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Psilocybin Exposures Reported to US Poison Centers: National Trends Over a Decade

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A B S T R A C T

Purpose: We describe trends in psilocybin exposures among adolescents and young adults as reported to US poison centers over the past decade.
Methods: We queried the National Poison Data System for cases involving psilocybin during January 1, 2013–December 31, 2022. Persons aged 13–25 years were included. We examined exposures to psilocybin by demographics, clinical effects, level of care, and medical outcome.
Results: During the 10-year study period, 4,055 psilocybin-involved exposures were reported among adolescents and young adults, 2,667 (65.8%) being single substance exposures. Most single substance cases received medical attention (adolescents: 75.3% [n = 1,176], young adults: 72.1% [n = 797]). We did not find significant change in the number of cases during 2013–2018. Cases started increasing in 2019. In 2022, cases more than tripled among adolescents and more than doubled among young adults, compared to 2018 ($p < .0001$).
Discussion: Continued national surveillance is critical to determine the impact of psilocybin exposures on youth as it becomes increasingly available.

IMPLICATIONS AND CONTRIBUTION

This study aims to trend psilocybin exposures among adolescents and young adults as reported to US poison centers over the past decade. Data presented in this paper set the stage for psilocybin exposure surveillance as the substance becomes increasingly available in the United States.

Psilocybin, a psychoactive alkaloid contained in hallucinogenic mushrooms, can cause intense psychedelic experiences, hallucinations, euphoria, and alterations in the perception of space and time. Historically, psilocybin was used as a psychedelic agent in religious and healing rituals [1]. In the United States, psilocybin is designated as Schedule I substance under the Controlled Substances Act. However, since May 2019, several US cities and states have taken steps to decriminalize the possession, use, and cultivation of psilocybin mushroom [2]. In addition to psilocybin-containing mushrooms, psilocybin is available as edibles, in the form of chocolate, gummies, and tea. In 2021, the National Survey on Drug Use and Health found lifetime use of psilocybin to be 9.9% for respondents aged 12 years or more, an increase from 8.1%–8.7% during 2009–2015 [3,4]. Exposure to psilocybin may result in adverse effects such as acute psychosis, delusions, agitation, tachycardia, and hypertension [5]. In this brief, we describe the trends in psilocybin exposures among adolescents and young adults as reported to US poison centers (PCs) over the past decade.

Methods

The National Poison Data System (NPDS) [6] was queried for cases involving exposure to psilocybin, during January 1, 2013–December 31, 2022. We included persons aged 13–25 years. Each

Conflicts of interest: The authors have no conflicts of interest to declare.

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PC submits, in near real-time, deidentified case data to NPDS, after providing necessary poison exposure management and information services to callers from the general public and healthcare providers. We identified cases involving psilocybin using generic code 0058000. Multiple substances (multiple exposures) can be reported for each call. We excluded cases classified as a confirmed nonexposure (reliable and objective evidence that exposure to hallucinogenic mushroom never occurred). Data included age, sex, level of healthcare received, reason for exposure, and medical outcome. The study was conducted on deidentified NPDS data and was exempt from comprehensive Institutional Review Board review.

Medical outcome classification

Cases followed to a known clinical outcome are coded as no effect (no symptoms occurred due to exposure), minor effect (symptoms were minimally bothersome), moderate effect (symptoms were more prolonged or systemic that usually require treatment), major effect (symptoms were life-threatening or resulted in significant disability or disfigurement), or death. Further details regarding data collection and definitions in NPDS are detailed in the NPDS annual reports [6].

Statistical analysis

We analyzed data using SAS statistical software (version 9.4; SAS Institute). We described psilocybin single substance cases and all psilocybin-involved cases and stratified data by age group. The description of all psilocybin-involved cases provides insights on the extent and characteristics of exposures involving psilocybin. The description of single substance cases provides additional information on the reason and severity of single substance exposures and allows the reader to assess the burden of psilocybin exposures on the health system. We analyzed

Table 1
Characteristics of single substance and all psilocybin-involved exposures among adolescents and young adults—National Poison Data System, United States, January 1, 2013—December 31, 2022

Characteristics	Psilocybin single substance exposures (N = 2,667)		All psilocybin-involved exposures (N = 4,055)	
	Adolescents (n = 1,561)	Young adults (n = 1,106)	Adolescents (n = 2,372)	Young adults (n = 1,683)
Sex				
Male	1,180 (75.6)	833 (75.3)	1,774 (74.8)	1,264 (75.1)
Female	377 (24.2)	273 (24.7)	594 (25.0)	419 (24.9)
Unknown	4 (0.2)	0	4 (0.2)	0
Reason for exposure				
Intentional—Abuse[a]	1,334 (85.5)	936 (84.6)	1,924 (81.1)	1,317 (78.3)
Intentional—Misuse[e]	64 (4.1)	40 (3.6)	80 (3.4)	56 (3.3)
Intentional—Suspected suicide	38 (2.4)	35 (3.2)	175 (7.4)	161 (9.6)
Intentional—Unknown	32 (2.0)	19 (1.7)	68 (2.9)	42 (2.5)
Unintentional—General[b]	43 (2.8)	39 (3.5)	52 (2.2)	47 (2.8)
Unintentional—Misuse[f]	16 (1.0)	10 (1.0)	19 (0.8)	13 (0.8)
Unknown	15 (1.0)	11 (1.0)	25 (1.0)	25 (1.5)
Other[c]	19 (1.2)	16 (1.4)	29 (1.2)	22 (1.2)
Level of care at healthcare facility				
Admission to CCU	56 (3.6)	45 (4.1)	191 (8.1)	137 (8.1)
Admission to NCCU	102 (6.5)	68 (6.1)	208 (8.8)	137 (8.1)
Treated in healthcare facility	989 (63.3)	656 (59.4)	1,433 (60.4)	952 (56.6)
Admission to psychiatric facility	29 (1.9)	28 (2.5)	84 (3.5)	82 (4.9)
Not referred to healthcare facility	178 (11.4)	135 (12.2)	206 (8.7)	157 (9.3)
Refused referral/did not arrive	57 (3.7)	52 (4.7)	65 (2.7)	55 (3.3)
Lost to follow-up/left AMA	150 (9.6)	122 (11.0)	185 (7.8)	163 (9.7)
Medical outcome				
Death	0	0	2 (0.1)	0
Major effect	46 (2.9)	32 (2.9)	98 (4.1)	85 (5.1)
Moderate effect	735 (47.1)	500 (45.3)	1,180 (49.7)	809 (48.1)
Minor effect	398 (25.5)	277 (25.0)	604 (25.5)	402 (23.9)
No effect	51 (3.3)	32 (2.9)	78 (3.3)	51 (3.0)
Not followed (minimal or no expected clinical effects)	128 (8.2)	102 (9.2)	154 (6.5)	132 (7.8)
Unable to follow, judged as a potentially toxic exposure	170 (10.9)	133 (12.0)	204 (8.6)	168 (10.0)
Unrelated effect[d]	33 (2.1)	30 (2.7)	52 (2.2)	36 (2.1)

CCU = critical care unit; NCCU = noncritical care unit; AMA = against medical advice.

[a] An exposure resulting from the intentional improper or incorrect use of a substance where the patient was likely attempting to gain a high, euphoric effect or some other psychotropic effect, including recreational use of a substance for any effect.

[b] All unintended exposures that are not otherwise defined.

[c] Unintentional—food poisoning, unintentional-occupational, adverse drug reaction, other-malicious, and other-contamination/tampering.

[d] The exposure was probably not responsible for the effect(s).

[e] An exposure resulting from the intentional improper or incorrect use of a substance for reasons other than the pursuit of a psychotropic effect.

[f] Unintentional improper or incorrect use of a nonpharmaceutical substance. Unintentional misuse differs from intentional misuse in that the exposure was unplanned or not foreseen by the patient.

trends in frequency using Poisson regression methods, stratified by age group (13–19, 20–25 years) and sex.

Results

During the 10-year study period, 4,055 psilocybin-involved exposures were reported to US PCs among adolescents and young adults (13–25 years), 2,667 (65.8%) being single substance exposures (Table 1). Of all psilocybin-involved exposures, males accounted for 74.8% (n = 1,774) of adolescents and 75.1% (n = 1,264) of young adults. The most frequently co-occurring substances among adolescents (n = 326; n = 144) and young adults (n = 164; n = 189) were marijuana and alcohol, respectively. Most exposures were classified as intentional abuse in both adolescents (n = 1,924; 81.1%) and young adults (n = 1,317; 78.3%) (Table 1). Most single substance cases received medical attention, including visits to healthcare facilities, admission to critical or noncritical care units or admission to psychiatric facilities (adolescents: 75.3% [n = 1,176]; young adults: 72.1% [n = 797]) and resulted in moderate effect in adolescents (n = 735; 47.1%) and young adults (n = 500; 45.3%). The most frequent clinical effects among single substance exposures included hallucinations/delusions (n = 975; 36.6%), agitation (n = 737; 27.6%), tachycardia (n = 539; 20.2%), and confusion (n = 426; 16.0%). Seizures were reported in 1.8% of single substance exposures (n = 49). Two cases of death were reported in association with psilocybin, both in multisubstance exposures. Fentanyl and hallucinogenic amphetamine were the primary cause of death in those two cases, respectively, with psilocybin ranked as the secondary cause of death.

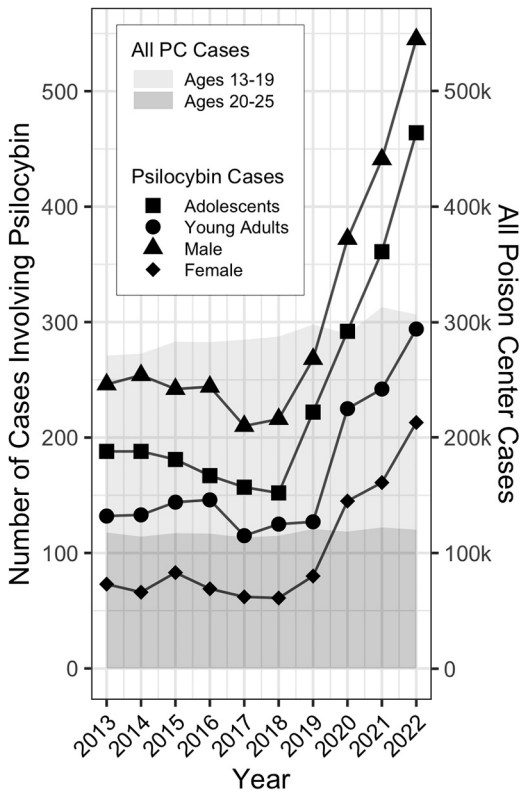

Figure 1. Trends in hallucinogenic mushroom poisonings among adolescents and young adults reported to US Poison Centers–United States, January 1, 2013–December 31, 2022.

Between 2013 and 2018, the number of psilocybin-related cases did not significantly change among adolescents, young adults, males, and females (Figure 1). We observed a significant yearly increase in the number of psilocybin-related cases among adolescents, starting 2019, and among young adults, starting 2020 ($p < .001$). In 2022, cases more than tripled among adolescents ($p < .0001$) and more than doubled among young adults, compared to 2018 ($p < .0001$) (Figure 1). Between 2013 and 2022, the number of cases more than doubled among males (246 vs. 545; $p < .0001$) and almost tripled among females (73 vs. 213; $p < .0001$). Between 2013 and 2022, analysis of PCs call volume revealed a yearly increase of < 4% in exposure calls among adolescents, except for 2021 (11% increase), 2020, and 2022 (2% and 3% decrease, respectively). On the other hand, the change in overall PC call volume among young adults ranged between −3% and +5%.

Discussion

NPDS data analyses demonstrated a significant increase in psilocybin-related calls to PCs, among adolescents and young adults that started in 2019 and continued into 2022. The increase in psilocybin-related calls cannot be explained by the change in PCs call volume. While the overall yearly total PCs exposure call volume is fluctuating, psilocybin-related calls are steadily increasing since 2019. Little is known on the current psilocybin-related emergency department visits. The Drug Abuse Warning Network data suggested an increasing trend in psilocybin-related emergency department visits between 2004 and 2011. However, the Drug Abuse Warning Network was discontinued after 2011 [3].

Our study is not designed to assess the impact of decriminalization in certain cities and states on the increase in psilocybin exposures among adolescents and young adults. However, several studies demonstrated the rise in cannabis poisoning among children and adolescents, following medicinal or recreational cannabis legalization/decriminalization. It is noteworthy that most evidence came from the United States [7].

Our findings are subject to at least four limitations. First, NPDS data are not designed to assess potential risk factors leading to increases in psilocybin-related cases. Second, reporting to PCs is voluntary; thus, NPDS data are an under-representation of all cases of hallucinogenic mushroom poisonings among adolescents and young adults. Third, NPDS data represent a fraction of the exposures. NPDS does not capture exposures in adolescents and young adults who do not develop signs and symptoms severe enough to call the PC or seek medical attention. This might have led to an overestimation of the severity of exposure to psilocybin. Fourth, NPDS data are susceptible to reporting and misclassification biases as data are affected by completeness of reporting from healthcare providers and the lay public, and accuracy of coding by PCs staff.

Conclusions

During the past decade, the number of psilocybin-related calls among adolescents and young adults reported to PCs significantly increased. This is particularly alarming since states and cities that have decriminalized psilocybin do not allow individuals aged less than 21 years its access or use. As psilocybin

might become more available, continued surveillance is critical to inform lawmakers and help guide public policy.

America's PCs maintain the NPDS, which houses deidentified case records of self-reported information collected from callers during exposure management and poison information calls managed by the country's PCs. NPDS data do not reflect the entire universe of exposures to a particular substance as additional exposures may go unreported to PCs; accordingly, NPDS data should not be construed to represent the complete incidence of US exposures to any substance(s). Exposures do not necessarily represent a poisoning or overdose and America's PCs are not able to completely verify the accuracy of every report. Findings based on NPDS data do not necessarily reflect the opinions of America's PCs.

Funding Sources

None.

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