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Association of adolescent cannabis use with poor mental health and suicidality in young adulthood: A cross-sectional study using YRBS 2023 data

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ABSTRACT

Introduction: Cannabis is the second most widely used psychoactive substance globally, with increasing use among the US adolescents amid shifting legalization and societal norms. Although cannabis is often perceived as benign, emerging evidence links adolescent use with severe mental health outcomes, including depression and suicidality.

Objective: This study aimed to examine the association between adolescent cannabis use and poor mental health and suicidal behavior among the US high school students.

Methods: This is a secondary data analysis from the 2023 youth risk behavior survey, a nationally representative, cross-sectional survey of the US high school students. The final analytic sample included 8,065 participants with complete data. Mental health outcomes included self-reported poor mental health within the past 30 days and suicide attempts within the past 12 months. The primary independent variable, cannabis use, was categorized as never, former, or current use. Multivariable logistic regression models were used to explore associations between cannabis use and mental health outcomes while adjusting for sociodemographic characteristics, adverse childhood experiences (ACEs), bullying, social media use, and sleep patterns.

Results: Current cannabis users had significantly higher odds of reporting poor mental health (AOR: 1.47, 95% CI: 1.26-1.72) and suicide attempts (AOR: 1.83, 95% CI: 1.34-2.49) compared to non-users. Former users also had elevated odds for suicide attempts (AOR: 1.80, 95% CI: 1.37-2.37). A dose-response relationship was observed with ACEs, where students with four or more ACEs had nearly five times higher odds of poor mental health and tenfold higher odds of suicide attempts compared to those with none.

Conclusion: Adolescent cannabis use is significantly associated with a higher risk of poor mental health and increased suicidality. These findings underscore the need for targeted prevention, early interventions, and trauma-informed public health strategies to reduce cannabis-related mental health risks among youth.

Keywords: adolescent, cannabis use, mental health, suicide, youth risk behavior survey, adverse childhood experiences, public health

INTRODUCTION

Cannabis, otherwise known as marijuana, weed, or pot, refers to a group of plants with psychoactive properties. It is the second most widely used psychoactive substance worldwide [1] after alcohol, with the United Nations Office on Drugs and Crime estimating that approximately 192 million people have used cannabis in the past year [2]. According to the National Cancer Institute (NCI), a psychoactive substance is “a drug or other substance that affects how the brain works and causes changes in mood, awareness, thoughts, feelings, or behavior” (examples include alcohol, caffeine, nicotine, marijuana, and certain pain medicines) [3]. The NCI further defines illicit drugs as drugs that are manufactured, obtained, or sold illegally [4]. While men are generally more likely to use cannabis, research suggests that women may be more vulnerable to its adverse effects, including increased risks of anxiety, depression, and cannabis use disorder (CUD) [5] and higher odds of depression have been observed among females, individuals with obesity or diabetes, those with lower education levels, and cigarette smokers in the USA [6].

Cannabis use has emerged as a growing public health concern in the USA due to evolving legislation, shifting societal perceptions, and increasing scientific evidence regarding its health implications [1, 7, 8]. Once classified strictly as an illicit drug, cannabis is now widely accepted for both medical and recreational use. This shift has led to increased consumption across diverse age groups and demographics [9]. Research has examined the impact of marijuana legalization on adolescent use patterns. For instance, the study in [10] investigated changes in adolescent marijuana use and perceptions before and after the initiation of retail marijuana sales in Colorado,

providing valuable insights into the potential effects of legalization on youth behavior.

According to the national survey on drug use and health, cannabis use among adults aged 18 and older rose from 7.59% in 2013 to 15.11% in 2022. As of 2025, 21 states and the District of Columbia have legalized recreational marijuana use, while 39 states permit its medical use [11]. Though legalization has created opportunities for medical applications and economic development, it has also introduced significant public health challenges, including impaired driving, accidental child ingestion, co-use with opioids, and the potential onset of CUD [12, 13]. Additionally, cannabis use is associated with other health risks, including cannabinoid hyperemesis syndrome, lung injury related to vaping, and cardiovascular complications [14].

The COVID-19 pandemic has exacerbated mental health issues among adolescents, potentially increasing their vulnerability to substance use. A scoping review in [15] identified increased cannabis use during the pandemic, particularly among young adults and students, driven by factors such as stress, boredom, and social isolation. Additional risk factors included younger age, increased symptom burden, and mental health conditions such as anxiety and depression. The review also noted mixed findings regarding cannabis type and consumption methods, underscoring the need for robust mental health support systems for adolescents.

Among these concerns, the association between cannabis use and mental health outcomes, particularly depression and suicidality, has emerged as a critical area of study [16]. Adolescents and young adults are particularly vulnerable, as early exposure to cannabis has been linked to a range of adverse mental health outcomes, including major depressive disorder (MDD), suicidal ideation, and suicide attempts [17, 18]. In a meta-analysis of 11 studies including over 23,000 individuals, the study in [19] found that adolescent cannabis use significantly increased the odds of developing depression (odds ratio [OR] = 1.37), suicidal ideation (OR = 1.50), and suicide attempts (OR = 3.46) in young adulthood.

Further strengthening this evidence base, the study in [20] observed a significant association between cannabis use and both depressive symptoms and suicidality in a meta-analysis review. Although causality could not be definitively established, the consistent correlation highlights the mental health risks associated with frequent use. In addition, the study in [21], drawing on data from the national comorbidity survey–adolescent supplement, reported that 22.5% of the US adolescents aged 13 to 18 had used cannabis at least once in their lifetime. Adolescents who used cannabis were found to be 2.35 times more likely to develop MDD and 3.32 times more likely to experience severe MDD. More alarmingly, they were 3.7 times more likely to attempt suicide, an association that persisted even after adjusting to depression. The study also emphasized a dose-response relationship: earlier initiation and more frequent use (e.g., three or more days per week) were linked to increased mental health risks.

The study in [22] similarly reported elevated odds of suicide attempts among youth with heavy or sustained cannabis use. The study in [23] further underscored the dangers of CUD, noting that individuals who received hospital-based treatment for CUD faced a 2.8-fold increased risk of mortality within five years, primarily due to suicide, trauma, and opioid poisoning. Additionally, it was noted that while cannabis may offer some therapeutic promise, its role in mood and anxiety disorders seems to be more harmful than helpful for young users, especially when used early and frequently [24, 25]. Despite growing evidence linking adolescent cannabis use to mental health outcomes, few studies have examined the association using a large nationally representative dataset.

To address these gaps, this study utilizes data from a nationally representative survey in the USA to provide critical insights into adolescent behavior, informing targeted prevention strategies and evidence-based public health policies. The objective of this study was to examine the association of adolescent cannabis use with depression and suicidality in young adulthood in the USA. This cross-sectional analysis of national survey data provides timely, population-level insights into these associations among the US adolescents.

METHODS

Data Source

Data from the 2023 youth risk behavior survey (YRBS), a biennial survey conducted by the Centers for Disease Control and Prevention (CDC) [26], were analyzed. YRBS monitors health risk behaviors among the US high school students, including cannabis use, depressive symptoms, and suicidal behaviors. The survey employs a three-stage cluster sampling design to produce a representative sample of students nationwide. The overall response rate for the 2023 YRBS was reported to be 35.4%, with a total of 20,103 usable responses after data editing. However, the current study analyzes data from 8,065 sample respondents with complete information on the variables of interest. YRBS questionnaire, data sets, and documentation are publicly available at https://www.cdc.gov/yrbs/index.html.

Outcome Variables

The outcome variables of interest were

(a) “poor mental health (past 30 days)” and

(b) “suicidal attempts (past 12 months)”, both coded as 1 for presence and 0 for absence.

The YRBS asked respondents these questions to gather this information:

1. For mental health assessment, students were asked, “during the past 30 days, how often was your mental health not good?”
2. For the assessment of suicidal attempts, students were asked, “during the past 12 months, did you ever seriously consider attempting suicide?”

Students responded to the mental health assessment question as either *never*, *rarely*, *sometimes*, *most of the time*, or *always*. YRBS further distinguishes students based on whether their reported mental health was *most of the time* or *always* not good. In this study, students falling under the two response categories were considered as having poor mental health (coded as 1). The affirmative response to the question on suicidal attempts was coded as 1.

Independent Variables

The exposure variable in this study was students' marijuana use, categorized as either current, former, or never. This variable was constructed based on two survey questions:

1. During your life, how many times have you used marijuana?
2. During the past 30 days, how many times did you use marijuana?

Students who answered '0 times' to the first question were categorized as 'never' users. Those who answered with some counts to the first question but '0 times' to the second question were categorized as 'former' users. Finally, students who answered with some counts to both questions were categorized as 'current' users. Students' demographic, socioeconomic, and behavioral characteristics were collected as covariates in the study.

1. Demographic factors included sex (male or female), age (14 years old or younger, 15 years old, 16 years old, or 17 years old), race (non-Hispanic White, non-Hispanic Black, multiple-Hispanic, Hispanic/Latino, multiple-non-Hispanic, Asian, or other).
2. Socio-economic factors included grade (9^{th}, 10^{th}, 11^{th}, or 12^{th}), being bullied on school property (yes or no), electronically bullied (yes or no), obese (yes or no), cumulative adverse childhood experiences (ACEs) count (0, 1, 2, or 3, 4, or more).
3. Behavioral factors included using social media several times a day (yes or no), getting 8 or more hours of sleep on average school night (yes or no).

The cumulative ACEs score was calculated from students' responses to individual questions about emotional abuse, physical abuse, sexual abuse, physical neglect, witnessed intimate partner violence, household substance use, household mental illness, and an incarcerated parent/guardian. Consequently, the total score possible was 8 with a score of 1 to each affirmative response on the individual questions. The cumulative ACEs count was calculated only for students with complete data on at least five individual ACEs. The final categorization of cumulative ACEs count as either 0, 1, 2 or 3, or 4 or more, followed guidelines from the CDC [27].

Statistical Analysis

YRBS uses a complex survey design to select respondents, necessitating the use of appropriate design-adjusted analyses to correct for potential bias and non-response. Accordingly, all statistical analyses presented in this study incorporated information on strata, clusters, and weights to enhance the validity and generalizability of the results. The analytic sample was restricted to those aged less than 18 years to ensure the reported adverse events occurred during childhood. Moreover, samples with missing information on any variable of interest were excluded from the study.

Descriptive statistics, including unweighted frequencies and weighted percentages, were used to summarize the characteristics of the study population. Bivariate associations between the outcomes and independent variables were assessed using Chi-squared test with Rao-Scott adjustment. Variables showing significant associations in the bivariate analysis were considered for inclusion in the multivariable logistic regression model. p-values less than 0.05 were considered statistically significant. The multivariable model produced estimates of the adjusted effects of each predictor on the outcome, accounting for the presence of other covariates. Results were presented as adjusted odds ratio (AOR) and their corresponding lower and upper bounds of the 95% confidence intervals (CIs). Variables with AOR whose CIs did not include 1.00 were declared statistically significant. All analyses were conducted using the R programming language with the 'survey' package to account for the survey design features [28].

Table 1. Characteristics of the YRBS 2023 respondents included in this study (N = 8,065)

Variables	Unweighted frequency	Weighted %
Marijuana use		
Current	1,489	16.5%
Former	1,114	12.6%
Never	5,462	70.9%
Sex		
Female	3,956	46.4%
Male	4,109	53.6%
Age		
14 years old or younger	928	12.6%
15 years old	2,343	28.8%
16 years old	2,425	29.2%
17 years old	2,369	29.3%
Race		
Asian	306	3.5%
Hispanic/Latino	378	6.7%
Multiple-Hispanic	1,309	20.6%
Multiple-non-Hispanic	874	6.2%
Non-Hispanic Black	944	13.8%
Non-Hispanic White	3,602	48.6%
Other	652	0.6%
Grade		
9^{th} grade	2,328	28.7%
10^{th} grade	2,505	29.9%
11^{th} grade	2,174	26.7%
12^{th} grade	1,058	14.8%
Bullied on school property (past 12 months)		
Yes	1,693	19.8%
No	6,372	80.20%
Electronically bullied (past 12 months)		
Yes	1,430	16.0%
No	6,635	84.00%
Use social media several times a day		
Yes	6,551	80.9%
No	1,514	19.10%
Get 8 or more hours of sleep on average school night		
Yes	1,826	23.3%
No	6,239	76.70%
Obese		
Yes	1,413	15.6%
No	6,652	84.40%
Cumulative ACE count		
0	1,832	24.4%
1	1,779	23.9%
2 or 3	2,542	32.9%
4 or more	1,912	18.8%

RESULTS

Distribution of Survey Participants

Table 1 presents the descriptive characteristics of the 8,065 students included in our study. The results reveal that most students (70.9%) had never used marijuana in their lives, 16.5% were current users, and 12.6% reported to be former users.

Table 2. Bivariate association between poor mental health and student characteristics

Variables	Poor mental health (past 30 days)		p
	Yes (N = 2,533)	No (N = 5,532)	
Marijuana use			< 0.001
Current	695 (25.4%)	794 (12.7%)	
Former	429 (15.9%)	685 (11.1%)	
Never	1,409 (58.7%)	4,053 (76.2%)	
Sex			< 0.001
Female	1,692 (64.4%)	2,264 (38.7%)	
Male	841 (35.6%)	3,268 (61.3%)	
Age			0.037
14 years old or younger	287 (11.5%)	641 (13.1%)	
15 years old	702 (26.6%)	1,641 (29.8%)	
16 years old	771 (29.4%)	1,654 (29.2%)	
17 years old	773 (32.5%)	1,596 (28.0%)	
Race			0.069
Asian	73 (2.6%)	233 (3.9%)	
Hispanic/Latino	102 (5.4%)	276 (7.3%)	
Multiple-Hispanic	444 (21.4%)	865 (20.2%)	
Multiple-non-Hispanic	296 (5.8%)	578 (6.4%)	
Non-Hispanic Black	232 (12.3%)	712 (14.5%)	
Non-Hispanic White	1,179 (51.5%)	2,423 (47.3%)	
Other	207 (0.9%)	445 (0.5%)	
Grade			0.021
9^{th} grade	691 (25.4%)	1,637 (30.1%)	
10^{th} grade	797 (29.7%)	1,708 (29.9%)	
11^{th} grade	711 (29.0%)	1,463 (25.7%)	
12^{th} grade	334 (15.9%)	724 (14.3%)	
Bullied on school property (past 12 months)			< 0.001
Yes	819 (32.4%)	874 (14.4%)	
No	1,714 (67.6%)	4,658 (85.6%)	
Electronically bullied (past 12 months)			< 0.001
Yes	758 (28.3%)	672 (10.7%)	
No	1,775 (71.7%)	4,860 (89.3%)	
Use social media several times a day			< 0.001
Yes	2,169 (85.6%)	4,382 (79.0%)	
No	364 (14.5%)	1,150 (21.0%)	
Get 8 or more hours of sleep on average school night			< 0.001
Yes	362 (14.6%)	1,464 (27.0%)	
No	2,171 (85.4%)	4,068 (73.0%)	
Obese			0.277
Yes	469 (16.9%)	944 (15.0%)	
No	2,064 (83.1%)	4,588 (85.0%))	
Cumulative ACE count			< 0.001
0	220 (9.6%)	1,612 (30.7%)	
1	419 (19.1%)	1,360 (26.0%)	
2 or 3	865 (36.7%)	1,677 (31.3%)	
4 or more	1,029 (34.6%)	883 (12.0%)	

The distribution of students by age was relatively balanced, with 29.3% of the students aged 17 years, 29.2% aged 16 years, 28.8% aged 15 years, and 12.6% aged 14 years or younger. Regarding gender distribution, slightly more than half (53.6%) of the students were male.

Most students (48.6%) identified themselves as non-Hispanic White, 20.6% as multiple-Hispanic, and 13.8% as non-Hispanic Black. Smaller proportions were identified as Asian (3.5%), Hispanic/Latino (6.7%), multiple non-Hispanic (6.2%), or other (0.6%). Regarding the level of education attained, the sample was evenly distributed across grades, with 9^{th} graders representing 28.7%, 10^{th} graders 29.9%, 11^{th} graders 26.7%, and 12^{th} graders 14.8% of respondents.

An estimated 19.8% of students reported being bullied on school property, and 16.0% reported being electronically bullied within the past 12 months. Social media use was high, with 80.9% of students reporting usage several times daily. Sleep duration was also notable, as only 23.3% of students reported getting eight or more hours of sleep on school nights, while 76.7% slept less than 8 hours. Regarding body weight status, 15.6% of students were classified as obese, while 84.4% were not. Exposure to ACEs varied across the sample: 24.4% of students reported no ACEs, 23.9% reported 1 ACE, 32.9% reported 2 or 3 ACEs, and 18.8% reported experiencing four or more ACEs. This distribution provides a context for understanding the cumulative adversity burden present in this adolescent population.

Bivariate Analysis Between Poor Mental Health During the Past 30 Days of the Survey and the Independent Variables

Table 2 presents the bivariate analysis results examining the association between the outcome variable "poor mental health (past 30 days)" and the independent variables. Marijuana use is found to be significantly associated with poor mental health ($p < 0.001$). Furthermore, it may be observed that all the independent variables except "obese" were significantly associated with students' poor mental health. Consequently, all variables with significant associations were included in the multivariable model.

Factors Associated With Poor Mental Health During the Past 30 Days of the Survey

The multivariable logistic regression model studying factors associated with students' poor mental health during the past 30 days of the survey is presented in **Table 3**. Adjusting for the effects of all the covariates included in this study, marijuana use was significantly associated with students' mental health. Former marijuana use was associated with 9% higher odds (AOR: 1.09, 95% CI: 0.82-1.43) of poor mental health compared with no marijuana use, although the association was not statistically significant. In contrast, current marijuana use was associated with 47% higher odds (AOR: 1.47, 95% CI: 1.26-1.72) of poor mental health compared to no marijuana use, and the association was statistically significant.

Male students had lower odds of reporting poor mental health (AOR: 0.42, 95% CI: 0.35-0.49) compared to females. Students' age, race, and grade did not significantly impact the odds of poor mental health. Students who reported being bullied on school property during the past 12 months of the survey had 79% higher odds (AOR: 1.79, 95% CI: 1.39-2.29) of poor mental health compared to those who did not report being bullied. Additionally, those who reported being electronically bullied during the past 12 months of the survey had higher odds (AOR: 1.47, 95% CI: 1.21-1.75) for poor mental health compared to those who did not report electronic bullying. ACEs had a significant impact on students' mental health. Compared to students who did not report any ACE, those with 1 ACE were 1.85 times more likely to report poor mental health (AOR: 1.85, 95% CI: 1.43-2.39), those with 2 or 3 ACEs were 2.63 times more likely (AOR: 2.63, 95% CI: 2.13-3.25), and students with 4 or more ACEs were 4.93 times more likely (AOR: 4.93, 95% CI: 3.61-6.74) to experience poor mental health. This finding suggests a graded increase in the likelihood of poor mental health with the number of ACEs, indicating that a higher number of ACEs is associated with greater odds of poor mental health.

Table 3. Multivariable logistic regression results in studying factors associated with poor mental health

Variables	AOR	Lower bound	Upper bound
Marijuana use			
Never	1.00		
Former	1.09	0.82	1.43
Current	1.47	1.26	1.72
Sex			
Female	1.00		
Male	0.42	0.35	0.49
Age			
14 years old or younger	1.00		
15 years old	0.93	0.64	1.34
16 years old	0.94	0.65	1.35
17 years old	1.05	0.65	1.71
Race			
Asian	1.00		
Hispanic/Latino	1.12	0.65	1.91
Multiple-Hispanic	1.34	0.80	2.25
Multiple-non-Hispanic	1.09	0.64	1.85
Non-Hispanic Black	1.17	0.75	1.82
Non-Hispanic White	1.39	0.87	2.22
Other	2.48	0.40	15.43
Grade			
9th grade	1.00		
10th grade	1.16	0.94	1.44
11th grade	1.17	0.85	1.62
12th grade	1.10	0.71	1.72
Bullied on school property (past 12 months)			
Yes	1.79	1.39	2.29
No	1.00		
Electronically bullied (past 12 months)			
Yes	1.46	1.21	1.75
No	1.00		
Use social media several times a day			
Yes	1.05	0.88	1.25
No	1.00		
Get 8 or more hours of sleep on average school night			
Yes	0.59	0.48	0.74
No	1.00		
Cumulative ACE count			
0	1.00		
1	1.85	1.43	2.39
2 or 3	2.63	2.13	3.25
4 or more	4.93	3.61	6.74

Bivariate Analysis Between Suicidal Attempt During Past 12 Months of the Survey and Independent Variables

Table 4 presents the results of the bivariate analysis examining the association between suicidal attempts during the past 12 months of the survey and the independent variables. Marijuana use is significantly associated with suicidal attempt ($p < 0.001$).

Table 4 also shows that students' sex, race, being bullied on school property, electronically bullied, social media use, sleep, obesity status, and cumulative ACE count are significantly associated with suicidal attempt during the past 12 months of the survey. These variables are considered for inclusion into the final multivariable model.

Factors Associated With Suicidal Attempt During Past 12 Months of the Survey

Results from the multivariable logistic regression model examining factors associated with students' suicide attempts during the past 12 months of the survey are presented in **Table 5**. One may observe that both former (AOR: 1.80, 95% CI: 1.37-2.37) and current (AOR: 1.83, 95% CI: 1.34-2.49) marijuana users had significantly higher odds for suicidal attempts compared to non-users. Regarding gender disparity, male students had reduced odds (AOR: 0.57, 95% CI: 0.46-0.71) for reporting suicidal attempts compared to females. Non-Hispanic Black (AOR: 1.99, 95% CI: 1.06-3.74) and non-Hispanic White students (AOR: 2.05, 95% CI: 1.18-3.57) had higher odds for reporting suicidal attempts compared to Asian students.

Consistent with its association with poor mental health, bullying was also significantly associated with the risk of suicide attempts. Students who reported being bullied on school property within the past 12 months of the survey had significantly higher odds of reporting a suicidal attempt (AOR: 2.18, 95% CI: 1.75-2.72) compared to those who did not report

Table 4. Bivariate association between suicidal attempt and student characteristics

Variables	Suicidal attempt (past 12 months)		p
	Yes (N = 1,808)	No (N = 6,257)	
Marijuana use			< 0.001
Current	597 (29.8%)	892 (13.4%)	
Former	371 (20.8%)	743 (10.6%)	
Never	840 (49.4%)	4,622 (76.0%)	
Sex			< 0.001
Female	1,187 (63.1%)	2,769 (42.5%)	
Male	621 (36.9%)	3,488 (57.5%)	
Age			0.694
14 years old or younger	194 (11.3%)	734 (12.9%)	
15 years old	526 (29.1%)	1,817 (28.8%)	
16 years old	563 (29.8%)	1,862 (29.1%)	
17 years old	525 (29.8%)	1,844 (29.2%)	
Race			0.031
Asian	43 (1.8%)	263 (3.9%)	
Hispanic/Latino	69 (5.2%)	309 (7.1%)	
Multiple-Hispanic	293 (19.5%)	1,016 (20.8%)	
Multiple-non-Hispanic	246 (7.2%)	628 (6.0%)	
Non-Hispanic Black	170 (12.9%)	774 (14.0%)	
Non-Hispanic White	843 (52.8%)	2,759 (47.6%)	
Other	144 (0.6%)	508 (0.6%)	
Grade			0.487
9th grade	534 (29.3%)	1,794 (28.5%)	
10th grade	562 (29.4%)	1,943 (30.0%)	
11th grade	494 (28.2%)	1,680 (26.4%)	
12th grade	218 (13.1%)	840 (15.2%)	
Bullied on school property (past 12 months)			< 0.001
Yes	723 (40.6%)	970 (14.9%)	
No	1,085 (59.4%)	5,287 (85.1%)	
Electronically bullied (past 12 months)			< 0.001
Yes	650 (35.3%)	780 (11.5%)	
No	1,158 (64.7%)	5,477 (88.5%)	
Use social media several times a day			< 0.001
Yes	1,531 (86.1%)	5,020 (79.7%)	
No	277 (13.9%)	1,237 (20.3%)	
Get 8 or more hours of sleep on average school night			< 0.001
Yes	241 (11.6%)	1,585 (26.0%)	
No	1,567 (88.4%)	4,672 (74.0%)	
Obese			0.013
Yes	360 (18.7%)	1,053 (14.9%)	
No	1,448 (81.3%)	5,204 (85.1%)	
Cumulative ACE count			< 0.001
0	77 (4.5%)	1,755 (29.0%)	
1	217 (13.9%)	1,562 (26.3%)	
2 or 3	588 (37.7%)	1,954 (31.8%)	
4 or more	926 (43.8%)	986 (12.9%)	

Table 5. Multivariable logistic regression results in studying factors associated with suicidal attempts

Variables	AOR	Lower bound	Upper bound
Marijuana use			
Never	1.00		
Former	1.80	1.37	2.37
Current	1.83	1.34	2.49
Sex			
Female	1.00		
Male	0.57	0.46	0.71
Race			
Asian	1.00		
Hispanic/Latino	1.68	0.90	3.11
Multiple-Hispanic	1.64	0.90	2.99
Multiple-non-Hispanic	2.00	0.99	4.07
Non-Hispanic Black	1.99	1.06	3.74
Non-Hispanic White	2.05	1.18	3.57
Other	2.03	0.60	6.84
Bullied on school property (past 12 months)			
Yes	2.18	1.75	2.72
No	1.00		
Electronically bullied (past 12 months)			
Yes	1.53	1.26	1.84
No	1.00		
Use social media several times a day			
Yes	0.96	0.75	1.24
No	1.00		
Get 8 or more hours of sleep on average school night			
Yes	0.51	0.40	0.64
No	1.00		
Obese			
Yes	1.15	0.91	1.46
No	1.00		
Cumulative ACE count			
0	1.00		
1	2.54	1.66	3.89
2 or 3	4.82	3.25	7.16
4 or more	10.04	6.77	14.89

such experiences. Similarly, those who experienced electronic bullying during the same period also had increased odds of suicidal attempt (AOR: 1.53, 95% CI: 1.26-1.84) relative to their peers who did not report being electronically bullied. Finally, ACEs were strongly associated with suicidal attempts among students. Compared to those who reported no ACEs, students with 1 ACE had 2.54 times higher odds of reporting suicidal attempts (AOR: 2.54, 95% CI: 1.66-3.89). Those with 2 or 3 ACEs had 4.82 times higher odds (AOR: 4.82, 95% CI: 3.25-7.16), while students with 4 or more ACEs had more than a 10-fold increase in the odds (AOR: 10.04, 95% CI: 6.77-14.89) to report suicidal attempts. This finding demonstrates a graded increase in the likelihood of suicidal behavior with the number of ACEs, indicating that greater adversity is associated with increased risk of suicidal attempts.

DISCUSSION

This study examined the association between marijuana use and adverse mental health outcomes, specifically poor mental health and suicide attempts, among adolescents and young adults in the USA, using data from the 2021 youth risk behavior surveillance system (YRBSS). Bivariate and multivariable logistic regression analyses revealed that both current and former marijuana users had significantly higher odds of experiencing poor mental health and attempting suicide compared to non-users. These findings are consistent with a significant body of previous research [29, 30]. They confirm earlier cross-sectional results and build on them by

(a) using the latest nationally representative YRBS cycle (2023),

(b) modeling cumulative ACEs as a continuous variable, and

(c) illustrating a dose-response relationship between ACE burden and suicidality.

Adolescents who currently use marijuana have 47% higher rates of reporting poor mental health (AOR: 1.47; 95% CI: 1.26-1.72). Additionally, the odds of reporting a suicide attempt were significantly elevated among both former users (AOR: 1.80; 95% CI: 1.37-2.37) and current users (AOR: 1.83; 95% CI: 1.34-2.49). Notably, current users have slightly higher odds than former users, suggesting a potential dose-response relationship between marijuana exposure and mental health risks. These findings also raise the possibility that the psychological effects of marijuana may persist even after cessation. Our results align with a growing body of literature documenting the association between adolescent marijuana use and adverse mental health outcomes. For instance, the study in [17] found that cannabis use during adolescence is significantly associated with an increased risk of depression and suicidal behavior in young adulthood. The studies in [16, 20] similarly reported that marijuana use was predictive of internalizing symptoms and suicide attempts. These studies reinforce the likelihood of a causal or contributory relationship between cannabis use and mental health disturbances in youth populations. However, the literature remains somewhat mixed. It was found no significant association between cannabis use and depression or anxiety after adjusting for confounding factors [31]. It was found that there were no significant changes in overall marijuana use among adolescents in Colorado after legalization [10]. It was highlighted the differential effects of cannabis compounds, emphasizing that tetrahydrocannabinol (THC) may exacerbate psychiatric symptoms, whereas cannabidiol (CBD) might have protective effects [24]. Discrepancies in findings across studies may stem from variations in study design, sample characteristics, cannabis composition (e.g., THC-to-CBD ratio), and contextual factors such as legalization status or perceived stigma.

Moreover, some studies highlight the nuanced roles of early initiation, frequency of use, and exposure to high-potency cannabis products in predicting mental health outcomes such as MDD and suicidality. While our study suggests a dose-response relationship, the association may be moderated by individual vulnerabilities and environmental conditions, as discussed in [23, 24]. Future studies should continue to explore these moderating factors using longitudinal and experimental designs. In addition, females exhibited significantly higher risks for both poor mental health and suicide attempts, suggesting that they may be more susceptible to the adverse neuropsychiatric effects of cannabis. This aligns with existing literature indicating that women may experience heightened risks of anxiety, depression, and CUD due to the effects of cannabis and cannabinoids [5, 31].

The findings of this study reveal a strong, graded association between ACEs and both poor mental health and suicide attempts among adolescents. Compared to those with no reported ACEs, students with one ACE were nearly twice as

likely to report poor mental health, while those with four or more ACEs experienced nearly a fivefold increase in odds. Similarly, the likelihood of suicide attempts increased dramatically with the number of ACEs, with students reporting four or more ACEs showing a tenfold increase in risk. These findings align with the well-documented dose-response relationship between ACE exposure and poor mental health outcomes [32, 33]. ACEs, including abuse, neglect, and household dysfunction, are known to disrupt neurodevelopment and stress regulation pathways, increasing vulnerability to mood disorders, emotional dysregulation, and self-harming behaviors [34, 35]. The steep increase in the odds of suicide attempts with each additional ACE in our study reinforces previous evidence that cumulative childhood adversity significantly elevates the risk of suicidal ideation and behavior in adolescence [36, 37].

Furthermore, these findings align with public health models that frame early life adversity as a key social determinant of health, influencing long-term psychological well-being and behavioral health trajectories [38]. Given this evidence, school-based interventions, trauma-informed care, and early screening for ACEs are critical components of mental health promotion and suicide prevention strategies among youth.

Our findings about the protective effects of sleep are consistent with the literature. Insufficient sleep has profound adverse effects on both physical and mental health [39, 40]. Disruptions in circadian rhythm initiate a series of molecular and behavioral changes, such as reduced cellular function, higher rates of cell death, and decreased neuronal excitability. These modifications hinder brain activity and connectivity, leading to slower response times, cognitive decline, and increased emotional instability [39]. Collectively, the evidence underscores the essential role of sleep in preserving overall physiological and psychological well-being.

Our study found that social media use was not significantly associated with poor mental health. The impact of social media on mental health remains controversial, with studies indicating both positive and negative effects. On one hand, social media can encourage social connection, provide peer support, and enhance access to mental health resources [41]. On the other hand, excessive use has been associated with heightened anxiety, depression, and poor sleep, especially among adolescents and young adults [42]. The variability in outcomes suggests that the effects depend on factors such as usage patterns, individual vulnerability, and the nature of online environments' interactions.

The public health implications of these findings are significant. Cannabis is the second most used psychoactive substance after alcohol and changing social norms along with increasing legalization have reduced the perceived risks, especially among adolescents and young adults. Therefore, targeted education is crucial to raise awareness of the potential mental health risks linked to cannabis use in these groups [43]. The COVID-19 pandemic has further exacerbated mental health issues among adolescents, potentially increasing their vulnerability to substance use, due to heightened stress, isolation, and limited access to care [15], thus underscoring the need for robust mental health support systems. Early prevention efforts should include school-based education, parental guidance, and clinical screening for cannabis use as a mental health risk factor.

The implications of our research highlight the need for comprehensive public health strategies to address the growing concerns related to marijuana use among adolescents. Policymakers, educators, and healthcare professionals should collaborate to develop age-appropriate educational campaigns, improve access to mental health care, and support trauma-informed interventions for adolescents at risk. Given the potential for marijuana to serve as both a marker and a contributor to psychological vulnerability, its role in youth mental health warrants continued attention in research, practice, and policy. By simultaneously modeling cannabis use, cumulative ACEs, bullying victimization, and sleep duration, this study offers new evidence on how each factor independently influences adolescent mental health beyond previous research.

Despite our study's strengths, several limitations must be acknowledged. The cross-sectional design of the YBRSS prevents us from establishing causality; we cannot determine whether marijuana use caused poor mental health and suicide attempts or vice versa. Relying on self-reported data introduces potential biases, such as social desirability and recall biases, which may affect the accuracy of reported marijuana use and mental health status. The study also lacks detailed contextual information on marijuana use, such as frequency and potency, and does not consider variations in state legalization, which could influence trends. Although the YRBSS provides a nationally representative sample, the findings may not be fully generalizable to all adolescents, particularly those outside traditional school settings. Additionally, we were unable to incorporate state-level cannabis policies or retail access; unmeasured policy differences may bias the associations in either direction. Residual confounding might remain despite adjustment for measured covariates. These limitations underscore the need for further research, especially longitudinal studies, to better understand the factors driving adolescent marijuana use and to develop effective prevention strategies. As emphasized in [7], rigorous longitudinal research is essential to clarify these complex relationships.

Future studies should incorporate longitudinal designs to confirm the causal pathways between marijuana use and adverse mental health outcomes, include objective biomarkers of cannabis exposure, and gather richer contextual data to elucidate these relationships better and evaluate the long-term effects of cannabis use, particularly its potential to contribute to severe psychiatric conditions like schizophrenia [43, 44]. Investigating the effects of specific cannabinoids (e.g., THC vs. CBD) on adolescent brain development and psychological functioning could inform more nuanced public health messaging. Additionally, research should investigate the specific contributions of early initiation, high-potency products, and frequency of use to the development of MDD and suicidality. It should also explore how socioeconomic status, race, gender, and family dynamics intersect with cannabis use and mental health in youth. Furthermore, studies should investigate the effects of state-level policies on adolescent marijuana use and mental health outcomes, as well as the role of social media and sleep duration as potential mediators or moderators of these relationships.

CONCLUSIONS

In this nationally representative analysis of YRBS 2023 data, adolescent cannabis use–particularly current use–was significantly associated with higher odds of poor mental health and suicide attempts. The findings, congruent with prior studies [29, 30], underscore the importance of early intervention for at-risk youth and of prevention strategies that account for co-occurring adversities and rapidly changing access environments. The study also highlights a strong association between ACEs and both poor mental health as well as suicide attempts. This highlights the critical role of trauma-informed care in schools and communities. While casualty cannot be established due to the study's cross-sectional design, the consistent associations emphasize the need for longitudinal research tracking cannabis use and mental health outcomes. Such evidence will be critical in guiding sustainable public health policies and informing educational and legislative measures aimed at mitigating these risks.

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AI statement: The authors stated that generative AI tools were used only to assist with language editing (spelling, grammar, and phrasing) and did not generate any original scientific content, study design, statistical analysis, or conclusions. The authors reviewed and verified all AI-assisted text, take full responsibility for the content of the manuscript, and ensured compliance with journal and institutional policies on AI use.

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