

People who make frequent emergency department visits based on persistence of frequent use in Ontario and Alberta: a retrospective cohort study

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Abstract

Background: The factors that underlie persistent frequent visits to the emergency department are poorly understood. This study aimed to characterize people who visit emergency departments frequently in Ontario and Alberta, by number of years of frequent use.

Methods: This was a retrospective cohort study aimed at capturing information about patients visiting emergency departments in Ontario and Alberta, Canada, from Apr. 1, 2011, to Mar. 31, 2016. We identified people 18 years or older with frequent emergency department use (top 10% of emergency department use) in fiscal year 2015/16, using the Dynamic Cohort from the Canadian Institute of Health Information. We then organized them into subgroups based on the number of years (1 to 5) in which they met the threshold for frequent use over the study period. We characterized subgroups using linked emergency department, hospitalization and mental health–related hospitalization data.

Results: We identified 252737 people in Ontario and 63238 people in Alberta who made frequent visits to the emergency department. In Ontario and Alberta, 44.3% and 44.7%, respectively, met the threshold for frequent use in only 1 year and made 37.9% and 38.5% of visits; 6.8% and 8.2% met the threshold for frequent use over 5 years and made 11.9% and 13.2% of visits. Many characteristics followed gradients based on persistence of frequent use: as years of frequent visits increased (1 to 5 years), people had more comorbidities, homelessness, rural residence, annual emergency department visits, alcohol- and substance use–related presentations, mental health hospitalizations and instances of leaving hospital against medical advice.

Interpretation: Higher levels of comorbidities, mental health issues, substance use and rural residence were seen with increasing years of frequent emergency department use. Interventions upstream and in the emergency department must address unmet needs, including services for substance use and social supports.

In many Canadian jurisdictions, the number of emergency department visits attributable to frequent users is increasing; understanding the drivers of high emergency department use is imperative so that patient needs can be addressed.^{1,2} For instance, emergency department use is higher in low-income neighbourhoods and rural communities with limited access to primary care.^{3,4} As well, 1 in 5 emergency department visits could be dealt with more efficiently in settings other than the emergency department.⁵

A small proportion of patients account for a disproportionate share of health care use and spending.⁶ Patients in the top 3% of emergency department utilization account for 30% of health care costs, and costs increase with persistent frequent use.^{7,8} Previous studies have indicated that one-third of high-cost health care users⁹ and 16.5% to

21.9% of people who make frequent visits to the emergency department (including those in our previous analysis in British Columbia)¹ continue to do so over multiple years. People with persistent frequent emergency department use have complex health needs and more conditions related to mental health and substance use than those with short-term frequent use.^{10,11}

Competing interests: See the end of the article.

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Using population-level analyses in multiple jurisdictions to understand the characteristics and unmet needs that underlie persistent frequent emergency department use is crucial to developing effective interventions that better meet people's needs, improve outcomes and optimize resource allocation. We hypothesized that people who make frequent visits to the emergency department have different characteristics and needs based on the persistence of their high use. This study aimed to characterize people in Ontario and Alberta who visited emergency departments frequently based on their number of years of frequent use (1 to 5 years).

Methods

Study design and setting

This was a retrospective administrative database study that captured patients who visited an emergency department in Ontario or Alberta from Apr. 1, 2011, to Mar. 31, 2016. We report study findings in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.¹²

Participants

We derived our study cohort from a subset of people aged 18 years or older who visited emergency departments frequently in the Canadian Institute for Health Information (CIHI) Dynamic Cohort of Complex, High System Users. We identified patients who were in the top 10% in terms of emergency department utilization during our most recent year of data (Apr. 1, 2015, to Mar. 31, 2016). We disaggregated results by province (Ontario and Alberta).

Data sources

CIHI created the Dynamic Cohort in Ontario and Alberta using in-house data sets to identify patient subsets with the highest acute care costs, lengths of stay, number of hospitalizations and number of emergency department visits.¹³

CIHI first stratified emergency department visit data from the National Ambulatory Care Reporting System (NACRS)¹⁴ by province of residence, fiscal year and age (< 18 yr and ≥ 18 yr). Within each stratum, CIHI generated emergency department visit counts per patient and then identified the top 10% of frequent emergency department visitors. CIHI also created a control group by randomly selecting patients from the remaining 90%, using a 4:1 ratio. CIHI repeated the cohort selection process each fiscal year, adding new patients and updating information from all previously included patients.¹³ Therefore, the Dynamic Cohort identifies a top 10% cohort in each fiscal year, adds patients each year who meet the threshold for frequent emergency department use, and follows this cohort forward in time.

For this analysis, we used the "ED Visit Indicator" variable collected in NACRS to differentiate emergency department visits from scheduled ambulatory care.¹⁵ All emergency departments in Ontario and Alberta submit level 3 NACRS data, leading to high emergency department coverage and mandatory reporting of discharge diagnoses.¹⁵

CIHI performed all data linkages using personal health numbers and provided anonymized study identifiers. We linked NACRS records for our study cohort to the Discharge Abstract Database (DAD) for hospitalizations and the Hospital Mental Health Database (HMHDB) for hospitalizations related to mental illness and substance use (including alcohol use).^{8,13,14,16} The HMHDB combines information on mental health-related hospitalizations in all Canadian provinces and territories by combining 4 administrative sources whose availability is variable in individual jurisdictions: DAD, the Hospital Morbidity Database, Hospital Mental Health Survey and the Ontario Mental Health Reporting System.^{8,17}

Study variables and definitions

All study variables and their data sources are outlined in Appendix 1, Table S1, available at www.cmajopen.ca/content/10/1/E220/suppl/DC1.

Persistence of frequent emergency department use

We classified our cohort (people who visited emergency departments frequently from Apr. 1, 2015, to Mar. 31, 2016) into subgroups based on the number of fiscal years (1 to 5) in which they met the threshold for frequent emergency department use over our 5-year study period (Apr. 1, 2011, to Mar. 31, 2016).

Demographic characteristics

We examined sex, age, province and rural or urban residence using NACRS. A "0" in the second character of a postal code denoted a rural address.¹⁸

Homelessness was documented in the HMHDB.¹⁹ This variable is not validated, but it is based on mandatory reporting fields: "postal code" in DAD (Ontario and Alberta) and "Usual Residential Status" in the Ontario Mental Health Reporting System database (Ontario only).

Emergency department visits

We summarized the characteristics of emergency department visits (ambulance arrival, triage level, diagnoses and disposition) in NACRS. Triage level was classified using the Canadian Triage and Acuity Scale (CTAS), a national tool that defines 5 acuity levels, allowing Canadian emergency departments to prioritize care.^{20,21} The CTAS has predictive validity for overall and intensive care unit admission, and good inter-rater reliability over multiple revisions in many settings.²²⁻²⁴

Diagnostic categories

Emergency department visit and admission diagnoses were classified in NACRS and DAD using the Canadian version of the *International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10-CA)*. The ICD-10-CA comprises 22 diagnostic chapters, as well as specific diagnoses.²⁵ We summarized both diagnostic chapters and specific diagnoses, an approach that has demonstrated improved coding reliability.²⁶

Most responsible discharge diagnoses in the HMHDB are described under mental health categories based on diagnostic classification systems specific to the data source. DAD employs ICD-10-CA. The Ontario Mental Health Reporting System and Hospital Mental Health Survey employ the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) classification system (DSM-5 for the Ontario Mental Health Reporting System and DSM-III or DSM-IV-TR for the Hospital Mental Health Survey).⁸

We examined alcohol-related presentations using ICD-10-CA codes related to intoxication, withdrawal and associated complications (Appendix 1, Table S2). We developed our definition based on a coding standard employed by CIHI, cross-referenced against an expert analysis of alcohol-related ICD-10-CA codes.^{27,28}

We defined presentations related to substance use with ICD-10 codes used by CIHI to quantify harms related to substance use in Canada²⁸ (Appendix 1, Table S3). These codes include presentations related to alcohol, opioids, cannabis, sedatives, cocaine, stimulants, hallucinogens, nicotine, inhalants and psychoactive substances. The category of substance use-related mental health admissions in the HMHDB is a classification unique to that database, as described above.²⁸

Charlson Comorbidity Index

The Charlson Comorbidity Index describes patients' status using a score (0–37) that includes 17 comorbidities.²⁹ It is a validated prognosticator of mortality, length of hospitalization, complications and costs.^{29–31} Although it was initially validated using admission diagnoses,³⁰ its calculation based on emergency department diagnoses also predicts short-term and long-term mortality.^{30,32–34} We used primary emergency department diagnoses in NACRS to calculate this index.

Statistical analysis

We first identified people who met the definition for frequent emergency department use in the fiscal year from Apr. 1, 2015, to Mar. 31, 2016, among patients in the Dynamic Cohort. We then classified people into subgroups based on the number of study years (1 to 5) that they met the threshold for frequent emergency department use. Given that this was a population-based study, that statistical testing on large data sets often produces very low *p* values, and that the objective of our analysis was descriptive, we felt that it was more important to rely on clinically meaningful rather than statistical differences across groups. Therefore, we used descriptive statistics to summarize subgroup characteristics with respect to emergency department visits, hospitalizations and mental health hospitalizations in fiscal year 2015/16, without undertaking tests of statistical significance or quantifying the magnitude of differences among groups. We performed all analyses using R (R Development Core Team, 2011).

Ethics approval

The University of British Columbia Clinical Research Ethics Board approved this study.

Results

We identified 252 737 people in Ontario and 63 238 people in Alberta who met the definition for frequent emergency department use between Apr. 1, 2015, and Mar. 31, 2016 (Tables 1 and 2; Appendix 1, Tables S4 and S5). As the number of years of frequent use went up, subgroups decreased in size but increased in terms of the proportion of total emergency department visits in 2015/16. In Ontario, 44.3% of the sample met the threshold for frequent emergency department use over 1 year, making 37.9% of the visits; over 2 years, 24.9% of the sample made 23.6% of the visits; over 3 years, 14.8% of the sample made 15.5% of the visits; over 4 years, 9.3% of the sample made 11.2% of the visits; and over 5 years, 6.8% of the sample made 11.9% of the visits.

Similarly in Alberta, 44.7% of the sample met the threshold for frequent emergency department use over 1 year, making 38.5% of visits; over 2 years, 23.3% of the sample made 22.4% of the visits; over 3 years, 14.3% of the sample made 14.9% of the visits; over 4 years, 9.4% of the sample made 11.0% of the visits; and over 5 years, 8.2% of the sample made 13.2% of the visits.

Characterization by persistence of frequent use

We have summarized demographic, emergency department visit and hospitalization characteristics of people with frequent emergency department use by persistence of frequent emergency department use in Tables 1 and 2 and Appendix 1, Tables S4 and S5. Many characteristics and health care utilization patterns appeared to follow a gradient based on the increasing persistence of frequent emergency department use.

Patient characteristics

Subgroups with increasingly persistent frequent emergency department use over 1 to 5 years were females (Ontario: 52.3% to 63.0%; Alberta: 51.5% to 63.6%), people with a rural residence (Ontario: 20.0% to 23.3%; Alberta: 31.9% to 50.4%) and people with a Charlson Comorbidity Index of 1 or higher (Ontario: 19.4% to 28.8%; Alberta: 18.3% to 29.7%).

Emergency department use

We observed increasingly persistent frequent use over 1 to 5 years with a rising median number of annual emergency department visits (Ontario: 4 to 7; Alberta: 6 to 9), arrivals by ambulance (Ontario: 18.3% to 27%; Alberta: 11.7% to 18.7%), alcohol-related visits (Ontario: 0.8% to 5.4%; Alberta: 1.1% to 5.7%), substance use-related visits (Ontario: 1.3% to 6.4%; Alberta: 1.6% to 6.0%) and leaving the emergency department against medical advice (Ontario: 4.0% to 8.1%; Alberta: 3.5% to 6.7%). The proportion of people who were transferred or admitted to hospital at the end of their emergency department visit decreased among subgroups from 1 to 5 years of frequent use (Ontario: 16.1% to 11.2%; Alberta: 12.0% to 8.7%).

Table 1 (part 1 of 3): Demographic, emergency department use and hospitalization characteristics for people who made frequent emergency department visits from Apr. 1, 2015, to Mar. 31, 2016, by persistent frequent use subgroup — Ontario

Characteristic	Subgroup: no. of study years in which the definition of frequent emergency department use was met				
	1	2	3	4	5
No. of patients (% of total)	112 048 (44.3)	62 813 (24.9)	37 338 (14.8)	23 397 (9.3)	17 141 (6.8)
No. of patients whose frequent emergency department use spanned consecutive yr (%)	—	27 868 (44.4)	12 807 (34.3)	9 068 (38.8)	17 141 (100.0)
Patient characteristics (NACRS metadata)					
Gender, <i>n</i> (%)					
Female	58 617 (52.3)	34 887 (55.5)	21 713 (58.2)	14 265 (61.0)	10 807 (63.0)
Male	53 430 (47.7)	27 924 (44.5)	15 624 (41.8)	9 132 (39.0)	6 333 (36.9)
Other	1 (0.0)	2 (0.0)	1 (0.0)	0 (0.0)	1 (0.0)
Age, yr, median (IQR)	53 (33–71)	53 (33–71)	52 (33–71)	50 (33–68)	48 (34–63)
Rural or urban, <i>n</i> (%)					
Rural	22 365 (20.0)	13 798 (22.0)	8 478 (22.7)	5 505 (23.5)	3 994 (23.3)
Urban	89 266 (79.7)	48 651 (77.5)	28 547 (76.5)	17 645 (75.4)	12 827 (74.8)
Not available	417 (0.4)	364 (0.6)	313 (0.8)	247 (1.1)	320 (1.9)
Weighted Charlson Comorbidity Index, <i>n</i> (%)					
0	90 259 (80.6)	48 656 (77.5)	27 898 (74.7)	17 300 (73.9)	12 211 (71.2)
1	14 820 (13.2)	10 077 (16.0)	6 979 (18.7)	4 546 (19.4)	3 753 (21.9)
2	4 756 (4.2)	2 877 (4.6)	1 774 (4.8)	1 130 (4.8)	847 (4.9)
3	961 (0.9)	663 (1.1)	431 (1.2)	285 (1.2)	223 (1.3)
4+	1 252 (1.1)	540 (0.9)	256 (0.7)	136 (0.6)	107 (0.6)
No. of emergency department visits per person, median (IQR)	4 (4–6)	5 (4–6)	5 (4–7)	6 (4–8)	7 (5–11)
Emergency department visit characteristics (NACRS metadata)					
No. of emergency department visits (% of total)	583 092 (37.9)	362 668 (23.6)	238 976 (15.5)	171 694 (11.2)	183 162 (11.9)
Arrival by ambulance, <i>n</i> (%)					
Air ambulance	97 (0.0)	54 (0.0)	34 (0.0)	49 (0.0)	59 (0.0)
Air and ground ambulance	313 (0.1)	263 (0.1)	193 (0.1)	114 (0.1)	105 (0.1)
Ground ambulance	106 309 (18.2)	76 772 (21.2)	55 184 (23.1)	40 820 (23.8)	49 225 (26.9)
No ambulance	476 373 (81.7)	285 579 (78.7)	183 565 (76.8)	130 711 (76.1)	133 773 (73.0)
Triage level (CTAS), <i>n</i> (%)					
1 (resuscitation)	5 404 (0.9)	3 406 (0.9)	2 224 (0.9)	1 544 (0.9)	1 632 (0.9)
2 (emergent)	119 647 (20.5)	76 365 (21.1)	50 578 (21.2)	35 773 (20.8)	38 922 (21.3)
3 (urgent)	266 440 (45.7)	163 842 (45.2)	108 364 (45.3)	77 876 (45.4)	83 289 (45.5)
4 (less urgent)	157 088 (26.9)	94 601 (26.1)	61 756 (25.8)	44 772 (26.1)	46 266 (25.3)
5 (nonurgent)	31 488 (5.4)	20 583 (5.7)	13 897 (5.8)	10 006 (5.8)	11 466 (6.3)
Unknown	2 506 (0.4)	3 456 (1.0)	1 873 (0.8)	1 491 (0.9)	1 253 (0.7)
Not available	519 (0.1)	415 (0.1)	284 (0.1)	232 (0.1)	334 (0.2)
Alcohol-related visit, <i>n</i> (%)					
Yes	4 948 (0.8)	5 387 (1.5)	5 654 (2.4)	5 486 (3.2)	9 873 (5.4)
No	578 144 (99.2)	357 281 (98.5)	233 322 (97.6)	166 208 (96.8)	173 289 (94.6)
Substance use-related visit, <i>n</i> (%)					
Yes	7 343 (1.3)	7 773 (2.1)	7 806 (3.3)	7 222 (4.2)	11 748 (6.4)
No	575 749 (98.7)	354 895 (97.9)	231 170 (96.7)	164 472 (95.8)	171 414 (93.6)

Table 1 (part 2 of 3): Demographic, emergency department use and hospitalization characteristics for people who made frequent emergency department visits from Apr. 1, 2015, to Mar. 31, 2016, by persistent frequent use subgroup — Ontario

Characteristic	Subgroup: no. of study years in which the definition of frequent emergency department use was met				
	1	2	3	4	5
Top 5 ICD-10-CA emergency department diagnoses, <i>n</i> (%)					
1	Drug therapies 25 570 (4.4)	Abdominal pain 12 194 (3.4)	Abdominal pain 8453 (3.5)	Abdominal pain 7056 (4.1)	Abdominal pain 9150 (5.0)
2	Abdominal pain 18 609 (3.2)	Drug therapies 11 110 (3.1)	UTI 7187 (3.0)	UTI 4956 (2.9)	Chest pain 5559 (3.0)
3	UTI 14 799 (2.5)	UTI 10 829 (3.0)	Drug therapies 5843 (2.4)	Chest pain 4509 (2.6)	Alcohol intoxication 5000 (2.7)
4	Chest pain 12 142 (2.1)	Chest pain 8651 (2.4)	Chest pain 5792 (2.4)	Drug therapies 3485 (2.0)	UTI 4798 (2.6)
5	Cellulitis of lower limb 10 178 (1.7)	Cellulitis of lower limb 5787 (1.6)	COPD 3576 (1.5)	COPD 2631 (1.5)	Drug therapies 3610 (2.0)
Visit disposition, <i>n</i> (%)					
Discharged	465 571 (79.8)	287 842 (79.4)	189 881 (79.5)	137 287 (80.0)	147 860 (80.7)
Transferred or admitted	94 122 (16.1)	57 491 (15.9)	35 777 (15.0)	23 383 (13.6)	20 504 (11.2)
Left against medical advice	23 127 (4.0)	17 159 (4.7)	13 210 (5.5)	10 976 (6.4)	14 745 (8.1)
Died	272 (0.0)	176 (0.0)	108 (0.0)	48 (0.0)	53 (0.0)
Hospitalization characteristics (DAD metadata)					
No. of patients with at least 1 admission, <i>n</i> (%)	43 548 (38.9)	24 536 (39.1)	14 465 (38.7)	8948 (38.2)	6717 (39.2)
No. of admissions	84 784	50 951	31 194	20 212	16 672
No. of admissions per person, median (IQR)	2 (1–2)	2 (1–3)	2 (1–3)	2 (1–3)	2 (1–3)
Time admitted, d, median (IQR)	4 (2–8)	4 (2–7)	4 (2–7)	3 (2–7)	3 (2–6)
Top 5 ICD-10-CA primary diagnoses, <i>n</i> (%)					
1	CHF 3865 (4.6)	CHF 2826 (5.5)	CHF 1774 (5.7)	COPD 987 (4.9)	COPD 751 (4.5)
2	UTI 1950 (2.3)	COPD 1642 (3.2)	COPD 1474 (4.7)	CHF 984 (4.9)	CHF 610 (3.7)
3	Pneumonia 1715 (2.0)	UTI 1453 (2.9)	COPD and respir. infection 954 (3.1)	COPD and respir. infection 632 (3.1)	COPD and respir. infection 453 (2.7)
4	COPD 1691 (2.0)	Pneumonia 1167 (2.3)	UTI 923 (3.0)	UTI 586 (2.9)	UTI 452 (2.7)
5	Myocardial infarction 1627 (1.9)	COPD and respir. infection 1162 (2.3)	Pneumonia 684 (2.2)	Pneumonia 461 (2.3)	Alcohol, withdrawal 353 (2.1)
Top 5 ICD-10-CA primary diagnosis chapters, <i>n</i> (%)					
1	Circulatory 15 152 (17.9)	Circulatory 8663 (17.0)	Circulatory 4891 (15.7)	Circulatory 2887 (14.3)	Circulatory 1951 (11.7)
2	Respiratory 8640 (10.2)	Respiratory 6679 (13.1)	Respiratory 4700 (15.1)	Respiratory 3062 (15.1)	Respiratory 2357 (14.1)
3	Digestive 12 393 (14.6)	Digestive 6904 (13.6)	Digestive 4158 (13.3)	Digestive 2707 (13.4)	Digestive 2111 (12.7)
4	Abnormal clinical findings 7671 (9.0)	Abnormal clinical findings 5027 (9.9)	Abnormal clinical findings 3230 (10.4)	Abnormal clinical findings 2222 (11.0)	Abnormal clinical findings 2098 (12.6)
5	Injury, poisoning 7780 (9.2)	Injury, poisoning 4436 (8.7)	Injury, poisoning 2608 (8.4)	Injury, poisoning 1768 (8.7)	Injury, poisoning 1506 (9.0)

Table 1 (part 3 of 3): Demographic, emergency department use and hospitalization characteristics for people who made frequent emergency department visits from Apr. 1, 2015, to Mar. 31, 2016, by persistent frequent use subgroup — Ontario

Characteristic	Subgroup: no. of study years in which the definition of frequent emergency department use was met				
	1	2	3	4	5
Discharge disposition, <i>n</i> (%)					
Transferred to another facility	4748 (5.6)	2629 (5.2)	1493 (4.8)	981 (4.9)	752 (4.5)
Transferred to a long-term care facility	8749 (10.3)	5708 (11.2)	3319 (10.6)	1924 (9.5)	1249 (7.5)
Transferred to other centre	833 (1.0)	524 (1.0)	351 (1.1)	235 (1.2)	201 (1.2)
Discharged to a home setting with support services	26 146 (30.8)	16 740 (32.9)	9943 (31.9)	6086 (30.1)	4572 (27.4)
Discharged home	39 714 (46.8)	22 332 (43.8)	14 103 (45.2)	9639 (47.7)	8546 (51.3)
Signed out against medical advice	1017 (1.2)	910 (1.8)	834 (2.7)	717 (3.5)	994 (6.0)
Died	3572 (4.2)	2106 (4.1)	1148 (3.7)	628 (3.1)	355 (2.1)
Did not return from pass	5 (0.0)	2 (0.0)	3 (0.0)	2 (0.0)	3 (0.0)
Mental health hospitalization-related characteristics (HMHDB metadata)					
No. of patients with at least 1 mental health-related admission, <i>n</i> (% of total)	6004 (5.4)	4543 (7.2)	3155 (8.4)	2218 (9.5)	2124 (12.4)
No. of mental health-related admissions	9876	7925	5757	4233	4754
Documented homelessness among patients with at least 1 mental health-related admission, <i>n</i> (%)					
Yes	225 (3.7)	259 (5.7)	193 (6.1)	151 (6.8)	214 (10.1)
No	5779 (96.3)	4284 (94.3)	2962 (93.9)	2067 (93.2)	1910 (89.9)
Length of hospital stay, <i>d</i> median (IQR)	7 (3–16)	7 (2–16)	6 (2–15)	5 (2–13)	4 (2–12)
Diagnosis category, <i>n</i> (%)					
Substance-related disorder	1659 (16.8)	1629 (20.6)	1422 (24.7)	1112 (26.3)	1355 (28.5)
Mood disorder	2885 (29.2)	2338 (29.5)	1477 (25.7)	1086 (25.7)	1123 (23.6)
Schizophrenic and psychotic disorder	2059 (20.8)	1639 (20.7)	1347 (23.4)	981 (23.2)	1003 (21.1)
Organic disorder	1584 (16.0)	1067 (13.5)	570 (9.9)	327 (7.7)	203 (4.3)
Other mental health disorder	866 (8.8)	555 (7.0)	393 (6.8)	291 (6.9)	382 (8.0)
Personality disorder	328 (3.3)	315 (4.0)	283 (4.9)	269 (6.4)	509 (10.7)
Anxiety disorder	451 (4.6)	330 (4.2)	233 (4)	145 (3.4)	162 (3.4)
Non-mental health disorder	35 (0.4)	41 (0.5)	27 (0.5)	20 (0.5)	12 (0.3)
Unknown disorder	9 (0.1)	11 (0.1)	5 (0.1)	2 (0.0)	5 (0.1)
Discharge disposition, <i>n</i> (%)					
Discharged home	8178 (82.8)	6405 (80.8)	4580 (79.6)	3408 (80.5)	3750 (78.9)
Transferred	1111 (11.2)	878 (11.1)	608 (10.6)	416 (9.8)	408 (8.6)
Died	48 (0.5)	27 (0.3)	15 (0.3)	10 (0.2)	5 (0.1)
Signed out against medical advice	146 (1.5)	160 (2.0)	187 (3.2)	137 (3.2)	199 (4.2)
Other*	393 (4.0)	455 (5.7)	367 (6.4)	262 (6.2)	392 (8.2)

Note: CHF = congestive heart failure, COPD = chronic obstructive pulmonary disease, CTAS = Canadian Triage and Acuity Scale, DAD = Discharge Abstract Database, ED = emergency department, HMHDB = Hospital Mental Health Database, ICD-10-CA = *International Statistical Classification of Diseases and Related Health Problems, 10th revision, Canadian version*, IQR = interquartile range, NACRS = National Ambulatory Care Reporting System, respir. = respiratory, UTI = urinary tract infection.
 *Including homeless and other; applies to records from the Ontario Mental Health Reporting System.

Table 2 (part 1 of 3): Demographic, emergency department use and hospitalization characteristics for people who made frequent emergency department visits from Apr. 1, 2015, to Mar. 31, 2016, by persistent frequent use subgroup — Alberta

Characteristic	Subgroup: no. of study years in which the definition of frequent emergency department use was met				
	1	2	3	4	5
No. of patients (% of total)	28 290 (44.7)	14 730 (23.3)	9058 (14.3)	5958 (9.4)	5202 (8.2)
No. of patients whose frequent emergency department use spanned consecutive yr (%)	–	6855 (46.5)	3214 (35.5)	2339 (39.3)	5202 (100.0)
Patient characteristics (NACRS metadata)					
Gender, <i>n</i> (%)					
Female	14 557 (51.5)	8085 (54.9)	5328 (58.8)	3689 (61.9)	3307 (63.6)
Male	13 733 (48.5)	6645 (45.1)	3730 (41.2)	2269 (38.1)	1895 (36.4)
Other	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Age, yr, median (IQR)	46 (29–65)	47 (30–66)	46 (31–65)	46 (32–64)	47 (34–62)
Rural or urban, <i>n</i> (%)					
Rural	9013 (31.9)	5581 (37.9)	3790 (41.8)	2729 (45.8)	2622 (50.4)
Urban	18 949 (67.0)	8897 (60.4)	5069 (56.0)	3092 (51.9)	2422 (46.6)
Not available	328 (1.2)	252 (1.7)	199 (2.2)	137 (2.3)	158 (3)
Weighted Charlson Comorbidity Index, <i>n</i> (%)					
0	23 114 (81.7)	11 472 (77.9)	6798 (75.0)	4350 (73.0)	3659 (70.3)
1	3543 (12.5)	2335 (15.9)	1701 (18.8)	1206 (20.2)	1125 (21.6)
2	1165 (4.1)	644 (4.4)	383 (4.2)	286 (4.8)	306 (5.9)
3	236 (0.8)	177 (1.2)	122 (1.3)	71 (1.2)	68 (1.3)
4+	232 (0.8)	102 (0.7)	54 (0.6)	45 (0.8)	44 (0.8)
No. of emergency department visits per person, median (IQR)	6 (5–8)	6 (5–9)	7 (5–10)	7 (6–11)	9 (7–15)
Emergency department visit characteristics (NACRS metadata)					
No. of emergency department visits (% of total)	206 562 (38.5)	120 083 (22.4)	80 140 (14.9)	59 006 (11.0)	70 934 (13.2)
Arrival by ambulance, <i>n</i> (%)					
Air ambulance	125 (0.1)	67 (0.1)	52 (0.1)	46 (0.1)	50 (0.1)
Air and ground ambulance	137 (0.1)	85 (0.1)	42 (0.1)	60 (0.1)	56 (0.1)
Ground ambulance	23 909 (11.6)	16 654 (13.9)	12 270 (15.3)	10 008 (17.0)	13 143 (18.5)
No ambulance	182 391 (88.3)	103 277 (86.0)	67 776 (84.6)	48 892 (82.9)	57 685 (81.3)
Triage level (CTAS), <i>n</i> (%)					
1 (resuscitation)	803 (0.4)	522 (0.4)	404 (0.5)	245 (0.4)	379 (0.5)
2 (emergent)	21 786 (10.5)	12 989 (10.8)	8874 (11.1)	6614 (11.2)	7736 (10.9)
3 (urgent)	62 041 (30.0)	37 457 (31.2)	25 443 (31.7)	18 529 (31.4)	22 203 (31.3)
4 (less urgent)	72 600 (35.1)	41 909 (34.9)	27 458 (34.3)	20 106 (34.1)	23 583 (33.2)
5 (nonurgent)	39 538 (19.1)	21 546 (17.9)	13 964 (17.4)	10 515 (17.8)	13 451 (19.0)
Unknown	9446 (4.6)	5422 (4.5)	3771 (4.7)	2826 (4.8)	3317 (4.7)
Not available	348 (0.2)	238 (0.2)	226 (0.3)	171 (0.3)	265 (0.4)
Alcohol-related visits, <i>n</i> (%)					
Yes	2356 (1.1)	2389 (2.0)	2314 (2.9)	2338 (4.0)	4046 (5.7)
No	204 206 (98.9)	117 694 (98.0)	77 826 (97.1)	56 668 (96)	66 888 (94.3)
Substance use-related visits, <i>n</i> (%)					
Yes	3247 (1.6)	3114 (2.6)	2890 (3.6)	2716 (4.6)	4249 (6.0)
No	203 315 (98.4)	116 969 (97.4)	77 250 (96.4)	56 290 (95.4)	66 685 (94.0)

Table 2 (part 2 of 3): Demographic, emergency department use and hospitalization characteristics for people who made frequent emergency department visits from Apr. 1, 2015, to Mar. 31, 2016, by persistent frequent use subgroup — Alberta

Characteristic	Subgroup: no. of study years in which the definition of frequent emergency department use was met				
	1	2	3	4	5
Top 5 ICD-10-CA emergency department diagnoses, <i>n</i> (%)					
1	Drug therapies 35297 (17.1)	Drug therapies 17185 (14.3)	Drug therapies 9425 (11.8)	Drug therapies 6187 (10.5)	Drug therapies 8240 (11.6)
2	Dressings 8806 (4.3)	Dressings 3791 (3.2)	Abdominal pain 1969 (2.5)	Abdominal pain 1647 (2.8)	Abdominal pain 2196 (3.1)
3	Abdominal pain 3993 (1.9)	Abdominal pain 2719 (2.3)	Dressings 1876 (2.3)	Dressings 1496 (2.5)	Migraine 2019 (2.8)
4	Orthopaedic 3773 (1.8)	UTI 2477 (2.1)	UTI 1831 (2.3)	UTI 1450 (2.5)	Alc. intoxication 1897 (2.7)
5	UTI 3611 (1.7)	Chest pain 817 (1.5)	Chest pain 1333 (1.7)	Alc. intoxication 1029 (1.7)	UTI 1499 (2.1)
Visit disposition, <i>n</i> (%)					
Discharged	174523 (84.5)	100848 (84.0)	67040 (83.7)	49366 (83.7)	59956 (84.5)
Transferred or admitted	24821 (12.0)	14059 (11.7)	9004 (11.2)	6287 (10.7)	6180 (8.7)
Left against medical advice	7153 (3.5)	5153 (4.3)	4071 (5.1)	3346 (5.7)	4778 (6.7)
Died	65 (0.0)	23 (0.0)	25 (0.0)	7 (0.0)	20 (0.0)
Hospitalization characteristics (DAD metadata)					
No. of patients with at least 1 admission, <i>n</i> (%)	11287 (39.9)	6248 (42.4)	3846 (42.5)	2590 (43.5)	2338 (44.9)
No. of admissions	22389	13125	8437	5895	5729
No. of admissions per person, median (IQR)	2 (1–3)	2 (1–3)	2 (1–3)	2 (1–3)	2 (1–3)
Time admitted, d, median (IQR)	4 (2–7)	3 (2–7)	4 (2–7)	3 (2–7)	3 (2–7)
Top 5 ICD-10-CA primary diagnoses, <i>n</i> (%)					
1	CHF 844 (3.8)	CHF 504 (3.8)	COPD 358 (4.2)	COPD 249 (4.2)	COPD 226 (3.9)
2	COPD 530 (2.4)	COPD 424 (3.2)	CHF 260 (3.1)	Alc. withdrawal 165 (2.8)	Alc. withdrawal 210 (3.7)
3	UTI 396 (1.8)	Pneumonia 274 (2.1)	COPD and respir. infection 223 (2.6)	CHF 160 (2.7)	COPD and respir. infection 161 (2.8)
4	Pneumonia 390 (1.7)	COPD and respir. infection 264 (2.0)	Pneumonia 177 (2.1)	COPD and respir. infection 157 (2.7)	Pneumonia 157 (2.7)
5	COPD and respir. infection 318 (1.4)	UTI 257 (2.0)	UTI 166 (2.0)	Pneumonia 137 (2.3)	CHF 129 (2.3)
Top 5 ICD-10-CA primary diagnosis chapters, <i>n</i> (%)					
1	Circulatory 3211 (14.3)	Digestive 1729 (13.2)	Respiratory 1164 (13.8)	Mental, behav. 945 (16.0)	Mental, behav. 975 (17.0)
2	Digestive 3186 (14.2)	Mental, behav. 1573 (12.0)	Mental, behav. 1153 (13.7)	Respiratory 850 (14.4)	Respiratory 844 (14.7)
3	Injury, poisoning 2373 (10.6)	Circulatory 1569 (12.0)	Digestive 1004 (11.9)	Circulatory 524 (8.9)	Digestive 676 (11.8)
4	Mental, behav. 2187 (9.8)	Respiratory 1562 (11.9)	Circulatory 874 (10.4)	Digestive 690 (11.7)	Injury, poisoning 534 (9.3)
5	Respiratory 2184 (9.8)	Injury, poisoning 1315 (10.0)	Injury, poisoning 870 (10.3)	Injury, poisoning 604 (10.2)	Abnormal clinical findings 453 (7.9)

Table 2 (part 3 of 3): Demographic, emergency department use and hospitalization characteristics for people who made frequent emergency department visits from Apr. 1, 2015, to Mar. 31, 2016, by persistent frequent use subgroup — Alberta

Characteristic	Subgroup: no. of study years in which the definition of frequent emergency department use was met				
	1	2	3	4	5
Discharge disposition among admissions, <i>n</i> (%)					
Transferred to another facility	2030 (9.1)	1117 (8.5)	691 (8.2)	492 (8.3)	425 (7.4)
Transferred to a long-term care facility	811 (3.6)	461 (3.5)	293 (3.5)	210 (3.6)	105 (1.8)
Transferred to other centre	381 (1.7)	198 (1.5)	138 (1.6)	95 (1.6)	86 (1.5)
Discharged to a home setting with support services	3075 (13.7)	1861 (14.2)	1151 (13.6)	702 (11.9)	542 (9.5)
Discharged home	14 971 (66.9)	8616 (65.6)	5557 (65.9)	3902 (66.2)	4009 (70)
Signed out against medical advice	492 (2.2)	493 (3.8)	392 (4.6)	366 (6.2)	468 (8.2)
Died	604 (2.7)	371 (2.8)	202 (2.4)	122 (2.1)	89 (1.6)
Did not return from pass	25 (0.1)	8 (0.1)	13 (0.2)	6 (0.1)	5 (0.1)
Mental health hospitalization–related characteristics (HMHDB metadata)					
No. of patients with at least 1 mental health–related admission, <i>n</i> (% of total)	1441 (5.1)	1055 (7.2)	752 (8.3)	589 (9.9)	601 (11.6)
No. of mental health–related admissions	2468	1802	1320	1085	1092
Documented homelessness among patients with at least 1 mental health–related admission, <i>n</i> (%)					
Yes	70 (4.9)	54 (5.1)	47 (6.3)	46 (7.8)	56 (9.3)
No	1371 (95.1)	1001 (94.9)	705 (93.8)	543 (92.2)	545 (90.7)
Length of hospital stay, d median (IQR)	5 (2–14)	4 (2–12)	4 (2–10)	4 (2–10)	4 (2–8)
Diagnosis category, <i>n</i> (%)					
Substance-related disorder	756 (30.6)	668 (37.1)	563 (42.7)	488 (45.0)	529 (48.4)
Mood disorder	536 (21.7)	322 (17.9)	211 (16.0)	175 (16.1)	175 (16.0)
Schizophrenic and psychotic disorder	336 (13.6)	250 (13.9)	167 (12.7)	139 (12.8)	99 (9.1)
Organic disorder	274 (11.1)	170 (9.4)	99 (7.5)	54 (5.0)	37 (3.4)
Other mental health disorder	324 (13.1)	217 (12.0)	139 (10.5)	122 (11.2)	120 (11.0)
Personality disorder	106 (4.3)	80 (4.4)	67 (5.1)	53 (4.9)	81 (7.4)
Anxiety disorder	128 (5.2)	86 (4.8)	69 (5.2)	44 (4.1)	51 (4.7)
Non–mental health disorder	8 (0.3)	9 (0.5)	5 (0.4)	10 (0.9)	0 (0.0)
Unknown disorder	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Discharge disposition, <i>n</i> (%)					
Discharged home	1972 (79.9)	1426 (79.1)	1055 (79.9)	857 (79)	868 (79.5)
Transferred	329 (13.3)	211 (11.7)	132 (10.0)	110 (10.1)	75 (6.9)
Died	8 (0.3)	6 (0.3)	2 (0.2)	1 (0.1)	0 (0.0)
Signed out against medical advice	157 (6.4)	158 (8.8)	128 (9.7)	116 (10.7)	149 (13.6)
Other*	2 (0.1)	1 (0.1)	3 (0.2)	1 (0.1)	0 (0.0)

Note: Alc. = alcohol, behav. = behavioural, CHF = congestive heart failure, COPD = chronic obstructive pulmonary disease, CTAS = Canadian Triage and Acuity Scale, DAD = Discharge Abstract Database, ED = emergency department, HMHDB = Hospital Mental Health Database, ICD-10-CA = *International Statistical Classification of Diseases and Related Health Problems, 10th revision, Canadian version*, IQR = interquartile range, NACRS = National Ambulatory Care Reporting System, respir. = respiratory, UTI = urinary tract infection.

*Including homeless and other; applies to records from the Ontario Mental Health Reporting System.

Hospitalizations

Overall, we found no difference across subgroups in the proportion of people who had at least 1 hospital admission (about 39%). Congestive heart failure and exacerbations of chronic obstructive pulmonary disease were common diagnoses at admission in all subgroups. Subgroups with 1 to 5 years of persistent frequent use had mental health–specific hospitalizations more often (Ontario: 5.4% to 12.4%; Alberta: 5.1% to 11.6%), of which increasing proportions were related to substance use (Ontario: 16.8% to 28.5%; Alberta: 30.6% to 48.4%) or involved documented homelessness (Ontario: 3.7% to 10.1%; Alberta: 4.9% to 9.3%).

We observed increasing persistent frequent use with more dispositions of leaving against medical advice from both general (Ontario: 1.2% to 6.0%; Alberta: 2.2% to 8.2%) and mental health–related hospitalizations (Ontario: 1.5% to 4.2%; Alberta: 6.4% to 13.6%), and also with decreasing in-hospital mortality (Ontario: 4.2% to 2.1%; Alberta: 2.7% to 1.6%).

Interpretation

Our results showed heterogeneous demographic, clinical and health care utilization characteristics in patients with persistent frequent emergency department use. In our study, among people who made frequent emergency department visits in 2015/16, 44.3% in Ontario and 44.7% in Alberta met the threshold for frequent use in only that year; smaller numbers had also visited frequently in the preceding 2 to 5 years (6.8% and 8.2% over all 5 years in Ontario and Alberta, respectively). We observed gradients in characteristics and health care utilization patterns, where increasing persistence of frequent use was seen with more females, more comorbidities, higher rates of homelessness and rural residence, higher annual numbers of emergency department visits, increasing numbers of presentations related to alcohol and substance use, and higher rates of leaving against medical advice. Conversely, we observed decreasing gradients for admission rates following an emergency department visit and for in-hospital mortality, but not with having at least 1 hospitalization.

Our population-level analysis provides a longitudinal characterization of frequent emergency department use in 2 large Canadian provinces, a distinctive opportunity afforded by the annually updated Dynamic Cohort from CIHI, which provides information about patients' transitions into and out of frequent use. Our analysis contributes new evidence that many characteristics of people with frequent emergency department use follow gradients based on persistence. Consistent with previous studies, we identified that frequent use is most often short-term.^{10,35,36} Associations between persistent frequent use and increasing comorbidity, mental health, substance use and homelessness could indicate predispositions to medical complications, return visits seeking more compassionate treatment³⁷ or gaps in effectual alternatives to emergency department care (e.g., primary or addictions care), in rural areas for instance.

Persistent frequent use may indicate that more community and social supports are required for discharge planning to prevent repeat visits. Furthermore, our finding of an increasing

prevalence of patients who left the emergency department against medical advice may suggest that complex care was inadequately provided (e.g., pain or withdrawal management), or that acute care services addressed patients' needs suboptimally.³⁸ As well, differences in clinical presentations (e.g., more presentations related to alcohol and substance use presentations among the most persistent subgroups) provide directions for resource allocation.

It is important to note that we did not have access to data on race or ethnicity. It is known that people from racialized communities experience health care differently (e.g., service access barriers, stigma, discrimination),³⁹ and this may influence the likelihood of frequent emergency department use and its persistence. Future analyses should explore associations with race or ethnicity.

Our results must be interpreted in light of the high mortality risk among people with frequent emergency department use. Our previous analyses of people who presented frequently to emergency departments in British Columbia found 1-year mortalities of 24.7% in a subgroup of older patients and 12.3% in a younger subgroup with prevalent substance use and mental illness.⁴⁰ An analysis of patients in Ontario demonstrated that 8.8% of patients with 5 or more annual alcohol-related emergency department visits died within 1 year.¹⁷ The present study likely captures these high-risk patient profiles. Furthermore, existing evidence shows that leaving against medical advice is associated with a high risk of hospital readmission and mortality.^{41,42}

Future studies should examine predictors of and triggers for persistent frequent emergency department use, and should engage patients in qualitative work to explore reasons for leaving against medical advice and codesign interventions to improve on the modest effectiveness of interventions described to date.^{43,44} Studies should also examine outcomes associated with persistent frequent emergency department use (e.g., mortality, overdose, incarceration, institutionalization, quality of life) such that interventions prioritize patients at highest risk and patient-centred outcomes.

Limitations

Our analytic approach may have introduced survivorship bias, because we identified our study cohort by first selecting patients who met our threshold for frequent use within our final year of data (fiscal year 2015/16). Patients who had died in the preceding 4 years would have been excluded. Therefore, our cohort likely underrepresents the sickest patients in the potential cohort at study outset in fiscal year 2011/12; our results must be interpreted with this limitation in mind.

We were able to link only the Dynamic Cohort to CIHI-held databases. We did not have access to provincially held records, including pharmacy, physician billing, ambulance service and vital statistics databases. Therefore, we were unable to examine important data related to family physician attachment, prescription medications, comprehensive service utilization and mortality. Other important variables were unavailable, such as employment, ethnicity and education. Nonetheless, our population-level analysis of the CIHI-created, longitudinal

Dynamic Cohort, linked comprehensively to acute care databases, contributes a broad characterization of the people who visit emergency departments frequently in Ontario and Alberta.

Our analysis is limited by data completeness and quality. Discharge diagnoses and homelessness variables were not validated. Nonetheless, mandatory level 3 NACRS reporting, low missingness and regular CIHI quality assurance increased data reliability. Furthermore, we used the NACRS “ED Visit Indicator” flag to identify emergency department visits and exclude prescheduled care. However, the accuracy and reliability of this variable was uncertain, and our analysis probably misclassified a minority of scheduled visits as emergency department visits.

Finally, because of delays in data acquisition and linkage inherent in all administrative data analyses, our data were not current, and 2016 was our most recent available year. Patterns of frequent emergency department use may have changed since then; still, our analysis highlights important findings (e.g., increasing frequency of emergency department use seen with mental health and substance use disorders) that remain relevant and should inform clinical and policy interventions.

Conclusion

People who make persistent frequent emergency department visits over multiple years have prevalent multimorbidity, mental health issues, substance use issues and homelessness, and they commonly leave against medical advice. Understanding the risk factors for persistent frequent emergency department use, exploring interventions (both in the emergency department and outside of it) to address physical and mental health needs that underlie frequent emergency department visits, and advocating for alternatives that better address care gaps (e.g., addiction services, social supports) are urgent implications of our findings.

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Data sharing: We accessed our data through a data request to the Canadian Institute for Health Information (CIHI). Additional investigators can access the data analyzed in this study through an independent data request to CIHI.

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