ED Administration

Defining, quantifying, and characterizing adult frequent users of a suburban Canadian emergency department

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ABSTRACT

Introduction: Frequent emergency department (ED) users are inconsistently defined and poorly studied in Canada. The purpose of this study was to develop uniform definitions, quantify ED burden, and characterize adult frequent users of a suburban community ED.

Methods: We retrospectively reviewed the administrative database of the WestView ED in Alberta for patients ≥ 18 years of age presenting during the fiscal year of 2010. Adult frequent users and extreme frequent users were defined as patients with yearly visit numbers greater than the 95th and 99th percentiles, respectively. Demographic information including age, sex, ED length of stay, diagnoses, Canadian Triage and Acuity Scale (CTAS) level, and disposition were collected and stratified by ED frequency of use categories.

Results: The study included 22,333 ED visits by 14,223 patients. Frequent users represented 3.1% of patients and 13.8% of visits. Extreme frequent users represented 0.8% of patients, 5.4% of visits, and 568,879 cumulative ED minutes (395 days). Nonfrequent users had one to four, frequent users had five or more, and extreme frequent users had eight or more visits over a 12-month period. Frequent users and extreme frequent users had a significantly longer ED length of stay overall and in most age categories. Alcohol-related behavioural disorders, anxiety, nausea/vomiting, and chronic obstructive pulmonary disease were prominent diagnoses, suggesting that psychiatric, somatic, and chronic illnesses may underlie recurrent visits. Admission rates were significantly higher for frequent compared to nonfrequent users.

Conclusions: We propose reproducible definitions for adult frequent and extreme frequent ED users and provide information on the characteristics and burden of care of these groups at a community Canadian suburban ED.

Adoption of these definitions would allow comparison across centres in future research and facilitate targeted interventions for frequent and extreme frequent ED users.

RÉSUMÉ

Introduction: Les utilisateurs fréquents des services d'urgence (SU) forment un groupe mal défini et ont fait l'objet de peu d'analyse au Canada. L'étude décrite ici visait à élaborer une définition uniforme des utilisateurs fréquents des services d'urgence suburbains, chez les adultes; à les caractériser et à quantifier leur fardeau dans les SU.

Méthode: Nous avons procédé à un examen rétrospectif de la base de données administrative du SU WestView, en Alberta, à la recherche de patients âgés de 18 ans et plus, ayant consulté un médecin au service des urgences au cours de l'exercice financier de 2010. Les grands utilisateurs et les très grands utilisateurs de SU ont été définis comme des patients comptant un nombre annuel de consultations supérieur au 95e rang et au 99e rang centile, respectivement. Il y a d'abord eu collecte de données démographiques sur l'âge, le sexe, la durée du séjour au SU, le diagnostic, le niveau d'urgence selon l'Échelle canadienne de triage et de gravité, et les suites à donner, puis classement des patients selon les catégories de fréquence d'utilisation des services d'urgence.

Résultats: Au total, 14,223 patients comptaient 22,333 consultations au SU. Les grands utilisateurs représentaient 3.1 % des patients mais totalisaient 13.8 % des consultations; quant aux très grands utilisateurs, ils représentaient 0.8 % des patients mais totalisaient 5.4 % des consultations et 568,879 minutes au SU (395 jours). Les utilisateurs ponctuels comptaient d'une à quatre consultations sur une période de 12 mois; les grands utilisateurs, cinq ou plus; et les très

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CAEP | Canadian Association of Emergency Physicians
ACMU | Association canadienne des médecins d'urgence

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grands utilisateurs, huit ou plus. Dans l'ensemble, les grands utilisateurs et les très grands utilisateurs avaient une durée de séjour au SU significativement plus longue que les autres utilisateurs, et ce, dans la plupart des tranches d'âge. Les diagnostics les plus fréquents étaient les troubles du comportement liés à l'alcool, l'anxiété, les nausées et vomissements, et la bronchopneumopathie chronique obstructive, ce qui donne à penser que les maladies mentales, somatiques, et chroniques peuvent motiver des consultations à répétition. Les taux d'hospitalisation étaient aussi significativement plus élevés chez les grands utilisateurs que chez les utilisateurs ponctuels.

Conclusions: Nous proposons des définitions reproductibles de grands utilisateurs et de très grands utilisateurs de services d'urgence, chez les adultes, en plus de fournir des données sur les caractéristiques de ces groupes et le fardeau de soins qu'ils imposent dans les SU surburbains au Canada. L'adoption de ces définitions permettrait de faire des comparaisons entre centres, dans de futurs travaux de recherche, et faciliterait la mise en oeuvre d'interventions ciblant les grands utilisateurs et les très grands utilisateurs de SU.

In the face of system capacity shortfalls and cost containment pressures, frequent emergency department (ED) users are receiving increasing attention.[1,2] Previous studies have employed inconsistent definitions of frequent ED use based on absolute cutoffs, most often four or more visits in 1 year[1–20] but ranging from three visits in 2 years[4] to three visits in 1 month.[18] One group of investigators created multiple thresholds based loosely on mean and standard deviation to describe gradients of frequency of use.[3] In another study, no specific visit threshold was defined.[21] This variability is problematic; without a uniform definition, it is impossible to compare results across centres, identify differences in support services and infrastructure that may influence the number of frequent users, and formulate generalizable policy recommendations.

Frequent ED users represent a disproportionate visit burden; previous work has shown that 4.5 to 8% of patients account for 21 to 28% of visits.[1] Frequent ED visits may predict return ED visits within 72 hours,[11] and certain subsets of frequent users may have longer ED length of stay (LOS) and higher admission rates.[12]

Frequent ED users appear to be heterogeneous, with a bimodal age distribution and differing chief complaints.[1] Substance abuse, mental illness,[1,3–5] perceived health status, previous hospitalization or ED use, chronic illness, low socioeconomic status, and perceived low physician availability have been identified as risk factors.[6–10]

Canadian studies on frequent ED users have to date been limited to select subpopulations.[4,6,14,15,22] In general, frequent ED users have been less well studied in Canada than in the United States. This represents an important gap as the results of American studies are likely not generalizable owing to Canada's unique geography, population distribution, and nationalized health insurance system. Beyond this, it is probable that frequent ED users differ from community to community because of regional differences in the provision of support services and infrastructure. Thus, the generalizability of results and interventions even within national borders may be limited without a uniform definition of frequency of use that permits cross-site comparisons. Clearly, the first step is to create and evaluate a set of standard definitions. The purpose of this study was to develop uniform definitions, quantify ED burden, and characterize adult frequent users of a suburban community ED.

METHODS

Study design

We retrospectively reviewed the administrative database of the WestView ED in Alberta for adult patients presenting during the fiscal year of 2010 (April 1, 2010–March 31, 2011). This was a secondary analysis of ED abstract data collected and provided by Alberta Health Services (AHS). The study was approved by the University of Alberta Health Research Ethics Board.

Study setting and population

The WestView ED is a 24-bed primary care suburban community ED with an average yearly census of 26,649 ED visits between 2005 and 2011. It serves a catchment population of 76,428 persons in the communities of Stony Plain, Spruce Grove, and Parkland County outside of Edmonton.[23]

Selection and description of participants

The study population comprised adults 18 years of age and older at the time of their visit who used the WestView ED at least once during the 12-month study period. We excluded children because we hypothesized a priori that the characteristics of pediatric frequent users would differ from those of adults and thus would make the identification of standard definitions and determination of visit patterns difficult in a combined analysis.

The WestView community ED visit database captures both ED and outpatient visits, including visits in which patients are asked to return for follow-up. During the planning stages of this project, a focus group was held involving two emergency physicians at the study site to identify the ICD-10-CA codes[24] used for scheduled return visits. Planned returns included a weekly cast clinic, to which patients requiring cast care are referred. To prevent these visits from skewing the data on adult frequent users, ICD-10-CA codes for orthopedic follow-up care were excluded if they occurred during the times and dates of a scheduled cast clinic. Additionally, WestView ED patients who require return visits for intravenous antibiotic treatments or low–molecular-weight heparin for venous thromboembolic disease or atrial fibrillation are asked to return to the ED to receive these treatments; therefore, ICD-10-CA codes for such conditions were excluded if they occurred on the same or a subsequent day after an initial visit with the same diagnostic code.

Data sources and data quality

To conduct this study, we used WestView ED data that had been submitted to AHS, aggregated provincially, and forwarded to the Canadian Institute of Health Information (CIHI) as part of the National Ambulatory Care Reporting System (NACRS). Our data were thus subject to rigorous checks applied by AHS and the CIHI for completeness and accuracy. Quality assurance measures include features built into abstraction software to verify the accuracy of patient data and visit information, audits to identify discrepancies in coding fields, and coding done by trained health information management professionals who follow Canadian coding standards. Furthermore, the NACRS carries out external database validation via occasional reabstraction studies involving chart reviews and comparison of results to the data originally submitted to the NACRS.[25] The last such reabstraction study was released in 2008 and included validation of diagnostic coding.[26] Additionally, AHS carried out an ambulatory care reabstraction study on 2003–2004 data, which involved reabstraction of randomly selected charts from ambulatory care settings including EDs across the province. Overall, high agreement rates were found between the reabstracted and original chart data. Provincially, ED data had 98% agreement for encounter and demographic data and 87% agreement for diagnosis, which were above AHS's predetermined target rates.[27] These results confirm the accuracy of the national and provincial ED databases from which our study data are drawn.

Statistical analysis

We used the frequency distribution of ED visits to define our adult frequent use categories. The primary advantage of distribution-based definitions compared to fixed cutoffs is that the frequent use thresholds identified are inherently adjusted for underlying visit volume, thus making the results comparable across institutions. As the data for the number of ED visits were not normally distributed, we used percentiles of the visit distribution to identify frequent use categories. We defined adult frequent users a priori as patients with a total number of yearly visits above the 95th percentile and adult extreme frequent users as patients with a total number of yearly visits above the 99th percentile. The 95th percentile represents the ED use of 95% of the study population and is thus conceptually similar to using two standard deviations from the mean in normally distributed data, whereas the 99th percentile captures the extremes of any distribution.

The following patient characteristics were collected for study patients and stratified by ED frequency of use categories: age, sex, ED LOS, Canadian Triage and Acuity Scale (CTAS) level, disposition, and primary ICD-10-CA diagnosis. All analyses were two-way comparisons between adult frequent users and users and between adult extreme frequent users and non-frequent users. Admission rates were compared using chi-square tests for proportions or chi-square exact tests as appropriate. LOS was compared using the Mann-Whitney test for means. Statistical significance was defined as an alpha level of ≤ 0.05, and no adjustments were made for multiple comparisons. All statistical analyses were conducted using *SPSS* version 19 (SPSS Inc, Chicago, IL).
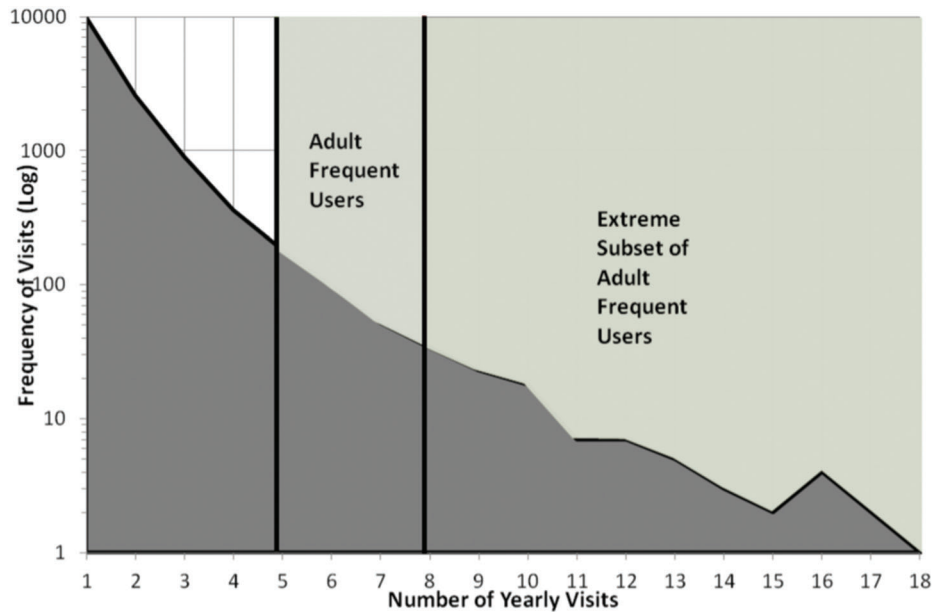
Figure 1. Distribution of patient visit counts during the study period.

RESULTS

A total of 22,333 ED visits made by 14,223 unique patients met the inclusion criteria, with a mean number of visits per patient of 2.68 (SD 3.03). A total of 8,575 visits were excluded (27.7% of total visits): 7,086 (83%) because they involved children and 1,489 (17%) because of scheduled returns. Visits by children and scheduled return visits represented 23% and 5% of total annual visits, respectively.

Figure 1 shows the distribution of patient visit counts during the study period, and Figure 2 shows the age distribution of patients stratified by frequency of use groups. When our definitions of adult frequent and extreme frequent use were applied to the study population, they resulted in a visit threshold of five or more annual visits for frequent use and eight or more annual visits for extreme frequent use.

Adult frequent users represented 3.1% of patients and accounted for 13.8% of all visits during the study
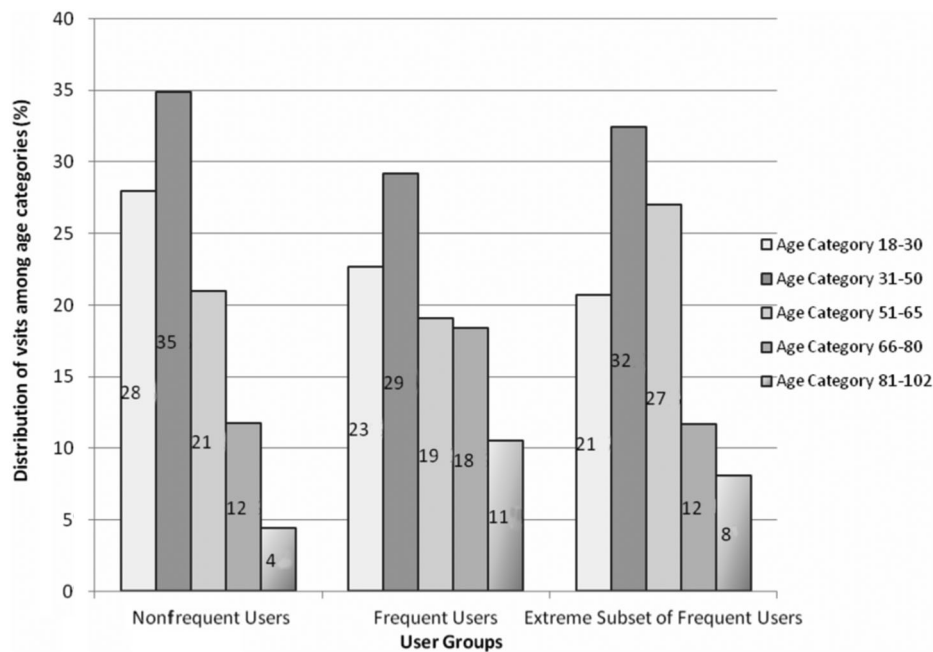

Figure 2. Age distribution of patients stratified by frequency of use groups.

Table 1. Demographic and visit characteristics of study population stratified by user group

Characteristic	Adult nonfrequent users (1–4 visits)	Adult frequent users (≥ 5 visits)	Extreme subset of adult frequent users (≥ 8 visits)
Patient			
Patients, *n* (% all patients)	13,778 (96.9)	445 (3.1)	111 (0.8)
Yearly visits per patient, mean (95% CI)	1.4 (1.4–1.4)	6.9 (6.6–7.2)	10.8 (10.0–11.6)
Male sex, % patients (95% CI)	50.0 (49.3–50.7)	48.3 (46.5–50.1)	47.7 (44.9–50.5)
Age at first visit in years, mean (95% CI)	45.0 (44.7–45.3)	50.9 (48.9–52.8)	49.1 (45.5–52.8)
Visit			
Visits, *n* (% all visits)	19,256 (86.2)	3,077 (13.8)	1,203 (5.4)
Visit triage level, % visits (95% CI)			
CTAS 1	0.6 (0.5–0.7)	0.6 (0.3–0.9)	0.9 (0.4–1.4)
CTAS 2	10.4 (10.0–10.8)	13.5 (12.3–14.7)	11.6 (9.8–13.4)
CTAS 3	40.0 (39.3–40.7)	45.9 (44.1–47.7)	49.3 (46.5–52.1)
CTAS 4	43.9 (43.2–44.6)	33.6 (31.9–35.3)	32.9 (30.2–35.6)
CTAS 5	5.2 (4.9–5.5)	6.4 (5.5–7.3)	5.3 (4.0–6.6)
ED LOS in minutes, mean (95% CI)	330.5 (322.0–339.0)	480.1 (452.2–508.0)*	472.9 (431.5–514.3)*
Top five primary diagnoses, *n* (% total visits for group)	Chest pain, unspecified, 570 (3.0)	Chest pain, unspecified, 81 (2.6)	Nausea with vomiting, 37 (3.1)
	Urinary tract infection, site not specified, 411 (2.1)	Other and unspecified abdominal pain, 72 (2.3)	Vomiting alone, 32 (2.7)
	Open wound of finger(s) without damage to nail, uncomplicated, 391 (2.0)	Urinary tract infection, site not specified, 66 (2.1)	Chest pain, unspecified, 31 (2.6)
	Other and unspecified abdominal pain 354 (1.8)	Headache, 48 (1.6)	Anxiety disorder, unspecified, 27 (2.2)
	Gastroenteritis and colitis of unspecified origin, 311 (1.6)	Nausea with vomiting, 48 (1.6)	Mental and behavioural disorders due to use of alcohol, acute intoxication, 22 (1.8)
Post-ED disposition, % visits (95% CI)			
Home or private dwelling	83.4 (82.9–83.9)	78.8 (77.4–80.2)	80.3 (78.1–82.5)
Left against medical advice	7.6 (7.2–8.0)	7.0 (6.1–7.9)	8.4 (6.8–10.0)
Residence with support services	2.3 (2.1–2.5)	5.3 (4.5–6.1)	4.8 (3.6–6.0)
Admitted as inpatient	2.4 (2.2–2.6)	4.4 (3.7–5.1)†	3.0 (2.0–4.0)

CTAS = Canadian Triage and Acuity Scale; ED = emergency department; LOS = length of stay.
*Statistically significant compared to nonfrequent user group using a Mann-Whitney test of means at an alpha level of 0.05.
†Statistically significant compared to nonfrequent user group using a chi-square test of proportions at an alpha level of 0.05.

period. The extreme subset of adult frequent users comprised 0.8% of patients, 5.4% of yearly visits, and 568,879 cumulative minutes (395 days) in the ED over the study year.

Table 1 shows the demographic and visit characteristics of the study population stratified by user group and illustrates, along with Figure 3, that ED LOS was statistically significantly longer for adult frequent users and the extreme frequent user subset compared to adult nonfrequent users. Adult frequent and extreme frequent users had a statistically significantly higher LOS than adult nonfrequent users in all age categories except for ages 81 to 102 years. Of visits by adult nonfrequent, frequent, and extreme frequent users,

2.4%, 4.4%, and 3.0%, respectively, resulted in hospital admission. The admission rate was statistically significantly higher for adult frequent users compared to nonfrequent users (Figure 4).

Table 2, Table 3, and Table 4 are available as online appendices at <http://www.xxx.xxx> and present demographic and visit data for adult nonfrequent, frequent, and extreme frequent users, respectively, categorized by age group. Chest pain and urinary tract infections were common primary diagnoses for both adult nonfrequent and frequent users. Nausea and/or vomiting were common diagnoses for younger groups of adult extreme frequent users, accounting for 9.6% of visits in patients ages 18 to 50 years. Mental and
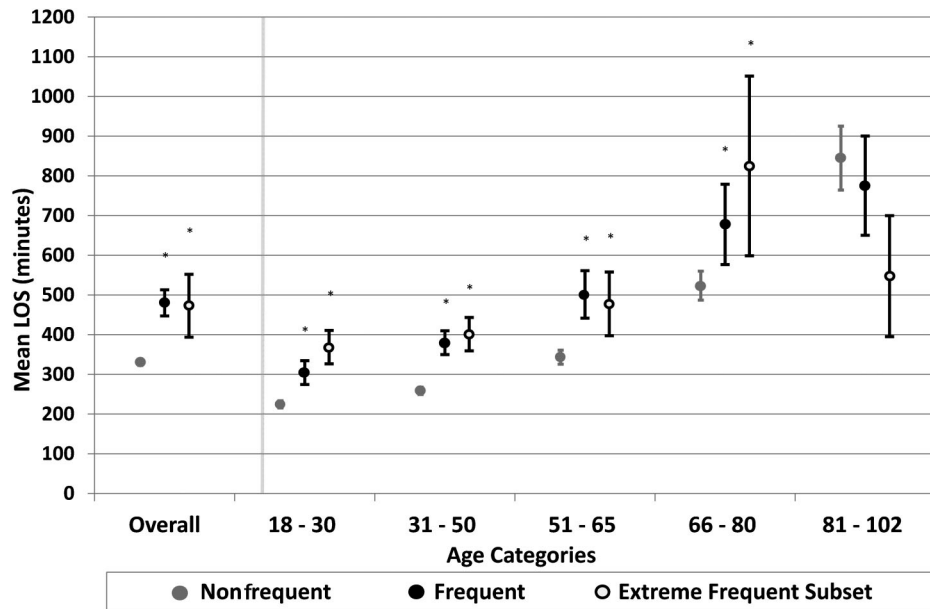
Figure 3. Mean emergency department length of stay (LOS) by adult user group and age category. Bars represent a 95% CI for the mean LOS. *Statistically significant compared to nonfrequent user group in the same age category using a Mann-Whitney test of means at an alpha level of 0.05.

behavioural disorders due to alcohol intoxication were among the top five primary diagnoses for adult extreme frequent users. Anxiety disorder was a common diagnosis for adult frequent users and the extreme frequent subset 18 to 50 years of age. Chronic obstructive pulmonary disease accounted for 14.3% of visits by adult extreme frequent users 66 to 80 years of age.

Admission rates for adult frequent users and the extreme frequent subset were not statistically significantly different from adult nonfrequent users of the same age categories except for the age group 81 to 102

years, in which the adult extreme frequent subset had a lower proportion of admissions than adult nonfrequent users.

DISCUSSION

We developed a standardized approach to defining frequent ED users and characterized the adult frequent ED users at a Canadian community suburban ED. Our distribution-based definitions offer advantages over the use of absolute cutoffs. First, this approach provides a measure of adult frequent ED use that is based on
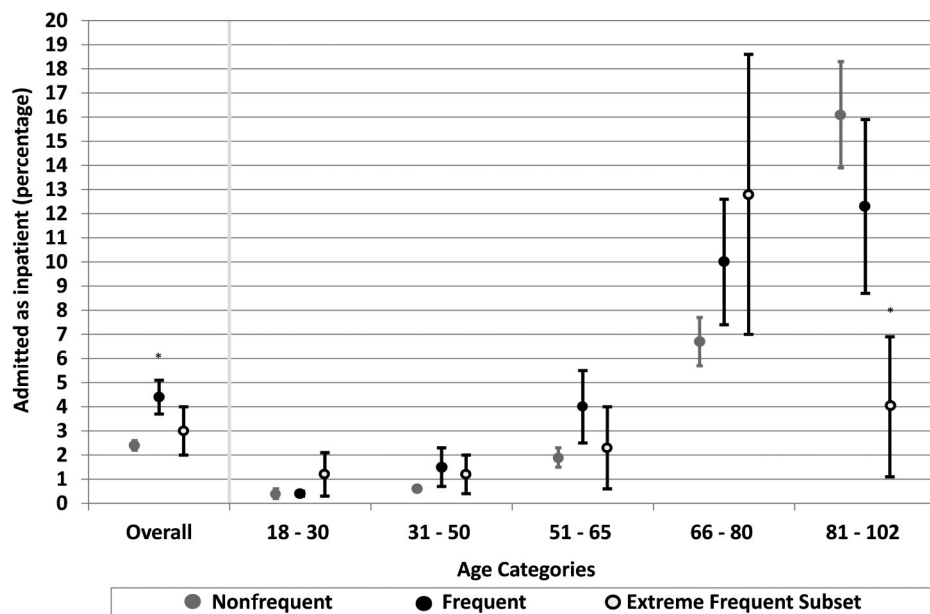

Figure 4. Visits ending in hospital admission by adult user group and age category. Bars represent a 95% CI for the percentage of patients admitted. *Statistically significant compared to the nonfrequent user group in the same age category using a chi-square test of proportions at an alpha level of 0.05.

Table 2. Demographic and visit characteristics of adult nonfrequent users by age category

Characteristic	Age category				
	18–30	31–50	51–65	66–80	81–102
Patient					
Patients, n (% of all nonfrequent user visits)	3,850 (27.9)	4,808 (34.9)	2,890 (21.0)	1,620 (11.8)	610 (4.4)
Yearly visits per patient mean (95% CI)	1.4 (1.4–1.4)	1.4 (1.3–1.4)	1.4 (1.4–1.4)	1.5 (1.4–1.5)	1.7 (1.6–1.8)
Male sex, % (95% CI)	48.1 (46.8–49.4)	51.9 (50.7–53.1)	48.1 (46.5–49.7)	49.2 (47.2–51.2)	41.0 (38.0–44.0)
Visit					
Visits, n (% of all nonfrequent user visits)	5,378 (27.9)	6,505 (33.8)	3,982 (20.7)	2,354 (12.2)	1,037 (5.4)
Visit triage level, % (95% CI)					
CTAS 1	0.2 (0.1–0.3)	0.3 (0.2–0.4)	1.0 (0.7–1.3)	1.4 (0.9–1.9)	0.9 (0.3–1.5)
CTAS 2	6.8 (6.1–7.5)	9.5 (8.8–10.2)	13.9 (12.8–15.0)	13.8 (12.4–15.2)	12.8 (10.8–14.8)
CTAS 3	38.1 (36.8–39.4)	39.2 (38.0–40.4)	38.3 (36.8–39.8)	44.6 (42.6–46.6)	50.8 (47.8–53.8)
CTAS 4	49.0 (47.7–50.3)	45.7 (44.5–46.9)	41.4 (39.9–42.9)	36.0 (34.1–38.0)	33.2 (30.3–36.1)
CTAS 5	5.8 (5.2–6.4)	5.4 (4.9–5.9)	5.4 (4.7–6.1)	4.2 (3.4–5.0)	2.3 (1.4–3.2)
ED LOS in minutes, mean (95% CI)	224.5 (216.5–232.4)	258.5 (249.4–267.7)	343.3 (325.6–361.0)	523.6 (487.1–560.1)	844.8 (764.4–925.3)
Top five primary diagnoses, n (% total visits for age category)	Open wound of finger(s) without damage to nail, uncomplicated, 141 (2.6)	Chest pain, unspecified, 212 (3.3)	Chest pain, unspecified, 167 (4.2)	Urinary tract infection, site not specified, 89 (3.8)	Urinary tract infection, site not specified, 61 (5.9)
	Gastroenteritis and colitis of unspecified origin, 119 (2.2)	Open wound of finger(s) without damage to nail, uncomplicated, 153 (2.4)	Other and unspecified abdominal pain, 78 (2.0)	Chest pain, unspecified, 78 (3.3)	Congestive heart failure, 47 (4.5)
	Urinary tract infection, site not specified, 98 (1.8)	Other and unspecified abdominal pain, 152 (2.3)	Urinary tract infection, site not specified, 73 (1.8)	Chronic obstructive pulmonary disease with acute exacerbation, unspecified, 61 (2.6)	Chest pain, unspecified, 26 (2.5)
	Sprain and strain of ankle, unspecified, 90 (1.7)	Gastroenteritis and colitis of unspecified origin, 100 (1.5)	Open wound of finger(s) without damage to nail, uncomplicated, 67 (1.7)	Dizziness and giddiness, 44 (1.9)	Dizziness and giddiness, 26 (2.5)
	Chest pain, unspecified, 87 (1.6)	Urinary tract infection, site not specified, 90 (1.4)	Unspecified renal colic, 56 (1.4)	Benign hypertension, 37 (1.6) Gastroenteritis and colitis of unspecified origin, 37 (1.6)	Pneumonia, unspecified, 20 (1.9)
Post-ED disposition, % (95% CI)					
Home or private dwelling	87.0 (86.1–87.9)	87.2 (86.4–88.0)	85.3 (84.2–86.4)	76.3 (74.6–78.0)	50.3 (47.3–53.3)
Left against medical advice	10 (9.2–10.8)	8.1 (7.4–8.8)	6.2 (5.5–6.9)	4.5 (3.7–5.3)	3.4 (2.3–4.5)
Residence with support services	0.1 (0.0–0.2)	0.5 (0.3–0.7)	1.1 (0.8–1.4)	4.8 (3.9–5.7)	23.5 (20.9–26.1)
Admitted as inpatient	0.4 (0.2–0.6)	0.6 (0.4–0.8)	1.9 (1.5–2.3)	6.7 (5.7–7.7)	16.1 (13.9–18.3)

CTAS = Canadian Triage and Acuity Scale; ED = emergency department; LOS = length of stay.

Table 3. Demographic and visit characteristics of adult frequent users by age category

Characteristic	Age category				
	18–30	31–50	51–65	66–80	81–102
Patient					
Patients, *n* (% of all frequent user visits)	101 (22.7)	130 (29.2)	85 (19.1)	82 (18.4)	47 (10.6)
Yearly visits per patient, mean (95% CI)	6.9 (6.2–7.5)	7.3 (6.6–8.0)	7.2 (6.6–7.7)	6.2 (5.8–6.5)	6.8 (6.0–7.6)
Male sex, % (95% CI)	45.1 (41.4–48.8)	40.3 (37.1–43.5)	60.3 (56.5–64.1)	53.1 (48.8–57.4)	51.9 (46.5–57.3)
Visit					
Visits, *n* (% of all frequent user visits)	678 (22.0)	928 (30.2)	625 (20.3)	522 (17.0)	324 (10.5)
Visit triage level, % (95% CI)					
CTAS 1	0.1 (0.1–0.7)	0.9 (0.3–1.5)	1.0 (0.2–1.8)	0.8 (0.6–1.2)	0 (0–0)
CTAS 2	8.1 (6.0–10.2)	13.5 (11.3–15.7)	18.7 (15.6–21.8)	13.6 (10.7–16.5)	14.5 (10.7–18.3)
CTAS 3	43.1 (39.4–46.8)	46.4 (43.2–49.6)	48.0 (44.1–51.9)	48.9 (44.6–53.2)	41.0 (35.6–46.4)
CTAS 4	41.2 (37.5–44.9)	32.5 (29.5–35.5)	27.7 (24.2, 31.2)	30.3 (26.4–34.2)	37.3 (32.0–42.6)
CTAS 5	7.4 (5.4–9.4)	6.7 (5.1–8.3)	4.6 (3.0–6.2)	6.5 (4.4–8.6)	7.1 (4.3–9.9)
ED LOS in minutes, mean (95% CI)	304.5 (271.6–337.3)*	379.8 (349.8–409.9)*	501.5 (441.7–561.3)*	677.8 (576.6–779.0)*	775.4 (650.4–900.4)
Top five primary diagnoses, *n* (% total visits for age category)	Tubulointerstitial nephritis, not specified as acute or chronic, 21 (3.1); Other and unspecified abdominal pain, 20 (2.9); Anxiety disorder, unspecified, 16 (2.4); Vomiting alone, 16 (2.4); Headache, 14 (2.1)	Chest pain, unspecified, 27 (2.9); Headache, 27 (2.9); Nausea with vomiting, 27 (2.9); Other and unspecified abdominal pain, 26 (2.8); Vomiting alone, 21 (2.3)	Chest pain, unspecified, 25 (4.0); Atrial fibrillation, 18 (2.9); Other and unspecified abdominal pain, 18 (2.9); Unspecified renal colic, 16 (2.6); Asthma, unspecified, without stated status asthmaticus, 14 (2.2); Chronic obstructive pulmonary disease with acute exacerbation, unspecified, 14 (2.2); Retention of urine, 14 (2.2)	Urinary tract infection, site not specified, 26 (5.0); Chronic obstructive pulmonary disease with acute exacerbation, unspecified, 24 (4.6); Atrial fibrillation, 15 (2.9); Epistaxis, 11 (2.1); Chest pain, unspecified, 10 (1.9)	Urinary tract infection, site not specified, 17 (5.2); Blood transfusion (without reported diagnosis), 13 (4.0); Pneumonia, unspecified, 11 (3.4); Chest pain, unspecified, 9 (2.8); Malaise and fatigue, 8 (2.5); Retention of urine, 8 (2.5)

Table 3. Continued

Characteristic	Age category				
	18–30	31–50	51–65	66–80	81–102
Post-ED disposition, % (95% CI)					
Home or private dwelling	85.4 (82.7–88.1)	85.2 (82.9–87.5)	82.1 (79.1–85.1)	70.7 (66.8–74.6)	53.4 (48.0–58.8)
Left against medical advice	4.8 (3.2–6.4)	7.1 (5.4–8.8)	7.2 (5.2–9.2)	4.4 (2.6–6.2)	3.4 (1.4–5.4)
Residence with support services	0.7 (0.5–1.0)	0.9 (0.3–1.5)	2.6 (1.4–3.8)	9.6 (7.0–12.1)	25.6 (20.8–30.4)
Admitted as inpatient	0.4 (0.3–0.9)	1.5 (0.7–2.3)	4.0 (2.5–5.5)	10.0 (7.4–12.6)	12.3 (8.7–15.9)

CTAS = Canadian Triage and Acuity Scale; ED = emergency department; LOS = length of stay.
*Statistically significant compared to nonfrequent user group in same age category using a Mann-Whitney test of means at an alpha level of 0.05.

commonly used statistical thresholds to identify the upper end of a distribution, in this case of the total number of visits per patient. Second, as this approach accounts for the total number of ED visits, it inherently controls for differences in infrastructure across centres that may influence the total number of ED visits. Although absolute visit thresholds are difficult to compare across sites as they are influenced and potentially distorted by the availability of regional support services (e.g., community mental health services or family physician accessibility), the measures we propose would allow cross-site comparisons. Finally, our definitions are reproducible by centres regardless of baseline population differences. Researchers could apply our percentile-based definitions to identify site-specific visit thresholds for adult frequent and extreme frequent use; various site thresholds could then be plotted to produce a regional distribution from which an overall mean or median could be calculated to facilitate comparisons. Such an approach would also allow the assessment of adult frequent ED use over time, using either a baseline year as a reference point or determining yearly thresholds of adult ED use depending on the study objective.

Our results indicate that in our study community, a small number of adult frequent and extreme frequent users account for a disproportionally large number of visits; these visits were significantly longer for frequent users and extreme frequent users than nonfrequent users overall and across all age categories except for the oldest group. The admission rate for adult frequent users was also higher.

Our results demonstrate heterogeneity but support the hypothesis that there are patterns of adult frequent and extreme frequent ED use. Psychiatric complaints and alcohol-related presentations were overrepresented for adult frequent and extreme frequent users. Common diagnoses for adult extreme frequent users were nausea and vomiting in patients 18 to 50 years of age and chronic obstructive pulmonary disease in patients 66 to 80 years of age. These trends suggest that somatic complaints and chronic conditions may underlie the multiple return visits of some adult extreme frequent users, a hypothesis supported by other published work.[1,4,5,7–10]

To our knowledge, no consistent definition for adult frequent ED use has been published to date. It is noteworthy that the frequent use thresholds we developed led to absolute cutoffs similar to those chosen by

Table 4. Demographic and visit characteristics of extreme subset of adult frequent users by age category

Characteristic	Age category				
	18–30	31–50	51–65	66–80	81–102
Patient					
Patients, n (% of all extreme frequent users)	23 (20.7)	36 (32.4)	30 (27.0)	13 (11.7)	9 (8.1)
Yearly visits per patient, mean (95% CI)	11.3 (9.4–13.2)	11.8 (9.9–13.7)	10.0 (9.1–10.9)	9.2 (8.0–10.4)	11.1 (8.4–13.8)
Male sex, % (95% CI)	52.2 (46.0–58.4)	41.7 (37.0–46.4)	56.7 (51.1–62.3)	23.1 (15.9–30.3)	66.7 (57.5–75.9)
Visit					
Visits, n (% all extreme frequent user visits)	248 (20.6)	417 (34.7)	305 (25.4)	133 (11.1)	100 (8.3)
Visit triage level, % (95% CI)					
CTAS 1	0.4 (0.01–2.2)	1.2 (0.4–2.8)	1.3 (0.4–3.3)	0.8 (0.0–4.1)	0 (0.0–0.0)
CTAS 2	5.2 (2.4–8.0)	10.1 (7.2–13.0)	15.4 (11.3–19.5)	15.0 (8.9–21.1)	17.0 (9.6–24.4)
CTAS 3	47.2 (41.0–53.4)	51.3 (46.5–56.1)	48.2 (42.6–53.8)	58.6 (50.2–67.0)	37.0 (27.5–46.5)
CTAS 4	40.3 (34.2–46.4)	31.9 (27.4–36.4)	31.8 (26.6–37.0)	18.8 (12.2–25.4)	41.0 (31.4–50.6)
CTAS 5	6.9 (3.7–10.1)	5.5 (3.3–7.7)	3.3 (1.3–5.3)	6.8 (2.5–11.1)	5.0 (1.6–11.3)
ED LOS in minutes, mean (95% CI)	368.6 (289.4–447.8)*	401.3 (359.2–443.4)*	477.6 (397.3–557.8)*	825.1 (598.8–1,051.4)*	547.4 (394.9–699.8)
Top five primary diagnoses, n (% total visits for age category)	Vomiting alone, 14 (5.6)	Nausea with vomiting, 23 (5.5)	Retention of urine, 11 (3.6)	Chronic obstructive pulmonary disease with acute exacerbation, unspecified, 15 (11.3)	Urinary tract infection, site not specified, 9 (9.0)
	Anxiety disorder, unspecified, 13 (5.2)	Vomiting alone, 17 (4.1)	Atrial fibrillation, 10 (3.3)	Atrial fibrillation, 6 (4.5)	Blood transfusion (without reported diagnosis), 7 (7.0)
	Nausea with vomiting, 10 (4.0)	Mental and behavioural disorders due to use of alcohol, acute intoxication, 13 (3.1)	Chest pain, unspecified, 10 (3.3)	Epistaxis, 6 (4.5)	Chest pain, unspecified, 6 (6.0)
	Right upper quadrant pain, 7 (2.8)	Anxiety disorder, unspecified, 11 (2.6)	Unspecified renal colic, 10 (3.3)	Chronic obstructive pulmonary disease with acute lower respiratory infection, 4 (3.0)	Angina pectoris, unspecified, 4 (4.0)
	Tubulointerstitial nephritis, not specified as acute or chronic, 6 (2.4)	Chest pain, unspecified, 10 (2.4)	Low back pain, 7 (2.3)	Dyspnea, 4 (3.0)	Mechanical complication of urinary (indwelling) catheter, 4 (4.0)
		Headache, 10 (2.4)		Mental and behavioural disorders due to use of alcohol, acute intoxication, 4 (3.0)	
		Other and unspecified abdominal pain, 10 (2.4)			

Table 4. Continued

Characteristic	Age category				
	18–30	31–50	51–65	66–80	81–102
Post-ED disposition, % (95% CI)					
Home or private dwelling	80.6 (75.7–85.5)	85.4 (82.0–88.8)	83.9 (79.8–88.0)	70.7 (63.0–78.4)	60.0 (50.4–70.0)
Left against medical advice	14.5 (10.1–18.9)	7.2 (4.7–9.7)	7.5 (4.5–10.5)	3.1 (0.8–7.5)	8.0 (2.7–13.3)
Residence with support services	2.0 (0.7–4.6)	1.0 (0.3–2.4)	3.3 (1.3–5.3)	8.3 (3.6–13.0)	28.0 (19.2–36.8)
Admitted as inpatient	1.2 (0.3–3.5)	1.2 (0.4–2.8)	2.3 (0.6–4.0)	12.8 (7.1–18.5)	4.0 (1.1–9.9)†

CTAS = Canadian Triage and Acuity Scale; ED = emergency department; LOS = length of stay.
*Statistically significant compared to nonfrequent user group in same age category using a Mann-Whitney test of means at an alpha level of 0.05.
†Statistically significant compared to nonfrequent user group in same age category using a chi-square exact test of proportions at an alpha level of 0.05.

other investigators, although most previously published articles do not specify a methodology for determining frequency of use[2,3,7,9,11,12,17,20]; this may reflect underlying similarities in study populations and/or communities or similarities between researchers' judgment regarding the extremes of their distribution of use and our percentile method or may be coincidental. Our distribution-based definition is novel and generalizable in that it would allow centres to characterize their unique populations of adult frequent users. Our findings support existing evidence that adult frequent ED users represent a disproportionate number of overall ED visits,[1] are heterogeneous,[1] have longer visits and more admissions in certain subgroups,[12] and often have chronic illness[10] and psychiatric comorbidity.[1,3–5] We did not, however, find the previously described bimodal age distribution.[1]

Our findings contribute to the evidence on adult frequent ED use in Canada and have important implications. For example, the prevalence of mental disorders points to the need for better community-based mental health care access and follow-up. Case management for frequent ED users has been tried, with mixed success.[16–20] Approaches employing multidisciplinary, individualized patient care plans with medical and social supports[21] and targeted dynamic psychotherapy for somatization disorders[28] have achieved significant reductions in Canadian ED use among frequent users. However, a clear definition of frequent use is a prerequisite for intervention.[13]

Future studies may expand the characterization of adult frequent and extreme frequent users by linking with additional databases to include potential predictors of adult frequent ED use such as socioeconomic status,[29] comorbidities, health care services use,[30] and family physician attachment or access. Additionally, our percentile-based methodology could be used by multiple EDs to determine an overall distribution of frequency of use, the mean or median of which could be used to establish regional, provincial, or national thresholds for adult frequent ED use that could serve as universal benchmarks.

Our findings are robust because we examined a large number of visit data. However, our study has several limitations that should be considered. First, we examined visit data at our study site without access to ED data from surrounding hospitals. Movement of patients between different sites is possible and may have affected our results. ED use by some adult

frequent users may have been underestimated if care was sought outside of our centre. Second, the ED database at our study site captured outpatient visits, which has the potential to distort our findings. We attempted to exclude such visits by consulting with site emergency physicians to identify the ICD-10-CA codes used for scheduled returns; however, our algorithm has not yet been validated and requires further study. Third, our results depend to some extent on database comprehensiveness.[31] Our ED database did not include family physician attachment and patient comorbidities; standard prospective collection of this information from ED users would enhance future studies. A final limitation involves the validity of our database. Although we did not independently validate the data used in this study, as previously described, the WestView ED data are subject to internal and external verification by AHS and the CIHI as part of the NACRS.

CONCLUSIONS

We have proposed reproducible definitions for adult frequent and extreme frequent ED users and provide information on the characteristics and burden of care of these groups at a community Canadian suburban ED. Adoption of these definitions would allow comparison across centres in future research and facilitate targeted interventions for frequent and extreme frequent ED users.

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