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Pediatric Cannabis Poisonings, United States Hospital Emergency Departments, 2018-2023

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Abstract

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Keywords

delta, tetrahydrocannabinol (THC), edibles, unintentional consumption, child safety

Acknowledgements/Disclaimers/Disclosures

The authors have no conflicts of interest to declare.

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Pediatric Cannabis Poisonings, United States Hospital Emergency Departments, 2018-2023**Matthew E. Rossheim,* PhD****Kayla K. Tillett, MPH****Cassidy R. LoParco, PhD****Melvin D. Livingston, PhD****Eric K. Soule, PhD****Carla J. Berg, PhD****Abstract**

This study estimated the annual number of pediatric cannabis poisonings and examined characteristics of patients and cannabis products involved. We reviewed case narratives and analyzed data from the National Electronic Injury Surveillance System (NEISS) among children 0-11 years. Our analysis identified 370 cases of pediatric cannabis poisoning, with most (90.5%) occurring in children 4 years or younger. 78% of identified products were cannabis edibles, primarily gummies. 45% were examined/treated without admission, 45% admitted/hospitalized, 5% held for observation, and 5% treated/transferred. By applying sampling weights, we estimated 8,429 pediatric cannabis poisonings presenting to U.S. hospital emergency departments from 2018 to 2023, with significant increases (by 461%) over this period. Findings suggest a sharp rise in pediatric cannabis poisonings, likely linked to the expanded cannabis market and proliferation of cannabis products resembling popular children's snacks. Stricter laws/regulations and other preventive measures are needed to protect vulnerable populations from accidental cannabis ingestion.

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Introduction

Cannabis products have recently become increasingly accessible throughout the United States. From 2018 to 2023, the retail availability of legal non-medical cannabis increased from 8 to 20 states (DISA, 2024). Moreover, following the Agriculture Improvement Act of 2018 (AKA 2018 Farm Bill), retail stores in other states began selling delta-8 tetrahydrocannabinol (THC) and other intoxicating products derived from hemp (LoParco et al., 2023).

The Farm Bill's definition of hemp ($\leq$ 0.3% delta-9 THC by weight) has resulted in the nationwide availability of intoxicating

cannabinoids synthesized from hemp, such as delta-8 THC (Rossheim et al., 2024a), which function similarly to the controlled substance delta-9 THC (i.e., marijuana) (LoParco et al., 2023; Rossheim et al., 2023). Moreover, businesses are calling delta-9 THC-laced food and beverages "hemp" and are also selling these products widely, including in smoke/vape shops (Rossheim et al., 2024a). The heavy weight of the food/drink means they can have high levels of delta-9 THC while still being under the 0.3% delta-9 THC by weight threshold. The increased availability of cannabis products is reflected in usage trends, with 2022 being the first year

Figure 1
Examples of THC edibles with youth-oriented packaging



that daily cannabis use exceeded daily alcohol consumption (Caulkins, 2024).

THC products are often sold resembling candy and snack brands popular among children (Figure 1) (FDA, 2022). This can lead to children unintentionally ingesting large doses of cannabinoids, causing sleepiness, confusion, difficulty walking, and – in severe cases – breathing problems, loss of consciousness, seizures, and death (FDA, 2022; Richards et al., 2017). Thousands of calls to U.S. poison control centers for delta-8 THC exposure have been reported, many involving pediatric patients (FDA, 2022). Yet, few studies have examined pediatric cannabis poisonings presenting at U.S. emergency departments since the cannabis market’s recent expansion.

Using National Electronic Injury Surveillance System (NEISS) data, Hammig and colleagues (2023) found an estimated 476 cases of pediatric cannabis poisonings presenting to hospital emergency departments in 2019 and an estimated 769 case in 2020. However, these findings are likely prior to the full effect of the Farm Bill on the cannabis retail market. Specifically, the first delta-8 THC related emergency department visit observed in the CDC’s National Syndromic Surveillance Program

(NSSP) presented in September 2020, and – seeing increased availability and reported cases of adverse events – the CDC issued an official health advisory on delta-8 THC in 2021 (CDC, 2021). Reflecting the growing public interest, by May 2021, there was one “delta 8” Google search in the U.S. for every 3 Google searches for “marijuana” (Livingston et al., 2022). Moreover, by 2023, intoxicating cannabis products were being sold in retail stores in every state (Rossheim et al., 2024a). One nationwide study of large cities noted their sale in 74% of smoke shops (Rossheim et al., 2024a). Considering the recent changes in cannabis product availability, there is an urgent need for more recent estimates of pediatric cannabis poisonings.

The current study estimated annual pediatric cannabis poisonings from 2018 to 2023 and examined patient and product characteristics. We hypothesized that pediatric cannabis poisonings would substantially increase during the study timeframe — due to the large expansion of cannabis retail — and that most of these pediatric poisonings would involve product types that likely appeal to children including gummies, chocolate bars, cookies, and candy. Moreover, we utilized additional keywords to

help detect cases exposed to cannabinoids derived from hemp.

Methods

Data Source

We analyzed National Electronic Injury Surveillance System (NEISS) data collected by the U.S. Consumer Product Safety Commission (CPSC). NEISS utilizes data from a probability sample of 100 of the more than 5,000 U.S. hospitals with at least 5 beds and an emergency department (CPSC, 2024). These data are designed to be weighted to provide nationally representative estimates of the total number of emergency department visits for injuries and poisonings and any associated consumer products.

Specifically, the NEISS system uses a fixed set of hospitals that do not change each year unless there is a specific reason to adjust the sample (CPSC, 2001). This set includes approximately 100 hospitals that have been selected to form a nationally representative sample based on various factors such as size, location, and the annual volume of emergency department visits. The method utilized stratified random samples for five strata, four based on size (number of emergency department visits), and the final one comprised of specialized children's hospitals (CPSC, 2001). Publicly available NEISS data do not include information about geographic locations.

To help ensure estimates are valid, the CPSC regularly updates the sampling frame, which includes reviewing all U.S. hospitals that meet inclusion criteria and their associated emergency department visit volumes. The agency then appropriately ratio-adjusts the statistical weights for the current NEISS sample to reflect the latest available data on the total number of emergency department visits (CPSC, 2000).

Keyword Search

We used information on patient demographic characteristics, diagnoses, and brief narratives describing events leading to the emergency department visit to identify and characterize cases. These narratives are derived from chart notes prepared by the medical staff at the time of the patient's emergency department visit (CPSC, 2000). We searched case narratives for keywords that reflect terminology commonly used for describing cannabis products, specifically: THC, marij*, marih*, canna*, canni*, mj, delta, cbd, hemp. The terms "CBD" and "hemp" were included in our search criteria due to the inconsistent and often inaccurate descriptions of products in the incident reports, which blurred distinctions between non-intoxicating and intoxicating cannabis derivatives. This approach was necessary because the descriptions provided did not allow for a reliable separation of product types.

Inclusion Criteria and Data Analysis

Inclusion criteria were patients 0-11 years old who ingested or inhaled cannabis products and were diagnosed with poisoning (diagnosis code 68). We focused on this age group based on prior research, indicating that their exposure is almost exclusively unintentional, and they are particularly susceptible to adverse effects (Hammig et al., 2023). Using case narratives, we created codes for the cannabis product type(s) (i.e., edibles, vapes/oil, and flower).

Our keyword search identified 462 cases among patients 0-11 years old. Each case was independently dual coded for both eligibility to be included in the study sample and, for those included, the types of cannabis products involved. We achieved 100% agreement in our coding process.

Table 1*Pediatric cannabis poisonings*

Year	Cases in Sample	National Estimate of Cases (95% CI)	Comparison Years	OR (95%CI)
Overall	370	8,429 (5099, 11759)		
2018	13	417 (0, 916)	--	--
2019	29	534 (109, 959)	2019 vs 2018	1.33 (0.54, 3.24)
2020	61	1,107 (503, 1710)	2020 vs 2019	2.54 (1.19, 5.43)
2021	83	1,536 (645, 2426)	2021 vs 2020	1.30 (0.76, 2.20)
2022	88	2,497 (1488, 3506)	2022 vs 2021	1.51 (0.93, 2.45)
2023	96	2,339 (1297, 3381)	2023 vs 2022	0.93 (0.59, 1.46)

Wald-type confidence intervals are estimated for each frequency. However, an alternative asymmetric CI based on an equivalent logistic regression model accounting for the complex survey design was estimated for the year 2018 to avoid bounding the CI estimates at 0 (estimated cases = 417, 95% CI: 138, 1258).

Unweighted percentages were used to describe the sample. Then, we generated weighted annual national estimates of pediatric cannabis poisonings from 2018 to 2023. To fully describe the trends over time, we estimated complex survey adjusted logistic regression models with year treated as a continuous linear variable, as well as treating year categorically to estimate the relative change between years. Additionally, we estimated associations between race/gender and the odds of being a pediatric cannabis poisoning case pooled across all years. This study was deemed “not human subjects research” by the lead author’s Institutional Review Board.

Results

Our keywords and inclusion criteria resulted in 370 cases (51.6% female). Most (90.5%) were ≤ 4 years old: 0-1 (38%), 2 (22%), 3 (17%), 4 (14%), 5 (3%), 6-11 years ($< 7\%$). Among cases with information on ethnicity ($n = 208$) 18.75% were Hispanic, and among those with information about race ($n = 219$), 50% were white and 41% were Black/African American.

Among cases with known product type (75%; $n = 276$), 78% were edibles, 10% vapes/oil, and 8% flower (including joints/blunts). Gummies comprised 66% of edibles and 51% of total products. Delta-8 THC products were specifically mentioned in 27 cases, all occurring within the span of 2021 to 2023. Just under half of all cases (45%) were treated/examined and released (i.e., not admitted), 45% admitted/hospitalized, 5% held for observation, and 5% treated and transferred to another hospital.

There were an estimated 8,429 pediatric cannabis poisonings presenting to U.S. hospital emergency departments from 2018 to 2023. Table 1 contains annual estimates, with an estimated 417 cases in 2018 (95% CI: 0, 916) and 2,339 in 2023 (95% CI: 1297, 3381), a 461% increase. The largest relative increase occurred between 2020 and 2019 (OR = 2.54, 95% CI: 1.19, 5.43), while the number of additional pediatric poisonings appears to have stabilized between 2022 and 2023 (OR = 0.93, 95% CI: 0.59, 1.46). When the relationship between time and the log-odds of pediatric poisoning was estimated as linear, we estimated an average annual

increase of 42% in the odds of a pediatric poisoning (OR=1.42, 95%CI: 1.23, 1.64).

Across all years, compared to White patients, Black patients had 2.5 times the odds of being a pediatric cannabis poisoning case (OR = 2.50, 95% CI: 1.58, 3.97). No difference was observed by gender.

Discussion

The current study illustrates an increasing pattern of pediatric cannabis poisonings treated in U.S. hospital emergency departments. This increase appears to correspond with the rapid growth of cannabis retail availability in the U.S. (DISA, 2024; Rossheim et al., 2024a). Patient disposition data highlight that a substantial number of these incidents required considerable medical attention.

This study found that Black patients had significantly greater odds of being a pediatric cannabis poisoning case than White patients. This disparity likely reflects broader structural and social determinants of health, including differences in retail availability, marketing practices, and socioeconomic factors that influence cannabis product exposure. Future research should explore the underlying causes of this disparity and identify policies that can mitigate inequities in pediatric cannabis exposure and poisoning outcomes. Although this race-based disparity was statistically significant in our analysis across all years, small sample sizes and missing data limited our ability to conduct more granular stratified analyses—such as by product type or race/ethnicity within specific years—and to detect statistically significant differences across certain time periods. As with most complex survey data, estimates based on larger samples are generally more stable and reliable (CPSC, 2024).

Product types were predominantly those that would appeal to children, and most cases (90.5%) involved children 4 years or

younger. This is likely influenced by the NEISS coding manual, which specifies to only code poisonings for children < 5 years old (CPSC, 2023). Because of this variation in coding criteria and the lack of a product code for cannabis in the database, estimates are likely underestimations, despite our use of numerous keywords which detected more cases than previous studies using these data (Hammig et al., 2023). However, the age distribution of cases even among those under 5 years old suggests that very young children may be more frequently poisoned with cannabis, potentially due to their developmental stage and likelihood of ingesting edibles mistaken for candy and/or more severe presentation of symptoms that warrant medical attention at a hospital emergency department.

The variability in terminology used to describe cannabis products, such as “contains CBD or THC,” “CBD hemp infused gummies,” “Delta 8 CBD gummies,” and “Delta 9 CBD gummy,” suggests a potential misunderstanding of these products by individuals reporting or recording exposure incidents. This confusion underscores a limitation in the dataset, as it was not possible to clearly disentangle the specific substances involved based solely on the reported descriptions. This mislabeling not only affects data collection but also exposes a critical public health concern regarding consumer awareness. A study conducted in Fort Worth, TX found that, when asked “What is delta-8?”, retailers often likened the product CBD or hemp, which are non-intoxicating (LoParco et al., 2022), raising concerns about widespread misinformation and the potential for unintentional intoxication among consumers.

Our findings reveal a significant increase in pediatric cannabis poisonings presenting to hospital emergency departments starting in 2020. This aligns with data from the Pediatric Health Information System database, which

included 45 U.S. hospitals and also noted a substantial increase in pediatric cannabis poisonings beginning in 2020 (Toce et al., 2023). However, many exposure cases may not present to hospital emergency departments. For instance, from 2021 to 2024, there were more than 10,000 calls to U.S. poison control centers related to delta-8 THC (America's Poison Centers, 2025), with children representing a large proportion of those exposed (Smith et al., 2024). Importantly, delta-8 THC is just one of dozens of hemp-derived intoxicating cannabinoids now sold in the U.S. (Rossheim et al., 2024b). Enhanced laws, accompanied by education and enforcement, are likely needed to prevent pediatric cannabis exposure and related poisonings.

Implications for Health Behavior Research

The rapid increase in pediatric cannabis poisonings revealed in this study highlights an urgent need for health behavior research to inform prevention, education, and policy efforts. A primary area of focus should be the role of product design, branding, and packaging, particularly for edibles that mimic popular children's snacks and candy. The current study underscores the need for comprehensive documentation of product characteristics in reports of cannabis poisonings. Research is also needed to assess the effectiveness of interventions such as standardized, clear labeling practices that accurately convey product contents/risks and child-resistant packaging. Public health campaigns targeting parents and caregivers may also help raise awareness about the dangers of storing cannabis products in ways accessible to children. Nearly half of these poisonings required hospitalization, underscoring the importance of studying the acute and long-term health outcomes of these incidents. Examining disparities in poisoning

rates across geographic and demographic groups could help identify populations at heightened risk and inform equitable prevention strategies. Finally, as cannabis legalization expands, researchers should evaluate the impact of state regulatory measures—such as marketing restrictions, potency limits, and enforcement of product safety standards—on reducing pediatric exposures. This research is critical to guiding evidence-based policies that protect children from the escalating risks posed by the increasingly commercialized cannabis industry (Rossheim et al., 2024a).

Discussion Questions

How do specific product characteristics contribute to unintentional pediatric poisonings, and what research is needed to understand their role in these incidents?

What are the acute and long-term health impacts of pediatric cannabis poisonings, and how can future studies better quantify these effects to guide public health interventions?

Are certain populations (e.g., based on geography, socioeconomic status, or ethnicity) at greater risk for pediatric cannabis poisonings? What research is needed to identify and address these disparities?

How effective are current state policies, such as child-resistant packaging and product labeling requirements, in preventing pediatric cannabis poisonings? What additional measures or modifications could be evaluated through research?

How do parental knowledge, attitudes, and behaviors regarding cannabis storage and safety influence pediatric exposure? What types of public health campaigns or educational initiatives could mitigate these risks?

Ethical Approval Statement

This study was deemed “not human subjects research” by the lead author’s Institutional Review Board.

Conflict of Interest

The authors report no conflicts of interest.

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