Emergency Department Pediatric Visits in Alberta for Cannabis After Legalization

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abstract

BACKGROUND AND OBJECTIVES: Canada legalized nonmedical cannabis possession and sale in October 2018. In the United States, state legalization has been tied to an increase in cannabis-related emergency department (ED) visits; however, little research exists on provincial changes in pediatric visits after nationwide legislation. We compared pre- and postlegalization trends in pediatric cannabis-related ED visits and presentation patterns in urban Alberta EDs.

METHODS: Retrospective National Ambulatory Care Reporting System data were queried for urban Alberta cannabis-related ED visits among patients aged <18 years from October 1, 2013, to February 29, 2020. Population subgroups included children (aged 0–11 years), younger adolescents (12 to 14 years), and older adolescents (15 to 17 years). We calculated interrupted time series, incident rate ratios (IRRs), and relative risk (RR) ratios to identify trend change. IRRs identified changes against growth-adjusted Alberta population, while RRs measured presentation pattern changes against prelegalization ED visits.

RESULTS: Pediatric visit volume did not change postlegalization when accounting for preexisting volume trends. Unintentional ingestions increased in children (IRR: 1.77, 95% confidence interval [CI]: 1.42 to 2.20 and RR: 1.24, 95% CI: 1.05 to 1.47, respectively) and older adolescents (IRR: 1.36, 95% CI: 1.07 to 1.71 and RR: 1.48, 95% CI: 1.21 to 1.81, respectively). Presentation patterns remained similar, although older adolescent co-ingestant use decreased (RR: 0.77, 95% CI: 0.67 to 0.88), whereas hyperemesis cases increased (RR: 1.64, 95% CI: 1.13 to 2.37).

CONCLUSIONS: Cannabis legalization has increased child and older adolescent unintentional cannabis ingestions, increasing child cannabis-related ED visits. Changes highlight need for public health interventions targeting pediatric exposures.

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Mr Yeung contributed to study design, data collection, analysis, interpretation, and drafting of the initial manuscript and subsequent revision; Mr Weaver contributed to designing and executing data analysis; Dr Riley Hartmann contributed to interpretation of data and manuscript revision and aided in drafting the final manuscript; Drs Lang and Ms Haines-Saah contributed to study design, interpretation, and revision of the final manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DOI: https://doi.org/10.1542/peds.2020-045922

Accepted for publication Jun 8, 2021

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

WHAT'S KNOWN ON THIS SUBJECT: Cannabis has become legally available to Canadian adults, potentially increasing likelihood of pediatric exposure. National cannabis legalization in Canada has increased older adolescent cannabis-related emergency department (ED) visits. American state-level cannabis legalization is associated with increased pediatric cannabis-related ED visits.

WHAT THIS STUDY ADDS: We are among the first to describe potential association between national nonmedical cannabis legalization and urban Albertan pediatric cannabis-related ED visits. We also describe changes associated with legalization for common co-diagnoses, co-ingestants, and unintentional ingestion rates in 3 age categories.

To cite: Yeung MEM, Weaver CG, Hartmann R, et al. Emergency Department Pediatric Visits in Alberta for Cannabis After Legalization. *Pediatrics*. 2021;148(4):e2020045922

Nonmedical cannabis was nationally legalized across Canada in October 2018. Edible cannabis products were legalized for sale in October 2019. Although management of cannabis distribution is provincially determined, the minimum age for use is 19 in most provinces, with the exception of Quebec, which stipulates a minimum age of use of 21, and Alberta, which stipulates a minimum age of use of 18. Outside Canada, at the state level, several US states have also legalized nonmedical cannabis distribution and consumption for adults. However, cannabis remains a federally illegal, Schedule I substance in the United States. US surveillance data suggest states with legalized nonmedical cannabis have observed increases in pediatric cannabis-related visits. Colorado data suggest increasing emergency department (ED) usage for pediatric cannabis-related harms, whereas national US data indicated cannabis use is common in ED visitors aged between 12 and 17 years.[1–3] Additionally, data from Colorado and Washington suggest a twofold to threefold increase on prelegalization pediatric cannabis-related ED visits rates and poison control center calls.[3,4] Alberta data have shown an increase in cannabis-related visits for children and adults combined, including an increase in unintentional ingestion in several age groups, including older adolescents (aged 15 to 17 years). Alberta data also demonstrated an increase in several related diagnoses, including physical sequelae, such as tachycardia, disorientation, and cannabinoid hyperemesis syndrome.[5] Children and adolescents can present for similar sequelae from acute intoxication, including tachycardia, respiratory distress, acute psychological crises, or injury related to cannabis use.[1,3] These sequelae, combined with findings from the US and Alberta, underscore the need to identify the impact of nationwide legalization on ED visits within this age cohort, potentially allowing for enhanced public health interventions, education, and clinical awareness of pediatric cannabis consumption.

To date, however, there are no studies on pediatric ED visits in Alberta in the context of national nonmedical cannabis legalization. Few previous studies have examined changes in common co-diagnoses, although such changes exist in adult populations. To our knowledge, there have been no published studies reporting on common co-diagnoses in the pediatric context. The overall question we sought to address in this study was the following: what impact has cannabis legalization had on pediatric cannabis-related ED visits? To answer the overarching question, we established 2 relevant objectives, which were (1) to identify change in cannabis-related pediatric and adolescent ED visit volume and (2) to identify changes in cannabis-related codiagnoses patterns in urban Alberta EDs pre- and postlegalization.

METHODS

Study Design and Data Collection

This study involved retrospective analysis of pre- and postlegalization data from the National Ambulatory Care Reporting System (NACRS). NACRS is a national administrative database for ambulatory care visitation and includes data on all visits to all EDs and urgent care centers in urban Alberta. All data within NACRS are pre-extracted and standardized to the Canadian *International Classification of Diseases, 10th Revision* (ICD-10). All ICD-10 codes used in this study were adjusted to the 2018 version of Canadian ICD-10 coding standards. Eligible patients included those aged 0 to 17 years (inclusive) with a cannabis-related ICD-10 code in primary or secondary diagnostic fields. ICD-10 codes used included all F12 (mental and behavioral disorders due to cannabinoid use) and T40.7 (poisoning from cannabinoids) classifications. Data were obtained from October 1, 2013, to March 1, 2020. The postlegalization period was defined as October 1, 2018, to March 1, 2020. Data were collected 5 years before legalization to ensure sufficient data existed to calculate prelegalization regression trends. Data beyond March 1, 2020, were excluded because of drop-offs in all health care visits after implementation of province-wide lockdowns for coronavirus disease 2019.[4] Data were collected from urban Alberta, defined as Calgary and Edmonton area hospitals, including St Albert and Sherwood Park, given their proximity to Edmonton. This urban area contains 16 EDs, including 2 dedicated tertiary-care pediatric EDs, and serves just under 2.5 million people. Of the 16 EDs, 12 are hospital-based, whereas 4 are freestanding departments located within urgent care centers. Urgent care center departments offer fewer services than hospital-based EDs but can still receive and treat patients with substance-related concerns. In February 2020, the region received >17 000 pediatric ED visits.

In addition to the aforementioned cannabis-related ICD-10 codes, data were also collected to identify if consumption was accidental or intentional, common comorbidities, and co-ingestants. Results were stratified by age, broken into those aged 0 to 11 years (child), those aged 12 to 14 years (younger adolescents), and those aged 15 to 17 years (older adolescents). No stratification occurred on the basis of cannabis reporting in secondary diagnostic fields because cannabis use may have contributed to the primary reason an individual presented to the ED. Potential hyperemesis cases were defined as an R11 classification (vomiting) paired with an F12 or T40.7 classification (no Canadian ICD-10 code exists for cannabis hyperemesis syndrome; thus, it is necessary to combine the R11 and F12 codes as a proxy). From patient data, we obtained ED visit date, age, sex, previous cannabis-related presentations, and disposition from the ED, including whether patients left the hospital from the ED or were admitted to a ward. A full list of ICD-10 codes used is available in Supplemental Table 4. The study was approved by the University of Calgary Research Ethics Board (REB19-0238).

Data Analysis and Outcomes

To determine if any significant changes occurred in overall volume, we calculated incident rate ratios (IRRs) for the total cohort and age subgroups. The IRR compared the ratio of presentations over the combined Alberta population for each month prelegalization to the ratio of presentations over the combined Alberta population of each month postlegalization. We also calculated relative risk (RR) ratios to compare changes in primary and secondary co-diagnoses patterns, unintentional ingestions, age groupings, and co-ingestants as a proportion of pediatric cannabis-related ED visits pre- and postlegalization. The RR allows for identification of changes among ED presentations, whereas the IRR allows for identification of changes against the entire Alberta population during the study period. Data were adjusted according to publicly released quarterly population reports by the government of Alberta. Although uneven time periods existed in the pre- and postlegalization periods, this is controlled for in the IRR and RR because average caseload per population is compared rather than total volumes. We also completed an interrupted time series (ITS) analysis via segmented simple linear regression comparing monthly volumes pre- and postlegalization. Because of the short postlegalization period, we estimated a common slope for the prelegalization and postlegalization periods and calculated the level change at legalization. Both the IRR and RR were calculated by using Wald confidence intervals (CIs) in R (version 3.6.1, R Foundation, Vienna, Austria) through the epiR package, with the population of urban Alberta and the number of pediatric cannabis-related ED visits used as denominators, respectively. Ninety-five percent CIs were calculated.

RESULTS

As indicated in Table 1, we identified 1920 pediatric cannabis-related ED presentations prelegalization, of which 51 (2.7%) were children (aged <12 years), 335 (17.5%) were younger adolescents (aged 12 to 14 years), and 1534 (79.9%) were older adolescents (aged 15 to 17 years). There were 602 presentations postlegalization, of whom 40 (6.6%) were children, 123 (20.4%) were younger adolescents, and 439 (72.9%) were older adolescents. Because we sampled visits rather than individual patients, duplicate patients were present in our data set. However, duplication frequency analysis highlighted that <1.6% of all individuals had previously presented for cannabis-related concerns.

As seen in Table 2 and Figs 1–4, the total number of pediatric cannabis-related ED visits did not increase between the pre- and postlegalization periods adjusted to the Alberta population (IRR: 1.01, 95% CI: 0.92 to 1.10 and absolute change in visits per month −2.20, 95% CI: −7.92 to 3.52). When looking at individual age groupings, the IRR highlighted an increase in the relative incidence of children presenting for cannabis-related concerns (IRR: 2.51, 95% CI: 1.62 to 3.88), and the proportion of children (RR: 2.41, 95% CI: 1.61 to 3.61) presenting to the ED postlegalization, when compared with the prelegalization period. However, ITS analysis did not identify significance (absolute visit change 0.11, 95% CI: −0.89 to 1.10). This increase in IRR and RR was not present in other age groups. Because the proportion of children admitted to hospital from the ED or discharged did not change pre- and postlegalization, we suspect the increase in child cannabis-related ED visits also contributed to the observed increase in discharged children (IRR: 2.62, 95% CI: 1.57 to 4.32) seen in Table 3. Because more children presented postlegalization for cannabis-related ED visits, it follows that more children were admitted and

TABLE 1 Demographics and Clinical Characteristics of Cannabis-Related ED Visits

Variable	Prelegalization Cohort (n = 1920)	Postlegalization Cohort (n = 602)
Age group		
Child (0–11 y)	51	40
Younger adolescent (12–14 y)	335	123
Older adolescent (15–17 y)	1534	439
Disposition[a]		
Admitted to hospital		
Child (0–11 y)	7	7
Younger adolescent (12–14 y)	43	10
Older adolescent (15–17 y)	212	60
Discharged		
Child (0–11 y)	38	31
Younger adolescent (12–14 y)	256	98
Older adolescent (15–17 y)	1100	324
Boys		
Child (0–11 y)	32	15
Younger adolescent (12–14 y)	138	58
Older adolescent (15–17 y)	853	251
Unintentional ingestion		
Child (0–11 y)	40	38
Younger adolescent (12–14)	68	25
Older adolescent (15–17)	248	105
Psychological co-diagnoses and co-ingestant totals		
Psychological co-diagnoses[b]		
Child (0–11 y)	10	5
Younger adolescent (12–14 y)	139	39
Older adolescent (15–17 y)	691	186
Co-ingestant use[b]		
Child (0–11 y)	5	1
Younger adolescent (12–14 y)	133	47
Older adolescent (15–17 y)	683	150

[a] Percentages will not add up to 100% because a minority of individuals left the ED against medical advice or before triage.
[b] Expanded on in Supplemental Table 4.

discharged compared with the prelegalization period.

The rate of older adolescents (aged 15–17 years) reporting co-ingestant (as determined by ICD-10 code) use decreased for alcohol (IRR: 0.73, 95% CI: 0.56 to 0.95), opiates (IRR: 0.31, 95% CI: 0.08 to 0.84), cocaine (IRR: 0.23, 95% CI: 0.10 to 0.48), and unclassified substances (IRR: 0.62, 95% CI: 0.44 to 0.85), and contributed to the overall decline in reported co-ingestant use (IRR: 0.70, 95% CI: 0.59 to 0.84). The proportion of older adolescents reporting co-ingestant use also declined for opiates (RR: 0.33, 95% CI: 0.12 to 0.92), cocaine (RR: 0.25, 95% CI: 0.12 to 0.52), and unclassified substances (RR: 0.67, 95% CI: 0.50 to 0.91), again contributing to the overall decline in the proportion of older adolescents reporting co-ingestant use (RR: 0.77, 95% CI: 0.67 to 0.88).

Among co-diagnoses, an increase was only noted in the proportion of hyperemesis presentations among older adolescents (RR: 1.64, 95% CI: 1.13 to 2.37). Personality and mood-related psychological co-diagnoses decreased among older adolescents (IRR: 0.50, 95% CI: 0.27 to 0.87 and IRR: 0.70, 95% CI: 0.54 to 0.90 respectively). Both also decreased as a proportion of all older adolescent cannabis-related ED visits postlegalization (RR: 0.55, 95% CI: 0.32 to 0.93 and RR 0.76, 95% CI: 0.61 to 0.96, respectively). Older adolescents made up the

TABLE 2 IRRs, RR Ratios, and ITS Results Comparing Pre- and Postlegalization ED Visits Per Age Group

Variable	IRR, n (95% CI)	RR Among All Cannabis-Related ED Visits, n (95% CI)	ITS Absolute Level Change in Monthly Visits, n (95% CI)
All pediatric visits	1.01 (0.92 to 1.10)	—[a]	−2.20 (−7.92 to 3.52)
Children	2.51 (1.62 to 3.88)	2.41 (1.61 to 3.61)	0.11 (−0.89 to 1.10)
Younger adolescent	1.18 (0.95 to 1.45)	1.14 (0.95 to 1.38)	1.92 (−0.08 to 3.94)
Older adolescent	0.92 (0.82 to 1.02)	0.95 (0.88 to 1.03)	−4.23 (−9.30 to 0.84)

—, not applicable.
[a] No RR exists because individual age groups were compared against the pediatric total.

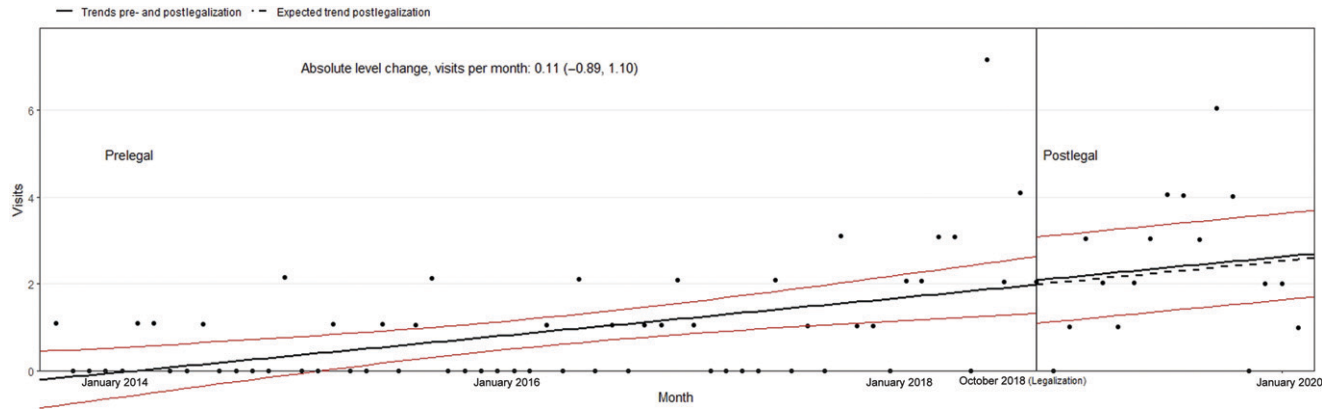

FIGURE 1
Urban ED pediatric cannabis-related visits over time for children aged 0 to 11 years.

vast majority of individuals with psychological co-diagnoses both pre- (82.3%) and postlegalization (80.9%), as expected, given preexisting trends in psychological comorbidity. Among toddlers and children, rare, but previously reported cardiac and respiratory distress were not observed within our cohort. In younger and older adolescents, changes were not observed in the number of individuals reporting cardiac and respiratory symptoms associated with cannabis consumption. We identified low sample sizes of patients presenting with seizure symptoms (prelegal n = 13, postlegal n = 6) and of patients who were admitted to intensive care (prelegal n = 5, postlegal n = 3).

Lastly, and perhaps most importantly, we witnessed an increase in child and older adolescent unintentional ingestion rates as well as in the proportion of all child and older adolescent cannabis-related visits stemming from unintentional ingestion (IRR: 1.77, 95% CI: 1.42 to 2.20; RR: 1.24, 95% CI: 1.05 to 1.47, and IRR: 1.36, 95% CI: 1.07 to 1.71; RR: 1.48, 95% CI: 1.21–1.81, respectively). Unintentional ingestions among younger adolescents did not change significantly pre- and postlegalization. Ingestions with intent for self-harm were present in our data set but did not exist in sufficient quantity for analysis. We identified no other common causes for ingestion.

DISCUSSION

Our study is among few to examine Albertan provincial pediatric cannabis-related ED visits in the national legalization context using ITS in addition to population-adjusted pre-post analysis. Our data indicated that, postlegalization, there was no overall change in pediatric cannabis-related ED visit incidence, but that both the rate

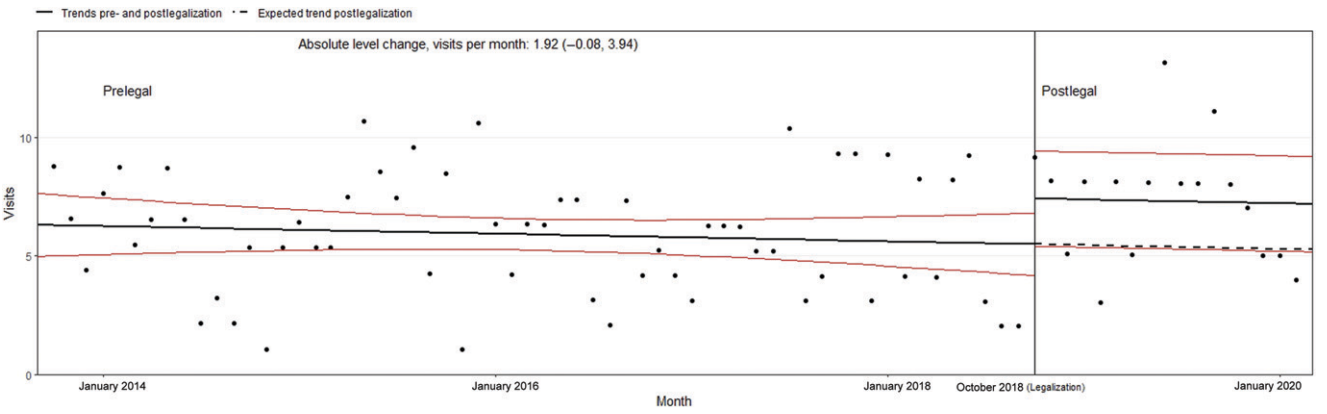

FIGURE 2
Urban ED cannabis-related visits over time for children aged 12 to 14 years.

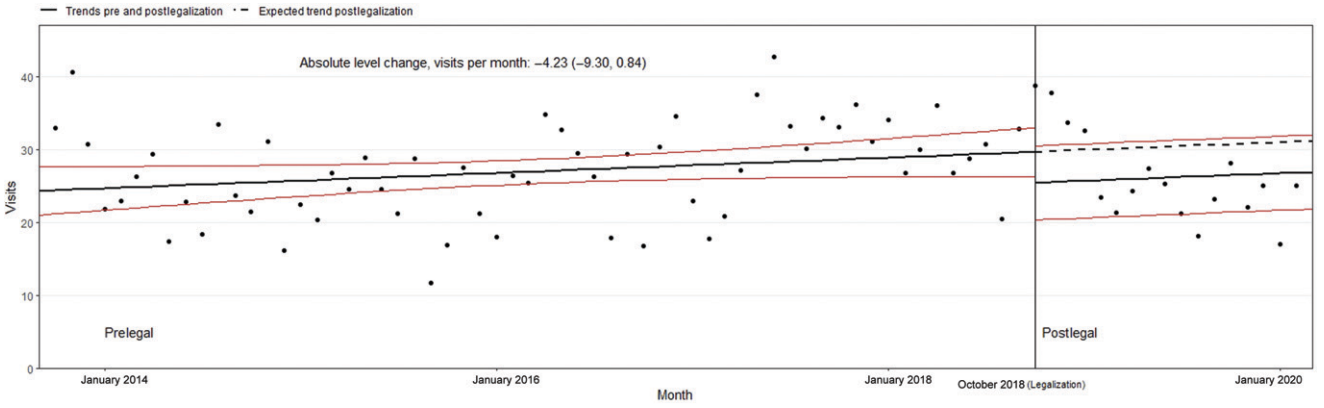

FIGURE 3
Urban ED cannabis-related visits over time for children aged 15 to 17 years.

and proportion of children aged <12 years had increased. These data suggest that, for children aged >11 years, nonmedical cannabis legalization for adults has not altered related ED visitation rates. Alberta data are in contrast to previous US studies, with adolescent cannabis-related ED visitation noted to increase postlegalization in Colorado.[2] Our data are consistent, however, with previous US research indicating the most common pediatric age group with cannabis-related ED visits is the group of those aged 12 and 17 years, pre- and postlegalization, with cannabis experimentation often beginning in that age range.[1,6]

For younger children, pre-post analysis suggests ED visits have increased and appear largely driven by unintentional ingestion, with a 77% increase postlegalization. However, ITS analysis suggests cannabis-related ED visits in young children continue to increase at the same rate pre- and postlegalization. Therefore, although cannabis legalization may be associated with greater availability in environments where children are present, ITS results suggest legalization is not associated with a sudden increase in visits. Our data are also suggestive of an increase in incidence, but not proportion, of milder cannabis presentations because the number of children discharged from the ED increased, whereas the number of those admitted to the hospital from the ED remained the same. Our data are consistent with observations made in Colorado during statewide nonmedical cannabis legalization and in Massachusetts after medical cannabis legalization but highlight visit increase may be unrelated to legalization.[3,7]

Co-ingestant and co-diagnoses patterns remained largely similar between the pre- and postlegalization time periods,

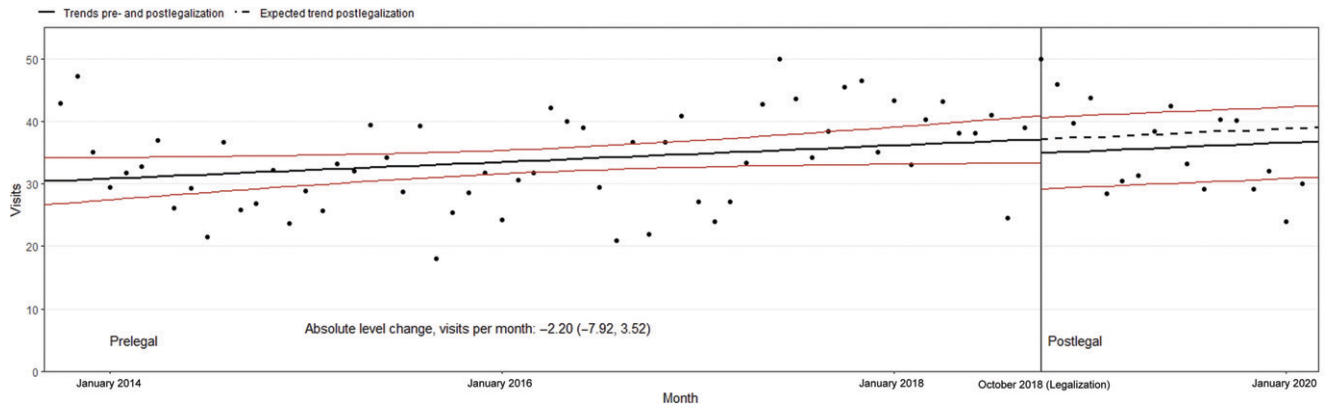

FIGURE 4
Urban ED pediatric cannabis-related visits over time for all pediatric visits.

TABLE 3 IRRs and RR Ratios Comparing Pre- and Postlegalization ED Visits

Variable	IRR (95% CI)	RR Among All Cannabis-Related ED Visits (95% CI)
Children (0–11 y)		
Disposition		
Transferred	1.07 (0.11 to 5.98)	0.43 (0.09 to 1.99)
Admitted	3.21 (0.96 to 10.71)	2.86 (0.90 to 9.07)
Discharged	2.62 (1.57 to 4.32)	1.04 (0.83 to 1.31)
Co-diagnoses		
Psychological co-diagnoses	1.60 (0.43 to 5.15)	0.64 (0.24 to 1.72)
Anxiety-related disorder	—	—
Nonmood psychotic disorder	—	—
Mood (affect) disorder	—	—
Personality and behavioral disorder	—	—
Hyperemesis	—	—
Unintentional ingestion	1.77 (1.42 to 2.20)	1.24 (1.05 to 1.47)
Intentional ingestion	0.58 (0.06 to 2.67)	0.23 (0.05 to 0.99)
Sign and symptoms of cognitive effect	2.67 (0.65 to 10.51)	1.32 (0.72 to 2.71)
Attention-deficit/hyperactivity disorder	—	—
Co-ingestants[a]		
Co-ingestant use	0.64 (0.01 to 5.73)	0.26 (0.03 to 2.10)
Alcohol	—	—
Opiates	—	—
Sedatives	—	—
Cocaine	—	—
Stimulant	—	—
Other	—	—
Younger adolescents (12–14 y)		
Disposition		
Transferred	1.28 (0.55 to 2.76)	1.09 (0.54 to 2.20)
Admitted	0.95 (0.73 to 1.23)	0.63 (0.33 to 1.22)
Discharged	1.04 (0.94 to 1.16)	1.04 (0.94 to 1.16)
Co-diagnoses		
Psychological co-diagnoses	0.88 (0.76 to 1.02)	0.76 (0.57 to 1.02)
Anxiety-related disorder	1.19 (0.75 to 1.83)	1.01 (0.70 to 1.45)
Nonmood psychotic disorder	0.64 (0.01 to 5.73)	0.54 (0.06 to 4.62)
Mood (affect) disorder	0.56 (0.29 to 0.98)	0.48 (0.28 to 0.81)
Personality and behavioral disorder	0.58 (0.35 to 2.81)	0.91 (0.37 to 2.23)
Hyperemesis	1.78 (0.47 to 5.92)	1.51 (0.52 to 4.43)
Unintentional ingestion	1.18 (0.71 to 1.89)	1.00 (0.67 to 1.51)
Intentional ingestion	1.18 (0.92 to 1.49)	1.00 (0.90 to 1.11)
Sign and symptoms of cognitive effect	0.64 (0.07 to 3.01)	0.54 (0.12 to 2.45)
Attention-deficit/hyperactivity disorder	0.72 (0.31 to 1.51)	0.61 (0.31 to 1.23)
Co-ingestants[a]		
Co-ingestant use	1.13 (0.79 to 1.59)	0.96 (0.74 to 1.25)
Alcohol	1.42 (0.87 to 2.27)	1.21 (0.81 to 1.80)
Opiates	0.46 (0.01 to 3.57)	0.39 (0.05 to 3.13)
Sedatives	0.99 (0.23 to 3.19)	0.84 (0.28 to 2.52)
Cocaine	0.80 (0.08 to 4.02)	0.68 (0.14 to 3.16)
Stimulant	1.20 (0.39 to 3.23)	1.02 (0.41 to 2.55)
Other	0.98 (0.51 to 1.78)	0.83 (0.49 to 1.43)
Older adolescents (15–17 y)		
Disposition		
Transferred	0.70 (0.46 to 1.03)	0.76 (0.53 to 1.10)
Admitted	0.92 (0.68 to 1.23)	1.00 (0.77 to 1.31)
Discharged	0.94 (0.83 to 1.07)	1.03 (0.97 to 1.10)
Co-diagnoses		
Psychological co-diagnoses	0.86 (0.73 to 1.02)	0.77 (0.68 to 0.88)
Anxiety-related disorder	0.94 (0.76 to 1.14)	1.02 (0.86 to 1.21)
Nonmood psychotic disorder	0.86 (0.51 to 1.41)	0.94 (0.59 to 1.51)
Mood (affect) disorder	0.70 (0.54 to 0.90)	0.76 (0.61 to 0.96)
Personality and behavioral disorder	0.50 (0.27 to 0.87)	0.55 (0.32 to 0.93)
Hyperemesis	1.50 (0.99 to 2.24)	1.64 (1.13 to 2.37)
Unintentional ingestion	1.36 (1.07 to 1.71)	1.48 (1.21 to 1.81)

TABLE 3 Continued

Variable	IRR (95% CI)	RR Among All Cannabis-Related ED Visits (95% CI)
Intentional ingestion	0.83 (0.74 to 0.94)	0.91 (0.86 to 0.96)
Sign and symptoms of cognitive effect	1.28 (0.60 to 2.58)	1.40 (0.72 to 2.71)
Attention-deficit/hyperactivity disorder	1.37 (0.95 to 1.94)	1.50 (1.08 to 2.07)
Co-ingestants[a]		
Co-ingestant use	0.70 (0.59 to 0.84)	0.77 (0.67 to 0.88)
Alcohol	0.73 (0.56 to 0.95)	0.80 (0.63 to 1.01)
Opiates	0.31 (0.08 to 0.84)	0.33 (0.12 to 0.92)
Sedatives	1.07 (0.58 to 1.88)	1.16 (0.68 to 2.00)
Cocaine	0.23 (0.10 to 0.48)	0.25 (0.12 to 0.52)
Stimulant	0.72 (0.47 to 1.08)	0.79 (0.54 to 1.15)
Other	0.62 (0.44 to 0.85)	0.67 (0.50 to 0.91)

—, insufficient sample size.

[a] Hallucinogens, inhalants and nicotine were excluded because of low sample size.

indicating the patient population has not substantially changed. In younger children, this is largely attributable to the majority (>95%) presenting without the psychological or physical symptomology of older youth and without co-ingestants. This is expected, given the low psychological comorbidity rate in young children. In older adolescents, declining postlegalization, co-ingestant use may be related to youth education focusing on harm reduction in addition to increasing cannabis availability compared with other substances.

As other countries consider legalizing nonmedical cannabis, public health campaigns should emphasize cannabis be kept safely away from young children and advise caregivers of risks associated with unintentional ingestion. Older adolescents also need to be aware of cannabis' effects and risks in its different forms. Despite stringent Health Canada regulations requiring health warnings and plain, child-resistant packaging to deter youth accessibility and appeal, accidental ingestions are increasing among children and older adolescents. Further research is necessary to identify whether consumption is owing to legal or illegal products and whether edibles, concentrates, or raw products pose greater potential risk. Although products appealing to children, such as gummy bears, are not permitted by Canada's legislation, they are widely available in illicit markets. Legal edibles in forms including candy, chocolates, and baked goods may be attractive to younger children and teenagers. Research determining if legal or illegally produced edibles are a common source of pediatric cannabis-related ED visits is important in the postlegalization Canadian context because research suggests edibles may play a role in unintentional pediatric cannabis ingestions.[7,8]

An increasing proportion of older adolescents also presented with cannabinoid hyperemesis syndrome symptoms postlegalization, consistent with patterns observed in adult cohorts.[5] Because the ICD-10 codes used to identify hyperemesis were unable to explicitly identify cyclic vomiting, the finding may be related to emesis consequent to nausea in first-time cannabis users. In addition, because cannabinoid hyperemesis syndrome is typically seen in individuals who are long-term cannabis users, this finding is inconsistent with decreasing intentional cannabis ingestion rates and warrants further investigation.[9]

Although we are reassured by lack of previously reported life-threatening sequalae (cardiorespiratory, neurologic encephalopathy, and seizures) related to cannabis exposure in our data set, potentially deadly effects underscore the need for cannabis legislation to consider pediatric exposure risks.[8–15] Community pediatricians should be aware of individuals storing cannabis in close proximity to children and should remind caregivers of hazards associated with improper and unlabeled storage, particularly for young children.

In the pediatric context, it should be noted that cannabis is an uncommon cause for ED visits, as seen in Fig 5. Other household products are more common and potentially more potent toxins. Previous US research suggests pediatric cannabis-related calls to poison control centers account for <1% of all calls.[7] Also important to note is that cannabis usage appears to be increasing globally, with steadily increasing use and subsequent increased ED visitation in some studies from Canada, the United States, and

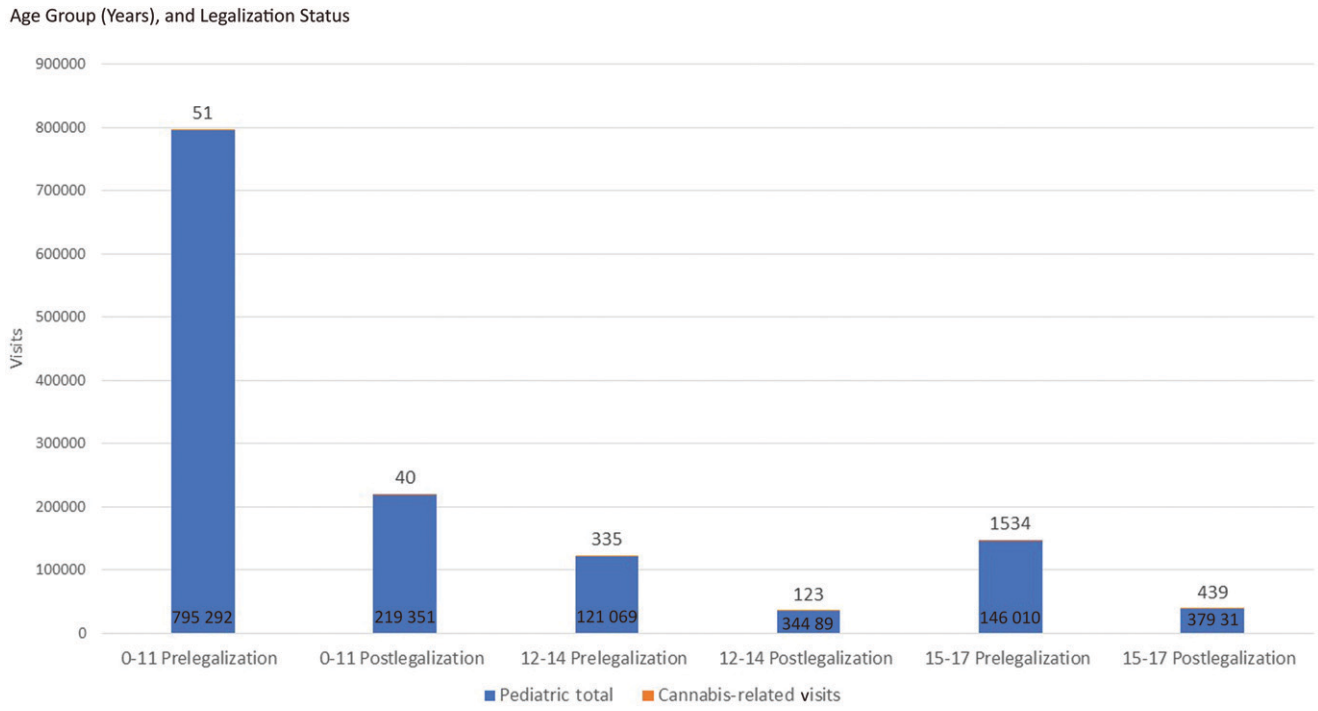

FIGURE 5
Total urban Alberta cannabis-related ED visits compared with pediatric ED visit totals.

European countries.[5,16–18] Data from Canada suggest this trend predates, but is exacerbated by, legalization.[5] Increasing use may offer more opportunity for pediatric exposure, both unintentional and intentional.

Because not all patients included in the data set underwent urine toxicology screening, our study relied on self-reported ingestions in the pre- and postlegalization periods. This limitation means it is possible the reported cannabis and co-ingestant consumption rate differs from what is reported here. Similarly, because NACRS data do not contain information on the reason for consumption (medicinal or nonmedicinal, intended for the patient or not intended for the patient), the product consumed (edible or concentrate), or the legality of the consumed cannabis, we could not identify how cannabis ended up in the possession of the patient or who the cannabis was intended for. It is important to note pediatric medical cannabis authorizations are permitted in Alberta but are rare and encouraged only in cases in which conventional therapies are ineffective.[19] Common adult synthetic cannabinoid medications dronabinol and nabilone are similarly permitted but not recommended for pediatric patients, with the former unavailable in Canada. Within our data set, we identified low (<10) case counts for co-diagnoses commonly associated with medical cannabis, including epilepsy, cancer, pain crises, autism, and rare diseases.[8] We identified several patients with attention-deficit/hyperactivity disorder (n = 151 prelegalization, n = 56 postlegalization), although it was unclear if cannabis ingestion was for a medicinal purpose. Because the data were retrospective and from an electronic database, it was difficult to identify if missing data were present in the data set. We suspect few missing data were present, however, because NACRS only accepts error-free abstracts.[20]

Additionally, we cannot discount the possibility cannabis legalization has increased the likelihood parents will be forthcoming about cannabis exposure when seeking emergency care for poisoned children. Similarly, providers may be more cognizant of cannabis as a potential ingestant after legalization, whereas older patients may be more likely to self-report. Inherent to studies on pediatric cannabis-related ED visits, we are limited by low sample size among younger children. The low sample size limits our ability to detect clinically significant differences in this population, although it

indicates cannabis legalization has not created significant public health concern for young children. We find strength in available data length and quality, with Alberta among 4 provinces where EDs are mandated to submit data with all co-diagnoses made in the ED to NACRS.[20] We also find strength in our inclusion of data from all urban Alberta hospitals, including both pediatric and adult EDs, because pediatric patients are commonly treated at nonpediatric EDs.

CONCLUSIONS

Nonmedical cannabis legalization is associated with a substantial increase in unintentional ingestions for children and older adolescents and may be contributory to increasing volumes of children presenting for cannabis ingestion. Fortunately, presentation severity is low, with most patients discharged and few intensive care admissions. Cannabis-related ED visitation continues to be concentrated in older adolescents, although there are fewer reports of co-ingestant use postlegalization. Future public health research and interventions should be focused on all-age unintentional poisoning prevention and on the type (medicinal versus nonmedicinal) and method of cannabis consumption (concentrates, edibles, etc) in ED presenters.

ACKNOWLEDGMENTS

We thank data analysts Erik Youngson and Majid Nabipoor-Sanjebad with the Alberta Innovates SPOR (Strategy for Patient Oriented Research) support unit for aiding in data extraction as well as Alberta Health Services for use of their facilities and resources.

ABBREVIATIONS

CI: confidence interval
ED: emergency department
ICD-10: *International Classification of Diseases, 10th Revision*
IRR: incident rate ratio
ITS: interrupted time series
NACRS: National Ambulatory Care Reporting System
RR: relative risk

FUNDING: This study was unfunded but was given analytical resources by Alberta Health Services.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

COMPANION PAPER: A companion to this article can be found online at www.pediatrics.org/cgi/doi/10.1542/peds.2021-051426.

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