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Early Age of Cannabis Initiation and Its Association With Suicidal Behaviors

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ABSTRACT

BACKGROUND: Suicide rates in the U.S. have continued to rise over the last 2 decades. The increased availability and broader legalization of cannabis is a public health concern, particularly among adolescents. The objective of this study was to examine the association between the age of cannabis initiation and lifetime suicidal ideations and attempts in a sample of adults aged 18 or older.

METHODS: Data are from the Collaborative Psychiatric Epidemiology Surveys (CPES), 2001 to 2003 (N = 15 238). The primary objective of the CPES was to collect data about the prevalence of mental disorders, impairments associated with these disorders, and their treatment patterns from representative samples of majority and minority adult populations in the U.S. Logistic regression analyses were conducted to test the association between cannabis initiation age (early ≤ 14 years old; later > 14 years old) and outcomes of lifetime suicide ideation and attempts. Cigarette use, cannabis use, gender, income, race, education, and age were controlled for the analyses.

RESULTS: Overall, 12.5% of participants reported suicide ideation, while 4.2% reported attempt. Early cannabis use was associated with a higher risk of suicide ideation (AOR = 3.32, 95% CI [2.75, 3.80]) than later cannabis use (AOR = 2.15, 95% CI [1.92, 2.39]). Early cannabis use was associated with a higher risk of suicide attempt (AOR = 4.38, 95% CI [3.48, 5.52]) than later cannabis use (AOR = 2.56, 95% CI [2.14, 3.06]). Wald chi-squared tests revealed significant differences between the early and late initiation for both ideation ($\chi^2 = 26.99$; $P < .001$) and attempts ($\chi^2 = 26.02$; $P < .001$).

CONCLUSIONS: Significant associations were found between early initiation of cannabis and suicide behaviors. As suicide rates continue to rise, it is recommended that clinicians, treatment providers, and other professionals consider the use of cannabis at an early age as a risk for subsequent suicide behaviors.

KEYWORDS: Early cannabis initiation, early cannabis use and suicide, suicide ideation and cannabis involvement, early cannabis onset and suicidal behaviors

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Background

Cannabis (marijuana) is the most widely used illicit drug worldwide.^{1,2} Adolescent cannabis use in the U.S. is widespread with more than 11.8 million young adults reporting cannabis use in the 2018 and 2019 annual surveys of U.S. middle and high school students. Students reported a significant increase in daily cannabis use, with about 11.8% eighth graders and 28.8% of 10th graders disclosing cannabis use in the past year.³ Adolescent cannabis use has been associated with negative outcomes including lower educational attainment,⁴⁻⁶ negative mental health outcomes,⁷ the use of other illicit drugs,^{8,9} and suicidal ideation and behaviors (SIB).^{9,10} Although there is increasing acceptance of recreational cannabis use, along with legalization for use among adults in several states,¹¹ the potential harms of cannabis use must not be understated,^{12,13} particularly SIB.

Suicide is among the leading causes of death in the U.S., and the adjusted rate for suicide in 2018 was the highest since 1941.^{14,15} The suicide rate in the U.S. has risen an average of 1.5% a year since 1999. If this rate of increase continues, the suicide rate from 2000 to 2050 in the U.S. is expected to double.¹⁶ Cannabis use has been linked to SIB,^{9,17} along with depression and anxiety, which are 2 major independent risk factors for suicide.¹⁸⁻²⁰ Its early initiation is a marker for risk, and been found to be linked to adverse outcomes, include SIB.^{10,21} Several extant studies have observed links between the age of cannabis involvement and SIB. In a longitudinal study from Sweden, Hengartner et al²² found that first cannabis use at ages 16/17 and 19/20 years was associated with almost a 2-fold higher odds of suicidality in adulthood (20-50 years of age). Han et al¹⁷ found that cannabis use in young adults was



associated with a higher prevalence of suicide ideation, plan, and attempt, with a greater risk among women. In a study of young adults from Mexico, Borges et al²³ found that cannabis initiation at age 15 or earlier was associated with a 5-fold risk of suicide attempt in young adulthood. In a study of youth age 13 to 16 from Oceania, Peltzer and Pengpid²¹ found that early cannabis initiation was associated with both suicide ideation and attempt.

While prior research has found links between early initiation of cannabis initiation and SIB, most studies have focused on SIB during adolescence, and are from outside the U.S. Only few studies have examined the link between adolescent age of cannabis initiation and suicidality, particularly in adulthood. It is important to examine this work among U.S. populations, as rates of suicide have continued to rise, along with changing attitudes and perceptions regarding cannabis use. Understanding pathways to SIB such as early cannabis initiation is essential, given its known risks. The current study examines the associated between early initiation of cannabis, and SIB during adulthood, using an ethnically diverse sample from the United States. We hypothesize that early initiation of cannabis, may be predictive of future SIB during adulthood.

Methods

Participants

The current study involved secondary analysis of data from the National Co-Morbidity Survey Replication (NCS-R), the National Survey of American Life (NSAL), and the National Latino and Asian American Study (NLAAS) as these were presented in the Collaborative Psychiatric Epidemiology Surveys (CPES), 2001 to 2003.^{24,25} CPES was designed to collect data from representative samples of majority and minority adult populations in the U.S., with oversampling of racial/ethnic minorities. The diverse race/ethnic composition of the sample is a strength of the CPES dataset. Although approximately 38% of the U.S. population identify as a race/ethnic minority,²⁶ most suicide research has focused on a White-centric lens.²⁷

The study employed probability sampling techniques to identify 252 geographic areas across the U.S., where adults were selected from each eligible household. The full sample included 20013 respondents (aged >18 years), of which 15328 participants responded to the variables of interest (cannabis use, suicidal thoughts, and behavior). All procedures that involved human subjects, including consent from all participants 18 years of age and older, were approved by the Institutional Review Board at the University of Michigan.^{28,29}

The CPES data were obtained from the Inter-university Consortium for Political and Social Research (Ann Arbor, MI). Our sample for the current study included 15328 respondents who stratified into gender and race/ethnicity strata as female (n=8981; 58.6%) and male (n=6347; 41.4%), non-Hispanic White (n=4175; 27.2%), Black (n=5532;

36.1%), Latino (n=3258; 21.3%), and Asian (n=2174; 14.2%). The mean age of the study sample was 43.38 years (SD=16.71) with a similar proportion of females and males (M=43.74, SD=16.98; M=42.89, SD=16.34, respectively).

Measures

All measures used in this study were from the CPES dataset. Each of the major variables used and its coding for analytic purposes are described below.

Suicide ideation and attempt. The primary outcomes of interest in the current study were the report of lifetime suicidal ideation and lifetime suicide attempt. Lifetime suicidal ideation dichotomously based on a positive response to any of the following questions: "Have you seriously thought about committing suicide?" "Did you ever think about committing suicide," "Have you seriously thought about committing suicide in the past 12 months." Lifetime suicide attempt was also coded dichotomously and based on a positive response to any of the following questions: "Have you ever attempted suicide?" or "Have you ever attempted suicide in past 12 months?"

Cannabis initiation. Age of cannabis initiation was based on the following question "How old were you the time you used marijuana or hashish?" Cannabis initiation was dummy coded into 3 variables of early initiation (age ≤14), later initiation (age ≥15), and no cannabis use (referent). This was based on prior work that has identified age 14 or earlier as marker of risk for early initiation.^{23,30,31}

Covariates. We selected a broad range of psychiatric and psychosocial covariates that are known to be associated with suicidal ideation and behaviors. Models included participant report of regular lifetime smoking (100 or more times),³² lifetime diagnosis of major depressive disorder (MDD),³³ income,^{34,35} education,³⁶ age, and race.^{15,37} Income was coded as 1 representing low income of <\$30000 and 0 representing income ≥\$30000. Education was coded as 1 representing <high school and 0 representing high school graduate or any education after high school. Self-report of race and ethnicity were dummy coded into 4 variables of non-Hispanic Black, Hispanic/Latino, Asian, and non-Hispanic White (reference group).

Data analysis

All coding was conducted in SAS 9.4 (SAS Institute, Cary, NC), with analyses conducted in Stata Version 17 (Stata-Corp LP, College Station, TX). Two separate logistic regression models were run with the independent variable of age of cannabis initiation (≤14 [representing early age]; ≥15 [representing later age]) and the dependent variables of suicide ideation and suicide attempt. In the first model, we tested whether early cannabis initiation was associated with lifetime suicide

Table 1. Sample demographics (n= 15 328).

DEMOGRAPHICS	N	%
Sex		
Female	8981	58.6
Male	6347	41.4
Race, ethnicity		
White, non-Hispanic	4175	27.2
Black	5532	36.1
Latino	3258	21.3
Asian	2174	14.2
Education		
<High school	3367	22.0
Graduated high school	4460	29.6
Some college	5263	34.3
Graduated college	2238	14.6
Income		
<\$30 000	6437	42.0
\$30 000-\$74 999	5487	35.8
≥\$75 000	3404	22.2
Cannabis initiation		
Early: age ≤14	1181	7.8
Later age ≥15	4746	30.1
No cannabis use	9401	61.3
Lifetime suicide ideation	2369	15.4
Lifetime suicide attempt among ideation	827	5.3
Lifetime major depressive disorder	3 036	19.8

Abbreviation: n, number.

ideation. In the second model, we tested the association between early cannabis initiation and suicide attempt. We controlled for age, sex, race/ethnicity, lifetime regular smoking, household income, level of education, in both models.

Results

Table 1 provides information about the demographic characteristics of our study sample. Early age of cannabis initiation was reported by 7.8% (n = 1180) of the sample while 30.1% (n = 4742) reported later age of initiation. Suicidal behaviors including lifetime suicidal ideation and lifetime suicide attempts were reported by 12.4% and 5.3% of the sample, respectively.

Bivariate analysis and chi-squared test of difference were conducted before conducting multivariate analysis. There were significant differences ($\chi^2=263.43$) found between early and

later initiation. Among early initiators, 31.9% reported suicidal ideation in comparison to 14.1% of participants who reported later cannabis initiation. Significant differences between early initiation and later initiation were also found for suicide attempt ($\chi^2=222.96$), and major depressive disorder ($\chi^2=108.10$).

In Table 2, we present the results of the regression models examining the association between age of cannabis initiation and suicide ideation. Early cannabis initiation was associated with higher odds (AOR = 3.32, 95% CI [2.75, 3.80]) of suicide ideation than later initiation (AOR = 2.15, 95% CI [1.92, 2.39]). Wald chi-square test revealed a significant difference between the early and late age of cannabis initiation for suicide ideation ($\chi^2=26.99$; $P<.001$). Lifetime MDD, and low income were also associated with higher odds of suicide ideation. Lower odds of suicide ideation were associated with non-Hispanic Black or Asian race/ethnicity as compared to the referent of non-Hispanic White and for males compared with females.

Table 3 shows the results of the regression models examining the association between age of cannabis initiation and suicide attempt. Early age of cannabis initiation was associated with a significantly higher odds of suicide attempt (AOR = 4.38, 95% CI [3.48, 5.52]) as compared with no cannabis initiation. There was a significant difference in the proportion of suicide attempts among early and late initiators of cannabis ($\chi^2=26.02$; $P<.001$). Later age of cannabis initiation was also associated with higher odds of a suicide attempt compared to non-users, although the odds were not as high as early age (AOR = 2.56, 95% CI [2.14, 3.06]). Additionally, lifetime MDD, less than a high school education, and low income were associated with slightly higher odds of suicide attempts. Non-Hispanic Black race/ethnicity and male sex were associated with lower odds of suicide attempts. Two tests were used to check for goodness of fit, including the Deviance and Pearson goodness of fit. Pearson results for both outcomes suicidal ideation ($P=.64$) and suicide attempt ($P=.17$) indicated that the model is a good fit, in which case we reject the null hypothesis.

Discussion

The goal of this study was to examine the association between early initiation of cannabis and suicidal behaviors among an ethnically diverse U.S. based sample. The findings of this study suggest that initiation of cannabis use before the age of 14 is associated with greater than a 3-fold increase in suicide ideation and greater than a 4-fold increase odds of suicide attempt. Later age of cannabis initiation was associated with a 2.5-fold increased odds of suicide attempt. The findings reveal that while cannabis use at any point of one's lifetime increases their risk for suicidal behaviors, initiating use at age 14 or earlier has the greatest risk.

Early cannabis use among adolescents is of concern because of its association with various psychiatric illnesses and psychosocial conditions.³⁸ Researchers have found adolescent

Table 2. Logistic regression analyses predicting lifetime suicide ideation.

VARIABLE	AOR	95% CI
Early cannabis use: Age ≤14	3.32	[2.75, 3.80]*
Later cannabis use: Age >14	2.15	[1.92, 2.39]*
No cannabis use	Ref	
Lifetime major depressive disorder	4.27	[3.86, 4.72]*
Lifetime regular smoking	1.11	[0.94, 1.33]
Non-Hispanic White	Ref	
Black	0.51	[0.44, 0.59]*
Latino	0.57	[0.49, 0.65]*
Asian	0.63	[0.53, 0.74]*
Male gender	0.73	[0.66, 0.81]*
Female gender	Ref	
Age	0.99	[0.98, 0.99]*
Education: < High school	1.09	[0.97, 1.24]
Income: <\$30000 per year	1.42	[1.28, 1.57]*

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; Ref, reference category.

*Significant ($P < .05$).

Table 3. Logistic regression analyses predicting lifetime suicide attempt.

VARIABLE	AOR	95% CI
Early cannabis use	4.38	[3.48, 5.52]*
Later cannabis use	2.56	[2.14, 3.06]*
No cannabis use	Ref	
Lifetime major depressive disorder	4.32	[3.70, 5.03]*
Lifetime regular smoking	1.26	[0.96, 1.64]
Non-Hispanic White	Ref	
Black	0.57	[0.45, 0.71]*
Latino	0.89	[0.72, 1.09]
Asian	0.71	[0.53, 0.95]*
Male gender	0.54	[0.45, 0.63]*
Female gender	Ref	
Age	0.98	[0.98, 0.99]*
Education: <High school	1.41	[1.17, 1.69]*
Income: <\$30000 per year	1.66	[1.41, 1.95]*

Abbreviations: AOR: adjusted odds ratio; CI: confidence interval; Ref: reference category.

*Significant ($P < .05$).

cannabis use increases the prevalence of comorbid psychiatric conditions such as bipolar disorder and depression.³⁹ Early and frequent use of cannabis can increase risk for drug dependence and addiction behavior, which can result in the use of other illicit drugs.³⁹ Adolescents may also use cannabis as a coping strategy for depressive symptoms.³⁹ Cannabis use during adolescence was associated with increased prevalence for anxiety in young adulthood.⁴⁰

Prior studies show early use of cannabis as a predictor for suicide attempts and suicide. Moreno-Mansilla et al³⁹ conducted a cross-sectional study and concluded that cannabis use among adolescents increases symptoms of depression and hopelessness which can lead to suicide attempts. The risk for suicide attempts is greater for adolescents less than 15 years of age. A systemic review and meta-analysis by Gobbi et al⁴⁰ reported that the high prevalence of cannabis use by adolescents creates the potential for many young people to develop depression and suicidality due to cannabis use. Doucette et al⁴¹ evaluated whether the cannabis legalization in Washington State and Colorado has led to the wide usage and deaths by suicide. Doucette et al⁴¹ and team have concluded that suicide is the second leading cause of death in the US for ages 15 to 34 in 2018.

Our study results highlight the potential benefit of addressing this issue with clinicians, schools, and other stakeholders, to focus on cannabis prevention, particularly at a young age, where risk is highest for suicidal behaviors. Cannabis use by youth and adolescents may be a sensitive topic, requiring unconventional interventions to facilitate private conversation without parents being present. Deleterious and long-term effects of cannabis use require further study, but include decrements in complex decision-making, cardiovascular and pulmonary effects, as well as adverse effects associated with cannabis contaminants. Preliminary studies have shown neurocognitive deficits in verbal learning, memory, and attention accuracy in adolescents who are heavy cannabis users, which may remit with up to 6 weeks abstinence.^{42,43} Cognitive functions appeared to be more severely affected in adolescents compared to adults.⁴³ Researchers are currently conducting the prospective 10-year Adolescent Brain Cognitive Development Study to test whether cognitive impairment occurs in children who use cannabis as compared with those who do not.⁴² Others are exploring whether prenatal THC exposure affects one of the brain's signaling pathways (brain-derived neurotrophic factor and its association with cannabis use disorder in young adulthood).^{44,45} Therefore, it is imperative that educational and public health efforts be directed toward screening for risk potential and prevention. Routinely scheduled pediatric visits are a potential place for screening to occur.

Prevention

Education efforts should be addressed to key stakeholders such as educators, parents, and community agency personnel, about the harms associated with the use of cannabis by youth and young adolescents.⁴⁶ Dedicated advocacy through formal

programs early on may provide the most effective prevention strategies. Interactive cannabis use prevention programs initiated during middle school years by teachers, have proven to be effective and should be considered nationwide to help youth and adolescents delay or abstain from cannabis use.⁴⁷ Educational materials should incorporate the actions that parents and guardians can take when working with their children's schools and community groups and link them to organizations such as the American Academy of Pediatrics, The Substance Abuse and Mental Health Services Administration, and the National Institute on Drug Abuse (NIDA) for additional guidance and resources.^{48,49}

Given the rapidly increasing legalization of recreational cannabis in the U.S., there is a need for an in-depth examination of the impact on health outcomes with an emphasis on youth and adolescents. According to the data analyzed, approximately 20% of the cannabis users in this sample started at ≤ 14 years of age. Few examinations of health outcomes pre- and post-legalization have been conducted and those with a focus on children and adolescents are scarce. One Colorado study of outcomes post-legalization reported, "though we found an apparent public health benefit in a reduction in opioid-related deaths following recreational cannabis legalization in Colorado, we note that expanded legalized cannabis use is also associated with significant potential harms."⁵⁰

Policy recommendations have been suggested by various groups to help protect youth and adolescents from unintentional ingestion or from an intentional early use of readily accessible cannabis. NIDA's Cannabis Policy Research Workgroup (2018) recommendations include developing prevention approaches using public policy, such as limiting outlet density, limiting use in public, and higher taxes (p. 4). Colorado's analysis of post-legalization data suggests that policy is needed to increase the use of child-resistant packaging and to provide education regarding the safe storage of marijuana products.⁵¹

Limitations

These findings should be interpreted with consideration of the limitations of the study. First, adolescent cannabis use continues to be studied, but data are limited by societal lack of early screening for underlying mental disorders, poor documentation of mental health and substance abuse, and challenges associated with illegal status of cannabis products. Second, parental use of cannabis should also be assessed as studies have found increased likelihood of use by children living in a household with a parent who has multiple health risk behaviors, such as smoking or cannabis use.⁵² Third, standardized state and federal medical terminology and coding for terms such as nondependent cannabis abuse and cannabis dependence would greatly improve data collection as well as public health surveillance at the local, state, and national levels.⁵³ Current commonly used screening questions do not reflect the various cannabis types, formulations, administration routes, and

strengths of available doses.⁵⁴ Standardized data collection practices would allow for development of an assessment algorithm for practitioners that should be applicable in any setting with regular updates as necessary. Fourth, the study does not examine regular use, or frequent use, and only focuses on initiation. It is highly possible that one may experiment with cannabis only once or few times, with limited consequences. Future studies should address the role of frequent or regular cannabis use and SIB. Finally, the age of the data is a limitation, which was collected from 2001 to 2003. However, we do not expect that the findings would yield significantly different results, if a similar study were conducted today. While prevalence rates for both SIB and cannabis have rising since 2001 to 2003, their associations have been highlighted and studied for decades.^{55,56} In light of these limitations, the study adds to the existing body of knowledge on cannabis initiation and suicide behaviors.

Conclusion

The current findings suggest initiating cannabis at an early age is a potent risk for suicidal behaviors. These findings are of concern because there have been unprecedented shifts in the cannabis policy environment over the last decade, including legalization of cannabis for recreational use in several U.S. states.¹³ The use of cannabis has become more widely acceptable and normative in recent years. Although safe cannabis use has been documented, adverse consequences have also been observed.¹² Many adolescents will use cannabis recreationally due to its greater acceptability and access, however the lack of data regarding adverse consequences of its use by youth and young adults should be considered.

Authors' Contributions

MAh, MAw, and SG led the study design. The literature review was conducted by TS, PF, JC, and KR. The data analysis was conducted by MAh and KAK. RPD, KR, SG, and JT provided critical edits and review. All authors read and approved the final manuscript.

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