



# Prevalence and correlates of cannabis poisoning diagnosis in a national emergency department sample

Christopher P. Salas-Wright<sup>a,b,\*</sup>, Jason T. Carbone<sup>c</sup>, Katherine J. Holzer<sup>c</sup>, Michael G. Vaughn<sup>c,d</sup>

<sup>a</sup> School of Social Work, Boston University, Boston, MA, 02215, United States

<sup>b</sup> Department of Public Health Sciences, Division of Prevention Science and Community Health, University of Miami, Miami, FL, 33146, United States

<sup>c</sup> School of Social Work, College for Public Health and Social Justice, Saint Louis University, St. Louis, MO, 63103, United States

<sup>d</sup> Graduate School of Social Welfare, Yonsei University, Seoul, Republic of Korea

## ARTICLE INFO

### Keywords:

Cannabis  
Marijuana  
Poisoning  
Mental health  
Drug use  
Emergency care

## ABSTRACT

**Background:** One of the primary cannabis-related reasons individuals seek emergency medical care is accidental cannabis poisoning. However, our understanding of the incidence and characteristics of those who receive emergency medical care due to cannabis poisoning remains limited. We address this gap by examining up-to-date information from a national study of emergency department (ED) data.

**Methods:** The data source used for this study is the Nationwide Emergency Department Sample (NEDS). An International Classification of Diseases (ICD-10-CM) diagnostic code was used to identify accidental poisoning by cannabis (T40.7 × 1A) as specified by healthcare providers. Logistic regression was employed to examine the relationship between ED admission for cannabis poisoning, sociodemographic factors, and mental health disorders.

**Results:** In 2016, an estimated 16,884 individuals were admitted into EDs in the United States due to cannabis poisoning, representing 0.014% of the total ED visits for individuals ages 12 and older. Individuals who sought care for cannabis poisoning were more likely to be young, male, uninsured, experience economic hardship, reside in urban central cities, and experience mental health disorders as compared to individuals admitted for other causes. Among cases that included the cannabis-poisoning code, many also had codes for accidental poisoning due to other substances such as heroin (4.7%), amphetamine (10.8%), cocaine (12.9%), and benzodiazepine (21.3%).

**Conclusions:** Despite the limitations of ICD-10 data, findings provide new evidence suggesting that practitioners be attuned to the prevention and treatment needs of high-risk subgroups, and that screening for mental health problems should be standard practice for individuals diagnosed with cannabis poisoning.

## 1. Introduction

We live in a time of tremendous change in cannabis policy in the United States (US). Beginning with California's approval of the Compassionate Use Act of 1996 (Bergstrom, 1997), allowing the use of cannabis for medical purposes, we have seen a steady progression of states opting to decriminalize, medicalize, and, in some cases, legalize the sale, possession, and use of cannabis (Salas-Wright and Vaughn, 2016). Indeed, while cannabis policies vary widely across jurisdictions, at present, cannabis use is only fully *illegal*—that is, not available for medical or recreational use nor decriminalized—in fewer than one third of US states.

As the cannabis policy landscape changes, we see compelling evidence that cannabis use among adults has increased markedly. Hasin

et al. (2015) examined data from the National Epidemiologic Study on Alcohol and Related Conditions (NESARC) and identified a twofold increase in cannabis use between 2001/2002 and 2012/2013. Analyzing data from the National Survey on Drug Use and Health (NSDUH), Compton and colleagues (2016) identified noteworthy increases in both daily and past 12-month cannabis use among adults, with changes beginning in the mid-2000's. During the same period, we also see evidence that fewer Americans view cannabis use as risky (Jarlenski et al., 2017; Okaneku et al., 2015; Salas-Wright et al., 2017; Sarvet et al., 2018) and an increasingly large number support medicalization/legalization initiatives (Hartig and Geiger, 2018; McCarthy, 2018).

Nevertheless, leading voices in public health and addiction medicine remain steadfast that cannabis use brings with it risk of adverse health consequences. Volkow et al. (2014) argue that cannabis should

\* Corresponding author at: School of Social Work, Boston University, 264 Bay State Road, Boston, MA, 02215, United States.

E-mail address: [cpsw@bu.edu](mailto:cpsw@bu.edu) (C.P. Salas-Wright).

<https://doi.org/10.1016/j.drugalcdep.2019.107564>

Received 5 February 2019; Received in revised form 3 July 2019; Accepted 14 July 2019

Available online 18 September 2019

0376-8716/ © 2019 Elsevier B.V. All rights reserved.

**Table 1**  
Receipt of Emergency Department Services for ICD-10 Cannabis Poisoning Diagnosis in 2016.

	ED Admissions for Cannabis Poisoning		Odds Ratio	
	Count	Incidence / 100,000	AOR	(95% CI)
<b>Sociodemographic Factors</b> (with corresponding % of sample)				
Age				
12-17 (6.45)	1781	0.55	<i>ref</i>	
18-29 (21.54)	6700	2.07	1.07	(0.93-1.24)
30-49 (29.84)	5430	1.68	<b>0.57</b>	<b>(0.47-0.69)</b>
50 and older (42.17)	2972	0.92	<b>0.24</b>	<b>(0.20-0.28)</b>
Gender				
Male (42.95)	10,929	3.38	<i>ref</i>	
Female (57.05)	5955	1.84	<b>0.40</b>	<b>(0.36-0.45)</b>
Insurance Payer				
Medicaid/Medicare (53.73)	7648	2.37	<i>ref</i>	
Private Insurance (29.11)	4341	1.34	<b>0.88</b>	<b>(0.79-0.98)</b>
Uninsured (12.31)	4044	1.25	<b>1.60</b>	<b>(1.35-1.89)</b>
Other (4.86)	831	0.26	0.92	(0.74-1.14)
Housing/Economic Problems				
Yes (0.51)	16,547	5.12	<b>1.94</b>	<b>(1.47-2.56)</b>
No (99.49)	337	0.10	<i>ref</i>	
Median Household Income				
Quartile 1 (lowest) (34.98)	5991	1.85	<i>ref</i>	
Quartile 2 (27.33)	3755	1.16	0.86	(0.73-1.02)
Quartile 3 (21.01)	3283	1.02	0.97	(0.81-1.17)
Quartile 4 (highest) (16.68)	3178	0.98	1.22	(0.97-1.54)
Urban-Rural Classification				
Central City (29.58)	6185	1.91	<i>ref</i>	
Suburban (20.81)	3247	1.00	<b>0.75</b>	<b>(0.64-0.88)</b>
Small/Medium City (31.72)	4974	1.54	<b>0.78</b>	<b>(0.62-0.98)</b>
Rural (17.88)	2078	0.64	<b>0.63</b>	<b>(0.50-0.79)</b>

Note: Adjusted odds ratios (AOR) adjusted for age, gender, insurance payer, housing/economic problems, household income, urban-rural classification, and mental health diagnosis. Odds ratios and 95% confidence intervals in bold are statistically significant. ED visits for cannabis poisoning represent 0.014% of the total ED visits for individuals 12 and older included in the 2016 Nationwide Emergency Department Sample. Values presented are survey adjusted population counts.

not be considered a “harmless pleasure”, noting that numerous studies indicate that cannabis use can lead to myriad adverse effects such as impaired memory and motor coordination, paranoia and psychosis, and cannabis use disorder. Scholars and policymakers have continued to examine the degree to which cannabis use is related to risk of injury and hospitalization (National Academies, 2017; Zhu and Wu, 2016). One of the primary cannabis-related reasons individuals seek emergency medical care is *cannabis poisoning*, a condition in which individuals are made ill—often presenting with acute anxiety, intermittent loss of consciousness, or nausea—as a result of excessive use (Galli et al., 2011; Heard et al., 2017). Cannabis poisoning may be of particular concern given increasing THC levels in cannabis (Chandra et al., 2019) and the growing popularity of “edibles” that have a slower psychoactive onset than smoking/vaping (Hudak et al., 2015).

Despite increased cannabis use and concern about cannabis-related medical care, our understanding of the incidence and characteristics of those who receive emergency medical care due to cannabis poisoning remains limited. The present study aims to address this important gap by examining up-to-date, national data on more than 30 million hospital-based emergency department (ED) visits using the Nationwide Emergency Department Sample (NEDS). Specifically, we present information on the demographic and mental health characteristics of individuals ages 12 and older who were admitted into an ED due to cannabis poisoning in 2016.

## 2. Method

### 2.1. Data and sample

Data from the 2016 NEDS Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality (AHRQ) was utilized for this analysis. NEDS is the largest, publicly available all-payer database of ED visits. The 33 million unique visits from 953

hospitals represents a 20 percent stratified sample of all hospital owned EDs in the United States. The weighted analysis allows for the calculation of national estimates, which represent 144 million ED visits (Agency for Healthcare Research and Quality, 2018). The analytic sample includes patients 12 and older discharged from the ED in 2016.

### 2.2. Measures

**Cannabis Poisoning.** A single dichotomous International Classification of Diseases (ICD-10-CM) (World Health Organization, 1993) diagnostic code was used to identify accidental poisoning by cannabis (Code = T40.7 × 1A). Here “accidental” excludes situations in which an individual intends to make themselves ill, focusing instead on poisoning resulting from unintended overconsumption, accidental use of THC-rich products, and other inadvertent poisonings. While healthcare providers have discretion in the selection of a cannabis poisoning diagnosis, symptoms that may prompt an ED visit include but are not limited to: anxiety, paranoia, and psychosis; heart palpitations, arrhythmia, or decreased blood pressure; and abdominal pain, nausea, and vomiting (Cooper and Williams, 2019).

**Mental Health Disorders.** Four mental health disorder categories were also identified on the basis of ICD-10-CM codes. These include psychotic (F20-F29), affective (F30-F39), anxiety (F40-F48), and behavioral and emotional disorders (F90-F98).

**Demographic Variables.** We examined key demographic variables available in the NEDS, including age, gender, median household income in patient’s ZIP code, primary payer, urban-rural classification of the patient, and problems related to housing/economic circumstances (ICD-10 code Z59).

## 3. Analyses

First, we estimated the national incidence of ED admissions for

cannabis poisoning. Using data from the US Census Bureau, as provided by AHRQ, allowed us to calculate the rate of cannabis poisoning ED admissions per 100,000 individuals in the US. Next, we employed logistic regression models to determine which covariates were associated with cannabis poisoning. We also examined differences in effect modification across gender. All estimates were weighted to account for NEDS complex sampling design using the *svyset* command and *svy* prefix in Stata 14.

#### 4. Results

In 2016, an estimated 16,884 individuals (95% CI = 14,846–18,917) were admitted into EDs in the US due to cannabis poisoning. This constitutes a rate of 6.15 admissions per 100,000 residents in the US ages 12 and older. ED visits for cannabis poisoning represented 0.014% of the total ED visits in the NEDS. Notably, among cases that included the cannabis-poisoning code, many also had codes for accidental poisoning due to other substances such as heroin (4.75%), amphetamine (10.77%), cocaine (12.90%), and benzodiazepine (21.32%). Table 1 displays the rate of cannabis poisoning by demographic subgroup and the adjusted odds ratios (AOR) for the odds of ED admission due to cannabis poisoning (as compared to admission for other ailments). Individuals admitted for cannabis poisoning were significantly less likely—compared to those ages 12–17—to be ages 30–49 or 50 and older. Those admitted for cannabis poisoning were also more likely to be uninsured and to experience housing/economic adversity, and to reside in central cities.

Due to large differences in rates across gender, we also tested for effect modification and conducted stratified analyses (not shown) examining the odds of ED admission due to cannabis poisoning among male and female patients. Several salient effect modifications and differences were identified. *First*, with respect to age, women admitted for cannabis poisoning were significantly more likely to be adolescents (ages 12–17) than young adults (ages 18–29) (AOR = 1.63, 95% CI = 1.35–2.00). In contrast, among men, those admitted for cannabis poisoning were significantly more likely to be young adults than to be adolescents (AOR = 1.59, 95% CI = 1.35–1.88). *Second*, among females, cannabis poisoning was not significantly associated with housing/economic adversity (AOR = 1.53, 95% CI = 0.76–3.10, *p* = 0.236); however, among males, those reporting cannabis poisoning were more than two times more likely to report problems related to housing/economic circumstances (AOR = 2.14, 95% CI = 1.55–2.95). That being said, although we see different results in terms of significance among females and males, gender did not significantly modify the link between cannabis poisoning and adversity.

As shown in Fig. 1, among the full sample of patients, those admitted to the ED for cannabis poisoning were significantly more likely to meet criteria for a psychotic, anxiety, mood, or behavioral/emotional disorder. Notably, we found that—among females—the magnitude of the association between cannabis poisoning and risk for an anxiety (AOR = 2.82, 95% CI = 2.34–3.40) or mood disorder (AOR = 2.30, 95% CI = 1.90–2.79) was significantly greater than that for males (Anxiety: AOR = 1.97, 95% CI = 1.63–2.37; Mood: AOR = 1.40, 95% CI = 1.19–1.66). Although gender did not significantly modify the effect, the link between poisoning and behavioral/emotional disorders was slightly stronger among males (AOR = 1.96, 95% CI = 1.49–2.59) than females (AOR = 1.49, 95% CI = 1.02–2.17).

#### 5. Discussion

Findings from the present study, conducted using data from more than 30 million ED visits, provides up-to-date information on the characteristics of individuals who received emergency medical care due to cannabis poisoning in 2016. We see clear evidence that those seeking care were substantially more likely to be young, male, uninsured, experience economic hardship, and reside in central cities. Simply, we see clear evidence that risk of emergency medical care receipt for cannabis poisoning is by no means evenly distributed.

We also see compelling evidence that individuals receiving care in an ED for cannabis poisoning are more likely than other patients to experience mental health disorders. More precisely, we found that risk of mood and anxiety disorders, and childhood onset behavioral and emotional disorders, was elevated among those with cannabis poisoning. This finding is consistent with prior research indicating that rates of psychiatric problems are elevated among marijuana users (Hasin et al., 2016; Oh et al., 2017) as well as research suggesting that drug use, psychological distress, and behavioral problems are closely intertwined (Salas-Wright et al., 2016). Notably, we also found that rates of admission for cannabis poisoning were nearly two times greater among those with psychotic disorders. This too is consistent with prior research suggesting a link between cannabis use and psychosis (Hartz et al., 2014; Moore et al., 2007).

Prior research highlights differences in cannabis use across gender (see Compton et al., 2016), but prior work had not examined gender differences in cannabis poisoning. We present novel findings suggesting that gender differences observed for cannabis use extend to ED admissions for poisoning as well. Beyond the finding that men were more likely than women to be admitted to an ED for cannabis poisoning, we also found that the characteristics of male and female admissions were distinct in important ways. For one, we found that risk of mood/anxiety

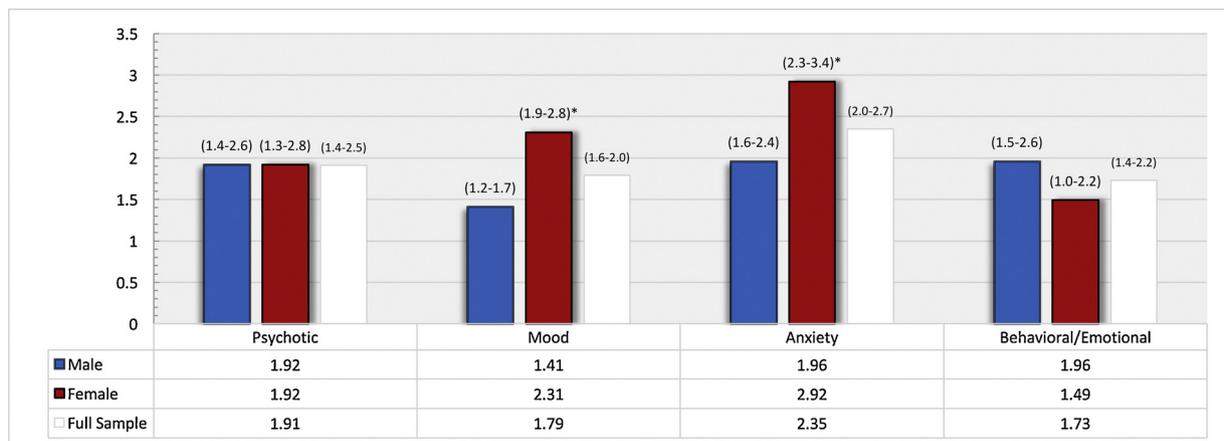


Fig. 1. Adjusted odds ratios (AOR) for the association between ICD-10 cannabis poisoning diagnosis and mental health disorder diagnosis. AORs adjusted for age, gender, insurance payer, housing/economic problems, household income, urban-rural classification, and other mental disorders. Asterisks signify significantly different effects (*p* < .05) between cannabis poisoning and outcomes among the male and female samples.

disorders was particularly pronounced among females admitted for cannabis poisoning. This is in keeping with prior research suggesting that cannabis use severity is more closely related to risk of depression and anxiety among women than among men (Lev-Ran et al., 2012; Patton et al., 2002). We suggest that training programs for clinical professionals emphasize these populations of elevated risk (Alford et al., 2009; Salas-Wright et al., 2018).

## 6. Limitations

Study findings should be interpreted in light of several limitations. First, data are cross-sectional and, therefore, they do not allow for causal interpretation. Second, the NEDS does not provide a population-based comparison for logit models, rather we are limited to comparing differences between individuals admitted to an ED for cannabis poisoning and those admitted for other reasons. Comparisons to the general population (i.e., those who did/did not visit an ED) may provide distinct results. Third, the use of ICD-10 codes has important limitations. For instance, the ICD-10 definition of cannabis poisoning does not allow us to distinguish between intoxication, typical/normal effects of cannabis consumption, and poisoning. It is also likely that healthcare providers' judgment in selecting the cannabis poisoning code may vary, thereby introducing uncertainty. We cannot determine the type/origin of cannabis (e.g., medical marijuana, synthetic cannabis), the mode of ingestion, and whether some cases examined represent repeated visits by the same individual. Finally, the NEDS data do not represent all cannabis-related poisonings as it only includes individuals who elected (or had someone volunteer) to take them to an ED.

## 7. Conclusion

The present study provides new evidence on the characteristics of individuals seeking emergency medical services for cannabis poisoning. Individuals who receive a diagnosis of cannabis poisoning are more likely to be young, male, uninsured, experience economic hardship, reside in urban central cities, and experience mental health disorders. Findings from this study suggest that practitioners be attuned to the prevention and treatment needs of high-risk subgroups, and that screening for mental health problems should be standard practice in the evaluation and treatment of those identified as experiencing cannabis poisoning. We also note that, in light of evidence that many individuals diagnosed with cannabis poisoning are also given diagnoses of poisoning for other substances (e.g., benzodiazepines), future research should examine the interconnectedness of cannabis poisoning with the use of other psychoactive drugs.

## Role of funding source

Research reported in this publication was supported by the National Institute on Alcohol Abuse and Alcoholism of the National Institutes of Health under Award Number K01AA026645. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

## Contributors

Dr. Salas-Wright lead all writing and presentation of data. Dr. Vaughn contributed to the study conceptualization and data analytic plan, as well as the writing and editing of the entire manuscript. Mr. Carbone conducted all statistical analyses. Ms. Holzer wrote the method section, edited text, and contributed to the overall conceptualization of the study. All authors have read and approve of the submission of this manuscript to *Drug and Alcohol Dependence*.

## Declaration of Competing Interest

No conflict declared.

## Acknowledgements

None.

## References

- Agency for Healthcare Research and Quality, 2018. HCUP Nationwide Emergency Department Sample (NEDS). Healthcare Cost and Utilization Project (HCUP), Rockville, MD. [www.hcup-us.ahrq.gov/nedsoverview.jsp](http://www.hcup-us.ahrq.gov/nedsoverview.jsp).
- Alford, D.P., Briden, C., Jackson, A.H., Saitz, R., Amodeo, M., Barnes, H.N., Samet, J.H., 2009. Promoting substance use education among generalist physicians: an evaluation of the Chief Resident Immersion Training (CRIT) program. *J. Gen. Intern. Med.* 24, 40–47.
- Bergstrom, A.L., 1997. Medical use of marijuana: a look at federal and state responses to California's Compassionate Use Act. *DePaul J. Health Care Law* 2, 155–167.
- Chandra, S., Radwan, M.M., Majumdar, C.G., Church, J.C., Freeman, T.P., ElSohly, M.A., 2019. New trends in cannabis potency in USA and Europe during the last decade (2008–2017). *Eur. Arch. Psychiatry Clin. Neurosci.* 269, 5–15.
- Compton, W.M., Han, B., Jones, C.M., Blanco, C., Hughes, A., 2016. Marijuana use and use disorders in adults in the USA, 2002–14: analysis of annual cross-sectional surveys. *Lancet Psychiatry* 3, 954–964.
- Cooper, Z.D., Williams, A.R., 2019. Cannabis and cannabinoid intoxication and toxicity. In: Montoya, L., Weiss, S. (Eds.), *Cannabis Use Disorders*. Springer, Cham., pp. 103–111.
- Hartig, H., Geiger, A., 2018. About Six-In-Ten Americans Support Marijuana Legalization. <http://www.pewresearch.org/fact-tank/2018/10/08/americans-support-marijuana-legalization/>.
- Hartz, S.M., Pato, C.N., Medeiros, H., Cavazos-Rehg, P., Sobell, J.L., Knowles, J.A., Bierut, L.J., Pato, M.T., Genomic Psychiatry Cohort Consortium, 2014. Comorbidity of severe psychotic disorders with measures of substance use. *JAMA Psychiatry* 71, 248–254.
- Hasin, D.S., Kerridge, B.T., Saha, T.D., Huang, B., Pickering, R., Smith, S.M., Jung, J., Zhang, H., Grant, B.F., 2016. Prevalence and correlates of DSM-5 cannabis use disorder, 2012–2013: findings from the National Epidemiologic Survey on Alcohol and Related Conditions–III. *Am. J. Psychiatry* 173, 588–599.
- Hasin, D.S., Saha, T.D., Kerridge, B.T., Goldstein, R.B., Chou, S.P., Zhang, H., Jung, J., Pickering, R.P., Ruan, W.J., Smith, S.M., Huang, B., Grant, B.F., 2015. Prevalence of marijuana use disorders in the United States between 2001–2002 and 2012–2013. *JAMA Psychiatry* 72, 1235–1242.
- Heard, K., Marlin, M.B., Nappe, T., Hoyte, C.O., 2017. Common marijuana-related cases encountered in the emergency department. *Am. J. Health. Syst. Pharm.* 74, 1904–1908.
- Hudak, M., Severn, D., Nordstrom, K., 2015. Edible cannabis-induced psychosis: intoxication and beyond. *Am. J. Psychiatry* 172, 911–912.
- Jarlenski, M., Koma, J.W., Zank, J., Bodnar, L.M., Bogen, D.L., Chang, J.C., 2017. Trends in perception of risk of regular marijuana use among US pregnant and nonpregnant reproductive-aged women. *Am. J. Obstet. Gynecol.* 217, 705–707.
- Lev-Ran, S., Imtiaz, S., Taylor, B.J., Shield, K.D., Rehm, J., Le Foll, B., 2012. Gender differences in health-related quality of life among cannabis users: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug Alcohol Depend.* 123, 190–200.
- McCarthy, J., 2018. Two in Three Americans Now Support Legalizing Marijuana. <https://news.gallup.com/poll/243908/two-three-americans-support-legalizing-marijuana.aspx>.
- Moore, T.H., Zammit, S., Lingford-Hughes, A., Barnes, T.R., Jones, P.B., Burke, M., Lewis, G., 2007. Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *Lancet* 370, 319–328.
- National Academies of Sciences, Engineering, and Medicine, 2017. *The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research*. National Academies Press, Washington, D.C.
- Oh, S., Salas-Wright, C.P., Vaughn, M.G., DiNitto, D.M., 2017. Marijuana use during pregnancy: a comparison of trends and correlates among married and unmarried pregnant women. *Drug Alcohol Depend.* 181, 229–233.
- Okaneku, J., Vearrier, D., McKeever, R.G., LaSala, G.S., Greenberg, M.I., 2015. Change in perceived risk associated with marijuana use in the United States from 2002 to 2012. *Clin. Toxicol. (Phila)* 53, 151–155.
- Patton, G.C., Coffey, C., Carlin, J.B., Degenhardt, L., Lynskey, M., Hall, W., 2002. Cannabis use and mental health in young people: cohort study. *BMJ* 325, 1195–1198.
- Salas-Wright, C.P., Amodeo, M., Fuller, K., Mogro-Wilson, C., Pugh, D., Rinfrette, E., Furlong, J., Lundgren, L., 2018. Teaching social work students about alcohol and other drug use disorders: from faculty learning to pedagogical innovation. *J. Soc. Work Pract. Addict.* 18, 71–83.
- Salas-Wright, C.P., Vaughn, M.G., 2016. The changing landscape of adolescent marijuana use risk. *J. Adolesc. Health* 59, 246–247.
- Salas-Wright, C.P., Vaughn, M.G., Cummings-Vaughn, L.A., Holzer, K.J., Nelson, E.J., AbiNader, M., Oh, S., 2017. Trends and correlates of marijuana use among late middle-aged and older adults in the United States, 2002–2014. *Drug Alcohol Depend.* 171, 97–106.
- Salas-Wright, C.P., Vaughn, M.G., Reingle Gonzalez, J.M., 2016. *Drug Abuse and Antisocial Behavior: A Biosocial Life Course Approach*. Palgrave Macmillan, New

- York.
- Sarvet, A.L., Wall, M.M., Keyes, K.M., Cerdá, M., Schulenberg, J.E., O'Malley, P.M., Johnston, L.D., Hasin, D.S., 2018. Recent rapid decrease in adolescents' perception that marijuana is harmful, but no concurrent increase in use. *Drug Alcohol Depend.* 186, 68–74.
- Volkow, N.D., Baler, R.D., Compton, W.M., Weiss, S.R., 2014. Adverse health effects of marijuana use. *N. Engl. J. Med.* 370, 2219–2227.
- World Health Organization, 1993. *The ICD-10 Classification of Mental and Behavioral Disorders: Diagnostic Criteria for Research*. World Health Organization, Geneva. <https://apps.who.int/iris/handle/10665/37108>.
- Zhu, H., Wu, L.T., 2016. Trends and correlates of cannabis-involved emergency department visits: 2004 to 2011. *J. Addict. Med.* 10, 429–436.