



ELSEVIER

 JOURNAL OF
 ADOLESCENT
 HEALTH

www.jahonline.org

Adolescent health brief

Impact of Marijuana Legalization in Colorado on Adolescent Emergency and Urgent Care Visits



George Sam Wang, M.D. ^{a,b,e,*}, Sara Deakyne Davies, M.P.H. ^{a,c,e}, Laurie Seidel Halmo, M.D. ^{a,e}, Amy Sass, M.D. ^{a,d,e}, and Rakesh D. Mistry, M.D., M.S. ^{a,b,e}

^a University of Colorado Anschutz Medical Campus, Aurora, Colorado

^b Section of Emergency Medicine, Children's Hospital Colorado, Aurora, Colorado

^c Research Informatics, Children's Hospital Colorado, Aurora, Colorado

^d Section of Adolescent Medicine, Children's Hospital Colorado, Aurora, Colorado

^e Department of Pediatrics, Children's Hospital Colorado, Aurora, Colorado

Article history: Received September 14, 2017; Accepted December 19, 2017

Keywords: Marijuana; Cannabis; Adolescent; Emergency Department; Colorado; Mental Health; Drug Abuse

ABSTRACT

Purpose: Approximately 6%–8% of U.S. adolescents are daily/past-month users of marijuana. However, survey data may not reliably reflect the impact of legalization on adolescents. The objective was to evaluate the impact of marijuana legalization on adolescent emergency department and urgent care visits to a children's hospital in Colorado, a state that has allowed both medical and recreational marijuana.

Methods: Retrospective review of marijuana-related visits by International Classification of Diseases codes and urine drug screens, from 2005 through 2015, for patients ≥ 13 and < 21 years old.

Results: From 2005 to 2015, 4,202 marijuana-related visits were identified. Behavioral health evaluation was obtained for 2,813 (67%); a psychiatric diagnosis was made for the majority (71%) of these visits. Coingestants were common; the most common was ethanol (12%). Marijuana-related visits increased from 1.8 per 1,000 visits in 2009 to 4.9 in 2015. ($p < .0001$)

Conclusions: Despite national survey data suggesting no appreciable difference in adolescent marijuana use, our data demonstrate a significant increase in adolescent marijuana-associated emergency department and urgent care visits in Colorado.

© 2018 Society for Adolescent Health and Medicine. All rights reserved.

IMPLICATIONS AND CONTRIBUTION

Adolescent marijuana-associated emergency department and urgent care visits increased in a state that has legalized medical and recreational marijuana. As more states begin to legalize marijuana, it is critical that multiple modalities of surveillance are used to fully evaluate the health impact on the adolescent population.

According to national survey data, 6%–8% of adolescents in the U.S. are daily or past-month users of marijuana and their risk perception of use has decreased [1,2]. Although over 50% of states have legalized marijuana, usage rates have remained similar [3,4].

Conflict of Interest: Dr. Wang receives royalties from UpToDate for authorship contributions to related topics. He also has a Colorado Department of Public Health and Environment grant evaluating the pharmacokinetics of CBD in pediatric epilepsy.

* Address correspondence to: George Sam Wang M.D., Section of Emergency Medicine, Department of Pediatrics, Children's Hospital Colorado, 13123 E 16th Ave B251, Aurora, CO 80045.

E-mail address: George.wang@childrenscolorado.org (G.S. Wang).

In one of the first states to legalize recreational marijuana use, subanalyses from national data sources have suggested increased adolescent marijuana use in Washington [5]. On the contrary, Colorado, another state that has legalized medical and recreational marijuana, has not confirmed these findings [5,6]. However, survey data may not reliably reflect the impact of legalization on adolescent health, in part due to the heterogeneity of decriminalization practices across the United States [7]. Furthermore, the impact of legalization on other comorbid aspects of adolescent health, such as drug use and behavioral health, needs to be better understood [8,9]. The Drug Abuse Warning Network reported a 61% increase of marijuana-related emergency

department (ED) visits for adolescents [10]. Since 2011, several states have legalized medical marijuana, and eight more have allowed recreational marijuana. The ED is an ideal setting to evaluate the impact of marijuana on acute health effects on adolescents. The ED can be the initial point of contact for medical care for many adolescents, especially for drug use and behavioral health concerns. The objective of this study was to evaluate the impact of marijuana legalization on adolescent visits to ED and urgent cares (UC) at a tertiary care children's hospital system in Colorado.

Methods

Marijuana-related visits to the ED or UC of a tertiary care children's hospital system from January 1, 2005 to December 31, 2015 for patients aged ≥ 13 and < 21 years were eligible. We combined ED and UC visits because our network is a combined system and includes dual billing at the same site. Marijuana-related visits included those with a discharge International Classification of Disease (ICD) 9/10 code for marijuana/cannabis use (305.2X, 969.9, E854.1, or F12.X), or urine toxicology screen positive for tetrahydrocannabinol (THC). Additional data collected via the medical record included demographics, ICD codes, urine toxicology results, behavioral health consultation, and final disposition. There are no strict criteria for a behavioral health consultation and is ordered at the discretion of the provider for behavioral concerns or drug abuse requiring further evaluation. Urine drug screens are required for patients admitted for behavioral health disorders. Otherwise, it is the discretion of the ED/UC provider. Descriptive statistics were calculated, and a chi-square was performed to compare the proportion of ED/UC visits due to marijuana between 2009 and 2015. This time period was chosen because 2009 was the first year of significant growth in local dispensaries and medical marijuana applications after the release of the Ogden Memo which decreased federal involvement on state marijuana legalization; the sale of recreational marijuana was initiated in 2014. Generalized linear modeling using a Poisson distribution using a log link was performed to compare rates in ED/UC visits over time. Analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC). The Colorado Multiple Institutional Review Board approved this study.

Results

From 2005 to 2015, a total of 4,202 marijuana-related visits were identified. Median age of subjects was 16.2 years (interquartile range, 15.1, 17.3) and 54% were male. The most common discharge ICD codes were cannabis abuse (62%), unspecified episodic mood disorder (20%), alcohol abuse (15%), and depressive disorder (14%). Behavioral health evaluation was obtained for 2,813 (67%); a comorbid psychiatric diagnosis was made for the majority (71%) of these visits (Table 1). Most patients (67%) had a positive urine toxicology screen for THC. Ethanol (12%) was the most common coingestant (Table 1). Most subjects (51%) were discharged home, 30% were admitted (medical/behavioral health), and the remainder were transferred to an outside facility. Annual marijuana-related visits increased from 161 in 2005, to 777 in 2015; annual behavioral health evaluations increased from 84 to 500 (Figure 1). The overall rate of marijuana-related visits increased from 1.8 per 1,000 ED/UC visits in 2009 to 4.9 per 1,000 ED/UC visits in 2015 ($p < .0001$). Marijuana-related behavioral

Table 1

Commonly associated ICD diagnosis codes and urine drug screen results in marijuana-related adolescent ED/UC visits

Common associated diagnosis categories ^a	Total N = 4,202
Psychiatric	2,984 (71%)
Depression	1,621 (39%)
Mood Disorder	924 (22%)
Conduct Disorder	566 (13%)
Anxiety/Panic Disorder	562 (13%)
Attention Deficit and Hyperactivity Disorder	490 (12%)
Bipolar	271 (6%)
Schizophrenia/Psychoses	208 (5%)
Other ^b	1,290 (31%)
Cannabis use, abuse, and misuse	2,617 (62%)
Substance abuse	1,385 (33%)
Respiratory	688 (16%)
Neurology	630 (15%)
Gastrointestinal	536 (13%)
Poisoning/Overdose	475 (11%)
Dermatology	466 (11%)
Infectious Disease	362 (9%)
Cardiovascular	360 (9%)
Other ^c	2,205 (52%)
Common coingestants on drug screen ^a	Total N = 4,202
Ethanol	509 (12%)
Amphetamines	180 (4%)
Benzodiazepines	158 (4%)
Opiates	155 (4%)
Cocaine	133 (3%)
Methamphetamines	56 (1%)
Phencyclidine (PCP)	27 (<1%)
Oxycodone	11 (<1%)
Barbiturates	8 (<1%)
3,4 Methylendioxyamphetamine (MDMA)	3 (<1%)

ED/UC = emergency department and urgent care; ICD = International Classification of Diseases.

^a Patients may have more than one diagnosis, and not all patients received a urine drug screen.

^b Other psychiatric disorders includes: counselling, eating disorder, personality disorder, delirium, adjustment disorder, phobia, developmental disorder, and autism.

^c Other includes: allergy, orthopedics, abuse/neglect, alcohol, trauma, renal, endocrine, Ear/Nose/Throat, Obstetrics/Gynecology, hematology, urology, neurosurgery, ophthalmology, tobacco, burn, oncology, rheumatology, and dental.

health consultations increased from 1.2 per 1,000 ED visits in 2009 to 3.2 per 1,000 ED visits in 2015.

Discussion

Despite national survey data suggesting no appreciable difference in adolescent marijuana use, our data demonstrate a significant 10-year increase in adolescent marijuana-associated ED/UC visits in Colorado, most notably in the years following commercialization of medical (2009) and recreational marijuana (2014). Marijuana-related ED/UC visits are of significant concern as patients are having significant acute medical or psychiatric symptoms requiring evaluation. As more states begin to legalize marijuana, the alarming prevalence of comorbid psychiatric disorders and drug use among adolescents presenting to our ED/UC settings for marijuana-related concerns further supports the need for implementation of comprehensive targeted marijuana education and prevention programs directed at youth, particularly those with concomitant psychiatric illness and drug use.

Our study is limited in that it was conducted at a tertiary care hospital system in a state with legalized marijuana and the findings may not be generalizable to nonlegal states. Not all patients

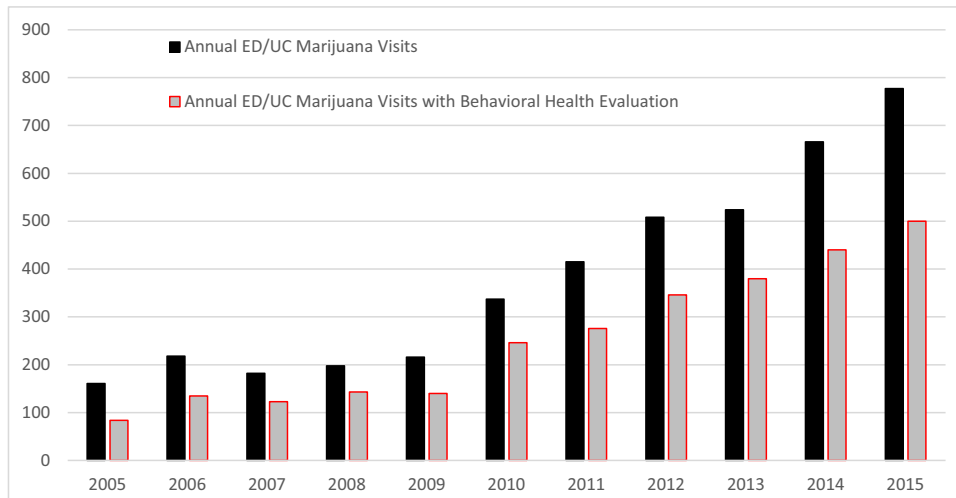


Figure 1. Annual marijuana-related emergency department (ED) and urgent care (UC) visits from a tertiary care children's hospital in Colorado.

received urine toxicology screens, and the diagnosis of marijuana use may have been made by history alone. While we recognize that not all providers may ask about drug use due to many potential barriers, marijuana is not a novel drug and there has been no changes in protocol or education in the medical clearance (which can be only performed by an attending physician) of behavioral health patients. There was an increase in behavioral health consultations from 18.1(2009) to 28.5 (2015) per 1,000 ED visits. Although urine drug screens increased from 13.4 (2009) to 22.6 per 1000 ED visits in 2013, rates decreased to 15.9 and 17.1 in 2014 and 2015, respectively.

Our research demonstrates that marijuana legalization has impacted our adolescent population by an increased in marijuana-related ED/UC visits. However, ED/UC visits are just one aspect of adolescent health. As more U.S. states begin to legalize marijuana, it is critical to evaluate other aspects of health by using multiple modalities of surveillance to fully evaluate the impact on the adolescent population, not just survey methodologies.

Funding Sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- [1] Center for Behavioral Health Statistics and Quality. 2016 national survey on drug use and health: Detailed tables. Rockville (MD): Substance Abuse and Mental Health Services Administration; 2017.
- [2] Johnston LD, O'Malley PM, Miech RA, et al. Monitoring the future national survey results on drug use, 1975–2016: Overview, key findings on adolescent drug use. Ann Arbor: Institute for Social Research, The University of Michigan; 2017.
- [3] Hasin DS, Wall M, Keyes KM, et al. Medical marijuana laws and adolescent marijuana use in the USA from 1991 to 2014: Results from annual, repeated cross-sectional surveys. *Lancet Psychiatry* 2015;2:601–8. doi:10.1016/S2215-0366(15)00217-5.
- [4] Johnson JK, Hodgkin D, Harris SK. The design of medical marijuana laws and adolescent use and heavy use of marijuana: Analysis of 45 states from 1991 to 2011. *Drug Alcohol Depend* 2017;170:1–8.
- [5] Cerda M, Wall M, Fent T, et al. Association of state recreational marijuana laws with adolescent marijuana use. *JAMA Pediatr* 2017;171:142–9.
- [6] University of Colorado Denver Community Epidemiology and Program Evaluation Group. 2015 Healthy Kids Colorado Survey. Available at https://www.colorado.gov/pacific/sites/default/files/PF_Youth_HKCS-2015-Exec-Summary.pdf.
- [7] Pacula RL, Smart R. Medical marijuana and marijuana legalization. *Annu Rev Clin Psychol* 2017;13:397–419.
- [8] Yurasek AM, Hadley W. Commentary: Adolescent marijuana use and mental health amidst a changing legal climate. *J Pediatr Psychol* 2016;41:287–9.
- [9] Ammerman S, Ryan S, Adelman WP, Committee on Substance Abuse, the Committee on Adolescence. The impact of marijuana policies on youth: Clinical, research, legal update. *Pediatrics* 2015;135:e769–85.
- [10] Emergency Department Visits for Substance Abuse. National hospital care survey. Available at: https://www.cdc.gov/nchs/data/nchs/ED_Substance_Abuse_Factsheet.PDF. Accessed November 21, 2017.