Journal of Addiction Psychiatry

https://doi.org/10.17756/jap.2026-054

Research Article

Open Access

Trends in Cannabis Exposure and Psychosis Among U.S. Adolescents in Emergency Rooms from 2016 to 2024

Sue D. Muggar[1*], Jaime A. Perez[2], Farrah Laviolette[1] and Molly McVoy[1]

[1]Department of Child Psychiatry, School of Medicine, Case Western Reserve University, University Hospitals, Cleveland, USA

[2]Department of Clinical Research, School of Medicine, Case Western Reserve University, University Hospitals, Cleveland, USA

[*]Correspondence to:
Sue D. Muggar
Department of Child Psychiatry,
School of Medicine,
Case Western Reserve University,
University Hospitals,
Cleveland, USA.
E-mail: sue.muggar@uhhospitals.org

Received: June 08, 2026
Accepted: August 10, 2026
Published: August 14, 2026

Citation: Muggar SD, Perez JA, Laviolette F, McVoy M. 2026. Trends in Cannabis Exposure and Psychosis Among U.S. Adolescents in Emergency Rooms from 2016 to 2024. *J Addict Psychiatry* 10(1): 13-24.

Copyright: © 2026 Muggar et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY) (http://creativecommons.org/licenses/by/4.0/) which permits commercial use, including reproduction, adaptation, and distribution of the article provided the original author and source are credited.

Published by USG United Scientific Group

Abstract

Objectives: To utilize a retrospective observational design to characterize adolescents aged 13 - 17 presenting to emergency rooms (ER) in the United States (US) from 2016 to 2024 with psychosis and/or delta-9-tetrahydrocannabinol (THC) exposure via urine drug screens (UDS) and to evaluate trends in THC exposure, psychiatric comorbidities, and demographics.

Material and Methods: De-identified, Institutional Review Board–exempt data from the TriNetX database were analyzed. Adolescents were identified with psychosis or THC exposure via International Classification of Diseases (ICD)-10 codes. Exclusions included neurocognitive and neurodevelopmental disorders, non-cannabis substance use, repeat ER visits, or prior antipsychotic use. Logistic regressions assessed trends and demographics.

Results: The odds of psychosis among adolescents with THC exposure decreased by 5% annually (adjusted odds ratio (OR) 0.95 per year, $p < 0.001$) while THC exposure among those with psychosis remained stable (OR = 1.00, 95% confidence intervals (CI): 0.98 - 1.02, $p = 0.80$). Among 22,705 adolescents with THC exposure, 1,799 (7.9%) had a psychosis diagnosis. Among 11,219 adolescents with psychosis, 1,993 (17.8%) were THC-positive. Males had higher odds of THC when presenting with psychosis (adjusted OR 1.73, $p < 0.001$). Black youth had lower odds of a psychosis diagnosis vs White youth (adjusted OR 0.55, $p < 0.001$). Among THC-positive adolescents, psychiatric comorbidities were associated with psychosis. In THC-negative patients, anxiety and depression were common.

Conclusion: This large national analysis highlights distinct demographic and psychiatric comorbidity patterns among adolescents presenting with psychosis and THC exposure, which may inform targeted ER assessment, risk stratification, and follow-up care.

Keywords

Cannabis use in adolescents, Psychosis in adolescents, Emergency rooms

Introduction

Recreational cannabis legalization has expanded across the US, accompanied by changing public perceptions regarding its safety and increasing availability of cannabis products. The Ohio State University legalized recreational cannabis use for adults aged 21 years and older in 2023 with retail sales beginning in 2024 [1]. Results from the 2016 National Survey on Drug Use and Health reported that the percentage of current cannabis users ages 12 and older was higher in 2016 at 8.9% compared to 6.2% in 2002 [2]. With the modifications in the laws surrounding cannabis use, there have been shifts in societal views of cannabis, which may explain increased use [3]. Based on surveys conducted by the Centers

for Disease Control and Prevention, in 2022, it was reported that 30.7% of 12th graders had used cannabis in the last year, and 6.3% reported using cannabis daily in the past 30 days [4]. Studies have shown that with an early age of initial use of cannabis can lead to more subsequent consequences. These include long-term impairments in cognition, worsening academic/vocational outcomes, and increased prevalence and incidence of mood (i.e. depression), psychotic disorders (i.e. schizophrenia), substance use disorders, and suicidality [5, 6].

THC is the primary psychoactive component of cannabis and exerts its effects mostly through CB1 receptors within the endocannabinoid system, leading to alterations in mood, perception, and cognition [7, 8]. These alterations can increase the risk of developing a psychotic disorder. A previous meta-analysis by Robinson et al. [9] found that cannabis use and the risk of psychosis significantly increased for weekly or more frequent cannabis use. Research increasingly supports that adolescents and young adults are more vulnerable to THC because their brains are still developing with exposure prior to age seventeen being more devastating [10]. Other literature suggests that being exposed to THC while synaptic pruning and myelination is still occurring can lead to poorer cognitive and emotional outcomes as an adult [11].

Currently, there are no studies evaluating the trends between positive THC UDS with those coming into the ER for a chief complaint of psychosis among adolescents. More emergency visits and hospitalizations for psychosis in both adolescent and adult patients who have had THC exposure have been anecdotally reported [12]. In the ER, patients can present with acute crises often in their most vulnerable form where the severity of their illness is intense and cannot manage it on their own. In addition, the ER can rapidly assess toxicology reports via urine or blood samples to identify any intoxication with any substances. Utilizing the UDS eliminates recall bias and social desirability concerns that may arise from self-report. These reports can be helpful in identifying if the presenting complaint is related to a primary psychosis disorder or a substance-induced psychosis. Population-based studies cannot capture this acute clinical intersection. For this study, it will only be reviewing the adolescent patient population during the specified time.

With the increasing number of states legalizing cannabis for recreational use, the hypothesis was that the number of ER visits of youth presenting with THC exposure would increase over time. The other prediction was that males would be more likely to be diagnosed with psychosis compared to females since males have a higher vulnerability to cannabis than females [13]. The primary objective of this observational study was to describe the population of adolescents, ages thirteen to seventeen, who came to the ER for psychosis, to ascertain if there is a correlation between the chief complaint of psychosis and a positive THC UDS, and if there is a correlation, to determine the rates of comorbid psychosis in this population. The secondary objective is to analyze the demographics and other psychiatric conditions associated with those who had a positive THC UDS and to determine whether there is a correlation among those who were diagnosed with psychosis.

Materials and Methods

Data was accessed through a large-scale, de-identified health research platform encompassing information from 101 healthcare organizations (HCOs) across the US, representing more than 150 million patients via TriNetX. Data was accessed on April 3, 2025. TriNetX compiles clinical data directly from its partner HCOs and implements strict protocols to ensure data quality and accuracy. It has been studied as a safe and sustainable way to build and maintain research-centric data networks [14].

Patients selected included ages 13 to 17 who presented to the ER with either a psychosis diagnosis or THC exposure. See supplemental table 1 for all code lists used to define psychosis and THC exposure. Codes for initial data collection were determined. ICD-10 codes pertaining to psychosis were a part of the inclusion criteria. The exclusion diagnoses accounted for any intellectual delay, autism, traumatic brain injuries, neurocognitive disorders, neurodegenerative diseases, and non-cannabis substance-induced psychosis. To avoid overlapping symptoms and potentially confounding variables, the above diagnoses were excluded. Since cannabis was the substance of interest, patients with exposure to other substances besides cannabis were excluded from the study. Additional exclusions included individuals who had incomplete demographic or clinical data required for the cohort assignment or regression analyses, a history of antipsychotic use (at or prior to the index ER visit), and more than one ER visit during the study period. Cases with missing required variables were excluded using a complete-case analysis; no imputation of missing data was performed. Patients who had a history of antipsychotic use at or prior to the index ER visit were excluded with the goal of capturing the most severe, acute, and new episodes of psychosis. Other variables of interest included gender, race, ethnicity, and whether a comorbid psychiatric diagnosis was present. Psychiatric diagnoses that were observed included attention deficit hyperactivity disorder (ADHD), depression, anxiety, and bipolar disorder. Variables that were not analyzed in this study included the following: socioeconomic status, family psychiatric history, frequency/potency/duration/dose of cannabis use, healthcare access, and regional policy differences regarding cannabis use due to the limitations of the TriNetX database.

Four cohorts were analyzed: adolescents who came into the ER with a chief complaint of psychosis alone, adolescents who came into the ER with psychosis and positive THC use, adolescents with a positive THC result, and adolescents with THC who were subsequently diagnosed with psychosis. It was important to differentiate the initial presentation as those patients who presented with psychosis first would be a higher risk population than analyzing adolescents who came into the ER with a positive THC UDS. The goal was to ascertain if there was a difference between these two presentations in adolescents to the ER. Demographic variables and psychiatric comorbidities were also identified to ascertain any correlations. The rate of THC use was determined for each year from 2016 to 2024. For statistical analyses, baseline characteristics were compared using independent t tests

Table 1: Codes and code descriptions for study inclusion criteria.

Code (ICD-10, logical observation identifiers names and codes)	Description
F20	Schizophrenia
F25	Schizoaffective disorders
F23	Brief psychotic disorder/acute and transient psychotic disorders
F22	Delusional disorders
F28	Other psychotic disorder not due to a substance or known physiological condition
F29	Unspecified psychosis is not due to a substance or known physiological condition
F21	Schizotypal disorder
F30.2	Manic episode, severe with psychotic symptoms
F31.2	Bipolar disorder, current episode manic, and severe with psychotic features
F31.5	Bipolar disorder, current episode depressed, and severe with psychotic features
F31.64	Bipolar disorder, current episode mixed, and severe with psychotic features
F33.3	Major depressive disorder, recurrent, and severe with psychotic symptoms
F06.1	Catatonic disorder due to known physiological condition
F09	Unspecified mental disorder due to known physiological condition
F10.95	Alcohol use, unspecified with alcohol-induced psychotic disorder
F14.95	Cocaine use, unspecified with cocaine-induced psychotic disorder
F15.95	Other stimulant use, unspecified with stimulant-induced psychotic disorder
F19.15	Other psychoactive substance abuse with psychoactive substance-induced psychotic disorder
F19.25	Other psychoactive substance dependence with psychoactive substance-induced psychotic disorder
F19.95	Other psychoactive substance use, unspecified with psychoactive substance-induced psychotic disorder
182824	Cannabinoids [presence] in urine by screen method
192898	Cannabinoids [presence] in urine by confirm method
34264	Cannabinoids - urine (legacy mapping)
34272	Cannabinoids - urine (legacy mapping)
489435	Cannabinoid confirmation (result component in confirmatory panels)
143123	Cannabinoids - laboratory mapping (legacy/variant)
194159	Carboxy THC - confirmatory result (panel component)
194167	THC/carboxy THC - confirmatory result (panel component)
215566	Cannabinoids - confirmatory mapping
215574	Cannabinoids - confirmatory mapping
438341	Cannabinoids - laboratory mapping (variant)
F12	Cannabis related disorders (family, including abuse/dependence/use and psychosis-specified subcodes)

for continuous variables (means and standard deviations) and chi-squared or Fisher's exact tests, as appropriate for categorical variables (frequencies and percentages). Separate logistic regression models were used to assess changes over time in the proportion of patients with concomitant THC exposure or psychosis at ER presentation for the year of ER visit, sex, race, and additional psychiatric comorbidities as main effects. Analyses were performed in R version 4.5.2 with a two-sided alpha of 0.05.

Results

Patient characteristics

A total of 22,705 adolescents presented to the emergency departments (ED) with a positive THC screen between 2016 and 2024, of whom 1,799 (7.9%) also had a concomitant psychosis diagnosis (Table 2). Adolescents with psychosis were slightly older on average than those without psychosis (16.3 vs 16.2 years, $p = 0.071$). Sex distributions differed significantly, with males representing a larger proportion of those with psychosis compared with those without (52.0% vs 49.4%, $p = 0.037$). Significant racial and ethnic differences were observed. A higher proportion of adolescents with psychosis were White (58.9% vs 48.6%, $p < 0.001$), while fewer were Black or African American (16.8% vs 25.6%, $p < 0.001$).

Among 11,219 adolescents who presented to the ER with a psychosis diagnosis, 1,993 (17.8%) had a concomitant positive THC screen (Table 3). Patients with psychosis who screened positive for THC were older than those without THC exposure (16.3 vs 15.9 years, $p < 0.001$). Compared with THC-negative adolescents, THC-positive adolescents with psychosis were more often male (51.1% vs 37.2%, p <

Table 2: Characteristics of patients presenting to the emergency department with a positive THC screen, stratified by concomitant psychosis diagnosis.

Characteristics	Overall	No psychosis	Psychosis	P-value
n	22,705	20,906	1,799	-
Age	16.2 ± 1.4	16.2 ± 1.4	16.3 ± 1.3	0.071
Sex	-	-	-	-
Female	10,912 (48.1%)	10,079 (48.2%)	833 (46.3%)	0.12
Male	11,264 (49.6%)	10,329 (49.4%)	935 (52.0%)	**0.037**
Unknown	529 (2.3%)	498 (2.4%)	31 (1.7%)	0.075
Race	-	-	-	-
White	11,229 (49.5%)	10,169 (48.6%)	1,060 (58.9%)	**<0.001**
Black or African American	5,662 (24.9%)	5,359 (25.6%)	303 (16.8%)	**<0.001**
Asian	595 (2.6%)	554 (2.6%)	41 (2.3%)	0.345
Native Hawaiian or other Pacific Islander	214 (0.9%)	196 (0.9%)	18 (1.0%)	0.791
American Indian or Alaska native	78 (0.3%)	73 (0.3%)	5 (0.3%)	0.62
Other race	2,158 (9.5%)	1,973 (9.4%)	185 (10.3%)	0.24
Unknown	2,769 (12.2%)	2,582 (12.4%)	187 (10.4%)	**0.015**
Ethnicity	--	-	-	-
Not Hispanic or Latino	13,311 (58.6%)	12,172 (58.2%)	1,139 (63.3%)	**<0.001**
Hispanic or Latino	4,402 (19.4%)	3,993 (19.1%)	409 (22.7%)	**<0.001**
Unknown	4,992 (22.0%)	4,741 (22.7%)	251 (14.0%)	**<0.001**
Comorbidities	-	-	-	-
ADHD	1,875 (8.3%)	1,697 (8.1%)	178 (9.9%)	**0.009**
Anxiety	3,668 (16.2%)	3,224 (15.4%)	444 (24.7%)	**<0.001**
Bipolar	491 (2.2%)	431 (2.1%)	60 (3.3%)	**<0.001**
Depression	4,685 (20.6%)	4,213 (20.2%)	472 (26.2%)	**<0.001**

Note: Significant p-values in bold.

0.001). Racial distributions were broadly similar across groups although Asian adolescents were less likely to have THC exposure (2.1% vs 4.6%, p < 0.001), and "other" race was slightly more common in the THC-positive group (10.3% vs 8.4%, p = 0.005) (Figure 1).

Trends and multivariable associations

Across the study period, temporal patterns differed depending on whether adolescents enter care through THC exposure or psychosis. In unadjusted models, receiving a psychosis diagnosis among adolescents presenting with THC exposure showed a significant decline with a 5% reduction in odds per calendar year, OR = 0.95 (95% CI, 0.93 - 0.97; p < 0.001), whereas the odds of THC positivity among adolescents presenting with psychosis did not change significantly over time, OR = 1.00 (95% CI, 0.98 - 1.02; p = 0.80). Given the non-significant temporal trend in THC positivity among patients presenting with psychosis, a post-hoc analysis was performed to evaluate the smallest temporal effects detectable with the available data. Because post-hoc power analyses are largely determined by the observed p-value, study sensitivity was assessed using minimal detectable effects. At 80% power, detectable annual OR were ≤0.963 or ≥1.038 in the THC-positive cohort and ≤0.965 or ≥1.036 in the psychosis cohort. The observed annual decline in psychosis among THC-positive adolescents (OR = 0.95) exceeded these thresholds, suggesting sufficient sensitivity. Conversely, the null association between year and THC positivity among patients presenting with psychosis (OR = 1.00) fell within the range that is difficult to detect, indicating that small effects in THC positivity cannot be completely excluded. These overall patterns remained consistent in multivariable models.

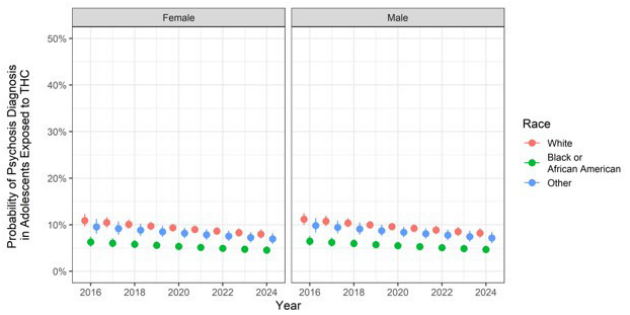


Figure 1: Logistic regression model estimated probability of psychosis at a THC positive related ED visits among adolescents, stratified by race and sex, across the years of 2016 - 2024.

Note: Points reflect adjusted predictions; error bars show 95% CIs.

In multivariable logistic regression models adjusting for sex and race in table 4, the odds of receiving a psychosis diagnosis among adolescents presenting with THC exposure

Table 3: Characteristics of patients presenting to the emergency department with a psychosis diagnosis, stratified by a concomitant positive THC screen.

Characteristics	Overall	No THC	THC	P-value
n	11,219	9,226	1,993	-
Age	16.0 ± 1.5	15.9 ± 1.5	16.3 ± 1.4	**<0.001**
Sex	-	-	-	-
Female	6,663 (59.4%)	5,727 (62.1%)	936 (47.0%)	**<0.001**
Male	4,448 (39.6%)	3,430 (37.2%)	1,018 (51.1%)	**<0.001**
Unknown	108 (1.0%)	69 (0.7%)	39 (2.0%)	**<0.001**
Race	-	-	-	-
White	6,499 (57.9%)	5,331 (57.8%)	1,168 (58.6%)	0.500
Black or African American	1,855 (16.5%)	1,511 (16.4%)	344 (17.3%)	0.336
Asian	465 (4.1%)	424 (4.6%)	41 (2.1%)	**<0.001**
Native Hawaiian or other Pacific Islander	99 (0.9%)	74 (0.8%)	25 (1.3%)	**0.050**
American Indian or Alaska native	46 (0.4%)	42 (0.5%)	4 (0.2%)	0.107
Other race	979 (8.7%)	773 (8.4%)	206 (10.3%)	**0.005**
Unknown	1,276 (11.4%)	1,071 (11.6%)	205 (10.3%)	0.092
Ethnicity	-	-	-	-
Not Hispanic or Latino	6,810 (60.7%)	5,559 (60.3%)	1,251 (62.8%)	**0.037**
Hispanic or Latino	2,058 (18.3%)	1,610 (17.5%)	448 (22.5%)	**<0.001**
Unknown	2,351 (21.0%)	2,057 (22.3%)	294 (14.8%)	**<0.001**
Comorbidities	-	-	-	-
ADHD	1,201 (10.7%)	995 (10.8%)	206 (10.3%)	0.557
Anxiety	3,338 (29.8%)	2,832 (30.7%)	506 (25.4%)	**<0.001**
Bipolar	330 (2.9%)	270 (2.9%)	60 (3.0%)	0.840
Depression	3,337 (29.7%)	2,799 (30.3%)	538 (27.0%)	**0.003**

Note: Significant p-values in bold.

Table 4: Logistic regression results from two complementary models: **(1)** odds of THC positivity among adolescents presenting to the ED with psychosis and **(2)** odds of psychosis among adolescents presenting to the ED with a positive THC screen.

Characteristics	Psychosis among THC-positive ED visits			THC use among psychosis ED visits		
	OR	95% CI	P-value	OR	95% CI	P-value
Year	0.96	0.94 – 0.98	**<0.001**	1.01	0.98 – 1.03	0.5
Sex	-	-	-	-	-	-
Female	Reference	-	-	Reference	-	-
Male	1.03	0.93 – 1.14	0.6	1.77	1.59 – 1.96	**<0.001**
Race	-	-	-	-	-	-
White	Reference	-	-	Reference	-	-
Black or African American	0.55	0.48 – 0.63	**<0.001**	1.05	0.92 – 1.20	0.5
Other	0.86	0.75 – 1.00	**0.046**	0.95	0.82 – 1.10	0.5

Note: Models include year, sex (female reference), and race (white reference); OR with 95% CIs. Significant p-values in bold.

decreased over the study period, OR = 0.96 per year (95% CI, 0.94 - 0.98; p < 0.001). In contrast, the odds of THC positivity among adolescents who presented to the ER with psychosis did not significantly change over time, OR = 1.01 per year (95% CI, 0.98 - 1.03; p = 0.50) (Figure 2).

Sex differences varied by clinical entry point. Among adolescents presenting with psychosis, males had 1.77-fold higher odds of THC positivity compared with females, OR = 1.77 (95% CI, 1.59 - 1.96; p < 0.001) (Table 4). However, among adolescents presenting with THC exposure, the odds of psychosis did not differ significantly by sex, OR = 1.03 (95% CI, 0.93 - 1.14; p = 0.60) (Table 4).

Racial differences were also observed. Among adolescents with THC exposure, Black or African American adolescents had significantly lower odds of psychosis relative to White adolescents, OR = 0.55 (95% CI, 0.48 - 0.63; p < 0.001) (Table 5). No significant racial differences were identified in the psychosis cohort with respect to THC positivity (Table 5).

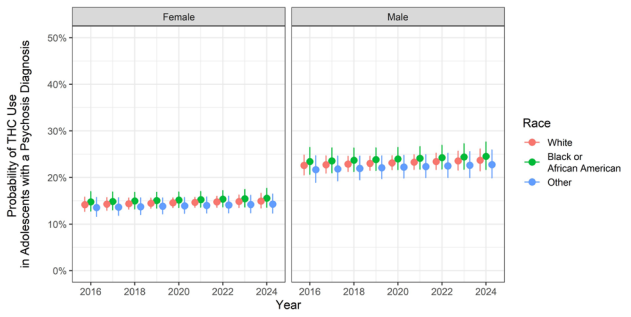


Figure 2: Logistic regression model estimated probability of THC positivity at psychosis related ED visits among adolescents, stratified by race and sex, across the years of 2016 - 2024.

Note: Points reflect adjusted predictions; error bars show 95% CIs.

In expanded multivariable models adjusting for demographic factors and psychiatric co-morbidities, temporal trends remained consistent with the primary analyses. Among adolescents with THC positive ER visits, each successive year was associated with lower odds of receiving a psychosis diagnosis, OR = 0.95 per year (95% CI, 0.93 - 0.98; p < 0.001). In contrast, the year of clinical presentation was not significantly associated with THC use among adolescents presenting with psychosis, OR = 1.01 (95% CI, 0.99 - 1.04; p = 0.30).

Sex effects again varied by clinical entry point. Among THC positive adolescents, odds of psychosis did not differ between sex, OR = 1.10 (95% CI, 0.99 - 1.22; p = 0.083). However, among adolescents presenting with psychosis, males had higher odds of THC use, OR = 1.73 (95% CI, 1.55 - 1.92; p < 0.001).

Racial differences were also consistent with prior models. Among THC-positive adolescents, Black or African American adolescents had significantly lower odds of a psychosis diagnosis than their White counterparts, OR = 0.59 (95% CI, 0.52 - 0.68; p < 0.001). No significant racial differences were noted in THC use among adolescents with psychosis.

Psychiatric co-morbidities showed distinct patterns. Anxiety, OR = 1.60 (95% CI, 1.40- 1.83; p < 0.001) and bipolar disorder, OR = 1.42 (95% CI, 1.04 - 1.90; p = 0.021) were associated with higher odds of psychosis among THC-positive adolescents, whereas ADHD and depression were not significant predictors. Among adolescents with psychosis, anxiety was associated with lower odds of THC use, OR = 0.82 (95% CI, 0.72 - 0.93; p = 0.002), but no other psychiatric comorbidity showed a significant correlation.

No formal adjustments for multiple comparisons were applied, and all reported p-values are unadjusted. Statistical significance was defined as a two-sided p < 0.05.

Discussion

This retrospective observational study aimed to demonstrate associations of cannabis use among adolescents aged 13 - 17 while also observing for any demographic and psychiatric comorbidity correlations. This study design cannot determine whether THC exposure contributed to psychosis, if emerging psychiatric illnesses influenced cannabis use, or whether both are related to shared underlying risk factors. It is also important to note that this population was specific to teens coming into the ER with psychosis or a positive UDS, which does not equate to the entire adolescent population of the US. Additionally, those that had THC exposure is not equivalent to the prevalence of cannabis use among adolescents. Based on increasing cannabis legalization and changing public perceptions, it was hypothesized that adolescent ER presentations with THC exposure would increase over time. Contrary to this expectation, the observed rate declined by about 5% annually. The reasons for the observed decline in THC exposure among adolescents presenting to the ER cannot be determined from this dataset. Although adolescent cannabis use has recently declined or remained stable in some surveys [15], the mechanisms underlying these trends remain unclear. Several hypotheses may explain this finding, including changes in adolescents' perceptions of cannabis-related risk, evolv-

Table 5: Expanded logistic regression results from two complementary models: **(1)** odds of THC positivity among adolescents presenting to the ED with psychosis and **(2)** odds of psychosis among adolescents presenting to the ED with a positive THC screen.

Characteristics	Psychosis among THC-positive ED visits			THC use among psychosis ED visits		
	OR	95% CI	P-value	OR	95% CI	P-value
Year	0.95	0.93, 0.98	**<0.001**	1.01	0.99, 1.04	0.3
Sex	-	-	-	-	-	
Female	-	-	-	-	-	-
Male	1.1	0.99, 1.22	0.083	1.73	1.55, 1.92	**<0.001**
Race	-	-	-	-	-	-
White	-	-	-	-	-	-
Black or African American	0.59	0.52, 0.68	**<0.001**	1.02	0.89, 1.17	0.7
Other	0.92	0.79, 1.06	0.2	0.93	0.81, 1.08	0.4
ADHD	1.06	0.88, 1.26	0.5	0.92	0.77, 1.09	0.3
Anxiety	1.6	1.40, 1.83	**<0.001**	0.82	0.72, 0.93	**0.002**
Bipolar	1.42	1.04, 1.90	**0.021**	1.14	0.83, 1.53	0.4
Depression	1.13	0.99, 1.28	0.066	0.97	0.86, 1.09	0.6

Note: Models include year, sex (female reference), race (white reference) and four psychiatric comorbid conditions (ADHD, anxiety, bipolar, and depression); OR with 95% CIs. Significant p-values in bold.

ing social behaviors such as greater engagement with digital media, changes in parental supervision, or differences in state and local policies affecting access to cannabis. However, these factors were not measured in the present study, and therefore, they should be considered speculative rather than explanatory. Despite the decline, THC exposure remains clinically relevant because previous literature has reported associations between earlier cannabis exposure and altered neurodevelopment, subsequent cannabis use disorder, and a range of psychiatric disorders [10, 11, 16]. This study was not designed to evaluate these relationships or to establish causality. Accordingly, it cannot be determined from these data whether THC exposure preceded psychosis, whether emerging psychiatric symptoms increased the likelihood of cannabis use, or whether both reflect shared underlying vulnerabilities.

This review demonstrated associated gender differences where males had a higher OR than females for those presenting to the ER with psychosis and having concomitant THC exposure. However, among adolescents presenting with THC exposure and subsequently being diagnosed with a psychosis diagnosis did not differ significantly by gender. The absence of gender differences in psychosis among THC-positive adolescents suggests that once exposure occurs, risk of psychosis may not differ by sex despite differences in healthcare-seeking behavior. Several hypotheses may explain why a greater proportion of males in this cohort presented to the ER with psychosis than females. These explanations were not tested in this study and should be considered as speculative and hypothesis-generating. One hypothesis is that stigma surrounding mental health among adolescent males may contribute to delayed help-seeking [17]. Discussing feelings can be observed as a more feminine trait, which can deter males from seeking care. Another potential explanation is that males are at an increased risk for earlier presentation of prodromal symptoms such as those that are seen with schizophrenia. In comparison to females, males tend to have their first episode of psychosis associated with schizophrenia earlier [18]. Consequently, the present findings cannot distinguish among these potential explanations, and further studies specifically designed to evaluate these factors are needed.

In terms of racial differences, there was an association of Black or African American adolescents who were less likely to be diagnosed with a psychosis diagnosis compared to their White counterparts. In general, there are known healthcare disparities among the Black or African American race. For example, the practice of redlining led to Black or African Americans living in lower socioeconomic neighborhoods, which has led to limited access to healthcare services. As a result, they have higher rates of hypertension, diabetes, and heart disease [19], which then leads to lower life expectancies compared to their White counterparts. One possible explanation is that Black or African American adolescents presenting with psychotic symptoms may have been differentially coded or diagnosed with behavioral disturbances (e.g., aggression, oppositional defiant disorder, conduct disorder) rather than psychotic disorders, or they may have differed in the likelihood of receiving a UDS during their ER encounter. If present, such differences in diagnostic coding could influence access to early psychosis programs and substance use interventions. However, the present dataset does not contain sufficient clinical detail to evaluate diagnostic or testing practices, and these possibilities should be considered as speculative.

With regards to ethnicity, there was a statistically significant association. However, there were many patients whose ethnicity was categorized as "unknown". Due to the "unknown" group (22% and 21% in table 2 and table 3, respectively), it cannot be certain that Hispanics were more likely to present to the ER with psychosis or THC exposure. Based on previous data collected by Wu et al. [20], it was reported that cannabis use was less common among Asian Americans and Hispanics during 2009 - 2011, but among cannabis users, they both had higher odds for cannabis use disorder.

Another variable observed was psychiatric comorbidities. The goal was to ascertain whether having a specific psychiatric comorbidity would increase the risk of being diagnosed with psychosis given the specific population analyzed. The observation of the cohort of patients who came into the ER with a positive THC and were then stratified into "no psychosis" vs "psychosis" showed statistical significance among all psychiatric comorbidities (ADHD, anxiety, depression, and bipolar disorder). Among the cohort of patients who came into the ER with a chief complaint of psychosis and then were stratified into "no THC" vs "positive THC", there was an association that patients without THC exposure were more likely to also have a diagnosis of anxiety or depression. Previous studies have reported associations between anxiety and subsequent psychosis [21-23]. The findings of this review are consistent with this literature but cannot determine whether anxiety contributes to psychosis risk or represents an early manifestation of emerging psychiatric illness. Depression can also increase the risk of psychosis as patients with severe major depressive disorder can experience psychotic symptoms, such as auditory or visual hallucinations [24].

Studies examining the relationship between cannabis and psychosis have reported heterogenous findings that may reflect differences in study design, measurement approaches, and population characteristics. For example, meta-analytic syntheses of observational, experimental, and medicinal cannabis studies have found substantially different rates of cannabis-associated psychotic symptoms across these designs, ranging from approximately 2% in medicinal cannabis trials to 19% - 21% in observational and experimental samples [25]. Similarly, systematic reviews have documented considerable heterogeneity in effect estimates ($I2 > 87\%$) when pooling studies of cannabis use frequency and psychosis risk [9]. This heterogeneity may partly explain why some studies report strong associations between cannabis use and positive symptoms [26] while others find mixed or null effects for specific symptom dimensions, such as negative symptoms, disorganization, or depression [27].

With respect to cannabis potency, the available evidence suggests that high-potency products (typically defined as THC > 10%) may confer greater risk. In the multicenter case-control study across Europe, daily use of high-potency cannabis was associated with nearly a five-fold increase in

odds of a psychotic disorder compared to those that never used cannabis (adjusted OR 4.8, 95% CI, 2.5 - 6.3) with population attributable fractions suggesting that 12% - 50% of first-episode psychosis cases could be prevented if high-potency cannabis were unavailable [28]. Consistent with these findings, use of high-potency cannabis resin has been associated with approximately two-fold increased risk of cannabis-associated psychotic symptoms requiring emergency medical treatment compared with herbal cannabis [29], and experimental studies demonstrated dose-dependent effects of THC administration on acute psychotic symptoms [25]. However, a recent systematic review found that certainty in the evidence regarding high-potency cannabis and health outcomes remains "very low" with most available studies limited by cross-sectional designs and spanning few adverse health domains [30]. The inability to characterize cannabis potency, cannabidiol content, frequency of use, and temporal relationships between exposure and symptom onset represents a critical limitation across this literature, including this study.

Recent large-scale epidemiologic studies similarly suggest that adolescent cannabis use in the US has remained relatively stable or declined despite expanding legalization [31, 32]. Analyses of the Youth Risk Behavior Survey demonstrated an overall decline in adolescent cannabis use through 2023 with modest demographic shifts, including relatively greater recent use among females and persistently lower use among Asian American adolescents [31]. Likewise, the Monitoring the Future survey completed by the National Institute of Drug Abuse reported stable past-year cannabis use in 2025, with 8% of eighth graders, 16% of tenth graders, and 26% of twelfth graders reporting use [32]. These national surveys are consistent with the present study, which demonstrated an annual decline in THC-positive ER presentations over the study period despite increasing cannabis legalization. However, direct comparison should be made cautiously because this review evaluated adolescents presenting to the ER who had UDS completed rather than measuring cannabis use prevalence in the general adolescent population.

Although national surveys suggest relatively stable cannabis use prevalence, large epidemiologic studies continue to report associations between adolescent cannabis exposure and adverse psychiatric outcomes. In the recent longitudinal cohort study by Young-Wolff et al. [16] adolescent cannabis use was associated with increased risk of psychotic, bipolar, depression, and anxiety disorders, with the strongest associations observed for psychotic disorders. Similarly, systematic reviews have consistently demonstrated that more frequent cannabis use is associated with greater risk of psychosis, while studies of high-potency cannabis have reported substantially higher odds of first-episode psychosis among daily users [9, 29]. The findings of this study complement rather than contradict these studies. Whereas those investigations estimated the long-term risk of developing psychiatric illnesses following cannabis exposure, the current study evaluated the coexistence of objectively detected THC exposure and coded psychosis diagnoses during acute ER encounters. As a result, these findings characterize patterns of presentations within an emergency care population rather than the longitudinal incidence of psychotic disorders.

While the above information was obtained during the analysis, there are limitations to this study that need to be addressed. First, TriNetX is constantly evolving where more HCOs are being added to the dataset. As a result, the original dataset has been updated already. Next, the initial analysis contained all patients who came to the ER in that time frame without taking into consideration repeated visits. With these patients added to the data, the CI was very large. To account for this, the first visit to the ER in the specified time frame was counted but not subsequent visits. The data showed that for these patients, they were mostly men and could have a repeat ER visit up to thirty times. Another limitation is that it was unknown what type of THC exposure these adolescents had upon presentation as the dataset lacked detailed information regarding cannabis exposure, including THC potency, cannabidiol content, dose, frequency of use, duration of use, route of administration (e.g., smoked, vaporized, edible), synthetic cannabinoid use, and the interval between cannabis exposure and symptoms onset. These factors may influence observed associations and limit interpretation of potential dose-response relationships.

Further research is needed to better categorize the cannabis exposure source (flower, edibles, concentrates, cartridges) as well as the potency, cannabidiol content, dose, frequency, duration of use, and route of administration. These variables were unavailable within TriNetX and may influence the observed associations. This sample does not provide information regarding acute intoxication vs remote use, high-potency vs lower-potency cannabis products, synthetic cannabinoid exposure, or cannabidiol content. This non-differential exposure misclassification likely biases the effect estimates towards the null hypothesis, meaning that true associations between cannabis use patterns and ER psychosis may be stronger than observed.

This study also relied on ICD-10 diagnostic coding obtained from electronic health records, which may be subject to diagnostic misclassification and variability in coding practices across HCOs. Diagnoses assigned during an ER encounter represent an initial clinical assessment and may change following longitudinal psychiatric evaluation. Therefore, the psychosis diagnoses used in this study should be interpreted as coded clinical diagnoses rather than confirmed longitudinal psychiatric diagnoses.

An additional source of potential bias is differential misclassification of both exposure and outcome across racial and ethnic groups. Diagnostic coding practices, provider thresholds for assigning psychosis diagnoses, and decisions to obtain a UDS may vary across HCOs and patient populations. As a result, some racial or ethnic groups may have been more or less likely to receive a psychosis diagnosis or undergo a UDS despite similar underlying clinical presentations. Likewise, race and ethnicity recorded in the electronic health record may not always reflect patients' self-identification, and approximately 21 -22% of patients were categorized as having "unknown" ethnicity, reducing the precision of ethnicity-specific analyses and potentially obscuring true differences between Hispanic and non-Hispanic adolescents. Since the reasons for the missing demographic data could not be determined within TriNetX,

it is unknown whether these data were missing at random or differed systematically across patient populations. If present, these sources of differential misclassification and missing demographic data could bias observed associations in either direction or may have contributed to the observed demographic differences found in this review. Furthermore, TriNetX does not contain data regarding provider decision-making or institutional testing protocols, precluding direct evaluation of these potential sources of bias.

Similarly, THC exposure was identified by UDS, which reflects recent cannabinoid metabolite detection rather than the timing, quantity, or clinical significance of cannabis use. As THC metabolites may remain detectable from days to weeks after use, a positive THC UDS does not equate to acute intoxication at the time of the ER presentation. Conversely, some patients with recent cannabis use may not have had a UDS, resulting in potential exposure misclassification. With these points, these exposure and outcome definitions likely bias the study toward identifying associations between recent THC exposure and ER psychosis presentations rather than establishing cannabis-induced psychosis or causal relationships.

Patients may experience symptoms of a psychiatric disorder before initiating cannabis use and then use cannabis in an attempt to self-medicate these symptoms. Likewise, several other potentially meaningful variables were unavailable within TriNetX. These include family psychiatric history, childhood adversity, socioeconomic status, trauma exposure, peer influences, previous use of other substances, and regional differences. Residual confounding from these and other unmeasured variables may have contributed to these observed associations and likely introduced bias.

For example, adolescents from lower socioeconomic households may face multiple barriers in accessing mental health services outside of the ER, which can potentially increase ER utilization for psychiatric crises. This can potentially inflate observed associations between THC exposure and ER presentations. On the other side, if adolescents are insured and have a high socioeconomic status, families may seek outpatient care first before going to the ER, which may underrepresent milder psychosis cases, selecting for more severe presentations. This selection bias could explain why the observed overlap between THC and psychosis (8% among THC-positive; 18% among psychosis) is lower than population-based estimates. In regard to family psychiatric history, without data on parental psychiatric history or family structure, the results cannot distinguish between cannabis precipitating psychosis in vulnerable adolescents, emerging psychosis prompting cannabis self-medication, or shared familial vulnerability underlying both patient situations. Healthcare access may have contributed to the observed racial differences as Black/African American adolescents may face structural barriers to outpatient mental health care, potentially resulting in delayed presentation to the ER when symptoms are severe. If this delay leads to diagnostic practices that emphasize behavioral disturbance over psychosis coding or if differences in diagnostic practices, including the potential influence of implicit bias, this could artifactually lower observed psychosis diagnoses in this group despite similar underlying psychopathology, which could partially explain the observed findings; however, the present analysis cannot evaluate these mechanisms. Additionally, families with resources who seek private psychiatric evaluations may never appear in this ER sample, meaning that the findings may not generalize to adolescents with adequate healthcare access. Finally, there are variations in state policies regarding retail density, marketing restrictions, and youth access, which influences cannabis availability and ER presentation patterns. The inability to organize patients by geographic region or policy environment means that the findings cannot distinguish between individual-level associations and ecological effects of legalization status on community-level cannabis use and healthcare utilization patterns. These unmeasured confounders preclude causal interpretation of the findings listed. Rather than estimating causal effects, this analysis describes patterns of co-occurring objective THC detection and coded psychosis diagnoses in a specific acute care setting.

An additional methodological consideration is that patients within the TriNetX network are clustered within HCOs, geographic regions, and time periods, which introduce hierarchical data structures that were not explicitly modeled in this study. Practice patterns, diagnostic coding, UDS practices, patient demographics, referral patterns, and local cannabis policies may vary across participating HCOs and states, potentially resulting in correlated observations within these sites [14]. Similarly, temporal changes in cannabis legislation, retail availability, commercialization, and public attitudes may differentially influence healthcare utilization and cannabis exposure across regions over time [1, 32]. Since the current study employed aggregate observational analyses rather than multilevel or mixed-effects models, residual between-site heterogeneity may have influenced the precision of the reported associations. Future studies using multilevel mixed-effects logistic regression or generalized estimating equations that account for clustering by HCOs, geographic region, and calendar period could provide more robust estimates while also permitting evaluation of organization-level and policy-level sources of heterogeneity.

These findings should therefore not be generalized to all adolescents. The study population consisted of adolescents who presented to the ER and had UDS, representing a subset with greater clinical acuity and a higher likelihood of psychiatric or substance-related concerns than adolescents in the general community. Many adolescents who use cannabis never present to the ER, and adolescents with psychosis managed in outpatient or inpatient psychiatric settings without ER evaluations were not present in the data. Likewise, a UDS is not universally performed on all adolescents presenting to the ER, which introduces an additional specific selection source. The UDS is performed according to clinical judgment, so adolescents included in this review may differ systematically from those who were not tested, further limiting the generalizability of these findings. Consequently, the observed rates of THC positivity, psychosis diagnoses, and their overlap should be interpreted as characterizing adolescents evaluated in an acute emergency care setting rather than estimates applicable to the broader adolescent population.

Future prospective longitudinal studies with standardized classification of cannabis exposure, psychiatric symptoms, genetic susceptibility, and environmental factors are needed to better understand the temporal relationship between cannabis use and psychosis. Further research should incorporate detailed measures of cannabis potency, cannabidiol content, dose, frequency, duration of use, route of administration, and timing of exposure relative to symptom onset. Standardized diagnostic assessments, more complete demographic data collection, and consistent UDS protocols across HCOs may reduce differential misclassification and improve the validity of demographic comparisons. Additionally, multilevel analytic approaches accounting for clustering by HCOs, geographic region, and policy environment, together with adjustments for family psychiatric history, socioeconomic status, trauma exposure, and other potential confounders, would provide more robust estimates of the associations observed in this review. Finally, studies that integrate ED, outpatient, and inpatient psychiatric data may improve generalizability and better categorize the continuum of adolescent cannabis-associated psychiatric presentations.

The modest overlap observed between THC exposure (8% of THC-positive adolescents carrying a psychosis diagnosis) and psychosis (18% of adolescents presenting with psychosis demonstrating concurrent THC positivity) differs from the stronger associations reported in longitudinal cohort studies and case-control investigations [16, 26, 29]. These differences are expected because the study designs address distinct clinical questions. Population-based studies estimate the future risk of psychotic disorders among cannabis users, whereas the current study analyzed adolescents at a single ER encounter using UDS and ICD-10 codes. Furthermore, UDS reflect recent cannabinoid metabolite detection rather than acute intoxication and provides no information regarding potency, frequency, duration of use, or temporal relationships between cannabis exposure and symptom onset. Therefore, these findings should be interpreted as describing patterns of co-occurring THC detection and psychosis within an acute-care setting rather than estimating the long-term psychiatric risk with adolescent cannabis use.

Understanding the patterns of THC-associated ER presentations may help identify populations in whom screening and early intervention efforts could be prioritized. The ER is often the first point of contact for a psychiatric evaluation and represents a unique opportunity to identify adolescents presenting with psychosis and concomitant THC exposure; many of whom may have limited prior contact with mental health services. These findings support comprehensive assessment of adolescents presenting with psychosis, including careful substance use histories, urine toxicology when clinically indicated, and evaluation of co-occurring psychiatric disorders. However, since a positive THC UDS reflects recent cannabinoid exposure rather than acute intoxication, urine toxicology should be interpreted alongside the clinical history and exam and should not be used in isolation to diagnose cannabis-induced psychosis. The ER may serve as an important junction for screening, risk stratification, and linkage to ongoing care rather than solely acute stabilization. Early intervention is crucial for the prognosis of these disorders, especially in adolescents, since their brains are still developing, although the present observational review cannot determine whether these interventions improve outcomes.

Critical neurodevelopment occurs during adolescence. Delaying or preventing cannabis initiation remains an important public health goal. These findings also have potential public health implications. From a health policy perspective, these findings support continued investment in systems that facilitate emergency department-based mental health and substance use screening, timely psychiatric evaluations, and coordinated referral pathways for adolescents following discharge from the ER. Educational initiatives directed towards adolescents, parents, schools, primary care providers, and emergency providers may improve awareness of the potential psychiatric risks associated with adolescent cannabis exposure while emphasizing that individual susceptibility varies. Additionally, these findings support continued surveillance of adolescent cannabis-related emergency presentations as cannabis policies and product availability change with the evolving policy landscape. Such surveillance may help identify changing patterns of presentation, emerging high-risk populations, and potential unintended consequences of legalization, although this observational dataset cannot establish the effects of policy changes.

As recreational cannabis legalization continues to expand, ongoing surveillance of adolescent cannabis-related ER presentations will be notable to monitor changing patterns of use, to evaluate potential unintended consequences, and to inform evidence-based public health policies aimed at reducing youth exposure. Particular attention should be allocated to the increasing availability of high-potency cannabis products, product labelling, youth-oriented marketing, and prevention strategies designed to limit adolescent access.

Conclusion

Overall, there is a measurable but limited overlap between THC exposure and psychosis among adolescents presenting to the ER. About 8% of teens who had a positive THC UDS were also diagnosed with a psychosis diagnosis, and about 18% of teens diagnosed with psychosis had concurrent THC detection. Among teens with psychosis, males were more likely to have concomitant THC exposure while Black or African American adolescents with THC exposure were less likely to receive a psychosis diagnosis than their White counterparts. Over time, psychosis became slightly less common among THC-positive teens, whereas the prevalence of THC positivity among adolescents presenting to the ER with psychosis remained relatively stable.

This study addresses a significant gap in the literature by characterizing objective THC detection among adolescents presenting to the ER with psychosis. These findings are most applicable to adolescents evaluated in acute emergency care settings and should not be extrapolated to the general adolescent population. With THC positivity reflecting recent rather than acute cannabis exposure and psychosis identified using ICE-10 coding, these findings describe clinical associations rather than causal relationships or confirmed substance-in-

duced psychosis. In the ER setting, it is important to distinguish between substance-induced psychosis vs primary psychosis.

As recreational cannabis legalization expands, surveillance using objective toxicology and standardized chief complaint data can inform screening protocols and brief interventions in acute care settings. Clinically, these observations reinforce the importance of comprehensive evaluations of teens presenting with psychosis, including careful substance use histories, urine toxicologies when clinically indicated, and assessing for co-occurring psychiatric disorders. The ER represents a critical opportunity to identify adolescents with concurrent psychotic symptoms and recent THC exposure that can help facilitate timely referrals to psychiatric and substance use services. From a public health perspective, these findings support continued surveillance of adolescent cannabis-related ER presentations, development of standardized screening and referral pathways, and educational initiatives aimed at delaying cannabis initiation, limiting youth exposure to high-potency cannabis products, and improving awareness of potential psychiatric risks. As cannabis policies and product availability continue to evolve, ongoing surveillance of adolescent cannabis-related ER presentations, coupled with standardized screening, timely intervention, and coordinated mental health referrals, will be essential to identify high-risk adolescents and reduce adverse psychiatric outcomes.

Acknowledgements

This project was supported by the clinical and translational science collaborative of Northern Ohio, which is funded by the National Institutes of Health (NIH), National Center for Advancing Translational Sciences, Clinical and Translational Science Award grant, UM1TR004528. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Conflict of Interest

None.

References

1. Moritz College of Law. 2024. Adult-use Marijuana in Ohio: What You Need to Know. The Ohio State University, USA.
2. SAMHSA. 2017. Key Substance Use and Mental Health Indicators in the United States: Results from the 2016 National Survey on Drug Use and Health.
3. Hammond CJ, Chaney A, Hendrickson B, Sharma P. 2020. Cannabis use among U.S. adolescents in the era of marijuana legalization: a review of changing use patterns, comorbidity, and health correlates. *Int Rev Psychiatry* 32(3): 221-234. https://doi.org/10.1080/09540261.2020.1713056
4. U.S. Centers for Disease Control and Prevention. 2024. Cannabis and Teens.
5. Volkow ND, Swanson JM, Evins AE, DeLisi LE, Meier MH, et al. 2016. Effects of cannabis use on human behavior, including cognition, motivation, and psychosis: a review. *JAMA Psychiatry* 73(3): 292-297. https://doi.org/10.1001/jamapsychiatry.2015.3278
6. Gobbi G, Atkin T, Zytynski T, Wang S, Askari S, et al. 2019. Association of cannabis use in adolescence and risk of depression, anxiety, and suicidality in young adulthood: a systematic review and meta-analysis. *JAMA Psychiatry* 76(4): 426-434. https://doi.org/10.1001/jamapsychiatry.2018.4500
7. Capodice JL, Kaplan SA. 2021. The endocannabinoid system, cannabis, and cannabidiol: implications in urology and men's health. *Curr Urol* 15(2): 95-100. https://doi.org/10.1097/cu9.0000000000000023
8. Howlett AC, Blume LC, Dalton GD. 2010. CB(1) cannabinoid receptors and their associated proteins. *Curr Med Chem* 17(14): 1382-1393. https://doi.org/10.2174/092986710790980023
9. Robinson T, Ali MU, Easterbrook B, Hall W, Jutras-Aswad D, et al. 2023. Risk-thresholds for the association between frequency of cannabis use and the development of psychosis: a systematic review and meta-analysis. *Psychol Med* 53(9): 3858-3868. https://doi.org/10.1017/s0033291722000502
10. Wilson W, Mathew R, Turkington T, Hawk T, Coleman RE, et al. 2000. Brain morphological changes and early marijuana use: a magnetic resonance and positron emission tomography study. *J Addict Dis* 19(1): 1-22. https://doi.org/10.1300/j069v19n01_01
11. Jacobus J, Tapert SF. 2014. Effects of cannabis on the adolescent brain. *Curr Pharm Des* 20(13): 2186-2193. https://doi.org/10.2174/13816128113199990426
12. Roehler DR, Hoots BE, Holland KM, Baldwin GT, Vivolo-Kantor AM. 2022. Trends and characteristics of cannabis-associated emergency department visits in the United States, 2006-2018. *Drug Alcohol Depend* 232: 109288. https://doi.org/10.1016/j.drugalcdep.2022.109288
13. Hjorthøj C, Compton W, Starzer M, Nordholm D, Einstein E, et al. 2023. Association between cannabis use disorder and schizophrenia stronger in young males than in females. *Psychol Med* 53(15): 7322-7328. https://doi.org/10.1017/S0033291723000880
14. Palchuk MB, London JW, Perez-Rey D, Drebert ZJ, Winer-Jones JP, et al. 2023. A global federated real-world data and analytics platform for research. *JAMIA Open* 6(2): 1-11. https://doi.org/10.1093/jamiaopen/ooad035
15. National Institute on Drug Abuse (NIDA). 2025. Reported Use of Most Drugs Remains Low Among U.S. Teens.
16. Young-Wolff KC, Cortez CA, Alexeeff SE, Silver, LD, Pacula RL, et al. 2026. Adolescent cannabis use and risk of psychotic, bipolar, depressive, and anxiety disorders. *JAMA Health Forum* 7(2): 1-11. https://doi.org/10.1001/jamahealthforum.2025.6839
17. Liddle SK, Vella SA, Deane FP. 2021. Attitudes about mental illness and help seeking among adolescent males. *Psychiatry Res* 301: 113965. https://doi.org/10.1016/j.psychres.2021.113965
18. Ochoa S, Usall J, Cobo J, Labad X, Kulkarni J. 2012. Gender differences in schizophrenia and first-episode psychosis: a comprehensive literature review. *Schizophr Res Treat* 2012: 1-9. https://doi.org/10.1155/2012/916198
19. Egede LE, Walker RJ, Campbell JA, Linde S, Hawks LC, et al. 2023. Modern day consequences of historic redlining: finding a path forward. *J Gen Intern Med* 38(6): 1534-1537. https://doi.org/10.1007/s11606-023-08051-4
20. Wu LT, Brady KT, Mannelli P, Killeen TK, NIDA AAPI Workgroup. 2014. Cannabis use disorders are comparatively prevalent among non-white racial/ethnic groups and adolescents: a national study. *J Psychiatr Res* 50: 26-35. https://doi.org/10.1016/j.jpsychires.2013.11.010
21. Goodwin RD, Fergusson DM, Horwood LJ. 2004. Panic attacks and psychoticism. *Am J Psychiatry* 161(1): 88-92. https://doi.org/10.1176/appi.ajp.161.1.88
22. Morales-Muñoz I, Palmer ER, Marwaha S, Mallikarjun PK, Upthegrove R. 2022. Persistent childhood and adolescent anxiety and risk for psychosis: a longitudinal birth cohort study. *Biol Psychiatry* 92(4): 275-282. https://doi.org/10.1016/j.biopsych.2021.12.003
23. McAusland L, Buchy L, Cadenhead KS, Cannon TD, Cornblatt BA, et

al. 2017. Anxiety in youth at clinical high risk for psychosis. *Early Interv Psychiatry* 11(6): 480-487. https://doi.org/10.1111/eip.12274

24. Wu Y, Zhao X, Li Z, Yang R, Peng R, et al. 2024. Prevalence and risk factors for psychotic symptoms in young, first-episode and drug-naïve patients with major depressive disorder. *BMC Psychiatry* 24(1): 1-10. https://doi.org/10.1186/s12888-024-05517-5
25. Schoeler T, Baldwin JR, Martin E, Barkhuizen W, Pingault JB. 2024. Assessing rates and predictors of cannabis-associated psychotic symptoms across observational, experimental and medical research. *Nat Ment Health* 2(7): 865-876. https://doi.org/10.1038/s44220-024-00261-x
26. Quattrone D, Ferraro L, Tripoli G, La Cascia C, Quigley H, et al. 2021. Daily use of high-potency cannabis is associated with more positive symptoms in first-episode psychosis patients: the EU-GEI case-control study. *Psychol Med* 51(8): 1329-1337. https://doi.org/10.1017/S0033291720000082
27. Argote M, Sescousse G, Brunelin J, Baudin G, Schaub MP, et al. 2023. Association between cannabis use and symptom dimensions in schizophrenia spectrum disorders: an individual participant data meta-analysis on 3053 individuals. *EClinicalMedicine* 64: 1-13. https://doi.org/10.1016/j.eclinm.2023.102199
28. Di Forti M, Quattrone D, Freeman TP, Tripoli G, Gayer-Anderson C, et al. 2019. The contribution of cannabis use to variation in the incidence of psychotic disorder across Europe (EU-GEI): a multicentre case-control study. *Lancet Psychiatry* 6(5): 427-436. https://doi.org/10.1016/S2215-0366(19)30048-3
29. Schoeler T, Ferris J, Winstock AR. 2022. Rates and correlates of cannabis-associated psychotic symptoms in over 230,000 people who use cannabis. *Transl Psychiatry* 12(1): 1-8. https://doi.org/10.1038/s41398-022-02112-8
30. Lake S, Murray CH, Henry B, Strong L, White K, et al. 2025. High-potency cannabis use and health: a systematic review of observational and experimental studies. *Am J Psychiatry* 182(7): 616-638. http://doi.org/10.1176/appi.ajp.20240269
31. Amrock SM, Sajkiewicz AJ. 2026. Trends in US adolescent cannabis use, 1991-2023. *Addict Behav* 176: 108634. https://doi.org/10.1016/j.addbeh.2026.108634
32. Winters KC, Lee CY. 2008. Likelihood of developing an alcohol and cannabis use disorder during youth: association with recent use and age. *Drug Alcohol Depend* 92(1-3): 239-247. https://doi.org/10.1016/j.drugalcdep.2007.08.005