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Why do patients come to the emergency department after using cannabis?

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Abstract

Background: Cannabis (MJ) policy liberalization in a majority of US states has impacted emergency department (ED) visits. It is important to understand why people come to the ED after using MJ because the drug is now available to experienced and naïve people across the country. The objectives of this study were to (1) improve upon administrative dataset methodology by performing additional chart review to describe ED visits related to cannabis, (2) understand why patients come to the ED after using cannabis, and (3) begin to inform our understanding of cannabis-attributable ED visits to start to educate patients and providers about cannabis' safety.

Methods: We performed a retrospective chart review of ED visits identified by cannabis ICD-9 and 10-CM codes between 2012 and 2016. Visits were reviewed and determined if the visit was partially attributable to cannabis based upon a pre-specified definition, then categorized into clinical complaint categories. Descriptive statistics, Chi-Square, and T-tests were used to elucidate the data.

Results: About one-fourth (25.74%) of visits with cannabis ICD-CM codes were found to be at least partially attributable to cannabis. These patients are more often young, Caucasian males when compared to the overall ED population ($p < .0001$). Patients with a cannabis-attributable visit were more often admitted to the hospital ($p < .0001$). The most common complaints in cannabis-attributable visits were gastrointestinal and psychiatric complaints, as well as intoxication. The number of cannabis-attributable visits rose with time ($p = .012$).

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Disclosure statement

All the authors report that they have no declaration of interest.

Conclusions: Based on a pre-specified definition, with good inter-rater reliability, we found that 25% of visits with a cannabis ICD-CM code were partially attributable to cannabis. These findings represent areas to target in cannabis user education as public perceptions change across time.

Keywords

Cannabis; ED visits; education

Introduction

Cannabis has been legalized for medical or recreational use on a state level in a majority of the United States, including 33 states, the District of Columbia, and the territories of Guam and Puerto Rico [1]. Colorado legalized medical cannabis in 2000, though medical use did not increase significantly until 2009 [2] when Attorney General Holder released a memo instructing state District Attorneys to de-emphasize incarceration of medical cannabis users. This resulted in a massive expansion in cannabis availability, which increased further when cannabis was recreationalized in 2012, allowing retail sale on January 1, 2014 [3]. Liberalization of cannabis policy resulted in increased use in both experienced and naïve users [4]. Increased emergency department (ED) visits associated with cannabis use in numerous states have been observed [4–7].

In 2016, the Council of State and Territorial Epidemiologist Cross Cutting Committee identified the lack of standardized methods for marijuana surveillance as a key public health challenge in states with legalized marijuana [8]. Emergency departments are important sites for public health surveillance. With increased availability and increased adverse effects associated with cannabis [4,9,10], it is important to understand the reasons for ED visits after using cannabis to better recognize and treat these cannabis-associated conditions. Colorado has a longer history of liberalization and wider availability of the drug, leading to more retrospective data to describe this population in the US; thus, Colorado's EDs are in a unique position to study the impact of cannabis liberalization. Prior work has shown that cannabis diagnosis codes are used in association with healthcare visits, but we do not know if these visits were actually attributable to cannabis or simply represent increased use in the community [11]. ICD-9-CM and –10-CM codes are increasingly utilized in administrative datasets, but incidence of cannabis diagnosis codes within these datasets does not indicate if the visits are cannabis-attributable. Additional chart review can be a meaningful tool to categorize these visits.

Most laypeople believe cannabis use is safe [12]. However, evidence suggests that cannabis use can exacerbate underlying mental health conditions [13]. Medical cannabis was originally approved for medical use as an antiemetic for cancer patients, but users may not be aware that cannabis can also cause gastrointestinal illness. Recent reports demonstrate increasing prevalence of cannabinoid hyperemesis syndrome (CHS), which can cause significant morbidity and even death [7,14,15]. Cannabis use is associated with increased risk of motor vehicle accidents and ~10% of regular users develop cannabis use disorder [16]. Cannabis users may be ill-informed or underappreciate the risks of cannabis use.

The objectives of this study were to (1) improve upon administrative dataset methodology by performing additional chart review to describe ED visits related to cannabis, (2) understand why patients come to the ED after using cannabis, and (3) begin to inform our understanding of cannabis attributable ED visits to start to educate patients and providers about cannabis' safety.

Methods

Study design and population

We completed a retrospective chart review of all ED visits with at least one cannabis ICD-9-CM or –10-CM code at the University of Colorado UCHHealth Hospital (UCH ED) in Aurora, Colorado between January 1, 2012 and December 31, 2016. Supplemental Table 1 includes all ICD-CM codes queried. Visits that noted synthetic cannabinoid exposure were not included in this cohort. Supplemental Table 2 includes criteria that were directly abstracted from the patient's medical record for each UCH ED visit.

Research assistants were trained using 50 UCH ED charts with cannabis ICD-CM code(s); charts were abstracted by both a medical toxicologist (AAM) and one of the research assistants (SKS and EM). The research assistants were retrained when discrepancies were identified, then an additional 250 charts were reviewed by the medical toxicologist to determine precision. The medical toxicologist arbitrated all visits where cannabis-attribution was questionable. The medical toxicologist abstracted a random sample of 10% of all charts reviewed by the research assistants and the kappa statistic was calculated to determine inter-rater reliability. A sensitivity analysis was performed using 1% of all UCH ED charts without cannabis ICD-9-CM or –10-CM codes to ensure adequate capture of cannabis-related visits using the ICD-CM code search strategy.

Attribution of cannabis visits

We determined if the visit was at least partially attributable to cannabis using a pre-specified definition. Visits partially attributable to cannabis were defined as fitting into at least one of three categories: (1) the ED physician identified cannabis as likely precipitating or contributing to the condition, (2) the patient was admitted to the hospital and the inpatient physician identified cannabis as likely precipitating or contributing to the condition, and/or (3) the urine toxicology screen was positive and there was a documented temporal (~24h of visit) exposure to cannabis in a condition or event known to be associated with cannabis use (for example anxiety or motor vehicle collision). To minimize over-attribution in the third criterion, both urine toxicology screening and noted temporal use were required to categorize those visits as cannabis-attributable.

Clinical complaints

The cannabis-attributable ED visits were then categorized into clinical complaint categories, including psychiatric, gastrointestinal, cardiovascular, respiratory, intoxication, motor vehicle collision, trauma, dermatologic, neurologic, altered mental status, and other. These categories were not mutually exclusive, and where "other" was chosen, there was an additional option to add clarifying comments.

Clinical complaint categories included additional branching information described in Table 1. For example, if psychiatric was the selected category, the visit was denoted as acute or chronic in nature. If the patient had a past medical history of psychiatric condition(s) or symptoms had persisted for at least one month, then the complaint was determined to be chronic in nature. If the patient had no prior history of psychiatric disease, then the complaint was determined to be an acute issue. If the ED visit was due to a chronic psychiatric complaint, then the reviewer made a further selection from a list of chronic diseases, including depression, anxiety, psychosis, post-traumatic stress disorder, schizophrenia, acute exacerbation of a chronic psychiatric disease, or other. If the visit was due to an acute psychiatric complaint, then the reviewer selected from a list of acute illnesses, including panic attack, acute anxiety, acute depression, acute psychosis, suicidal ideation, suicide attempt, and other. If other was chosen, the reviewer was able to input a free-text description.

Gastrointestinal visits were coded as either CHS or general GI illness, unrelated to CHS (episode of vomiting after edible ingestion, for example). Visits were coded as CHS if (1) there was an ED diagnosis of cyclic vomiting episode or (2) there were at least three visits for vomiting, without another identified etiology, associated with cannabis use, within one year of the index visit to the ED [17].

If intoxication was chosen as the clinical complaint, then the type of intoxication was selected from mutually-exclusive categories of (1) single drug (cannabis only), (2) alcohol and cannabis, (3) polydrug use (without alcohol), and (4) polydrug use and alcohol.

Reviewers also abstracted the route of exposure (e.g., oral ingestion or vaporization) and dose information if outlined in the record. If the route of exposure was not overtly stated as edible ingestion or vaporized, then it was assumed that the patient utilized an inhaled form of the drug, as this is the most common form of ingestion in CO [18–20].

Data analysis

Descriptive statistics were utilized to characterize population demographics, use patterns, and clinical complaints. Chi-square values and one sample T-test were used with SPSS version 25 (IBM, Armonk, NY) to compare differences between groups. This research study was approved by the local Institutional Review Board; informed consent was waived due to the retrospective nature of the study.

Results

Demographics

A total of 449,031 patients were seen in the UCH ED over the study period. Cannabis ICD-9-CM or –10-CM codes were present in 9973. Of these, 2567 (25.74%) were found to be at least partially attributable to cannabis. Table 2 captures the demographic data of the cohort. The visits reviewed had a kappa statistic of 0.79 (95% CI: 0.75–0.83), indicative of good inter-rater reliability.

As depicted in Table 2, the median age of cannabis-attributable visits was lower and had a narrower interquartile range as compared to the overall UCH ED population (39 (27, 54) in the overall population vs. 30 (24, 41) in the cannabis-attributable population). Over 65% of the cannabis-attributable visits were of male gender, as compared to just 43.5% of the overall ED ($p < .0001$). The most common race associated with the cannabis-attributable visits was Caucasian, though there was an almost 10% increase in African American race when compared to the overall ED population ($p < .0001$). Between the years 2012 and 2016, over 95% of people who visited the UCH ED were Colorado residents, as compared to just 90.2% of the cannabis-attributable cohort ($p < .0001$). Patients with a cannabis-attributable visit were more often admitted to the hospital (15.9% overall admissions vs. 31.6% cannabis-attributable admissions, $p < .0001$), though their median lengths of stay in the ED were shorter (2.95 h overall ED population vs. 2.00 h cannabis-attributable population, $p < .0001$). Lastly, more than 50% of the cannabis-attributable visits had Medicaid insurance, as compared to just 35.6% of the overall UCH ED population ($p < .0001$).

Clinical complaints attributable to cannabis

Table 1 shows the breakdown of clinical complaint categories as well as percent admitted by complaint. Not all visits were analyzed for branching logic under acute and chronic psychiatric type (63.0% of visits analyzed), gastrointestinal type (62.2% analyzed), and intoxication type (61.3% analyzed). The most common clinical complaint categories were gastrointestinal (GI), intoxication, and psychiatric-related, with the rest of the clinical complaints accounting for less than 7% of the total. Of the psychiatric visits, almost 75% were related to acute complaints, with suicidal ideation and anxiety causing the majority of these visits. Just 25% of the psychiatric complaints were chronic in nature, with most of these patients experiencing an acute exacerbation of a chronic mental health condition such as schizophrenia or depression. The vast majority (85%) of the gastrointestinal-related visits were due to exacerbations of CHS. The intoxication category had a relatively even distribution between the four types analyzed: cannabis only, cannabis and alcohol, polydrug use (cannabis and at least one other drug), and polydrug use and alcohol. By type, 17.0% of the intoxication category was due to cannabis only, with 16.3% due to both cannabis and alcohol, 14.9% intoxicated on multiple drugs inclusive of cannabis, and finally 13.0% with polydrug use and alcohol. Overall, 27.9% of the intoxication that individuals experienced was due to cannabis and other drug use, with or without alcohol.

Table 1 also highlights the percent of each overarching complaint that were admitted to UCH or transferred to another hospital (including inpatient psychiatric facilities). Of note, six of the seven (85.7%) dermatologic complaints were admitted. Over half (53.6%) of the respiratory and trauma (51.5%) complaints and 42.4% of the cardiovascular complaints were admitted. The lowest percentage of admissions was from the intoxication category, at 25.7%.

Visits by year

Figure 1 illustrates the crude rate of visits per 1000 total ED visits by year. The number of visits determined to be at least partially attributable to cannabis rose significantly across the five years studied, when accounting for total number of UCH ED visits ($p=.012$). As depicted in Figure 2, the total number of visits for each clinical complaint category rose each

year, with almost every complaint experiencing a steep rise from 2015 to 2016. We found that the rise in the number of visits per year in each complaint was statistically significant ($p=.016$, 0.015 , 0.013 , and 0.048 for psychiatric, gastrointestinal, intoxication, and other, respectively).

Discussion

This study represents the largest dataset of reviewed ED visits with attribution to cannabis. Others have described ED visits with cannabis ICD-CM codes, but these administrative datasets were not reviewed for attribution to cannabis, potentially inflating the association of cannabis in ED visits. This improved method allows for additional public health surveillance of cannabis use. Based on a pre-specified definition, with good inter-rater reliability, we found that about 25% of visits with at least one cannabis ICD-CM code were at least partially attributable to cannabis use. This finding demonstrates that increases in the number of visits with cannabis associated ICD-CM codes do not necessarily represent an increase in cannabis-attributable visits. Rather, rises in cannabis-associated ICD-CM codes can represent increased availability and use of cannabis in the community.

We found that people come to the ED after using cannabis primarily due to gastrointestinal upset, psychiatric complaints, and intoxication. Recently, there have been at least two deaths attributed to CHS [14], which demonstrates the severity of this disorder. Less severe cases in our cohort show that this condition can be debilitating, leading to recidivism to the UCH ED in many patients. Blanco et al. found within a representative US sample, cannabis use is associated with increased risk of alcohol abuse disorder, cannabis abuse disorder, nicotine dependence, as well as any other drug use disorder [21]. We saw that, while patients intoxicated on cannabis only accounted for the large group within our intoxication category, more than a quarter of the intoxication type category represented polydrug use. Another previous study has found that cannabis use is associated with increased risk of psychosis, especially in patients who had never experienced psychiatric exacerbations prior [22]. Our previous work has shown that edible versions of cannabis exhibit a delayed drug effect, which can lead consumers to become intoxicated after multiple ingestions [10].

Interestingly, we found that although patients more often present to the UCH ED with gastrointestinal, psychiatric complaints, or intoxication, these patients were less often admitted to the hospital. The dermatologic, respiratory, trauma, and cardiovascular complaint categories had the highest percentages of admission rates, suggesting that these patients are more severely ill than their gastrointestinal or psychiatric complaint counterparts. Intoxicated patients likely became sober in the ED and did not need further medical attention. Patients with gastrointestinal complaints likely received anti-nausea and anti-emetic medications in the ED, which eased their symptoms. Patients with psychiatric complaints also likely received stabilizing medication in the ED and were able to be discharged without further medical complaints. This data suggests that while patients less often come to the ED with cannabis-associated dermatologic, respiratory, traumatic, and cardiovascular complaints, these complaints require further medical attention because they are more medically complicated and warrant admission to an inpatient setting.

These findings represent a few areas to target in user education, which can take place in the ED: first, that cannabis can cause gastrointestinal upset and symptoms associated with cyclic vomiting that may not be well understood. Second, continued education is needed around the potential for cannabis to exacerbate mental health conditions. Since the majority of the findings in this cohort were from patients without a past medical history of psychiatric symptoms, it is important to educate cannabis users on the potential for psychiatric symptoms after use. Additionally, many patients in this cohort were clinically intoxicated when presenting to the ED; 29.8% of them intoxicated with cannabis, alcohol, or multiple other drugs. Polydrug use increases the risk of adverse drug events and education around this phenomenon in cannabis users is necessary. Finally, clear and user-friendly labeling must be utilized for cannabis edibles to communicate the delayed onset of effects.

Public perceptions of cannabis have changed in recent decades, with many people classifying it as relatively benign [23]. Svrakic et al. postulated that this was due to the lack of overt signs of intoxication, which enforces this benign classification. Generationally, many later Baby Boomers and Gen X'ers were told that marijuana is a "gateway drug" during the beginning of the "War on Drugs" in the 1970s. Since then, Gil Kerlikowske, the Director of the Office of National Drug Control Policy during the Obama administration, would not use the term "war on drugs," finding that it was "counterproductive" [24]. A Pew research poll found that just 12% of Americans thought that cannabis should be legalized in 1969, compared to 61% in 2017. A 2018 review noted that US adults and adolescents are gradually viewing cannabis as harmless, though this review also noted numerous comorbidities associated with cannabis use; this finding is corroborated in our study [25]. Cannabis continues to be legalized on the state level for both medical and recreational purposes in states across the US even though the US Food and Drug Administration has approved drugs with cannabidiol, a pharmacologically active component in cannabis, and other synthetic versions of cannabis such as dronabinol for treatment of chemotherapy-induced nausea [26]. This discordance of legality between the state and federal levels can be confusing for consumers, and continues to fuel a knowledge gap in the general public that cannabis is safe to use.

Limitations

This study was internally limited in several ways. Cannabis use was self-reported and providers are more likely to ask about cannabis use in patients who have diagnoses known to be associated with cannabis use, such as cyclic vomiting. While cannabis use is part of the routine nursing screen theoretically administered to every patient, documentation of social history with drug use is not always delineated unless drug use is suspected. Drug use is more consistently documented in patients with psychiatric complaints, increasing the association with these conditions. Retrospective chart reviews are inherently limited, as the chart documentation may not fully detail such relevant information as route of ingestion and frequency of prior cannabis use. External validity is limited by retrospective review chart review from a single ED in a region with high cannabis availability; though this study does represent more charts than any retrospective study to our knowledge with a method that has been validated in a psychiatric population [13]. There are at least 10 cannabis dispensaries

located within 5 miles of the UCH ED, which likely yields a higher number of incident visits than other comparable academic research institutions.

Conclusion

We found, through individual chart review, that 25% of visits with a cannabis ICD-CM codes are at least partially attributable to cannabis. The most common complaints in patients presenting to the ED for cannabis-attributable visits are gastrointestinal and psychiatric conditions. At the UCH ED, patients with cannabis-attributable visits are more likely to be younger Caucasian males when compared to the overall ED population. Between 2012 and 2016 there were at least 2567 visits that were attributable to cannabis use; we must begin to address this gap in public perception of the drug to ensure users do not view cannabis as free from all adverse health implications.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Figure 1.

The rate of visits partially attributable to cannabis by year, as calculated by the total number of cannabis-attributed visits that year divided by the total number of Emergency Department visits at the University of Colorado UCHHealth. One-sample *t*-test was used to compare groups ($p=.012$).

Figure 2.

The distribution of clinical complaint categories by year, as calculated by the total number of cannabis-attributable visits in each complaint category by year. Only the top three complaints are parsed out here for brevity. One sample *t*-test was utilized to compare groups ($p=.016$, $.015$, $.013$, and $.048$ for psychiatric, gastrointestinal, intoxication, and other, respectively).

Table 1.

Distribution of clinical complaint category and admitted percentage in cannabis-attributable UCH ED visits between 2012 and 2016 (total $n = 2567$).

Clinical complaint category	n (%)	n (%) admitted
Cardiovascular	92 (3.6)	39 (42.4)
Respiratory	153 (6.0)	82 (53.6)
Motor vehicle collision	34 (1.3)	12 (35.3)
Trauma	68 (2.7)	35 (51.5)
Dermatologic	7 (0.3)	6 (85.7)
Psychiatric	633 (24.8)	177 (28.0)
Acute	299 (74.9)	–
Panic attack	11 (1.7)	–
Anxiety	85 (13.4)	–
Depression	6 (1.0)	–
Psychosis	75 (11.9)	–
Suicide attempt	118 (18.6)	–
Other	22 (3.5)	–
Chronic	0 (0.0)	–
Depression	100 (25.1)	–
Anxiety	21 (3.3)	–
Psychosis	18 (2.8)	–
PTSD	21 (3.3)	–
Schizophrenia	2 (0.3)	–
Acute exacerbation of chronic mental health condition	28 (4.4)	–
Other	94 (14.9)	–
Suicidal ideation	13 (2.1)	–
Gastrointestinal	788 (30.9)	283 (35.9)
Cannabinoid hyperemesis syndrome	415 (84.7)	–
Other	75 (15.3)	–
Neurologic	164 (6.4)	53 (32.3)
Altered mental status	194 (7.6)	76 (39.2)
Intoxication	759 (29.8)	195 (25.7)
Cannabis only	129 (17.0)	–
Cannabis and alcohol	124 (16.3)	–
Polydrug use	113 (14.9)	–
Polydrug use and alcohol	99 (13.0)	–
Other	63 (2.5)	22 (34.9)

Demographics of the overall ED population as compared to the visits with a cannabis ICD-CM code and cannabis-attributable visits between the years 2012 and 2016.

Table 2.

Demographic variable	All ED visits <i>n</i> = 449,031	Visits with a Cannabis ICD-CM code <i>n</i> = 9973	Cannabis-attributable visits <i>n</i> = 2567
Age, median (interquartile range)	39 (27, 54)	36 (27, 48)	30 (24, 41)
Gender			
Male	195,485 (43.5%)	6247 (62.6%)	1674 (65.2%)
Female	253,511 (56.5%)	3725 (37.4%)	893 (34.8%)
Unknown	35 (0.01%)	1 (0%)	0 (0%)
<i>p</i> Value (comparison with All ED visits)		<i>p</i> < .0001	<i>p</i> < .0001
Race			
American Indian and Alaska native	2685 (0.6%)	65 (0.7%)	9 (0.4%)
Asian	12,487 (2.8%)	70 (0.7%)	31 (1.2%)
Black or African American	124,462 (27.7%)	3408 (34.2%)	939 (36.6%)
More than one race	769 (0.17%)	8 (0.08%)	0 (0%)
Native Hawaiian and other pacific islander	1190 (0.27%)	16 (0.2%)	4 (0.2%)
Other	100,588 (22.4%)	1577 (15.8%)	455 (17.7%)
Unknown		51 (0.5%)	14 (0.6%)
White or Caucasian	2601 (0.58%)	4778 (47.9%)	1115 (43.4%)
<i>p</i> Value (comparison with All ED visits)	204,249 (45.5%)	<i>p</i> < .0001	<i>p</i> < .0001
Ethnicity			
Hispanic	100,339 (22.4%)	1622 (16.3%)	457 (17.8%)
Non-Hispanic	346,422 (77.2%)	8318 (83.4%)	2101 (81.9%)
Unknown	2270 (0.5%)	33 (0.33%)	9 (0.35%)
<i>p</i> Value (comparison with All ED visits)	–	<i>p</i> < .0001	<i>p</i> < .0001
State			
Colorado	427,245 (95.2%)	9418 (94.4%)	2315 (90.2%)
Outside Colorado	21,786 (4.9%)	555 (5.6%)	252 (9.8%)
<i>p</i> Value (comparison with All ED visits)	–	<i>p</i> = .0004	<i>p</i> < .0001
Disposition			

Demographic variable	All ED visits <i>n</i> = 449,031	Visits with a Cannabis ICD-CM code <i>n</i> = 9973	Cannabis-attributable visits <i>n</i> = 2567
Admit	71,537 (15.9%)	4315 (43.3%)	810 (31.6%)
ED observation	1790 (0.4%)	65 (0.65%)	19 (0.74%)
Death	393 (0.09%)	0 (0%)	0 (0%)
Discharge	358,686 (79.9%)	5160 (51.7%)	1605 (62.5%)
ICU admit	11 (0.00%)	2 (0.02%)	0 (0%)
Left against medical advice	1551 (0.4%)	50 (0.50%)	6 (0.23%)
Left without being seen	8035 (1.8%)	91 (0.91%)	29 (1.13%)
Other	2779 (0.6%)	98 (0.98%)	44 (1.71%)
Transfer	2969 (0.7%)	0 (0%)	0 (0%)
Transfer to psychiatric facility	1280 (0.3%)	192 (1.93%)	54 (2.10%)
<i>p</i> Value (comparison with All ED visits)	–	<i>p</i> < .0001	<i>p</i> < .0001
Insurance			
Indigent	118,059 (26.3%)	442 (5.1%)	235 (10.0%)
Medicaid	159,674 (35.6%)	4225 (48.6%)	1190 (50.6%)
Medicare	72,832 (16.2%)	1683 (19.4%)	361 (15.4%)
Other	94,852 (21.1%)	2192 (25.2%)	507 (21.6%)
VA	3614 (0.8%)	154 (1.8%)	58 (2.5%)
<i>p</i> Value (comparison with All ED visits)	–	<i>p</i> < .0001	<i>p</i> < .0001