

Emergency Department Presentations of Cannabis-Related Neuropsychiatric Toxicity in Children and Adolescents

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ABSTRACT

Background: Pediatric cannabis exposures in the United States have risen with expanding legalization, increased availability of edible products, and higher emergency department (ED) utilization. Neuropsychiatric manifestations are clinically significant because they can mimic primary psychiatric or neurologic disease and often require intensive management. Their prevalence and characteristics in pediatric ED settings remain incompletely defined.

Methods: We conducted a retrospective cohort study of patients younger than 19 years diagnosed with cannabis toxicity at seven Michigan EDs (rural, university-affiliated, and tertiary pediatric) from November 2018 through March 2024. Demographics, exposure characteristics, clinical features, and outcomes were compared between patients with neuropsychiatric symptoms and those with other toxicity using chi-squared and t-tests.

Results: Among 936 encounters, 444 patients (47.4%) had neuropsychiatric symptoms and 492 (52.6%) had other toxicity. Common neuropsychiatric presentations included acute anxiety (23.4%), somnolence (21.0%), depression (10.8%), aggression or mania (9.2%), hallucinations (6.1%), delusions (5.9%), and seizures (5.4%). Compared with others, these patients were more likely to be female, have edible exposures, preexisting psychiatric conditions, and polysubstance use. Fifty-three patients (11.9%) required sedation and/or restraints, and approximately one-third required admission, psychiatric transfer, or incarceration.

Conclusions: Neuropsychiatric toxicity accounted for nearly half of pediatric cannabis-related ED visits and was associated with substantial resource use and frequent escalation of care. Higher-risk features included edible ingestion, psychiatric comorbidity, and polysubstance use. These findings support prevention strategies emphasizing safe storage, caregiver counseling, and targeted risk recognition in adolescents.

Keywords: Cannabis; Pediatric; Adolescents; Emergency department; Neuropsychiatric; Toxicity; Edibles; Psychiatric comorbidity; Polysubstance use

Introduction

Cannabis exposure among children and adolescents has become an increasingly visible emergency medicine problem as recreational legalization has expanded and commercial products have become more accessible¹⁻³. Edible preparations are particularly concerning because they may contain high concentrations of tetrahydrocannabinol, resemble routine snack products, and are associated with both unintentional ingestion in younger children and intentional use among adolescents⁴. At the same time, clinicians must distinguish cannabis toxicity from primary neurologic, toxicologic, and psychiatric illnesses in patients whose symptoms may be nonspecific or behaviorally disruptive⁵.

Prior literature has documented rising pediatric emergency department visits for cannabis exposure and highlighted common manifestations, including altered mental status, lethargy, ataxia, irritability, and vomiting^{3,4,6}. Broader reviews of cannabis-related emergency care also report that anxiety, panic, psychosis, and agitation occur across age groups and may necessitate prolonged observation, sedation, or psychiatric evaluation^{2,3,5}. However, the pediatric literature has focused heavily on unintentional ingestion in younger children, while less is known about the prevalence and full spectrum of neuropsychiatric chief complaints in a mixed population of children and adolescents treated in diverse emergency department settings.

Michigan is an important setting for this question because legalization of recreational cannabis was associated with an increase in statewide emergency department visits for acute cannabis intoxication. The present study therefore examined pediatric emergency department presentations of cannabis-related neuropsychiatric toxicity across seven Michigan hospitals. The objective was to describe the prevalence, clinical characteristics, and disposition of neuropsychiatric presentations compared with other forms of cannabis toxicity.

Methods

Study Design/Setting

This retrospective cohort analysis included consecutive children and adolescents diagnosed with cannabis toxicity in seven emergency departments in Michigan from November 2018 through March 2024. Participating sites comprised three rural medical centers, three university-affiliated hospitals, and one tertiary children's hospital, spanning 13 counties. This multicenter design was intended to capture a broad range of pediatric cannabis presentations across regional practice settings.

Study population

All emergency department patients younger than 19 years who presented to participating hospitals between November 2018 and March 2024 with acute cannabis-related disorders or poisoning were eligible for inclusion. For individuals with multiple ED encounters during the study period, each visit was included in the analysis. Cases were identified through institutional data acquisition services using primary ICD-10 diagnostic codes F12 (cannabis-related disorders) and T40.7 (cannabis poisoning). Patients with missing or incomplete documentation were excluded. Children were categorized into two cohorts: those presenting with neuropsychiatric symptoms and those presenting with other forms of cannabis toxicity.

Data collection

Data was collected by a team of medical students trained in chart abstraction using simulated electronic medical records. Data was recorded on a standardized abstraction form. A single investigator supervised the abstraction process and ensured consistent application of variable definitions. Questionable cases were jointly reviewed by all investigators to reach consensus and assign the appropriate code. Collected variables included demographics; exposure characteristics such as edible use, preexisting psychiatric conditions, and polysubstance use; presenting symptoms; need for restraint or sedation; emergency department length of stay; and final disposition. For this study, cannabis intoxication was defined as alterations in perception, mild motor impairment, euphoria, and intensification of ordinary sensory experiences⁷. Cannabis toxicity was defined as harmful effects resulting from excessive use or consumption of cannabis products, particularly those with high concentrations of psychoactive compounds such as tetrahydrocannabinol (THC)⁵. Cannabinoid hyperemesis syndrome (CHS) was defined by chronic cannabis use with recurrent episodes of nausea and vomiting and abdominal discomfort, often relieved by hot bathing⁸.

Statistical analysis

The primary outcome of this study was the prevalence and clinical characterization of neuropsychiatric cannabis toxicity among pediatric emergency department visits for cannabis exposure. A priori sample size estimation indicated that approximately 1,000 participants would be required to achieve 95% confidence with a $\pm 3\%$ margin of error around the estimated proportions⁹. Secondary outcomes included measures of acuity and resource utilization, as well as disposition outcomes. Data were entered into a Microsoft Excel database (Microsoft Corp., Redmond, WA, USA), and all analyses were conducted using SAS statistical software (SAS Institute, Cary, NC, USA). One investigator performed a blinded critical review of a random 10% sample of charts to assess data reliability using kappa statistics. Pearson's chi-squared test, Fisher's exact test, and one-way ANOVA were used to compare the two study cohorts across key demographic and outcome variables, with a P value < 0.05 considered statistically significant. The study protocol was approved by the Institutional Review Board at Corewell Health.

Results

A total of 936 pediatric patients were evaluated for cannabis toxicity during the study period. Of these, 444 (47.4%) presented with neuropsychiatric symptoms as the chief complaint, while 492 (52.6%) had other forms of cannabis toxicity, most commonly intoxication or cannabinoid hyperemesis syndrome. Neuropsychiatric manifestations therefore accounted for a substantial proportion of pediatric cannabis-related emergency encounters in this cohort.

The neuropsychiatric cohort had a mean age of 16.3 years, compared with 16.9 years in the non-neuropsychiatric cohort, and 57.0% were female, compared with 48.8% in the comparison group (**Table 1**). White patients comprised 65.8% of the neuropsychiatric cohort and 56.9% of the other-toxicity cohort. Neuropsychiatric presentations were also more often associated with edible exposure (29.5% vs 15.2%), psychiatric comorbidity (15.3% vs 9.2%), and polysubstance abuse (22.1% vs 15.7%).

Table 1: Demographic and clinical characteristics of pediatric patients with cannabis-related neuropsychiatric symptoms versus other cannabis toxicity.

Variable	Neuropsychiatric symptoms (n=444)	Other cannabis toxicity (n=492)	P value
Mean age, years (SD)	16.3 (1.3) _	16.9 (1.7) _	<0.001 _
Female sex	253 (57.0%) _	240 (48.8%) _	0.0122 _
White race	292 (65.8%) _	280 (56.9%) _	0.0053 _
Duration of symptoms, hours	3.3 (4.0) _	15.1 (19.5) _	<0.001 _
Edible cannabis exposure	131 (29.5%) _	75 (15.2%) _	<0.001 _
Psychiatric comorbidity	68 (15.3%) _	45 (9.2%) _	0.0043 _
Polysubstance abuse	98 (22.1%) _	77 (15.7%) _	0.0123 _
Sedation and/or restraint	53 (11.9%) _	17 (3.5%) _	<0.001 _
ED length of stay, hours	4.7 (3.3) _	2.9 (2.4) _	<0.001 _
Hospital admission	69 (15.5%) _	44 (8.9%) _	0.0020 _
Psychiatric transfer	57 (12.8%) _	11 (2.2%) _	<0.001 _
Jail disposition	20 (4.5%) _	4 (1.0%) _	<0.001 _

Clinical presentations in the neuropsychiatric group were heterogeneous (**Table 2**). The most common symptoms were acute anxiety (23.4%), altered mental status (22.3%), somnolence (21.0%), depression (10.8%), aggression or manic behavior (9.2%), syncope (7.9%), hallucinations (6.1%), delusions (5.9%), vertigo (5.6%), seizures (5.4%), ataxia (4.7%), headache (4.7%), speech difficulties (4.1%), paranoia (3.8%), suicidal ideation (3.8%), and visual disturbances (2.0%). These findings build on prior pediatric reports that emphasize nonspecific neurologic symptoms by demonstrating a broad range of psychiatric and behavioral emergencies alongside altered mentation^{4,6,10,11}.

Table 2: Neuropsychiatric chief complaints among pediatric cannabis-toxicity presentations (N=444).

Symptom	Frequency among neuropsychiatric cohort
Acute anxiety	104 (23.4%)
Altered mental status	99 (22.3%)
Somnolence	93 (21.0%)
Depression	48 (10.8%)
Aggression or mania	41 (9.2%)
Syncope	35 (7.9%)
Hallucinations	27 (6.1%)
Delusions	26 (5.9%)
Vertigo	25 (5.6%)
Seizures	24 (5.4%)
Ataxia	21 (4.7%)
Headache	21 (4.7%)
Speech difficulties	18 (4.1%)
Paranoia	17 (3.8%)
Suicidal ideation	17 (3.8%)
Visual difficulties	9 (2.0%)

Markers of acuity and resource use were more pronounced in the neuropsychiatric group. Fifty-three patients (11.9%) required sedation and/or physical restraint, compared with 17 patients (3.5%) in the other-toxicity cohort. Emergency department length of stay was longer among neuropsychiatric patients (4.7 ± 3.3 hours vs 2.9 ± 2.4 hours). Disposition outcomes included

hospital admission in 15.5%, transfer to a psychiatric facility in 12.8%, and jail disposition in 4.5%. Collectively, approximately one-third of patients with neuropsychiatric symptoms required an escalated disposition rather than routine discharge. Interrater reliability for data abstraction was excellent, with a median kappa of 0.80.

Discussion

This study suggests that neuropsychiatric toxicity is not a rare or peripheral manifestation of pediatric cannabis exposure but instead accounts for nearly half of cannabis-related emergency presentations in a multicenter Michigan cohort. This finding is clinically meaningful because many prior pediatric discussions focus on altered consciousness after unintentional ingestion in younger children^{6,10,11}, whereas this cohort highlights a broader emergency medicine burden that includes anxiety, agitation, psychotic symptoms, suicidality, and seizure-like presentations. The data therefore support viewing pediatric cannabis toxicity as a spectrum spanning both toxicologic and acute behavioral health care¹⁰.

The association between neuropsychiatric presentations and edible use aligns with broader concerns about high-potency products, delayed symptom recognition, and easier pediatric access to edible cannabis formulations⁵. Similarly, the higher prevalence of psychiatric comorbidity and polysubstance use in the neuropsychiatric cohort suggests that underlying vulnerability may influence both symptom expression and the intensity of disposition³. For practicing clinicians, this reinforces the need to assess co-ingestions, baseline mental health history, suicidality, and safety risks when adolescents present after suspected cannabis use.

The proportion of patients requiring sedation, restraint, psychiatric transfer, or admission also underscores the operational impact of these visits on emergency departments¹². These encounters may require additional staffing, extended observation, behavioral de-escalation resources, and coordination with psychiatric services or law enforcement¹³. In academic and community emergency departments alike, recognizing this pattern may inform trainee education, toxicology pathways, and pediatric mental health response planning¹⁴.

This study also has public health implications. The American Academy of Pediatrics and related pediatric guidance emphasize prevention by avoiding child-accessible edible products, securing storage, using original packaging, and seeking rapid poison-center consultation after suspected ingestion¹⁵. The current findings add that prevention messaging should not be limited to young children with accidental ingestion, because adolescents may present with serious neuropsychiatric effects and substantial downstream utilization. In states with legalized cannabis markets, targeted education for caregivers and youth may help reduce avoidable emergency department visits¹⁶.

Limitations

Several limitations should be acknowledged. First, the retrospective design introduces risks of misclassification, incomplete documentation, and reporting bias, particularly when symptom descriptions, exposure details, or mental health histories were inconsistently recorded. Second, causation cannot be definitively established, particularly in patients with

co-ingestions, preexisting psychiatric illness, or unreliable exposure histories. Therefore, the observed neuropsychiatric manifestations should be interpreted as associations rather than direct effects of cannabis alone. Third, the cohort was drawn from a regional Michigan network, which may limit generalizability to other states, age distributions, or cannabis markets, especially in jurisdictions with different regulatory frameworks, product potency profiles, or patterns of edible use.

Fourth, identification of cases using ICD-10 coding (cannabis-related disorders or poisoning) may have missed patients whose cannabis exposure was underrecognized or not coded, and may have included encounters in which cannabis use was incidental rather than central to the presenting complaint. Fifth, the study relied on clinician-assigned chief complaints and chart abstraction to classify presentations as neuropsychiatric versus other toxicity, which raises the possibility of classification error and overlap between categories, particularly among patients with mixed neurologic and psychiatric symptoms. Sixth, although chart abstraction training and interrater reliability procedures were used, the available data did not capture all potentially relevant variables (such as dose, route, specific product potency, timing of ingestion, or standardized psychiatric assessments), limiting the ability to explore dose–response relationships or more nuanced mental health outcomes.

Finally, the findings span a period during which cannabis laws, product availability, and public awareness continued to evolve, so temporal changes within the study period may have influenced both presentation patterns and documentation practices in ways that could not be fully controlled for.

Conclusions

In this multicenter pediatric cohort, cannabis-related neuropsychiatric toxicity accounted for nearly half of emergency department presentations for cannabis exposure and was frequently associated with escalation of care, including sedation or restraint, prolonged observation, psychiatric transfer, or hospital admission. Patients with neuropsychiatric symptoms were more likely to be female, to have consumed edible cannabis products, and to have documented psychiatric comorbidities or histories of polysubstance use, highlighting a subgroup of youth with overlapping behavioral health and substance-use vulnerabilities. The breadth of presentations—including anxiety, depression, agitation or manic behavior, psychotic symptoms, suicidality, and seizure-like events—underscores that pediatric cannabis toxicity often straddles toxicologic and acute mental health domains rather than presenting solely as nonspecific neurologic depression.

These findings support prevention strategies that limit child and adolescent access to high-potency edible products, promote secure storage and clear caregiver counseling about risks, and encourage rapid poison-center engagement after suspected ingestion. They also suggest that clinicians should maintain a high index of suspicion for cannabis involvement when adolescents present with acute behavioral or psychiatric changes and incorporate structured risk assessment for suicidality, co-ingestions, and underlying mental health disorders into their evaluation. Finally, the observed resource intensity of neuropsychiatric cannabis presentations indicates that emergency departments should integrate these patterns

into trainee education, care pathways, and pediatric mental health response planning, particularly in regions with legalized cannabis markets and increasing youth exposure.

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