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Mind the gap: revealing the association between depression, marijuana use, and mental health care utilization

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Mind the Gap: Revealing the Association between Depression, Marijuana Use, and Mental Health Care Utilization

By

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Abstract

Depression is a widespread mental health condition affecting millions worldwide, with young adults being particularly vulnerable. The concurrent use of marijuana has become an increasingly relevant factor in treating depression, especially in this population. However, recent literature reviews have highlighted a significant gap in knowledge regarding treatment outcomes in adolescents who utilize both mental health treatments, including antidepressants (AD), and marijuana. This research seeks to better understand the relationship between mental health treatment utilization and marijuana together by exploring the association between depression, marijuana use, and mental health care utilization. Our findings suggest that depression and marijuana use tend to co-occur, and mental health treatment does not reduce this association. Moreover, mental health services may increase the association of marijuana use with depression significantly in adults aged 18 – 25 years old. Our study highlights the potential negative impact of marijuana use on mental health, specifically the increased odds of experiencing a major depressive episode (MDE) in individuals who use marijuana regardless of whether they are utilizing mental health treatment. These results have important implications for public health interventions and substance use prevention efforts, particularly among young adults, who have the highest prevalence of marijuana use and major depressive episodes.

Introduction

Depression and anxiety are rampant mental health conditions affecting millions worldwide, particularly adolescents. As a result, antidepressant medication (AD) has emerged as an effective treatment option for individuals experiencing these disorders. However, with the widespread use of cannabis, the concurrent use of marijuana has become an increasingly relevant factor in treating depression and anxiety, particularly in adolescents (Substance Abuse and Mental Health Services Administration, 2021). Unfortunately, despite extensive research on the psychological and physiological effects of cannabis, little is known about the impact of marijuana use on the efficacy of prescribed medications for mental health, such as ADs, particularly in individuals who use both substances.

Antidepressants have been popular for treating mood disorders like depression, anxiety, and sleeping difficulties. They can balance chemicals in the brain, improving mood, concentration, and sleep quality. However, there has been a recent surge in the use of these medications, leading some observers to express concerns over the drastic spike in antidepressant prescriptions in the late twentieth and early twenty-first centuries (Auday, 2022). While SSRIs, such as fluoxetine, citalopram, sertraline, paroxetine, and escitalopram, are the most commonly prescribed antidepressant, they can produce various side effects, including nausea, vomiting, weight gain, diarrhea, sleepiness, and sexual problems. Despite their effectiveness in treating depression and anxiety, it may take several weeks for antidepressants to reach their full therapeutic effect. Additionally, patients may need to try multiple

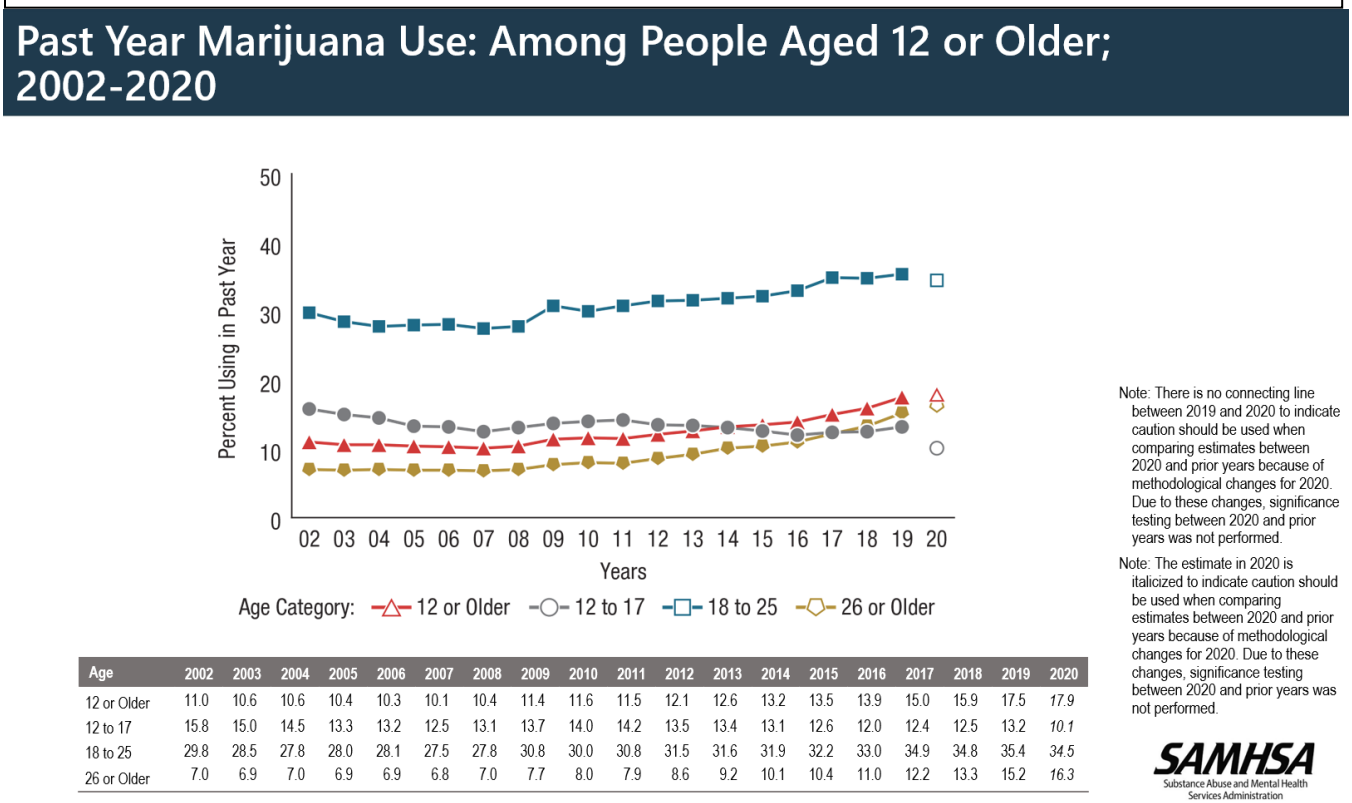
medications before finding the best one (Commonly Prescribed Antidepressants and How They Work, n.d.).

As an alternative treatment option, self-medicating with marijuana may seem viable for depression; however, current research suggests that there is insufficient evidence to support its effectiveness (Feingold & Weinstein, 2021). In addition, studies have shown that the association between cannabis use and depression may be stronger in specific populations, such as men during adolescence and emerging adulthood and women during midlife (Feingold & Weinstein, 2021). While some preclinical evidence suggests that alterations in the endocannabinoid system may benefit patients with depression, using cannabis as an antidepressant is still in its early stages of examination (Feingold & Weinstein, 2021). Therefore, more research is needed to understand better the potential benefits and drawbacks of using marijuana as a form of self-medication for depression.

Moreover, there is limited support for the effectiveness of selective serotonin reuptake inhibitors (SSRIs) in reducing depressive symptoms or substance use rates in adolescents with depression and a co-occurring substance use disorder (Feingold & Weinstein, 2021). Although SSRIs are one of the most commonly prescribed treatments for depression, the efficacy of these drugs in treating depression has been called into question (Feingold & Weinstein, 2021). As such, exploring alternative treatment options for depression, such as using marijuana, has become a topic of interest for many researchers. Given the limited research on this topic, caution should be exercised when considering marijuana as a form of self-medication for depression.

Initially, understanding the actual numbers of those who are affected the most by marijuana and major depressive episodes is crucial. According to the 2020 National Survey of Drug Use and Health (NSDUH) Releases, the highest percentage of people who used marijuana in the past year were young adults aged 18 to 25, with a prevalence of 34.5%. This percentage was significantly higher than that of adults aged 26 or older, who had a prevalence of 16.3%. Adolescents aged 12 to 17 had the lowest percentage, with a prevalence of 10.1%, although an increased use trend can be observed in this age group (Substance Abuse and Mental Health Services Administration, 2021). These findings highlight the urgency of addressing marijuana use among young adults 18 - 25 years old, which doubles the usage rate of any other age group. Various physiological and psychological changes occur throughout the adolescent period, heightening their sensitivity to external factors. Cannabis exposure is considered one of these factors that may threaten their well-being, as evidenced by a multitude of research indicating a correlation between cannabis use and the onset of depression (White et al., 2022).

Figure 1. Past Year Marijuana Use: Among People aged 12 or older; 2002-2020.



Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
12 or Older	11.0	10.6	10.6	10.4	10.3	10.1	10.4	11.4	11.6	11.5	12.1	12.6	13.2	13.5	13.9	15.0	15.9	17.5	*17.9*
12 to 17	15.8	15.0	14.5	13.3	13.2	12.5	13.1	13.7	14.0	14.2	13.5	13.4	13.1	12.6	12.0	12.4	12.5	13.2	*10.1*
18 to 25	29.8	28.5	27.8	28.0	28.1	27.5	27.8	30.8	30.0	30.8	31.5	31.6	31.9	32.2	33.0	34.9	34.8	35.4	*34.5*
26 or Older	7.0	6.9	7.0	6.9	6.9	6.8	7.0	7.7	8.0	7.9	8.6	9.2	10.1	10.4	11.0	12.2	13.3	15.2	*16.3*

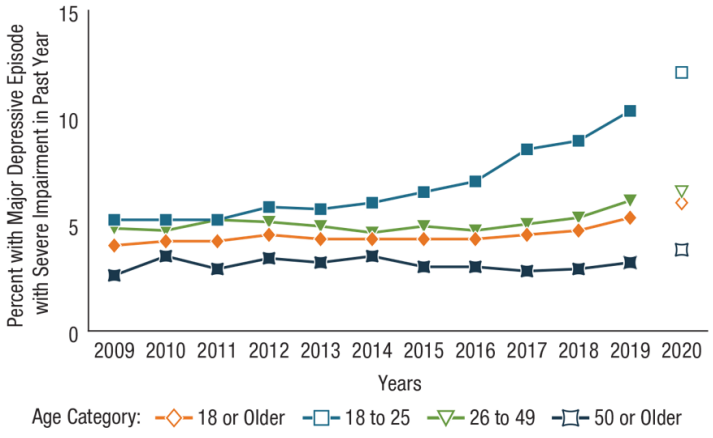
Note. This graph displays the significantly higher percentage of 18 – 25 year olds smoking marijuana in the past year compared to other age groups. From "Key substance use and mental health indicators in the United States: Results from the 2020 National Survey on Drug Use and Health (HHS Publication No. PEP21-07-01-003, NSDUH Series H-56)," by Substance Abuse and Mental Health Services Administration. (2021).

Secondly, as depression increases in prevalence, it is essential to understand who is most at risk. According to the 2020 National Survey of Drug Use and Health (NSDUH) releases, among adults aged 18 or older in 2020, 8.4 percent (or 21.0 million people) had experienced a past-year major depressive episode (MDE), and 6.0 percent (or 14.8 million people) had a past year major depressive episode with severe impairment. The dominance of past-year major depressive episodes was highest among young adults aged 18 to 25, followed by adults aged 26 to 49, and then adults aged 50 or older. Specifically considering individuals aged 18-25, 17.0 percent (or 5.6 million people) had a past-year MDE, and 12.1 percent (or 4.0 million people)

had a past-year MDE with severe impairment (Substance Abuse and Mental Health Services Administration, 2021). These statistics highlight the significant impact of depression on young adults, and the urgent need to understand why their age group suffers the most.

Figure 2. Major Depressive Episode with Severe Impairment in the Past Year: Among Adults Aged 18 or Older; 2009 - 2020.

Major Depressive Episode with Severe Impairment in the Past Year: Among Adults Aged 18 or Older; 2009-2020



Age	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
18 or Older	4.0	4.2	4.2	4.5	4.3	4.3	4.3	4.3	4.5	4.7	5.3	*6.0*
18 to 25	5.2	5.2	5.2	5.8	5.7	6.0	6.5	7.0	8.5	8.9	10.3	*12.1*
26 to 49	4.8	4.7	5.2	5.1	4.9	4.6	4.9	4.7	5.0	5.3	6.1	*6.5*
50 or Older	2.6	3.5	2.9	3.4	3.2	3.5	3.0	3.0	2.8	2.9	3.2	*3.8*

Note: There is no connecting line between 2019 and 2020 to indicate caution should be used when comparing estimates between 2020 and prior years because of methodological changes for 2020. Due to these changes, significance testing between 2020 and prior years was not performed.

Note: The estimate in 2020 is italicized to indicate caution should be used when comparing estimates between 2020 and prior years because of methodological changes for 2020. Due to these changes, significance testing between 2020 and prior years was not performed.

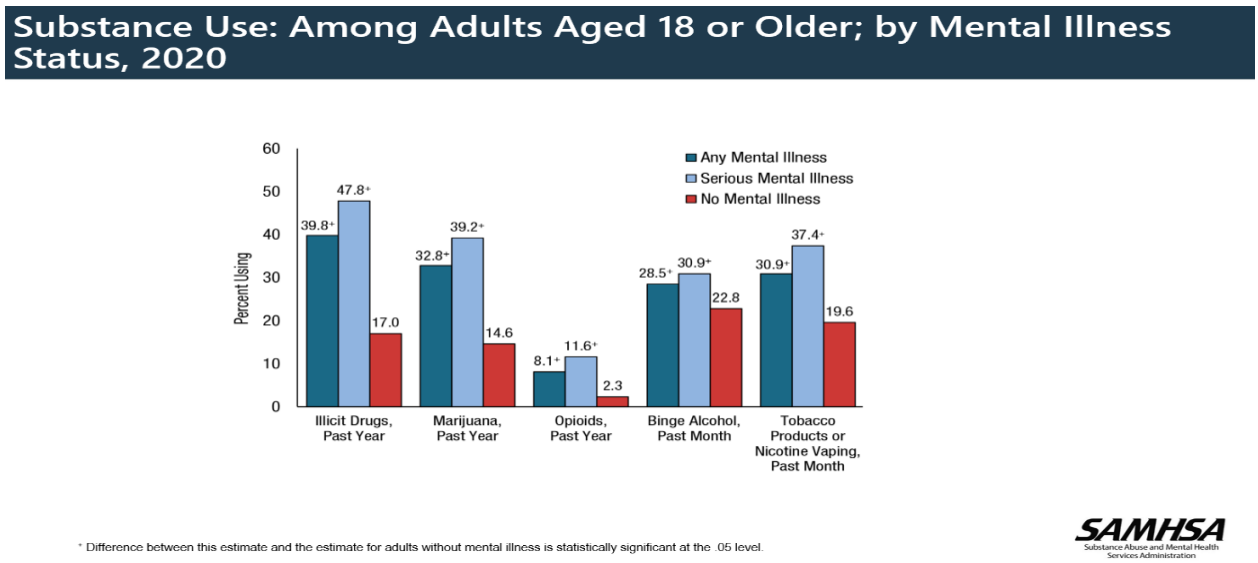
SAMHSA
Substance Abuse and Mental Health Services Administration

Note. This graph displays the significantly higher percentage of 18 – 25 year olds experiencing major depressive episodes compared to other age groups. From "Key substance use and mental health indicators in the United States: Results from the 2020 National Survey on Drug Use and Health (HHS Publication No. PEP21-07-01-003, NSDUH Series H-56)," by Substance Abuse and Mental Health Services Administration. (2021).

While the increase of depression is well documented, there is also a concurrent increase in drug use within the United States, making this intersection an interesting point to study when considering a potential underlying relationship. The 2020 National Survey of Drug Use and Health (NSDUH) data reveals that among adults aged 18 or older, those with serious mental illness (SMI) or any mental illness (AMI) in the past year were more likely than those without

mental illness to be past-year users of illicit drugs (47.8% for SMI and 39.8% for AMI, compared to 17.0% for those with no mental illness), past year users of marijuana (39.2% and 32.8% vs. 14.6%), or past year misusers of opioids (11.6% and 8.1% vs. 2.3%). Furthermore, adults with SMI or AMI were more likely to engage in binge alcohol use (30.9% and 28.5% vs. 22.8%) and tobacco or nicotine use (37.4% and 30.9% vs. 19.6%) in the past month (Substance Abuse and Mental Health Services Administration, 2021).

Figure 3. Substance Use: Among Adults Aged 18 or Older; by Mental Illness Status, 2020



Note. These statistics indicate a positive correlation between the risk of substance use and misuse among individuals with mental illnesses. From "Key substance use and mental health indicators in the United States: Results from the 2020 National Survey on Drug Use and Health (HHS Publication No. PEP21-07-01-003, NSDUH Series H-56)," by Substance Abuse and Mental Health Services Administration. (2021).

These statistics indicate a positive correlation between the risk of substance use and misuse among individuals with mental illnesses. Particularly alarming is the significantly higher prevalence of illicit drug and marijuana use among those with SMI or AMI than those without mental illness. In addition, a recent investigation utilizing information derived from past surveys established that individuals with a history of major depressive episodes (MDE) in the previous

year exhibited elevated rates of substance use relative to those without such a history (Choi et al., 2022). This finding and prior research highlight the necessity for targeted prevention and intervention strategies to address the intricate interrelationship between mental illness and substance abuse.

Understanding the potential risks and benefits associated with the co-use of marijuana and antidepressants (AD) in adolescents is critical for informed treatment decisions and optimizing mental health outcomes. While marijuana use may offer therapeutic benefits for mental health conditions commonly treated with AD, it can also interfere with the efficacy of AD and increase the risk of adverse events. In addition, recent literature reviews have revealed a significant gap in knowledge regarding treatment outcomes in this population, emphasizing the need for further research to inform clinical practice and develop evidence-based interventions (Hen-Shoval et al., 2022).

Identifying the pharmacological, physiological, and behavioral interactions between AD and marijuana and the factors influencing the decision to use these substances together can inform appropriate screening and intervention strategies to mitigate potential harm and improve health outcomes for this vulnerable population. Filling the significant gap in knowledge regarding the co-use of AD and marijuana in adolescents will not only contribute to the development of evidence-based interventions but also promote positive health outcomes and reduce the harm associated with substance misuse. As SSRIs are often considered the first-line pharmacological treatment for depression in adolescents, understanding the potential impact of marijuana use on their efficacy is crucial for informed treatment decisions and optimizing mental health outcomes (Chu & Wadhwa, 2023).

Given the high prevalence of depression and the widespread use of antidepressants, it is essential to understand the mechanisms by which these medications work. On average, 66% of those who experience MDE receive treatment, with SSRIs being a commonly prescribed first-line pharmacological treatment due to their relative safety and tolerability compared to other antidepressant medications (Chu & Wadhwa, 2023). SSRIs are often regarded as relatively safe and tolerable compared to alternative antidepressant medications. Mechanistically, SSRIs are thought to elicit their therapeutic effects by augmenting serotonin levels in the brain. Serotonin functions as a neurotransmitter and is crucial in regulating mood, emotion, and sleep. Upon release from nerve cells, serotonin binds to receptors on adjacent nerve cells before being reabsorbed by the cell that released it. By blocking the reuptake process, SSRIs increase the availability of serotonin to bind to receptors on neighboring nerve cells, thereby elevating serotonin levels and potentially mitigating depressive symptoms. While low serotonin levels cannot be solely attributed to the development of depression and other mental health disorders, elevating serotonin levels has been shown to ameliorate symptoms and enhance responsiveness to alternative treatment modalities such as cognitive-behavioral therapy. In addition, it is noteworthy that SSRIs can interact unpredictably with other medications (Chu & Wadhwa, 2023).

To understand how antidepressants (AD) and marijuana may interact and identify potential risks and benefits of their use together in adolescents, it is crucial to conduct research. While no studies have directly examined the impact of marijuana use on the effectiveness and tolerability of selective serotonin reuptake inhibitors (SSRIs) in adolescents, Vaughn (2021) conducted a recent study investigating the potential effects of marijuana use on

the efficacy of antidepressant medication in adolescents. However, using marijuana and antidepressants in adolescents can have adverse effects, such as decreased effectiveness of the antidepressant medication and increased risk of side effects (Vaughn et al., 2021).

Marijuana can interfere with the effectiveness of antidepressant metabolism. Enzymes in the liver metabolize antidepressants, and marijuana can inhibit these enzymes, leading to increased levels of the antidepressant in the blood and an increased risk of side effects. Additionally, marijuana can interfere with the effectiveness of antidepressants by affecting their neural synapses. Antidepressants increase the levels of certain neurotransmitters in the brain, such as serotonin. Marijuana can block the receptors for these neurotransmitters, which can decrease their effectiveness. Although there is existing literature suggesting a direct interaction between cannabinoids and SSRIs, there are no direct studies examining the coadministration of SSRIs with cannabinoids (either CBD or recreational marijuana) and their tolerability and efficacy. Therefore, it is essential to conduct further studies to understand the interaction between AD and marijuana and to determine whether this combination is beneficial or detrimental for adolescents (Vaughn et al., 2021).

Additionally, evidence suggests that marijuana use may reduce depression symptoms in the short term but ultimately increase baseline depression in the long run (Jacobus et al., 2017). With the continued increase in marijuana legalization and the decreased perception of harm among adolescents, healthcare providers need to be aware of the potential risks and benefits of combining marijuana and antidepressants. Providing patients with accurate information to make informed decisions about their treatment options is crucial, particularly considering the

potential for increased SSRI side effects due to marijuana affecting liver metabolism (Vaughn et al., 2021).

This senior thesis hypothesizes that adults who have had a MDE and used marijuana in the past year will have lower odds of using marijuana if prescribed medication for mental health or utilized mental health treatments, suggesting that medication may be a protective factor against continued marijuana use. However, as a cross-sectional epidemiological study, the results are correlative associations from which causal results cannot be determined. Therefore, further research is necessary to confirm the findings and to fully elucidate the complex interactions between marijuana and antidepressants in individuals with depression and anxiety. In addition, a more nuanced understanding of the relationships between marijuana use and depression is necessary to improve treatment outcomes and promote mental health in young adults who may benefit from antidepressants as a widely accepted and effective treatment option.

Methods

Data Source

The present study utilizes public-use data and documentation from the 2020 National Survey for Drug Use and Health (NSDUH) survey, which was obtained from the Substance Abuse and Mental Health Services Administration's (SAMHSA) website (http://www.datafiles.samhsa.gov). The NSDUH survey is a comprehensive and representative survey that measures the prevalence of substance use among the civilian, non-institutionalized population in the United States, focusing on individuals aged 12 and over. The survey is conducted annually, making it one of the largest population-based studies in the field.

The public-use data utilized in this study contains information from 32,893 individuals who were interviewed for the survey. The data contains 2,899 different measured variables, allowing for a comprehensive understanding of substance use patterns and related mental health issues among the general population. To focus on a specific subgroup, study participants were selected based on the following criteria: (a) they were 18 years old or older (n=20,860), and (b) they had a diagnosis of Major Depressive Episode (MDE) in the past year (n=2,898). Another part of our study only looked at adults aged 18 – 25 years old with past-year MDE, accounting for 1,333 participants out of 2,898 total with past-year MDE.

Measures

Major Depressive Episodes (MDE)

Individuals were classified as having had a major depressive episode (MDE) if they reported at least five or more of the following nine symptoms nearly every day (except where noted) in the same 2-week period in their lifetime, in which at least one of the symptoms was a depressed mood or loss of interest or pleasure in daily activities: (1) depressed mood most of the day; (2) markedly diminished interest or pleasure in all or almost all activities most of the day; (3) significant weight loss when not dieting or weight gain or decrease or increase in appetite; (4) insomnia or hypersomnia; (5) psychomotor agitation or retardation; (6) fatigue or loss of energy; (7) feelings of worthlessness; (8) diminished ability to think or concentrate or indecisiveness; and (9) recurrent thoughts of death or recurrent suicide ideation. Unlike the other symptoms listed previously, recurrent thoughts of death or suicidal ideation did not need to have occurred nearly every day (Center for Behavioral Health Statistics and Quality).

The selection criteria used in this study were based on the presence of MDE in the past 12 months for individuals aged 18+. Sociodemographic factors, substance use, and mental health services utilization were analyzed across different MDE statuses: no lifetime MDE, prior-to-past-year MDE, and past-year MDE.

Marijuana Use

Respondents were asked about their lifetime use of marijuana and their use in the past year and past month. These measures were derived from questions specifically designed to assess the lifetime and recency of marijuana use. The lifetime use question inquired about the

respondent's history of using marijuana or hashish, even once, with the recency question asking about the length of time since the respondent's last use of marijuana or hashish. The data obtained from these questions were used to determine the prevalence of marijuana use among the study participants (Center for Behavioral Health Statistics and Quality). Our study focuses explicitly on the past-year use of marijuana as the primary indicator of substance use patterns in this population.

Mental Health Service Utilization among Adults

For adults aged 18 or older, use of mental health services was defined as the receipt of treatment or counseling for any problem with emotions, nerves, or mental health in the 12 months prior to the interview in any inpatient or outpatient setting or the use of prescription medication to treat a mental or emotional condition. Respondents were asked in the adult mental health utilization section of the questionnaire about their receipt of mental health services. Respondents also were asked not to report inpatient or outpatient treatment for the use of alcohol or drugs (Center for Behavioral Health Statistics and Quality).

Prescription Medication

Respondents were classified as having used prescription medication as a mental health service if they reported taking prescription medications prescribed for them to treat a mental or emotional condition (Center for Behavioral Health Statistics and Quality).

Tobacco Product Use

This measure indicates use of any of the following tobacco products: cigarettes, smokeless tobacco, cigars, or pipe tobacco. Tobacco product use in the past year includes past month pipe tobacco use; however, it does not include use of pipe tobacco more than 30 days ago but within 12 months of the interview because the survey did not capture this information. Measures of tobacco product use in the respondent's lifetime, the past year, or the past month also do not include reports from separate questions about use of cigars with marijuana in them (blunts). Tobacco product use does not include questions added in 2020 for the use of e-cigarettes or another vaping device to vape nicotine (Center for Behavioral Health Statistics and Quality).

Illicit Drugs

Illicit drugs include marijuana, cocaine (including crack), heroin, hallucinogens, inhalants, methamphetamine, or prescription psychotherapeutics that were misused, which include pain relievers, tranquilizers, stimulants, and sedatives. Illicit drug use refers to use of any of these drugs based on responses to questions for these substances in the respective questionnaire. Responses to questions about the use of the following drugs were not included in these measures: GHB (gamma hydroxybutyrate), nonprescription cough or cold medicines, synthetic marijuana, and synthetic stimulants. Kratom was not included as an illicit drug because it is not a controlled substance nationally (Center for Behavioral Health Statistics and Quality).

Alcohol Use Disorder

Respondents who used alcohol on 6 or more days in the past 12 months were classified as having an alcohol use disorder if they met two or more of the following criteria: (1) used alcohol in larger amounts or for a longer time period than intended; (2) had a persistent desire or made unsuccessful attempts to cut down on alcohol use; (3) spent a great deal of time in activities to obtain, use, or recover from alcohol use; (4) felt a craving or strong desire to use alcohol; (5) engaged in recurrent alcohol use resulting in failure to fulfill major role obligations at work, school, or home; (6) continued to use alcohol despite social or interpersonal problems caused by the effects of alcohol; (7) gave up or reduced important social, occupational, or recreational activities because of alcohol use; (8) continued to use alcohol in physically hazardous situations; (9) continued to use alcohol despite physical or psychological problems caused by alcohol use; (10) developed tolerance (i.e., needing to use alcohol more than before to get desired effects or noticing that the same amount of alcohol use had less effect than before); and (11) experienced a required number of withdrawal symptoms after cutting back or stopping alcohol use (Center for Behavioral Health Statistics and Quality).

Analysis

All analyses were performed using R statistical software (v4.1.2; R Core Team 2021) and the following packages: “dplyr” (v1.0.9; Wickham, François, Henry, and Müller (2022), “epiDisplay” (v3.5.0.2; Virasakdi Chongsuvivatwong 2022), and “epitools” (v0.5-10.1; Tomas J. Aragon 2020). A Pearson’s χ^2 test to compare sociodemographic and health characteristics, cannabis, alcohol, other substance use disorders, and other mental health treatments among three groups of individuals: those with no lifetime MDE, those with prior-to-past year MDE, and those with past-year MDE. Next, we performed a logistic regression model to test the association of marijuana use and treatment (prescription medication or any mental health treatment) with major depressive episode (MDE) in the past year for adults 18+. Thirdly, we performed another logistic regression model to test association of marijuana use and treatment (prescription medication or any mental health treatment) with major depressive episode (MDE) in the past year for adults 18 – 25. Confounders in these logistic regression models were prescription drugs for mental health, any mental health treatment, sociodemographic and health characteristics, tobacco use, illicit drug use, alcohol abuse, and nicotine dependence. Lastly, we performed odds ratios analysis between different outcomes using either exposure 1: prescription for mental health vs no prescription, and exposure 2: any mental health treatment vs no mental health treatment. Results are presented as odds ratios with 95% confidence intervals and a significant $p < 0.05$.

Figure 4. Example of odds ratio table used to calculate odds ratio values from variable outcomes and exposures.

	Outcome	
Exposure	Major Depressive Episode & Marijuana Use (Case)	Major Depressive Episode (Control)
Prescription for Mental Health	*a*	*b*
No Prescription	*c*	*d*

$$Odds\ Ratio\ (OR) = \frac{ad}{bc}$$

OR=1 Exposure does not affect odds of outcome
OR>1 Exposure associated with higher odds of outcome
OR<1 Exposure associated with lower odds of outcome

Results

Pearson's χ^2 test

Table 1: Sociodemographic Characteristics by Major Depressive Episode (MDE) Status				
Variable	No Lifetime MDE n = 20,860 (71.99%)	Prior-to-Past-Year MDE n = 5,219 (18.01%)	Past-Year MDE n = 2,898 (10.00%)	χ^2
Gender (%)				< 0.001
• Male	47.94	32.92	30.57	
• Female	52.06	67.08	69.43	
Age (%)				< 0.001
• 18 – 25 Years Old	26.94	38.09	46.00	
• 26 – 34 Years Old	20.72	21.67	21.01	
• 35 – 49 Years Old	27..47	26.96	22.74	
• 50 Years and Older	24.87	13.28	10.25	
Race (%)				< 0.001
• White	65.75	73.54	72.60	
• Hispanic	13.93	11.67	12.66	
• Black/African American	9.57	5.56	5.24	
• Native American/Alaska Native	0.46	0.21	0.21	
• Asian	6.28	3.37	2.83	
• More than one race	3.13	5.08	5.83	
Education Level (%)				< 0.001
• Less than High School	8.60	5.82	6.83	
• High School	21.29	17.84	19.70	
• Some College/Associates	29.59	35.79	38.44	
• College Graduate	40.52	40.54	35.02	
Income (%)				< 0.001
• Less than $20,000	14.72	19.06	22.60	
• $20,000 – $49,999	24.52	27.04	29.71	
• $50,000 – $74,999	15.61	15.67	15.22	
• $75,000 or More	45.15	38.23	32.47	
Employment Status (%)				< 0.001
• Employed Full Time	52.05	48.73	43.55	
• Employed Part-Time	14.19	19.24	20.32	
• Unemployed	5.34	6.57	7.83	
• Other (includes not in labor force)	28.42	25.46	28.30	
Marital Status (%)				< 0.001
• Married	47.56	34.80	28.26	
• Widowed	2.60	1.82	1.73	
• Divorced or Separated	9.05	11.00	10.28	
• Never Been Married	40.79	52.39	59.73	
Resident of a Medical Cannabis Legal State (%)				0.1375
• Resident	72.07	73.31	73.08	
• Not a Resident	27.93	26.69	26.92	

Table 1 presents a comprehensive breakdown of demographic characteristics of individuals with past year Major Depressive Episodes (MDE). The data reveals that most individuals who experienced past year MDE were female, accounting for 69.43% of the sample. Moreover, 46% of individuals with past year MDE fell in the age bracket of 18 – 25 years, while 72.60% identified as white. In addition, a substantial proportion of individuals with past year MDE were employed full-time, comprising 43.55% of the sample, and 59.73% had never been married. Notably, many individuals resided in medical cannabis legal states, constituting around 73% of the total sample, regardless of their MDE status.

Table 2: Cannabis, Alcohol, Other Substance Use and Use Disorders, and Other Mental Health Treatments by Major Depressive Episode (MDE) Status

Variable	No Lifetime MDE n = 20,860 (71.99%)	Prior-to-Past-Year MDE n = 5,219 (18.01%)	Past-Year MDE n = 2,898 (10.00%)	χ^2
Past Year Marijuana **Use** (%)				< 0.001
• Used within the past year	19.66	34.89	40.17	
• Did not use within the past year	80.34	65.11	59.83	
Past Month Marijuana **Use** (%)	12.57	22.86	28.65	< 0.001
Past Year Marijuana **Abuse** (%)	0.50	1.32	1.66	
Past Year Tobacco Use (%)				< 0.001
• Used within the past year	23.50	31.11	34.02	
• Did not use within the past year	76.50	68.88	65.98	
Past Month Tobacco Use (%)	17.53	22.59	25.02	< 0.001
Past Month Nicotine Dependence (%)	7.00	10.56	11.73	< 0.001
Past Year Alcohol Abuse (%)	2.41	3.81	4.66	<0.001
Past year any illicit drug **use** other than marijuana (%)				< 0.001
• Used within the past year	8.21	20.04	23.29	
• Did not use within the past year	91.88	79.96	76.71	
Past month any illicit drug use (%)	13.73	25.87	29.99	< 0.001
Past year any illicit drug **abuse** other than marijuana (%)	0.23	0.92	1.24	0.3623
Took any prescription medication for mental health in the past year (%)	10.00	42.73	49.65	< 0.001
Past year received inpatient mental health treatment (%)	0.55	2.36	3.69	0.5706
Past year received outpatient mental health treatment (%)	6.45	33.01	39.99	< 0.001
No mental health treatment in the past year because individual did not think treatment was needed (%)	0.58	3.51	5.00	0.002
No mental health treatment in the past year because individual could not afford (%)	2.06	15.62	21.46	< 0.001

Table 2 depicts the prevalence of substance use among individuals with and without a history of Major Depressive Episodes (MDE). The data indicates that a more significant proportion of individuals with past-year MDE reported using marijuana in the past year, accounting for 40.17% of the sample, compared to those with no lifetime MDE, with only 19.66% reporting use. Additionally, a higher percentage of individuals with past-year MDE reported tobacco use in the past year, constituting 34.02% of the sample, in contrast to those with no lifetime MDE, with only 23.50% reporting use. The results further demonstrate that individuals with past-year MDE were more likely to report past-year alcohol abuse, with 4.66% of the sample reporting such behavior, compared to 2.41% of those with no lifetime MDE. Moreover, a more significant proportion of individuals with past-year MDE reported using illicit drugs other than marijuana in the past year, accounting for 23.29% of the sample, compared to those with no lifetime MDE, with only 8.21% reporting use.

Odds Ratios Analysis:

Table 3: Odds Ratio Analysis for All Adults Aged 18+	
All Adults 18+	**Odds Ratio (95% CI) * Denotes Significance**
Exposure: marijuana use **Outcome**: major depressive episode in the past-year	**2.60 (2.40 – 2.82) ***
Exposure: prescription medication for mental health **Outcome**: major depressive episodes and marijuana use in the past year	**1.09 (0.94 – 1.26)**
Exposure: utilizing any mental health treatment **Outcome**: major depressive episodes and marijuana use in the past year	**1.12 (0.96 – 1.30)**

The odds ratio analysis in Table 3 examines the relationship between marijuana use and major depressive episode (MDE) in the past year and the relationship between prescription medication or any mental health treatment and MDE and marijuana use in the past year. The results show that for all adults aged 18+, the odds for MDE in the past year increased 2.60 times (95% CI: 2.40 – 2.82) for those who reported using marijuana, indicating a significant positive association between marijuana use and MDE. For the outcomes of prescription medication for mental health and utilizing any mental health treatment, the odds ratios were 1.09 (95% CI: 0.94 – 1.26) and 1.12 (95% CI: 0.96 – 1.30), respectively. These results suggest no significant association between these mental health treatments and the co-occurrence of MDE and marijuana use in the past year among all adults aged 18+.

Table 4: Odds Ratio Analysis for All Adults Aged 18 - 25	
All Adults 18 – 25 Years Old	**Odds Ratio (95% CI)** *** Denotes Significance**
Exposure: 18 – 25 years old compared to 26+ years old **Outcome:** major depressive episodes in the past year	**2.30 (2.13 – 2.49) ***
Exposure: major depressive episodes in the past year and being 18 – 25 years old compared to 26+ **Outcome:** prescription medication for mental health	**0.59 (0.51 – 0.68) ***
Exposure: major depressive episodes in the past year and being 18 – 25 years old compared to 26+ **Outcome:** utilizing any mental health treatment	**0.62 (0.53 – 0.73) ***
Exposure: 18 – 25 years old compared to 26+ years old **Outcome:** marijuana use in the past-year	**2.34 (2.20 – 2.48) ***
Exposure: marijuana use in the past-year and being 18 – 25 years old **Outcome:** major depressive episodes in the past year	**2.12 (1.88 – 2.39) ***
Exposure: marijuana use and major depressive episodes in the past-year **Outcome:** prescription medication for mental health	**1.37 (1.11 – 1.71) ***

Analysis of odds ratios for adults age 18 – 25 are summarized in Table 4 for various outcomes and exposures; all were statistically significant. Adults aged 18 – 25 had significantly increased odds of experiencing a major depressive episode in the past year when compared to adults aged 26 and over (OR = 2.30 (95% CI: 2.13 – 2.49)). While there is an increased odds of 130% for MDE amongst 18 – 25 year-olds, this age group also exhibits a decreased odds of both being prescribed a medication for mental health (OR = 0.59 (95% CI: 0.51 – 0.68)) and utilizing any mental health treatment (OR = 0.62 (95% CI: 0.53 - 0.73)) when compared to adults over the age of 26. Additionally, for the young-adult age group of 18 – 25, those who used

marijuana in the past year had statistically significant increased odds of experiencing a MDE in the past year (OR = 2.12 (95% CI: 1.88 – 2.39)). For those individuals who both used marijuana and experience a past-year MDE, the odds of being prescribed a medication for mental health also increased (OR = 1.37 (95% CI: 1.11 – 1.71)) indicating a positive association between MDE and marijuana use and mental health prescriptions.

Logistic Regression Analysis

Table 5: Association of Marijuana Use and Treatment (Prescription Medication or Any Mental Health Treatment) with Major Depressive Episode (MDE) in the Past Year for Adults 18+: Logistic Regression

	Marijuana Use	
	Took Prescription Medication for Mental Health	Any Mental Health Treatment
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Treatment	0.83 (0.46 -1.52)	1.00 (0.54 – 1.84)
Overall Health	1.08 (0.77 – 1.52)	1.06 (0.76 -1.49)
Sex	0.66 (0.36 – 1.19)	0.64 (0.35 – 1.15)
Education Level	0.84 (0.60 – 1.18)	0.83 (0.59 – 1.16)
Employment Status	0.99 (0.77 – 1.26)	0.98 (0.77 – 1.25)
Past Year Tobacco Use	1.87 (0.93 -3.75)	1.88 (0.93 – 3.78)
Past Year Illicit Drug Use	3.11 (1.67 – 5.78)***	3.07 (1.65 – 5.71)***
Past Year Alcohol Abuse	2.31 (0.98 – 5.43)	2.30 (0.98 – 5.41)
Past Year Nicotine Dependence	1.24 (0.57 – 2.67)	1.22 (0.57 -2.65)

* p <0.05; ** p<0.01; ***p<0.001

Table 5 presents the results of a logistic regression analysis, which revealed that individuals aged 18 and above with a past year history of MDE had significantly higher odds of using marijuana when using illicit drugs in the past year, even after adjusting for potential confounding factors such as mental health treatment, overall health, gender, education level, employment status, tobacco use, and nicotine dependence.

Table 6: Association of Marijuana Use and Treatment (Prescription Medication or Any Mental Health Treatment) with Major Depressive Episode (MDE) in the Past Year for Adults 18 - 25: Logistic Regression		
	Marijuana Use	
	Took Prescription Medication for Mental Health	Any Mental Health Treatment
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Treatment	1.14 (0.88 – 1.48)	1.14 (0.88 – 1.47)
Overall Health	1.00 (0.86 – 1.15)	1.00 (0.87 – 1.16)
Sex	1.24 (0.94 – 1.65)	1.24 (0.94 – 1.65)
Education Level	1.02 (0.88 – 1.18)	1.01 (0.87 – 1.18)
Employment Status	0.92 (0.82 – 1.03)	0.92 (0.82 – 1.03)
Past Year Tobacco Use	3.52 (2.59 – 4.80) ***	3.52 (2.59 – 4.80) ***
Past Year Illicit Drug Use	7.01 (4.97 – 9.90) ***	6.99 (4.95 – 9.86) ***
Past Year Alcohol Abuse	5.01 (2.42 – 10.40) ***	5.04 (2.43 – 10.46) ***
Past Year Nicotine Dependence	1.26 (0.72 – 2.21)	1.26 (0.72 – 2.20)

* p <0.05; ** p<0.01; ***p<0.001

Table 6 displays the outcomes of a logistic regression analysis that examined the association between past-year MDE and marijuana use among individuals aged 18-25 while controlling for mental health treatment, overall health, gender, education level, employment status, tobacco use, and nicotine dependence. The findings revealed that individuals in this age group with a past-year history of MDE had significantly elevated odds of using marijuana in conjunction with tobacco, illicit drugs, and alcohol abuse in the past year.

Discussion

The aim of this study was to examine the association between past-year MDE, past-year marijuana use, and how utilizing mental health treatment, including antidepressants and other methods, can affect past-year marijuana use. We also specifically aimed to compare the age group 18 – 25 years old to 26+ years old due to evidence (Table 1) indicating that adults aged 18 – 25 had the highest prevalence of past-year MDE. Table 2 follows by showing that 19.66% of those that had no lifetime MDE used marijuana in the past year and that 40.17% of those who had past-year MDE used marijuana in the past year. These results follow the trends seen in Figure 1 and Figure 2, showing the significant difference in adults 18 – 25 years old using marijuana and having major depressive episodes compared to other age groups.

A key finding of this study is presented in Table 3, which shows that adults aged 18 and above who used marijuana in the past year had significantly increased odds, 2.60 times (95% CI: 2.40 – 2.82), of experiencing MDE in the past year based on our odds ratio analysis. The current study's findings, consistent with previous research, highlight the co-occurrence of cannabis use and depression. Prior research has further demonstrated that individuals with depression are at consistent risk of developing marijuana use disorder symptoms, underscoring the need for targeted substance use interventions in this population (Dierker et al., 2018). Our results underscore the potential negative impact of marijuana use on mental health, particularly the increased risk of experiencing a major depressive episode in individuals who use marijuana. These findings have important implications for public health interventions and substance use prevention efforts. It is important to note in a cross-sectional study that a causal relationship

cannot be elucidated, so this analysis could also be read as MDE increases the odds of marijuana use by 160%. This understanding can be applied to all the following odds ratio analyses.

A significant finding from this analysis is that 18 – 25 years old have an increased odds (OR = 2.30 (95% CI: 2.13 – 2.49)) of experiencing a MDE in the past year when compared to adults aged 26 and older (Table 4). Additionally, when 18 – 25 year olds, who have had a MDE in the past year, have significantly decreased odds of having a prescription for a mental health condition (OR = 0.59 (95% CI: 0.51 – 0.68)) or utilizing any mental health treatment (OR = 0.62 (95% CI: 0.53 – 0.73)), when compared to adults aged 26 and older. These results are incredibly important because even though adults aged 18 – 25 are the most at risk for MDE, they are seeking significantly less help from prescription medication or utilizing any mental health treatment. While the reasons for this discrepancy are unclear, the finding highlights the need for targeted interventions to increase accessibility to mental health services for young adults. Future directions of this study could analyze employment trends and education in this age group to see if there are any underlying associations between employment/education and access to health care. Addressing the barriers that prevent young adults from seeking mental health treatment can ultimately improve their mental health outcomes and reduce the risk of developing more severe conditions such as marijuana use disorder.

In light of the findings discussed in the previous paragraph, it is important to note that the relationship between marijuana use and mental health is complex and not fully understood. The current study's results indicate that there may be a bidirectional relationship between marijuana use and MDE, with each potentially influencing the other. The finding that 18 – 25-

year-olds have increased odds (OR = 2.34 (95% CI: 2.20 – 2.48)) of using marijuana when compared to adults aged 26 and older (Table 4) highlights the need for targeted interventions and prevention efforts in this age group. Previous literature has consistently reported a positive association between marijuana use and an increased risk of depression (White et al., 2022). Our study supports these findings by demonstrating that adults aged 18 – 25 had increased odds (OR = 2.12 (95% CI: 1.88 – 2.39)) of experiencing MDE in the past year if they used marijuana in the past year. Additionally, our findings of increased odds of marijuana use among 18–25-year-olds with a history of major depressive episodes and a prescription for a mental health condition support previous literature (Hen-Shoval et al., 2022) and suggest a potential association between psychiatric treatment and cannabis use among this population. These results were shocking as they were directly contrary to the hypothesis: adults who have had a MDE and used marijuana in the past year will have lower odds of using marijuana if they were prescribed medication for mental health or utilized mental health treatments.

Lastly, it is important to realize that these relationships do not happen in a vacuum Considering the potential influence of confounding factors on both exposure and outcome, our study utilized logistic regression analysis with a range of covariates, including treatment, overall health status, gender, education level, employment status, tobacco use, illicit drug use excluding marijuana, alcohol abuse, and nicotine dependence, as these factors can provide insight into mental health, access to care, and the role of addictive substances in the mental health paradigm, and can effectively control for potential confounding effects.

Our findings demonstrate that individuals aged 18+ who have had MDE in the past year have significantly increased odds of marijuana use when using illicit drugs in the past year when

controlling for mental health treatment, overall health status, gender, education level, employment status, tobacco use in the past-year, illicit drug use excluding marijuana in the past-year, alcohol abuse in the past-year, and nicotine dependance (Table 5). In comparison, our other logistic regression analysis table 6, presents that individuals aged 18 - 25 who have had MDE in the past year have significantly increased odds of marijuana use when using tobacco, illicit drugs, and abusing alcohol in the past year when controlling for mental health treatment, overall health, gender, education level, employment status, tobacco use, and nicotine dependence Analyzing covariates within a study helps to control for confounding effects and establish important associations that allow for more targeted interventions and a better understanding of at-risk demographics. Additionally, accounting for these factors in analysis improves the researcher's confidence in the conclusions drawn from the study and explains variance in the outcome variable that would otherwise be considered error variance.

The results of this study highlight the complex interplay between mental health, substance use, and other demographic factors. Specifically, the findings suggest that individuals who have experienced MDE in the past year are more likely to use marijuana and when they also engage in tobacco use, alcohol abuse, and other illicit drugs. These results correspond to prior research, which established a correlation between mental health problems and substance use disorders, particularly among young adults. Furthermore, previous literature demonstrated that impulsive sensation-seekers with lower anxiety and self-esteem are susceptible to early-onset frequent polysubstance use. The identification of such high-risk groups underlines the significance of preventive measures to deter adolescent polysubstance use (Carbonneau et al., 2022).

In this study, we have shed light on the complex relationship between mental health, substance use, and demographic factors among adolescents. The finding that medication or treatment may not be a protective factor against continued marijuana use highlights the need for a multifaceted approach to addressing substance use disorders, including prevention, early intervention, and comprehensive treatment. The link between cannabis use and increased risk of developing depression or suicidality in young adulthood underscores the urgency of preventing and reducing cannabis use among youth (Gobbi et al., 2019). In this regard, educating the public about the dangers and consequences of drug abuse based on facts and scientific evidence is crucial, particularly among youth and young adults. The DEA is aware of the negative consequences of marijuana use among this population and provides resources to assist in prevention efforts (Preventing Marijuana Use among Youths & Young Adults., 2017). Therefore, evidence-based strategies are needed to reduce the harms associated with substance use among young people. It is our hope that these findings will inform public health policy and prompt appropriate players in the public health realm to take action in implementing such strategies to reduce the harms associated with substance use among young people.

Conclusions

In conclusion, our study provides evidence of a co-occurring relationship between MDE and marijuana use, with a stronger association observed among young adults. We also observed that mental health treatments may not necessarily reduce this association and could potentially increase the likelihood of marijuana use in individuals aged 18-25 with a history of MDE. Our findings emphasize the importance of considering the relationship between marijuana use and other substances, such as alcohol, tobacco, and illicit drugs, in conjunction with depression. It is crucial for future research to explore the implications of mental health treatment on substance use, specifically regarding marijuana use among young adults. Future analysis of this relationship can include case-control studies to further assess the association as well as cohort studies to investigate relative risk and temporality of the exposure and outcome.

Furthermore, our study highlights the need for targeted interventions and prevention efforts to reduce depression and substance use in this age group. Analyzing the data on mental health treatment utilization and past-year marijuana use can better understand the potential impact of mental health treatment on substance use and identify effective strategies to improve mental health outcomes. We acknowledge that our study has limitations, such as the use of self-reported data and the lack of a causal relationship between MDE and marijuana use. Nevertheless, our findings provide crucial insights into the complex relationship between depression, marijuana use, and mental health care utilization.

Given the implications of our study, we recommend that public health policies and strategies prioritize efforts to reduce substance use and implement strategies to improve

mental health outcomes, particularly among young adults. In addition, we hope that our study will inspire future projects to build upon our findings and develop effective interventions to address the co-occurring relationship between depression and marijuana use. Ultimately, our goal is to improve the mental health and well-being of individuals affected by these issues and help them lead healthier, fulfilling lives. We can make significant strides towards achieving this objective by continuing to explore this complex relationship and implementing evidence-based interventions.

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