Non-fall-related injuries	0.38 (0.25–0.58)	0.74 (0.54–1.03)
Factors influencing health status	0.66 (0.49–0.89)	1.09 (0.82–1.44)
Other		
Adverse drug reactions	0.30 (0.13–0.65)	0.91 (0.47–1.79)

Note: CI = confidence interval, COPD = chronic obstructive pulmonary disease, ICD-10-CA = Canadian version of the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*, RR = rate ratio. Low-frequency ICD-10 chapters are not shown (i.e., pregnancy, certain conditions originating in the perinatal period, congenital malformations, and external causes of morbidity and mortality).
*The week of the lowest rate is based on the lowest rate during the pandemic period (Mar. 1, 2020 to Feb. 21, 2021) compared with equivalent weeks during the historical period (Mar. 3, 2019 to Feb. 23, 2020). The latest weekly rate is as of the week of Feb. 21, 2021 (pandemic period) compared with the week of Feb. 23, 2020 (historical period).
†Dementia codes include F00–F03, G30.

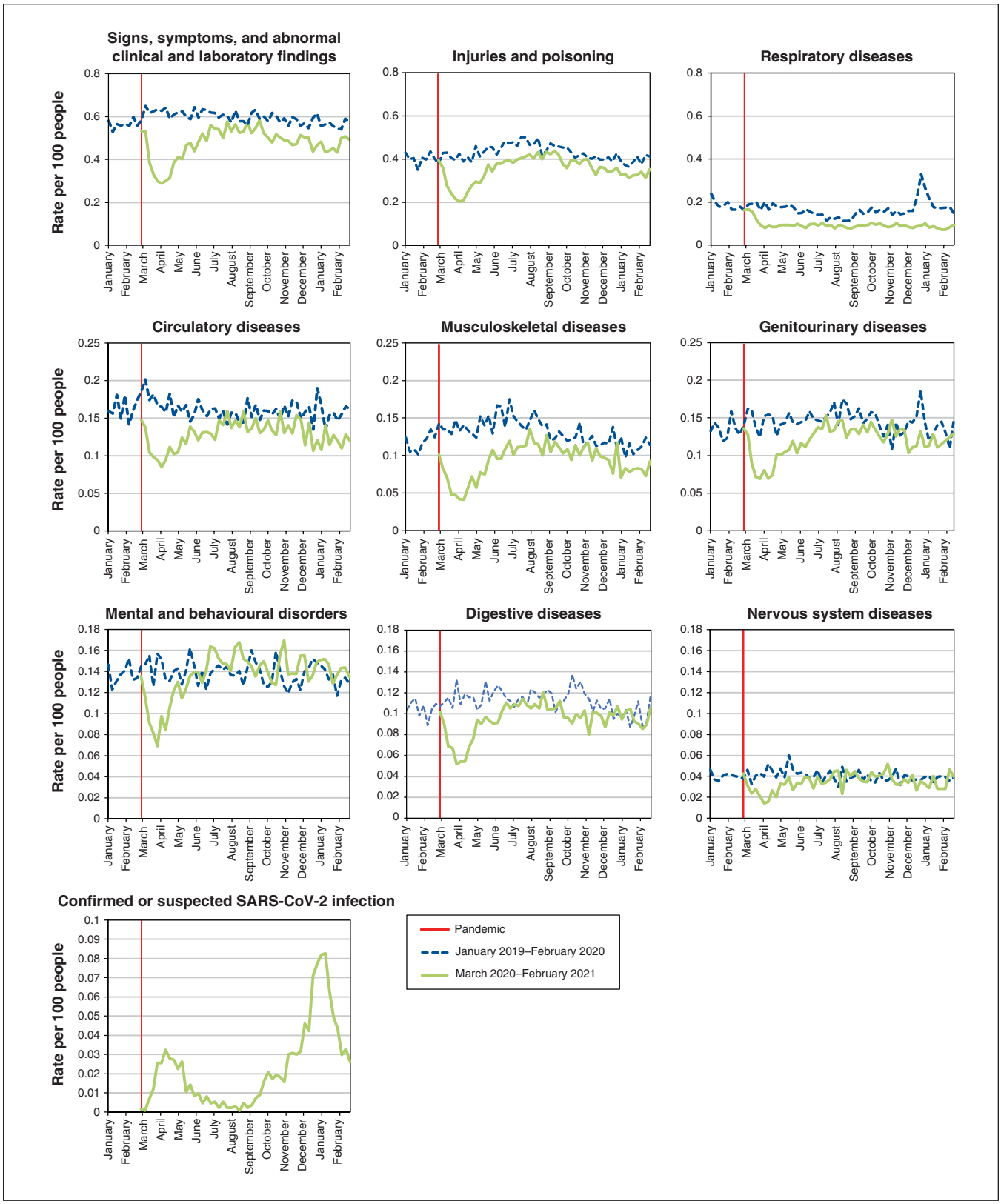

Figure 3: Weekly rates of emergency department visits by ICD-10-CA chapter* among community-dwelling people with dementia during the historical and pandemic periods in Ontario. Historical rates shown are from January 2019 to February 2020. Pandemic rates shown are from March 2020 to February 2021. Note: ICD-10-CA = Canadian version of the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*. The red line represents the beginning of the first COVID-19 pandemic wave in Ontario. *Selected ICD-10-CA chapters are shown for the main presenting diagnosis.

in Hong Kong showed that telehealth interventions improved mental health and reduced caregiver burden among people with dementia during the pandemic.[25] This may point to the opportunity for virtual care to address gaps in care for people with dementia and avoid presentation to the emergency department.

Lower rates of visits to the emergency department for diagnoses that require urgent acute care such as circulatory diseases and injuries are concerning because this may reflect care that was forgone or delayed, which could lead to poor outcomes. Other population-based studies have also shown similar declines in visits to the emergency department for diagnoses that require urgent care, such as fall-related injuries, during the COVID-19 pandemic.[26,27] Appropriate messaging by health care practitioners and public health officials is necessary to ensure all patients feel secure coming to the emergency department to receive timely acute care services. This may be especially important for people with dementia who are vulnerable to decline and have high levels of comorbid chronic conditions. Similar to several studies during the pandemic,[13,28,29] we noted increases in the proportion of visits to the emergency department for which patients were admitted to hospital. Although we did not observe any other differences in patient characteristics at admission to the emergency department, this finding likely represents admissions because of COVID-19, as well as possibly more severe or delayed presentations among higher-urgency visits to the emergency department.

We observed declines in visits to the emergency department across key diagnostic groupings (e.g., circulatory diseases and injuries) as has been found in other studies.[12,30,31] Rates of the visits for these conditions remained below historical levels by the end of the second wave. We found declines for visits to the emergency department for cardiac diseases similar to those for AMI and stroke reported in a US study involving older adults (18%–28%). It is unlikely that the decline in rates of AMI and stroke observed represent true declines but may represent hesitancy or delays in seeking care. There is evidence that mortality for AMI increased during the COVID-19 pandemic, possibly because of delays in seeking treatment, which underscores the need for additional surveillance and public health messaging for patients not to delay seeking care.

We also observed sustained declines in rates of visits for respiratory diseases, whereas results in other studies have been mixed. Increases seen in other studies may have been due to SARS-CoV-2 infections. Although reductions in visits for influenza, pneumonia and chronic lower respiratory infections that we observed and those found in several other studies likely reflect low circulating levels of respiratory viruses because of public health measures.

We found that visits to the emergency department for mental and behavioural disorders (i.e., delirium) showed declines but rebounded by the end of the second wave. Studies involving the general populations in the US and Australia have shown smaller declines but have also shown rebounds to at or above historical levels. Other studies have noted increased rates of visits for anxiety and substance use disorders.[11,12,32,33] Qualitative studies have shown an increased burden of behavioural and psychosocial symptoms among people with dementia and their care partners during the pandemic, which is likely associated with social isolation and service cancellation owing to pandemic-related restrictions.[1,34] Thus, the decline in visits to the emergency department that we observed for mental and behavioural disorders is unlikely to reflect a true decreased burden but may reflect people who did not present to health care providers for treatment and increased burden on care partners in managing these issues at home or management via care that has shifted to other settings (e.g., virtual physician or community care). Family physicians may have provided virtual support for behavioural and psychological symptoms in people with dementia during the pandemic. Ongoing reductions in social support services, including day programs, support groups and other in-person services, during the pandemic[35] may have contributed to the rapid rebound in rates of visits to the emergency department for mental and behavioural disorders among people with dementia and underscore the importance of the emergency department in caring for patients with these concerns.

Limitations

Some limitations to our study should be noted, such as the lack of information on behavioural symptoms of dementia and severity of cognitive impairment, which may have helped understand the reasons for presentation to the emergency department. Furthermore, although validated in a primary care sample, the dementia ascertainment is not a clinical diagnosis and there is potential for misclassification.

Although we excluded persons residing in long-term care homes (publicly funded facilities that provide 24-h nursing support for people who can no longer live independently), we were unable to distinguish those who resided in private retirement homes from the broader community-dwelling population in the administrative data holdings. Retirement homes are privately paid and provide housing for older adults who require less care than persons residing in long-term care homes. Owing to their congregate nature, people living in these settings may have experienced different patterns of use of the emergency department because of provincial pandemic restrictions on visitors or an increased likelihood of SARS-CoV-2 infection.[36] We were also unable to identify whether people with dementia lived alone or with a spouse or care partner.

Conclusion

We observed large declines in visits to the emergency department overall and for both urgent and nonurgent conditions during the first 2 waves of the COVID-19 pandemic among community-dwelling people with dementia, which did not return to historical levels by the end of the second wave. We also found declines in visits for conditions that

required urgent care such as fall-related injuries and circulatory diseases, which raises concerns about people with dementia receiving adequate and immediate acute care. Future research might evaluate long-term outcomes associated with the sustained reductions in emergency department use during the pandemic.

References

1. Roach P, Zwiers A, Cox E, et al. Understanding the impact of the COVID-19 pandemic on well-being and virtual care for people living with dementia and care partners living in the community. *Dementia* 2021;20:2007-23.
2. Brown EE, Kumar S, Rajji TK, et al. Anticipating and mitigating the impact of the COVID-19 pandemic on Alzheimer's disease and related dementias. *Am J Geriatr Psychiatry* 2020;28:712-21.
3. Smith EE, Couillard P, Fisk JD, et al. Pandemic dementia scarce resource allocation. *Can Geriatr J* 2020;23:216-8.
4. Amjad H, Carmichael D, Austin AM, et al. Continuity of care and health care utilization in older adults with dementia in fee-for-service Medicare. *JAMA Intern Med* 2016;176:1371-8.
5. Gosse PJ, Kassardjian CD, Masellis M, et al. Virtual care for patients with Alzheimer disease and related dementias during the COVID-19 era and beyond. *CMAJ* 2021;193:E371-7.
6. Geddes MR, O'Connell ME, Fisk JD, et al.; Alzheimer Society of Canada Task Force on Dementia Care Best Practices for COVID-19. Remote cognitive and behavioral assessment: report of the Alzheimer Society of Canada Task Force on dementia care best practices for COVID-19. *Alzheimers Dement (Amst)* 2020;12:e12111.
7. LaMantia MA, Stump TE, Messina FC, et al. Emergency department use among older adults with dementia. *Alzheimer Dis Assoc Disord* 2016;30:35-40.
8. Gomez D, Simpson AN, Sue-Chue-Lam C, et al. A population-based analysis of the impact of the COVID-19 pandemic on common abdominal and gynecological emergency department visits. *CMAJ* 2021;193:E753-60.
9. Yu AYX, Lee D, Vyas M, et al. Abstract P246: Population-based rates of emergency department visits for stroke in the different phases of COVID-19 restriction and reopening. *Stroke* 2021;52(Suppl 1):AP246.
10. COVID-19's impact on emergency departments. Ottawa: Canadian Institute for Health Information; 2021. Available: https://www.cihi.ca/en/covid-19-resources/impact-of-covid-19-on-canadas-health-care-systems/how-covid-19-affected (accessed 2021 July 14).
11. Keyes D, Hardin B, Sweeney B, et al. Change in urban and non-urban pattern of ED use during the COVID-19 pandemic in 28 Michigan hospitals: an observational study. *BMJ Open* 2021;11:e043024.
12. Hartnett KP, Kite-Powell A, DeVies J, et al.; National Syndromic Surveillance Program Community of Practice. Impact of the COVID-19 pandemic on emergency department visits: United States, January 1, 2019–May 30, 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:699-704.
13. Jeffery MM, D'Onofrio G, Paek H, et al. Trends in emergency department visits and hospital admissions in health care systems in 5 states in the first months of the COVID-19 pandemic in the US. *JAMA Intern Med* 2020;180:1328-33.
14. Chen MY, Langan S, Benchimol EI. Routinely collected electronic health data and STI research: RECORD extension to the STROBE guidelines. *Sex Transm Infect* 2016;92:2-3.
15. Ng R, Lane N, Tanuseputro P, et al. Increasing complexity of new nursing home residents in Ontario, Canada: a serial cross-sectional study. *J Am Geriatr Soc* 2020;68:1293-300.
16. Jaakkimainen RL, Bronskill SE, Tierney MC, et al. Identification of physician-diagnosed Alzheimer's disease and related dementias in population-based administrative data: a validation study using family physicians' electronic medical records. *J Alzheimers Dis* 2016;54:337-49.
17. Bullard MJ, Musgrave E, Warren D, et al. Revisions to the Canadian emergency department triage and acuity scale (CTAS) guidelines 2016. *CJEM* 2017;19(Suppl 2):S18-27.
18. NACRS Meta Data Dictionary. Ottawa: Canadian Institute for Health Information; 2016. Available: https://www.cihi.ca/sites/default/files/document/nacrs_meta_data_dictionary_2015_oct_en.pdf (accessed 2022 June 1).
19. Sloane PD, Schifeling CH, Beeber AS, et al. New or worsening symptoms and signs in community-dwelling persons with dementia: incidence and relation to use of acute medical services. *J Am Geriatr Soc* 2017;65:808-14.
20. Mondor L, Maxwell CJ, Bronskill SE, et al. The relative impact of chronic conditions and multimorbidity on health-related quality of life in Ontario long-stay home care clients. *Qual Life Res* 2016;25:2619-32.
21. Butt AA, Azad AM, Kartha AB, et al. Volume and acuity of emergency department visits prior to and after COVID-19. *J Emerg Med* 2020;59:730-4.
22. Giannouchos TV, Biskupiak J, Moss MJ, et al. Trends in outpatient emergency department visits during the COVID-19 pandemic at a large, urban, academic hospital system. *Am J Emerg Med* 2021;40:20-6.
23. Bronskill SE, Maclagan LC, Maxwell CJ, et al. Trends in health service use for Canadian adults with dementia and Parkinson disease during the first wave of the COVID-19 pandemic. *JAMA Health Forum* 2022;3:e214599.
24. Glazier RH, Green ME, Wu FC, et al. Shifts in office and virtual primary care during the early COVID-19 pandemic in Ontario, Canada. *CMAJ* 2021;193:E200-10.
25. Lai FH-Y, Yan EW-H, Yu KK-U, et al. The protective impact of telemedicine on persons with dementia and their caregivers during the COVID-19 pandemic. *Am J Geriatr Psychiatry* 2020;28:1175-84.
26. Harmon KJ, Fliss MD, Marshall SW, et al. The impact of the COVID-19 pandemic on the utilization of emergency department services for the treatment of injuries. *Am J Emerg Med* 2021;47:187-91.
27. Law RK, Wolkin AF, Patel N, et al. Injury-related emergency department visits during the COVID-19 pandemic. *Am J Prev Med* 2022 Feb. 21 [Epub ahead of print]. doi: 10.1016/j.amepre.2022.01.018.
28. Lucero AD, Lee A, Hyun J, et al. Underutilization of the emergency department during the COVID-19 pandemic. *West J Emerg Med* 2020;21:15-23.
29. Ojetti V, Covino M, Brigida M, et al. Non-COVID diseases during the pandemic: Where have all other emergencies gone? *Medicina (Kaunas)* 2020;56:512.
30. Gluckman TJ, Wilson MA, Chiu S-T, et al. Case rates, treatment approaches, and outcomes in acute myocardial infarction during the coronavirus disease 2019 pandemic. *JAMA Cardiol* 2020;5:1419-24.
31. Lange SJ, Ritchey MD, Goodman AB, et al. Potential indirect effects of the COVID-19 pandemic on use of emergency departments for acute life-threatening conditions: United States, January–May 2020. *Am J Transplant* 2020;20:2612-7.
32. Grunau B, Helmer J, Lee S, et al. Decrease in emergency medical services utilization during early stages of the COVID-19 pandemic in British Columbia. *CJEM* 2021;23:237-41.
33. Rennert-May E, Leal J, Thanh NX, et al. The impact of COVID-19 on hospital admissions and emergency department visits: a population-based study. *PLoS One* 2021;16:e0252441.
34. Tam MT, Dosso JA, Robillard JM. The impact of a global pandemic on people living with dementia and their care partners: analysis of 417 lived experience reports. *J Alzheimers Dis* 2021;80:865-75.
35. Giebel C, Lord K, Cooper C, et al. A UK survey of COVID-19 related social support closures and their effects on older people, people with dementia, and carers. *Int J Geriatr Psychiatry* 2021;36:393-402.
36. Costa AP, Manis DR, Jones A, et al. Risk factors for outbreaks of SARS-CoV-2 infection at retirement homes in Ontario, Canada: a population-level cohort study. *CMAJ* 2021;193:E672-80.

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