

Cannabis-related emergency department visits by youths and their outcomes in Ontario: a trend analysis

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Abstract

Background: Cannabis-related emergency department visits can be an entry point for youths to mental health and substance use care systems. We aimed to examine trends in cannabis-related emergency department visits as a function of youths' age and sex.

Methods: Using administrative data, we examined all visits to emergency departments in Ontario, Canada, from 2003 to 2017, by youth aged 10–24 years (grouped as 10–13, 14–18 and 19–24 yr) to determine trends in cannabis-related emergency department visits. Cannabis-related visits were identified using *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* codes for cannabis poisoning and mental disorders due to cannabinoids. We categorized presentations as “less severe” versus “more severe” using scores assigned by nurses at triage.

Results: We examined 14 697 778 emergency department visits. Cannabis-related visits increased from 3.8 per 10 000 youths (95% confidence interval [CI] 3.5–4.0) in 2003 to 17.9 (95% CI 17.4–18.4) in 2017, a 4.8-fold increase (95% CI 4.4–5.1). Rates increased for both sexes and each age group. Males were more likely to have a visit than females (rate ratios ≥ 1.5 in 2003 and 2017). The number of cannabis-related visits in 2017 was 25.0 per 10 000 (95% CI 24.0–25.9) among youth aged 19–24 years, 21.9 per 10 000 (95% CI 20.9–22.9) among those aged 14–18 years, and 0.8 per 10 000 (95% CI 0.5–1.0) among those aged 10–13 years. In 2017, 88.2% (95% CI 87.3%–89.0%) of cannabis-related visits and 58.1% (95% CI 58.0%–58.2%) of non-cannabis-related visits were triaged as “more severe,” (rate ratio 1.52, 95% CI 1.50–1.53). Similarly, in 2017, 19.0% (95% CI 18.0%–20.1%) of cannabis-related visits and 5.8% (95% CI 5.7%–5.8%) of non-cannabis-related visits resulted in hospital admission (rate ratio 3.3, 95% CI 3.1–3.5).

Interpretation: Rates of cannabis-related emergency department visit by youths aged 10–24 years increased almost fivefold from 2003 to 2017, with increases in visit severity and hospital admissions. These trends describe an emerging public health problem, and research is needed to identify the causes of this increase and the health and social consequences of cannabis-related visits for these youths.

Cannabis use can have chronic and acute health consequences resulting in the use of hospital emergency services. Patients may present to the emergency department with agitation, psychosis, anxiety or emesis after cannabis use.^{1,2} Younger children seen in the emergency department after ingestion of cannabis may present with unexplained lethargy, ataxia, tachycardia, mydriasis or hypotonia.^{3,4} Cannabis exposure in children may require intubation or admission to the intensive care unit.³ Cannabis exposure, particularly in youth under 18 years, is also associated with an increased risk of psychosis and long-term cognitive problems.^{5,6}

The nonspecific presenting symptoms of cannabis use can pose a diagnostic challenge for emergency department physicians, particularly if the patient does not disclose recent cannabis use or if ingestion was unknown to the child's caregivers or bystanders. Such patients may undergo costly diagnostic tests, including bloodwork, electrocardiography and neuroimaging.⁷ By quantifying the trends of cannabis-related visits, physicians can be furnished with information to encourage

maintenance of a high index of suspicion for cannabis use, which may result in improved management of cannabis-related emergency department visits among youths. The emergency department is also an important entry point for youths to the mental health and substance use care systems, so understanding trends in cannabis-related emergency department visits is important for health system planning and the organization of connected care systems.

Therefore, the objectives of our study were to present annual rates of cannabis-related emergency department visits, and the severity of such visits, among youths aged 10–24 years

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in Ontario from 2003 to 2017. We studied these trends as a function of youths' age and sex because these differences in drug use are well established.^{8,9}

Methods

Study design, setting and participants

This study is an analysis of trends in routinely collected data. We examined all visits to Ontario emergency departments from 2003 to 2017 by youth aged 10–24 years with an Ontario Health Insurance Plan number. This period was chosen to align with our previous study of trends in emergency department visits for mental health and self-harm.¹⁰ This age range captures the highest-risk groups for cannabis-related emergency department visits.^{11,12}

Data sources

Data on emergency department visits were obtained from the Canadian National Ambulatory Care Reporting System (NACRS). The variables collected from the NACRS database included *International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10)* diagnostic codes,¹³ Canadian Triage and Acuity Scale (CTAS) scores,^{14–16} year of emergency department presentation, sex and age. The Registered Persons Database was used to link emergency department youth records with rural status and neighbourhood income quintile. The Ontario population counts by year, age and sex were obtained from population estimates by Statistics Canada held by the Ontario Ministry of Health and were linked using encoded identifiers at ICES.

Measurements

Cannabis-related visits

Cannabis-related visits were identified using ICD-10 codes T407 “(Poisoning by narcotics and psychodysleptics [hallucinogens]: cannabis [derivatives])”¹⁷ and F12 “(Mental and behavioural disorders due to use of cannabinoids).”¹⁸ ICD-10 codes have not been validated for cannabis-related emergency department visits. However, studies of opioid poisoning in routinely collected health records¹⁹ and alcohol intoxication in emergency department records²⁰ suggest that these codes have moderate validity.

Gibson and colleagues²¹ studied the quality of NACRS data by carrying out re-abstractions of charts at several Ontario emergency departments and found agreement rates for ICD-10 codes that ranged from 86% to 90%. DeYoung and colleagues²² noted excellent sensitivity and specificity by using the same ICD-10 codes to identify cannabis-related emergency department visits, and several studies have used these codes to identify such visits.^{23–28} However, another study suggests that use of health administrative data to identify substance use presentations has low sensitivity but high specificity.²⁹

Visit severity

Triage nurses assign a CTAS score to patients on entry to the emergency department. For clarity of presentation, we grouped the 5 CTAS levels as less severe (“nonurgent” or

“less urgent”) versus more severe (“urgent,” “emergent” or “resuscitation”). We also recorded whether patients presenting to the emergency department were admitted to hospital.

Demographic variables

Data were gathered on patients' age, grouped as 10–13, 14–18 and 19–24 years. The age breakpoints were chosen as proxies for stages in child development, between younger and older adolescents, and older adolescents and young adults. We also gathered data on patient sex, residence in a rural census area and income quintile of the patient's census area.

Statistical analysis

To describe changes in emergency department visits, we calculated the rates of cannabis-related visits per 10000 emergency department visits in 2003 and 2017. Some youths had more than 1 cannabis-related visit in a year. To eliminate the clustering of visits among youths, our primary analyses examined counts of youths with at least 1 cannabis-related visit in a year. We divided these counts by the Ontario youth population during each year³⁰ to report rates of youths with at least 1 cannabis-related visit per 10000 youths. We plotted these rates from 2003 to 2017 with loess-smoothed curves with 95% confidence intervals (CIs). We conducted a Poisson regression analysis of trends in the rates of youths with cannabis-related visits to the emergency department, and to determine how those trends varied by age and sex (description of statistical methods is available in Appendix 1, www.cmajopen.ca/content/10/1/E100/suppl/DC1).

Rate ratios were used to capture the association between cannabis-related visits and demographic characteristics. We reported rate ratios with 95% CIs³¹ and, given our large sample size, omitted significance tests. Statistics were calculated using R Version 4.0.3.

Ethics approval

The Research Ethics Board of the Children's Hospital of Eastern Ontario approved this study.

Results

A total of 14697778 emergency department visits by eligible patients occurred between 2003 and 2017. Table 1 reports the demographic characteristics of patients and counts of cannabis-related emergency department visits in 2003 and 2017.

Rates of cannabis-related visits

Cannabis-related emergency department visits increased between 2003 and 2017 for both sexes and all age groups (Table 1). Among patients aged 10–24 years, cannabis-related visits increased from 11.0 (95% CI 10.3–11.7) to 51.7 (95% CI 50.3–53.1) visits per 10000 emergency department visits, a 4.7-fold increase (95% CI 4.4–5.0).

In 2017, rates of cannabis-related visits were higher among males (69.7 visits/10000 visits, 95% CI 67.3–72.1) than females (36.6 visits/10000 visits, 95% CI 35.0–38.2; rate ratio 1.9, 95% CI 1.8–2.0). Rates were higher among youths aged 19–24 years

Table 1: Cannabis-related visits among youths aged 10 to 24 years, per 10 000 emergency department visits, 2003 and 2017, in Ontario

Variable	2003				2017				Increase 2003–2017† (95% CI)
	Non-cannabis-related visits	Cannabis-related visits	Cannabis-related visits/10 000 ED visits* (95% CI)	Rate ratio† (95% CI)	Non-cannabis-related visits	Cannabis-related visits	Cannabis-related visits/10 000 ED visits* (95% CI)	Rate ratio† (95% CI)	
All visits	900 256	992	11.0 (10.3–11.7)	–	1 004 909	5 224	51.7 (50.3–53.1)	–	4.7 (4.4–5.0)
Sex									
Male	449 828	650	14.4 (13.3–15.5)	1.9 (1.7–2.2)	458 291	3 215	69.7 (67.3–72.1)	1.9 (1.8–2.0)	4.8 (4.4–5.3)
Female (Ref.)	450 428	342	7.6 (6.8–8.4)	–	546 618	2 009	36.6 (35.0–38.2)	–	4.8 (4.3–5.4)
Age, yr									
19–24	401 511	449	11.2 (10.1–12.2)	6.7 (4.7–9.5)	495 218	3 186	63.9 (61.7–66.1)	23.7 (18.0–31.3)	5.7 (5.2–6.3)
14–18	308 047	511	16.6 (15.1–18.0)	9.9 (6.9–14.1)	320 522	1 987	61.6 (58.9–64.3)	22.9 (17.3–30.2)	3.7 (3.4–4.1)
10–13 (Ref.)	190 698	32	1.7 (1.1–2.3)	–	189 169	51	2.7 (2.0–3.4)	–	1.6 (1.0–2.5)
Income quintile§									
1 (lowest)	203 770	262	12.8 (11.3–14.4)	1.5 (1.2–1.9)	240 088	1 395	57.8 (54.7–60.8)	1.2 (1.1–1.3)	4.5 (3.9–5.1)
2	184 854	219	11.8 (10.3–13.4)	1.4 (1.1–1.7)	197 856	1 042	52.4 (49.2–55.6)	1.1 (1.0–1.2)	4.4 (3.8–5.1)
3	176 001	197	11.2 (9.6–12.7)	1.3 (1.1–1.6)	194 966	932	47.6 (44.5–50.6)	1.0 (0.9–1.1)	4.3 (3.6–5.0)
4	171 713	174	10.1 (8.6–11.6)	1.2 (1.0–1.5)	187 129	951	50.6 (47.4–53.8)	1.1 (1.0–1.2)	5.0 (4.3–5.9)
5 (highest) (Ref.)	157 796	134	8.5 (7.0–9.9)	–	180 877	859	47.3 (44.1–50.4)	–	5.6 (4.6–6.7)
Rural status§									
Nonrural	668 154	866	12.9 (12.1–13.8)	2.4 (2.0–3.0)	820 631	4 607	55.8 (54.2–57.4)	1.8 (1.6–1.9)	4.3 (4.0–4.6)
Rural (Ref.)	230 609	122	5.3 (4.3–6.2)	–	180 651	574	31.7 (29.1–34.3)	–	6.0 (4.9–7.3)

Note: CI = confidence interval, ED = emergency department, Ref. = reference category.
 *Cannabis-related visits/10 000 ED visits = 10 000 × (cannabis-related visits)/(non-cannabis-related visits + cannabis-related visits).
 †Rate ratio is the ratio of the rates of cannabis-related visits/10 000 youths by category.
 ‡Increase 2003–2017 = (cannabis-related visits/10 000 in 2017)/(cannabis-related visits/10 000 in 2003).
 §Income quintile and rural status had < 1% missing data.

(63.9 visits/10 000 visits, 95% CI 61.7–66.1) and youths aged 14–18 years (61.6 visits/10 000 visits, 95% CI 58.9–64.3) than among those aged 10–13 years (2.7 visits/10 000 visits, 95% CI 2.0–3.4). The rate ratios were more than 20-fold greater for both older groups compared with the younger age group.

Rates in 2017 were higher among youths residing in areas with the lowest income quintile (57.8 visits/10 000 visits, 95% CI 54.7–60.8) than among those living in areas with the highest income quintile (47.3 visits/10 000 visits, 95% CI 44.1–50.4) (rate ratio 1.2, 95% CI 1.1–1.3). Finally, youths who resided in a nonrural census area had 55.8 cannabis-related visits per 10 000 emergency department visits (95% CI 54.2–57.4), and those living in a rural area

had 31.7 visits per 10 000 visits (95% CI 29.1–34.3) (rate ratio 1.8, 95% CI 1.6–1.9).

Rates of youths with at least 1 cannabis-related visit

Figure 1 presents the trends between 2003 and 2017 in rates of youths with at least 1 cannabis-related visit per 10 000 Ontario youths. Table 2 contrasts the rates in 2003 and 2017. Figure 1A presents the rates for all youths, which increased from 3.8 youths per 10 000 (95% CI 3.5–4.0) in 2003 to 17.9 (95% CI 17.4–18.4) in 2017 (rate ratio 4.8, 95% CI 4.4–5.1). Rates of youths with cannabis-related visits per 10 000 increased between 2003 and 2017 for both sexes (Figure 1B), each age group (Figure 1C), and each age × sex subgroup (Figure 1D).

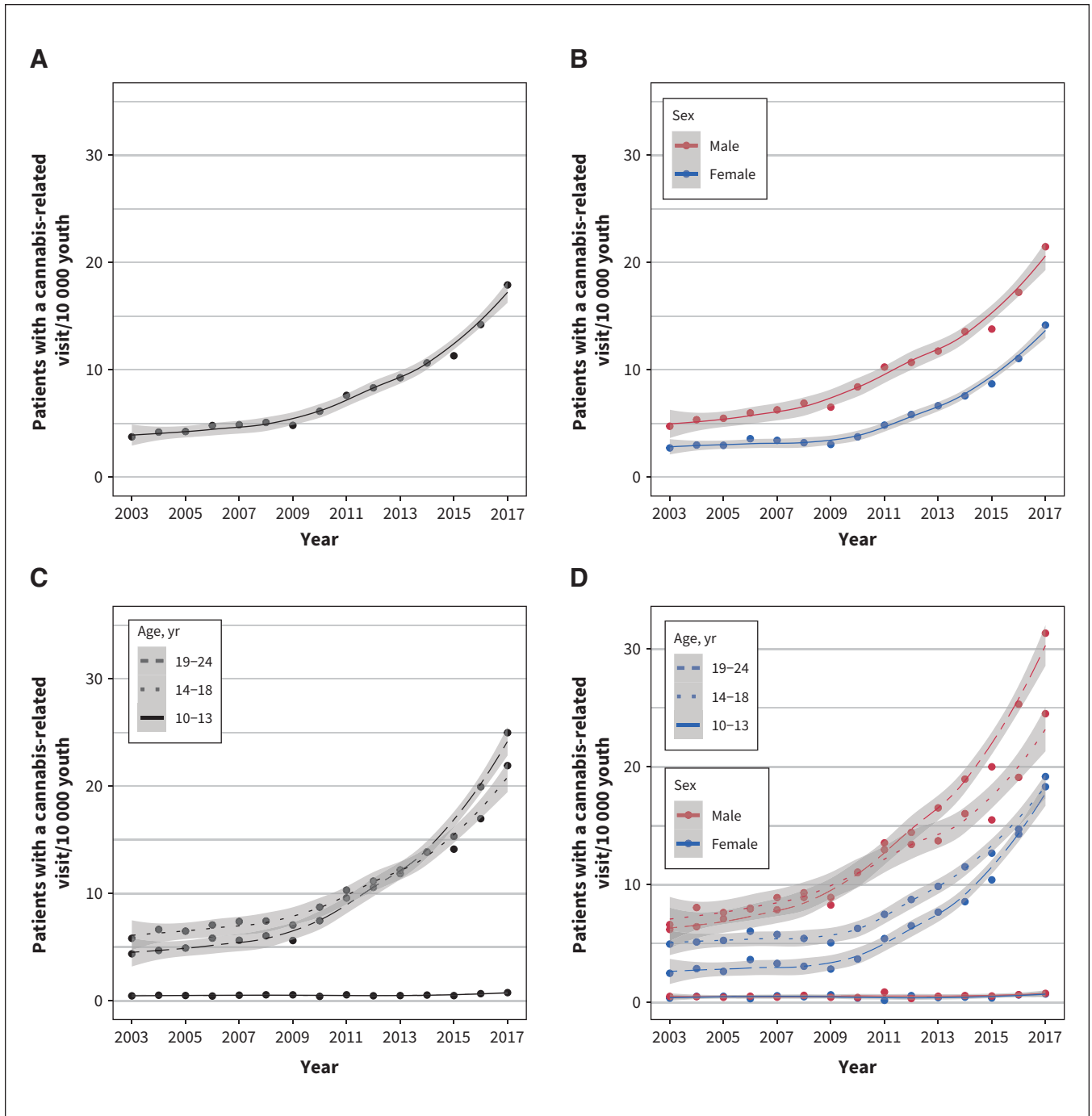


Figure 1: Trends in rates of youths with at least 1 cannabis-related emergency department visit per 10000 Ontario youths. (A) All cannabis-related visits; (B) patients with a cannabis-related visit, by sex; (C) patients with a cannabis-related visit, by age; (D) patients with a cannabis-related visit, by sex and age. Note: Smoothed curves with 95% confidence bands (shaded areas) were fit to the rates using the loess method.

Males had higher rates than females throughout the time period, with rate ratios of 1.5 or greater in both 2003 and 2017.

Figure 1C shows increases in youths with cannabis-related visits per 10000 between 2003 and 2017 among youths aged 19–24 years (rate ratio 5.7, 95% CI 5.2–6.3) and youths aged 14–18 years (rate ratio 3.8, 95% CI 3.4–4.2). The increases in the 2 older groups were nonlinear, with

accelerating growth over time. In 2017, the rate was 25.0 per 10 000 youths (95% CI 24.0–25.9) for youths aged 19–24 years, and the rate was 0.8 (95% CI 0.5–1.0) for those aged 10–13 years (rate ratio 33.0, 95% CI 24.8–43.7).

Finally, Figure 1D and Table 2 show that the sex difference in youths per 10000 occurred among the groups aged 19–24 and 14–18 years, where the rates for males were 1.3 or more

Table 2: Youths with cannabis-related emergency department visits per 10000 youths, by age and sex, in Ontario

Variable	2003				2017				Increase, 2003–2017† (95% CI)
	Youths with cannabis-related visits	Ontario population	Cannabis-related visits/10000 youths (95% CI)	Rate ratio* (95% CI)	Youths with cannabis-related visits	Ontario population	Cannabis-related visits/10000 youths (95% CI)	Rate ratio* (95% CI)	
All	947	2514869	3.8 (3.5–4.0)	–	4612	2573692	17.9 (17.4–18.4)	–	4.8 (4.4–5.1)
Sex									
Male	611	1285110	4.8 (4.4–5.1)	1.7 (1.5–2.0)	2834	1319346	21.5 (20.7–22.3)	1.5 (1.4–1.6)	4.5 (4.1–4.9)
Female (Ref.)	336	1229759	2.7 (2.4–3.0)	–	1778	1254346	14.2 (13.5–14.8)	–	5.2 (4.6–5.8)
Age, yr									
19–24	424	969310	4.4 (4.0–4.8)	9.6 (6.7–13.7)	2776	1111515	25.0 (24.0–25.9)	33.0 (24.8–43.7)	5.7 (5.2–6.3)
14–18	491	844430	5.8 (5.3–6.3)	12.7 (8.9–18.2)	1787	815590	21.9 (20.9–22.9)	28.9 (21.8–38.4)	3.8 (3.4–4.2)
10–13 (Ref.)	32	701129	0.5 (0.3–0.6)	–	49	646587	0.8 (0.5–1.0)	–	1.7 (1.1–2.6)
Age 19–24 yr									
Male	305	491595	6.2 (5.5–6.9)	2.5 (2.0–3.1)	1782	568668	31.3 (29.9–32.8)	1.7 (1.6–1.8)	5.1 (4.5–5.7)
Female (Ref.)	119	477715	2.5 (2.0–2.9)	–	994	542847	18.3 (17.2–19.4)	–	7.4 (6.1–8.9)
Age 14–18 yr									
Male	287	433667	6.6 (5.9–7.4)	1.3 (1.1–1.6)	1026	418657	24.5 (23.0–26.0)	1.3 (1.2–1.4)	3.7 (3.2–4.2)
Female (Ref.)	204	410763	5.0 (4.3–5.6)	–	761	396933	19.2 (17.8–20.5)	–	3.9 (3.3–4.5)
Age 10–13 yr									
Male	19	359848	0.5 (0.3–0.8)	1.4 (0.7–2.8)	26	332021	0.8 (0.5–1.1)	1.1 (0.6–1.9)	1.5 (0.8–2.7)
Female (Ref.)	13	341281	0.4 (0.2–0.6)	–	23	314566	0.7 (0.4–1.0)	–	1.9 (1.0–3.8)

Note: CI = confidence interval, Ref. = reference category.
 *Rate ratio is the ratio of the rates of cannabis-related visits/10000 youths by category.
 †Increase, 2003 to 2017 = (cannabis-related visits/10000 youths in 2017)/(cannabis-related visits/10000 youths in 2003).

times greater than for females in 2003 and 2017. The rate ratios for males versus females among youths aged 10–13 years, however, were not statistically different from 1.0. In Appendix 1, the data presented in Figure 1 have been analyzed using Poisson regression. The results of that analysis show that, as reported above, there has been an accelerating increase in rates of youths with cannabis-related emergency department visits, with higher rates for males, and less increase for youths aged 10–13 years.

Triaged visit severity and hospital admissions

Figure 2A shows that cannabis-related visits were more likely to be triaged as severe than non-cannabis-related visits. In 2003, 65.7% (95% CI 62.8%–68.7%) of cannabis-related visits were severe, and 31.0% (95% CI 30.9%–31.1%) of non-cannabis-related visits were severe (rate ratio 2.1, 95% CI 2.0–2.2) (Table 3). In 2017, 88.2% (95% CI 87.3%–89.0%) of cannabis-

related visits were severe, and 58.1% (95% CI 58.0%–58.2%) of non-cannabis-related visits were severe (rate ratio 1.52, 95% CI 1.50–1.53). The severity of both types of visits increased over time (rate ratio 1.3, 95% CI 1.3–1.4, for cannabis-related and 1.9, 95% CI 1.9–1.9, for non-cannabis-related visits).

Figure 2B shows that cannabis-related visits were more likely to result in hospital admissions. In 2003, 9.0% (95% CI 7.2%–10.8%) of cannabis-related visits resulted in hospital admission, and 5.0% (95% CI 5.0%–5.1%) of non-cannabis-related visits resulted in admission (rate ratio 1.8, 95% CI 1.5–2.2) (Table 3). In 2017, 19.0% (95% CI 18.0%–20.1%) of cannabis-related visits resulted in admission, and 5.8% (95% CI 5.7%–5.8%) of non-cannabis-related visits resulted in admission (rate ratio 3.3, 95% CI 3.1–3.5). Admissions increased from 2003 to 2017 for both types of visits (rate ratio 2.1, 95% CI 1.7–2.6, for cannabis-related and 1.2, 95% CI 1.1–1.2, for non-cannabis-related visits).

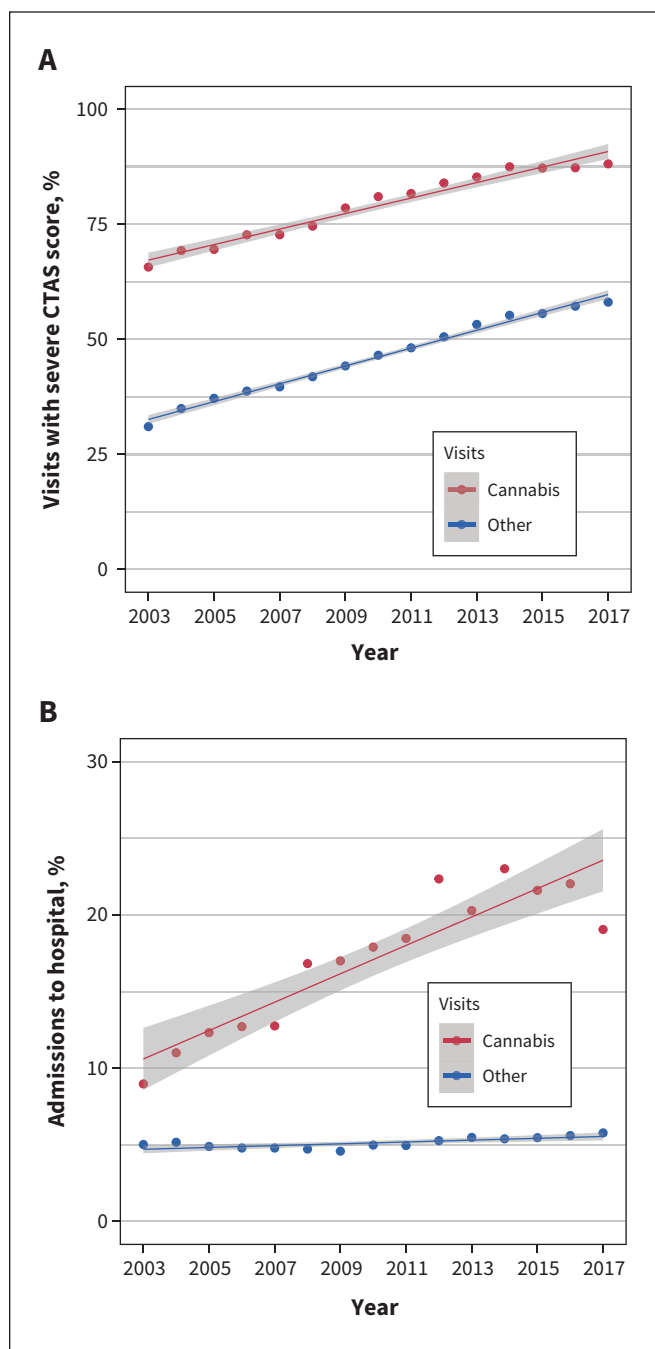


Figure 2: Trends in severity of emergency department visits and hospital admissions by visit type (cannabis related and other). (A) Severe CTAS scores by year and visit type, (B) hospital admissions by year and visit type. Note: CTAS = Canadian Triage and Acuity Scale. A severe CTAS score includes visits coded as urgent, emergent or resuscitation. Lines are ordinary least squares fits with 95% confidence intervals (shaded areas).

Interpretation

In 2017, 4612 Ontario youths aged 10–24 years had emergency department visits for cannabis exposure, nearly 5 times the number in 2003. Although this was a small absolute

increase in visit rates, from 0.1% to 0.5% of all visits, the increase in rates of emergency department visits for cannabis exposure accelerated over time, and the rapid increase raises concern about the impact of cannabis on youth.

Cannabis-related emergency department visits were more common among males, although rates increased for both sexes. Cannabis-related visits were more common and increased more quickly among youth aged 14–18 and 19–24 years than among those aged 10–13 years. Similar increases in cannabis-related visits among youths have been reported in other jurisdictions, including the United States,^{12,32} Colorado,³³ Washington state³⁴ and France.³⁵

In the current study, cannabis-related visits were more severe at presentation than visits for other conditions, and the proportion of cannabis-related visits triaged as severe increased between 2003 and 2017. The triaged severity of non-cannabis-related visits also increased during this period, so it is conceivable that use of the CTAS has changed over time. However, a patient with a cannabis-related visit was twice as likely to be admitted to hospital in 2017 than in 2003, and in 2017 they were more than 3 times as likely to be admitted to hospital than those with non-cannabis-related visits. On balance, the data suggest that the severity of cannabis-related visits has increased, which is consistent with the increasing potency of cannabis-related preparations discussed below.

One possible explanation for the increase in cannabis-related emergency department visits is an increase in cannabis use in the adolescent population. However, the Canadian Tobacco, Alcohol and Drugs Survey reported no increase from 2015 to 2017 in past-year cannabis use for youth aged 15 to 24 years.³⁶ The Ontario Student Drug Use and Health Survey found substantial self-reported decreases in cannabis use among Ontario high school students, from 28.0% in 1999 to 19.0% in 2017.³⁷

Emergency department visits could increase even when cannabis use in the general youth population decreased if use increased in a small but high-risk subset of the population. Many of these youths may have concurrent mental health problems, and emergency department visits for these problems have increased during the same period.¹⁰ However, it is unclear whether this increase is a result of increased prevalence of mental health disorders or increased help-seeking for these disorders.³⁸ An alternative explanation is that as cannabis has become increasingly accepted for Canadian adults, cannabis surveillance has increased within emergency departments. If so, the increase in cannabis-related emergency department visits could reflect a greater propensity for clinicians to diagnose a visit as cannabis related.

Cannabis-related emergency department visits may also have increased because cannabis users are increasingly exposed to potent cannabis products or efficient modes of drug administration. Chandra and colleagues³⁹ report that the tetrahydrocannabinol (THC) concentrations in cannabis preparations seized in the US nearly doubled from 2008 to 2017. Tetrahydrocannabinol concentrations in European samples likewise doubled from 2006 to 2016;⁴⁰ potency increases have also been reported by French police³⁵ and

Table 3: Severe emergency department visits* and admissions to hospital, by cannabis-related and non-cannabis-related visit, 2003 and 2017

Visit type	2003†			2017†			Increase 2003–2017§ (95% CI)
	No. of severe visits	Severe visits, % (95% CI)	Rate ratio‡ (95% CI)	No. of severe visits	Severe visits, % (95% CI)	Rate ratio‡ (95% CI)	
Visits coded resuscitation, emergent or urgent¶							
Cannabis related	652	65.7 (62.8–68.7)	2.1 (2.0–2.2)	4606	88.2 (87.3–89.0)	1.52 (1.50–1.53)	1.3 (1.3–1.4)
Non-cannabis related	279 253	31.0 (30.9–31.1)		583 799	58.1 (58.0–58.2)		1.9 (1.9–1.9)
Visit type	2003			2017			Increase 2003–2017§ (95% CI)
	No. of transfers	Transfers, % (95% CI)	Rate ratio‡ (95% CI)	No. of transfers	Transfers, % (95% CI)	Rate ratio‡ (95% CI)	
ED visits with hospital admission							
Cannabis related	89	9.0 (7.2–10.8)	1.8 (1.5–2.2)	995	19.0 (18.0–20.1)	3.3 (3.1–3.5)	2.1 (1.7–2.6)
Non-cannabis related	45 172	5.0 (5.0–5.1)		58 022	5.8 (5.7–5.8)		1.2 (1.1–1.2)

Note: CI = confidence interval, ED = emergency department.
 *A severe Canadian Triage and Acuity Scale (CTAS) score includes visits coded as urgent, emergent or resuscitation.
 †992 cannabis-related and 900 256 non-cannabis-related emergency department visits in 2003; 5224 cannabis-related and 1 004 909 non-cannabis-related emergency department visits in 2017.
 ‡Rate ratio = (% of cannabis-related visits)/(% of non-cannabis-related visits).
 §Increase 2003–2017 = (% of visits in 2017)/(% of visits in 2003).
 ¶Severe visits, which was the CTAS score collapsed to visits coded “resuscitation, emergent or urgent,” had less than 1% missing data.

Dutch retailers.⁴⁰ Synthetic cannabinoids are of particular concern; patients may present to the emergency department with agitation or somnolence, emesis, tachycardia and hypertension.⁴¹ Cannabis vaping can deliver high doses of THC and has been increasing among US adolescents.^{42–44} We speculate that potent preparations and modes of drug administration may also explain the increasing acuity of presentation noted in our study.^{45,46} The long-term effects of these novel products and consumption patterns are not currently known.

With more potent cannabis formulations and ingestion methods, youths may present to the emergency department in a way that is difficult to distinguish from a primary psychotic disorder. The agitation of acute paranoia would be scored higher on the CTAS (e.g., these individuals may require physical or chemical restraint). These patients may also require hospitalization if discriminating between cannabis toxicity and psychosis requires too much time for a typical emergency department visit, which may explain the increase in admission rates over time.

Awareness of cannabis-related emergency department visits is relevant in Canada after the *Cannabis Act* came into effect on Oct. 17, 2018,⁴⁷ legalizing recreational use for people aged 18 years and older. Colorado’s legalization was followed by increases in cannabis-related emergency department visits, calls to poison control centres and hospitalizations.^{48,49} This suggests that Canadian rates of cannabis-related emergency

department visits may continue to rise. Because edible cannabis preparations are now available throughout Canada, vigilance is required concerning the exposure to cannabis among children.

We suggest that emergency department clinicians maintain a high index of suspicion for cannabis exposure in young people presenting with nonspecific somnolence or psychomotor agitation. Asking about possible cannabis exposure early in the clinical encounter may help avoid unnecessary diagnostic testing. Parents and youth should be counselled about the acute and chronic risks of cannabis exposure, including the possible effects on mental health and the safety of prolonged use or of products with high THC concentrations.^{5,6,25}

Limitations

Our study was observational and used administrative data. Administrative records are subject to several forms of error, including inaccurate or incomplete documentation of problems by clinicians and errors in coding and abstraction of data from clinical records, so that health administrative data to identify substance use presentations has low sensitivity but high specificity. ICD-10 codes have not been validated for cannabis-related emergency department visits. Consequently, some of the visits are likely misclassified in our data, as has been found in a recent study of ICD-10 coding of opioid misuse.⁵⁰ Therefore, our results likely underestimate the rates of cannabis-related emergency department visits.

NACRS records lack information about the cannabis preparation, how the youth consumed the drug or whether the youth was a chronic user. They do not include standardized mental health assessment instruments. Given that NACRS records have limited information, our understanding of the presenting features, treatments and discharge planning for these patients is limited. Our data may also overstate the increase in cannabis visits if youths have become more likely to disclose use over time. Finally, our study uses data from a single Canadian province and may have limited generalizability.

Conclusion

Cannabis-related emergency department visits increased in Ontario from 2003 to 2017 among youths aged 14 to 24 years. Moreover, these visits were increasingly likely to be triaged as severe and to result in hospitalization. These trends describe an emerging public health problem. Research is needed to identify the causes of this increase and the health and social consequences of cannabis-related visits for these youths. Further studies of the complex and multifactorial predictors and causes of cannabis-related emergency department presentations will help guide preventive efforts. Youths with multiple emergency department visits related to substance use are of special concern. Future studies will be able to assess the effect of the legalization of cannabis on trends in emergency department visits. Research is also needed on the follow-up care patients receive after discharge from the emergency department or hospital after a cannabis-related visit.

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to calculate the annual emergency department visit counts and demographic statistics analyzed in this article. William Gardner carried out the analyses of the visit counts. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Data sharing: The data set from this study is held securely in coded form at ICES. While data sharing agreements prohibit ICES from making the data set publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at <https://www.ices.on.ca/DAS>. The full data set creation plan and underlying analytic code are available from the authors on request, understanding that the computer programs may rely on coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification. R code is available from the corresponding author.

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