Unveiling the Impact: Analyzing Marijuana Use on Mental Health and Social Bonds in Young Adults

DA 401 Senior Capstone

Ha Tieu

1. Abstract

The objectives of this study were to examine the impact of marijuana use on mental health and social connections among young adults aged 18 to 25 in the United States in the year 2021. Data for the study were sourced from the Substance Abuse and Mental Health Services Administration, encompassing a sample of 13,972 participants, which included both marijuana users and non-users. The findings revealed that the non-users group exhibited better emotional health and overall well-being compared to their marijuana-using counterparts. Moreover, in unique circumstances such as the COVID-19 pandemic, non-users experienced less impact on their mental health compared to marijuana users. Within the group of marijuana users, higher consumption was associated with mental health issues and conflicts within social connections.

2. Introduction

In 2019, 48.2 million Americans, representing approximately 18% of the population, reported using marijuana at least once in their lifetime (CDC, 2021). In this statistics, it is alarming to note that 3 in 10 people who use marijuana have a disorder, and for people who use it before 18, the risk is even greater. In addition, research has uncovered the direct effect of marijuana use on brain and heart health such as lost memory, attention, learning ability or leading to increased risk of stroke, heart disease, and other vascular disease (CDC, 2021).

Despite these concerning findings, marijuana use is increasing rapidly in recent years in the U.S., especially among young adults. In 2021, the National Institute of Health reported marijuana use among young adults reached an all-time high. The key findings include past-year, past-month, and daily marijuana use (use on 20 or more occasions in the past 30

days) “reached the highest levels ever since these trends were first monitored in 1988”. In detail, for past-year, 43% of young adults reported using marijuana, a significant increase from five years ago (34% in 2016) and ten years ago (29% in 2011). In the past month using, 29% of young adults reported in 2021, compared to 21% in 2016 and 17% in 2011. Similarity trending, 11% of young adults reported using daily in 2021, compared to 8% in 2016 and 6% in 2011.

To gain a deeper understanding of this phenomenon, it is essential to explore the motivations behind marijuana use in young adults. Some existing studies have identified these motivations , which generally fall into two primary categories: addressing emotional needs (such as curiosity, seeking happiness or joy, and alleviating stress or boredom) and facilitating social connections (whether due to peer pressure or the desire to bond with friends) (Christine et al., 2006; Patrick et al., 2011b). Consequently, it is clear that there might be a relationship between the motives for marijuana use and the mental well-being of young adults.

Coincidentally, there has also been a substantial rise in mental health issues among young adults over the past decade. According to the American Psychology Association (2019), mental health issues increased by 63% among young adult people aged 18 to 25 from 2009 to 2017. This leads to a potential assumption that the rise in mental health issues over the past decade has contributed to the increased use of marijuana among young adults. However, while we consider mental health issues could be one of marijuana motives in young adults, it is worth noticing that research also found marijuana use potentially worsen mental health issues (Brian et al., 2000; George et al., 2002; Theresa et al., 2007; Jan C. el al., 2012).This seems to create a loop of circles, or an interrelated relationship between these two variables.

Reflecting on the motivations for marijuana use among young adults, particularly the pursuit of emotional needs (such as seeking happiness or joy, and relieving stress or boredom) and the facilitation of social connections (in response to peer pressure or the desire to bond with friends), it is plausible that marijuana use may offer short-term benefits to fulfill these motives. However, in the long-term, there is potential for adverse effects on the mental health of young adults and the quality of their social connections (Alanna et al., 2022; Judith et al., 2008). Recent research by Alanna and colleagues in 2022 also suggests an association between social anxiety and higher rates of marijuana problems among young adults.

Moreover, for young adults grappling with severe mental health issues, engaging heavily in marijuana use or struggling with substance disorders can potentially contribute to a pathway of suicidal thoughts. For suicuide trend alone, over the past decade, the suicide rate among young adults, parallel to trends in marijuana use and mental health issues, has witnessed a significant increase. As of 2019, the CDC reported that 1 in 6 youths had contemplated suicide within the past year, marking a substantial 44% surge since 2009. During that period, the suicide rate peaked, making it the second leading cause of death among individuals aged 15 to 24 in the United States (National Alliance on Mental Illness, 2019). Regard these changing, research has consistently identified a robust association between marijuana use and suicide attempts, especially among individuals contending with major depression (Beth et al., 2021; Jesse et al., 2023; National Institute of Health, 2021; Ceri et al., 2018; Andre et al., 2018). In summary, this insight adds another layer of complexity to the relationship between marijuana use and mental health issues in young adults.

Despite the intricate layers and complex issues entwining mental health and marijuana use in young adults, there remains a dearth of comprehensive research examining the overarching impact of marijuana use on mental health or the intercorrelation between these two factors. Addressing this challenge could provide additional insights into the significant

trends observed in recent years regarding both marijuana use and mental health issues among young adults in the United States.

In our research, we propose a hypothesis suggesting that despite the primary motives for marijuana use among young adults being to address emotions or foster social connections in the short-term (Christine et al., 2006; Patrick et al., 2011b), there is the potential for marijuana use to have lasting impacts on both mental health and social interactions in young adult under diverse dimensions. Utilizing data from the Substance Abuse and Mental Health Service Administration (SAMSHA) in 2021, we aimed to examine how frequency of marijuana use can affect mental health and social connection for the young adult age 18 to 25 years old.

3. Methods

3.1. Data

The research data is sourced from the Substance Abuse and Mental Health Services Administration (SAMHSA), a government agency dedicated to collecting and analyzing data related to substance abuse and mental health in the United States since 1992. SAMHSA's comprehensive data encompass demographics and geography. For this study, we utilized the 2021 National Survey on Drug Use and Health[1], an annual SAMHSA report, adhering to the instructions provided in the Codebook. The selected sections for collecting data include marijuana use, past-year frequency of marijuana use, adult mental health, substance disorders, and demographics. Focusing on the age group of young adults, we extracted data using the age range variable (code: CATAGE) with a value equal to 2, denoting the age range from 18 to 25 years old.

3.2 Limitation & Challenge

[1] 2021 SAMSHA Link Codebook: https://www.datafiles.samhsa.gov

The data variables in the SAMHSA survey fall into three primary types: a few are continuous (such as the number of days using marijuana in past year), while the majority consist of binary (Yes/No questions) and ordinal variables. Initially challenging due to the simplicity of categories, adapting statistical tests to the variable's characteristics is crucial for obtaining accurate results. Additionally, the most recent year available in the SAMHSA annual report is 2021, followed by 2020 and 2019. However, 2020, being post-pandemic, and 2019, during the pandemic period, have both experienced disruptions. Since this research exclusively focuses on 2021, further investigations across other years are warranted to capture a broader picture and identify trends in mental health issues and marijuana use among young adults.

3.3 Program Language & Software

For our research, we employ Python in Google Colab as our main software, utilizing key packages including pandas, numpy, matplotlib, seaborn, and scipy.stat. Link GitHub: https://github.com/tieuh1/desktop

4. Results

To examine the impact of marijuana use on young adults aged 18 to 25, we have divided this population into two distinct groups: marijuana users and non-users. In the subsequent analysis, we compared mental health and social interaction within the marijuana user group. This approach would aid in gaining insights into the varying degrees of impact that marijuana may have on each subgroup, depending on the quantity of marijuana they choose to consume.

4.1. Marijuana users & Non-users

Utilizing the variables outlined in the SAMSHA codebook, our first analysis focused on the mental health of marijuana users and non-users, examining two key aspects: emotional health and overall well-being.

4.1a. Emotional Health

In this section, our primary objectives are twofold: firstly, to examine whether a significant association or relationship exists between marijuana use and emotional health levels, and secondly, to assess if there is a notable difference in the distribution of emotional health levels between marijuana smokers and non-smokers. To categorize participants into two groups, namely marijuana users and non-users, we employed the variable MJEVER, indicating whether the individual has ever used marijuana. The responses are coded as "1" for Yes and "2" for No. SAMSHA assesses emotional health by inquiring about five specific emotions experienced in the past year: feeling nervous, hopeless, restless, depressed, and feeling down on oneself. Each emotion is associated with a distinct question regarding the frequency the participant felt, rated on a scale from 1 to 5. The scale ranges from 1 (all the time) to 5 (none of the time).

To compare emotional health between marijuana users and non-users, we utilized each of the five emotion variables (ordinal variables) in conjunction with the MJEVER variable (a binary variable with Yes/No responses to whether using marijuana in the past). Given the characteristics of these variables (ordinal and binary), we employed the *Chi-square Independence* test for the first goal, aiming to ascertain an association between marijuana use and emotional health levels. For the second goal, we utilized the *Mann-Whitney U* test to determine if there is a significant difference in the distribution of emotional health levels between marijuana smokers and non-smokers. Conducting these statistical test, we had the p-value report as below (**Table 1**).

	Feeling nervous	Feeling hopeless	Feeling restless	Feeling depressed	Feel down on yourself
Chi-square Independence	p = 1.1062e-08	p= 5.767e-18	p=3.419e-09	p=2.235e-25	p=6.538e-19
Mann-Whitney U test	p = 9.7470e-13	p=8.546e-22	p=2.458e-12	p=3.903e-27	p=1.070e-21

Table 1: Chi-Square and Mann-Whitney test on 5 types of emotion

As gleaned from the table, the results reveal that all five emotions exhibit a p-value less than 0.05 in the Chi-square Independence test, pointing to a significant association between emotional health and marijuana use. Furthermore, the Mann-Whitney U test indicates that the p-values for all five emotions are less than 0.05, providing statistical evidence of difference in emotional health levels between marijuana users and non-users.

To further re-examine how significant difference of emotional health between marijuana user and non-users, we constructed a bar chart to support the statistical tests above. This involved calculating the percentage of participants across five feeling levels: "none of the time," "little of the time," "some of the time," "most of the time," and "all of the time". **Figure 2** illustrates the distribution for the level of feeling depressed (refer to the **Appendix** for the remaining four emotions).

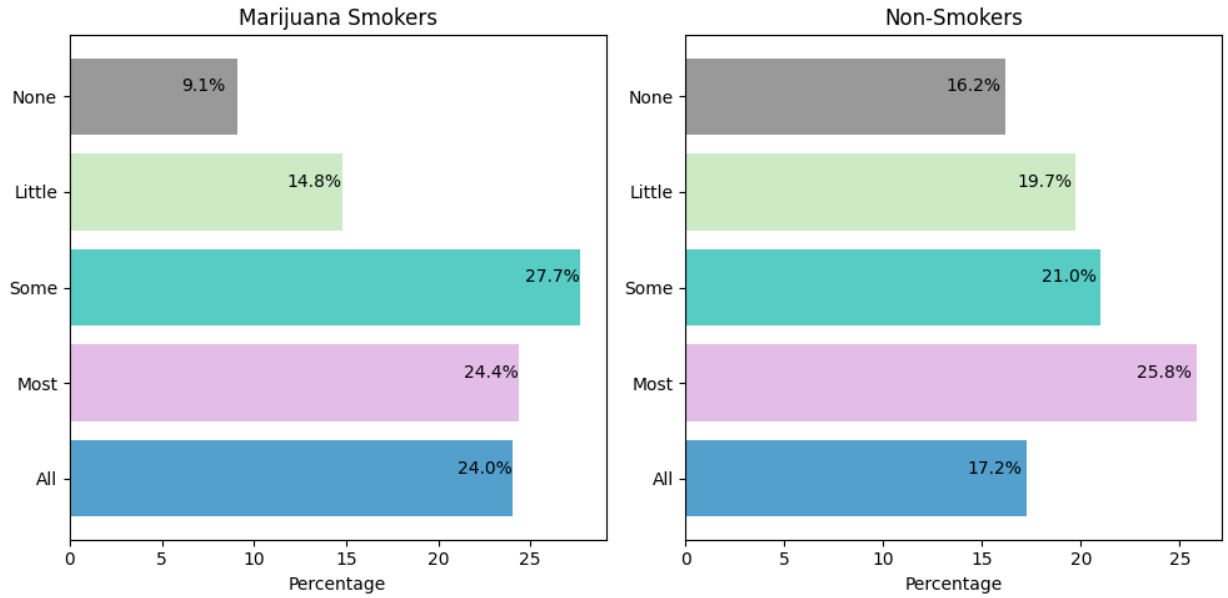

Figure 1: Feeling Depressed between marijuana users and non-users

For the two lowest feeling levels, "none of the time" and "little of the time," non-smokers exhibit a higher percentage of participants compared to marijuana users. Conversely, at the highest feeling level, "all of the time," marijuana users have a significantly higher percentage than non-users (24% versus 17.2%). The moderate feeling levels, "some of the time" and "most of the time," show a small margin (~5%) between the two groups.

Examining the remaining four emotions (see **Appendix**) reveals a consistent pattern across all feeling levels for both groups marijuana users and non-users. These results indicate that non-smokers experience significantly fewer emotional health issues than marijuana smokers. Furthermore, these bar charts effectively support the statistical findings, confirming the differences in emotional health levels between marijuana users and non-users.

4.1b. Overall well-being

Overall Health Evaluate in Past Year: We undertook a comparison of overall health between marijuana users and non-users by utilizing the variable "HEALTH", wherein participants evaluate their health over the past year on a scale ranging from 1 to 5. This scale is defined as

follows: 1 for excellent, 2 for very good, 3 for good, 4 for fair, and 5 for poor. The pie chart below, labeled as **Figure 2**, illustrates the percentage distribution of how participants in both groups perceive their overall health at each level.

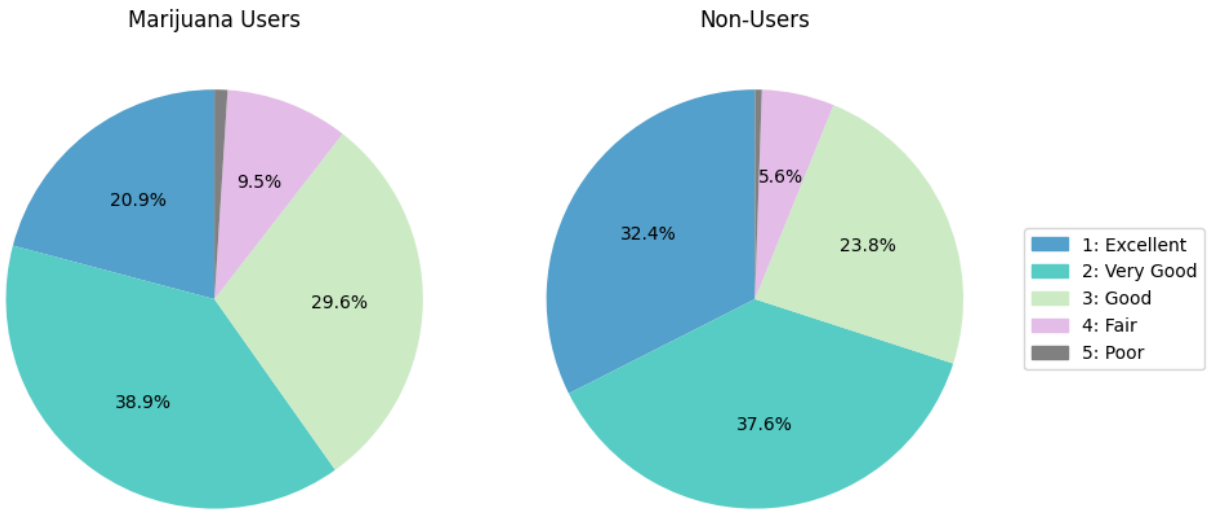

Figure 2: Overall health in past year between marijuana users and non-users

The pie chart illustrates notable distinctions between marijuana users and non-users in their perceptions of overall health. Specifically, the percentage of participants who rated their health as "excellent" is significantly lower among marijuana users (20.9%) compared to non-users (32.4%). Conversely, the proportion of participants who feel their health is "fair" or "poor" is higher among marijuana users. For those reporting "very good" or "good" health, the differences are relatively small, with a 1.3% gap for "very good" and a 5.8% gap for "good" health levels. In summary, non-users exhibit better overall health performance in the past year compared to marijuana users.

Mental health in COVID-19 pandemic: In addition to assessing overall health, we aimed to delve into the mental health levels of two groups under the special circumstances of the COVID-19 pandemic. **Figure 3** illustrates the impact of COVID-19 on the mental health of each group. The intensity levels range from 1 to 5, with 1 indicating the lowest impact (not at all) and 5 representing the highest level of influence (a lot).

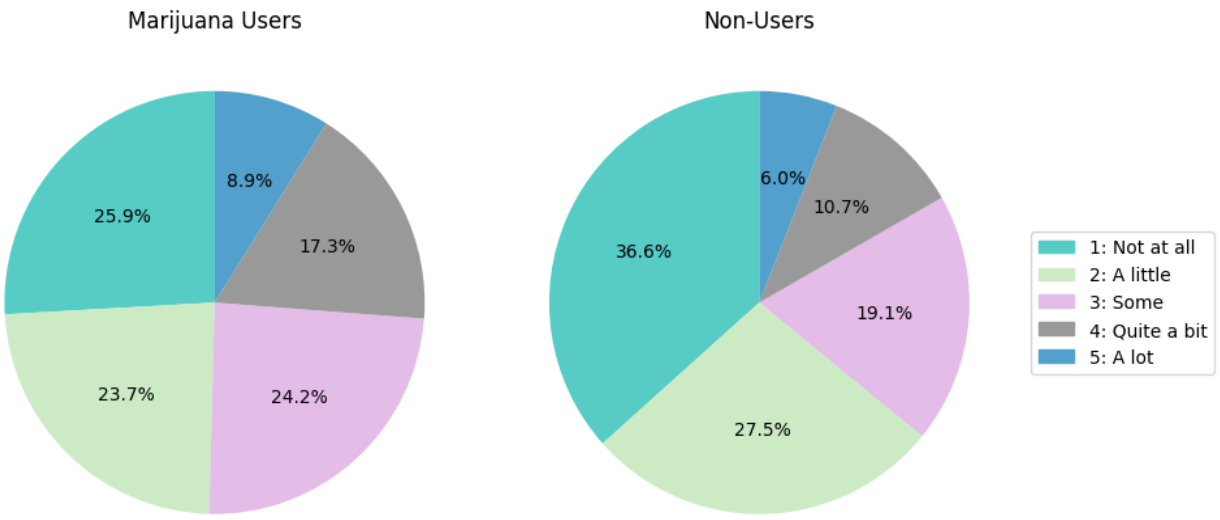

Figure 3: COVID affect on mental health between marijuana users and non-users

The pie chart suggests that the impact of COVID-19 on mental health is less pronounced among non-marijuana users compared to marijuana users. Non-users exhibit a significantly higher percentage of participants reporting being "not at all" affected by COVID-19 compared to marijuana users (36.6% versus 25.9%). Conversely, for the two highest affect levels, namely "a lot" and "quite a bit," non-users have a lower percentage of participants than marijuana users.

4.2 Mental health affect among marijuana users:

To assess the mental health effects of marijuana within the group of marijuana users, we explored two dimensions: substance disorder, which encompasses potential consequences of heavy marijuana use or withdrawal symptoms after quitting, and social connection, considering how marijuana users interact in their home, work, school, or with family and friends. The primary variable for this analysis is "Past Year Marijuana Use by days" (code: IRMJFY), indicating the frequency of marijuana use among individuals who use marijuana. The range of this variable spans from 1 to 365 days.

4.2a Substance Disorder

Long-lasting mental health issues: In the initial analysis within the substance disorder section, we aimed to examine whether the frequency of marijuana use contributes to long-lasting mental health issues among young adults. Utilizing the Yes/No question regarding whether participants have experienced any long-lasting mental health problems caused by marijuana use (code: UDMJMNTLPRB), we generated a box plot. The x-axis represents past year marijuana use (days), while the y-axis depicts the categories of participants' responses (Yes or No), as illustrated in **Figure 4**.

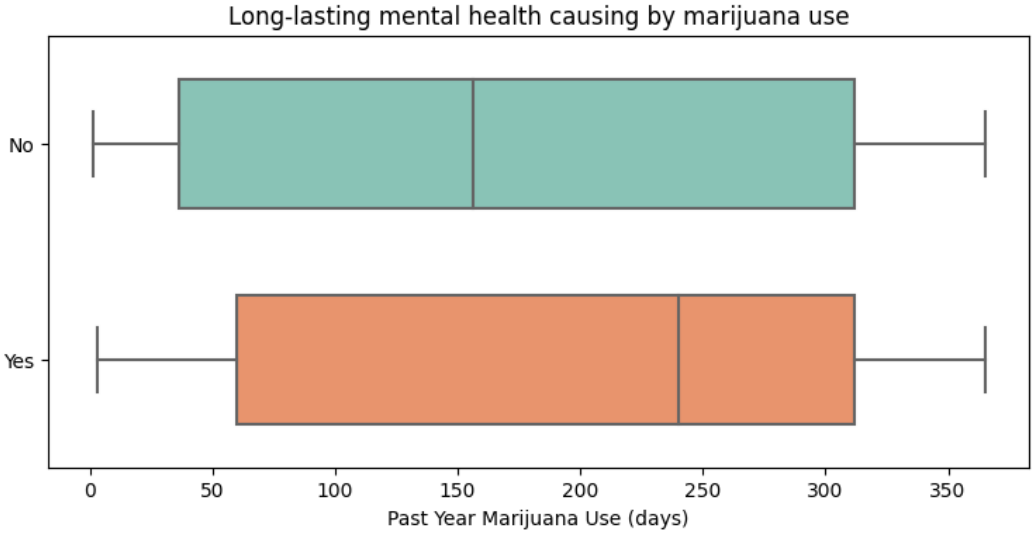

Figure 4: Long-lasting mental health causing by marijuana use

Our boxplot indicates that participants who responded "Yes" to experiencing long-lasting mental health issues caused by marijuana have, on average, consumed more marijuana in the past year compared to those who answered "No." Upon conducting the mean and median calculations for these two groups, the results reveal a mean of 202.96 days and a median of 240.00 days for the "Yes" group, while the "No" group shows a mean of 174.92 days and a median of 156.00 days. This stark contrast suggests a significant gap, implying that a higher frequency of marijuana use is linked to a greater likelihood of experiencing long-lasting mental health issues among participants.

Withdraw symptoms after cutting down or quitting: In alignment with our exploration of substance disorders related to drug use, it is crucial to consider withdrawal symptoms that may arise when participants attempt to cut down or quit using marijuana. According to the SAMHSA codebook, these withdrawal symptoms can manifest in various ways, impacting both physical health (e.g., headache, fever, weight loss) and mental health (e.g., feeling anxious, trouble sleeping). For the purpose of this project, which focuses on the mental health effects of marijuana use, we will specifically analyze four mental symptoms outlined in the codebook: feeling angry, inability to sit still, difficulty sleeping, and feeling anxious. Similar to the boxplot depicting long-lasting mental health issues, for each withdrawal symptom, we present a visualization where the x-axis represents past year marijuana use by days, and the y-axis indicates the response (Yes or No) regarding whether participants experienced these feelings as they attempted to cut down or quit marijuana use (**Figure 5**).

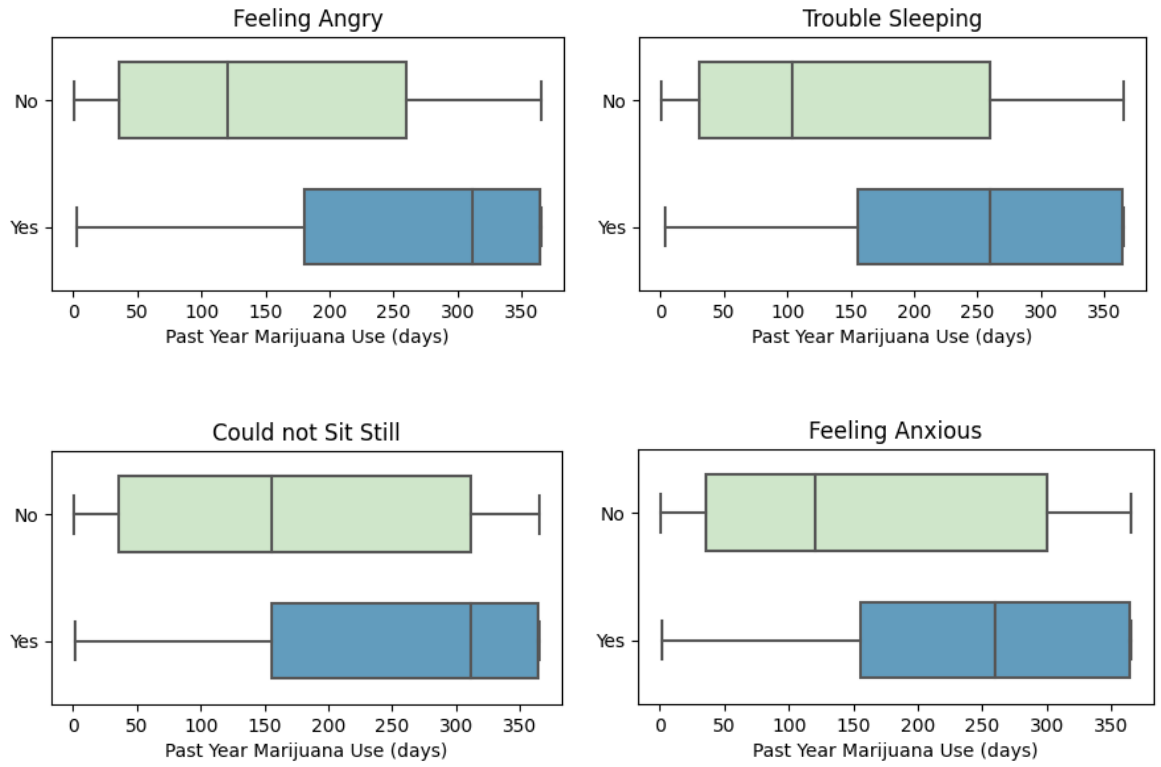

Figure 5: Mental symptomps after quitting marijuana use

As depicted in the boxplot panel above, across all four emotional symptoms, participants who answered "Yes" to experiencing withdrawal symptoms demonstrated a higher level of marijuana consumption in the past year compared to those who answered "No." Notably, for the symptoms "Trouble Sleeping" and "Could not Sit Still," the third quartile (Q3) of the "No" response group equals the median of the "Yes" response group, emphasizing a substantial gap between these two groups. In summary, the boxplot panel illustrates an association: as participants consume more marijuana, they are more likely to experience withdrawal symptoms related to mental health when attempting to quit or cut down on marijuana use.

4.2b. Social Connection

As human are social species, it is crucial to not only see how frequency of marijuana use could affect the users' mental health but also to consider its effects on their social connections within work, school, home environments, and relationships with family and friends.

Normal Activities: In the SAMSHA Codebook, normal activities encompass general daily responsibilities in work, school, and home. The codebook explains that individuals using marijuana may face serious problems in these areas, such as missing work or school, getting demoted, losing a job, or failing to fulfill family responsibilities. We aim to explore the correlation between the number of days individuals are unable to carry out these normal daily activities due to mental health issues and the frequency of marijuana use. Both variables are measured over the past year and range from 1 to 365 days. The correlation is visually represented in **Figure 6** below.

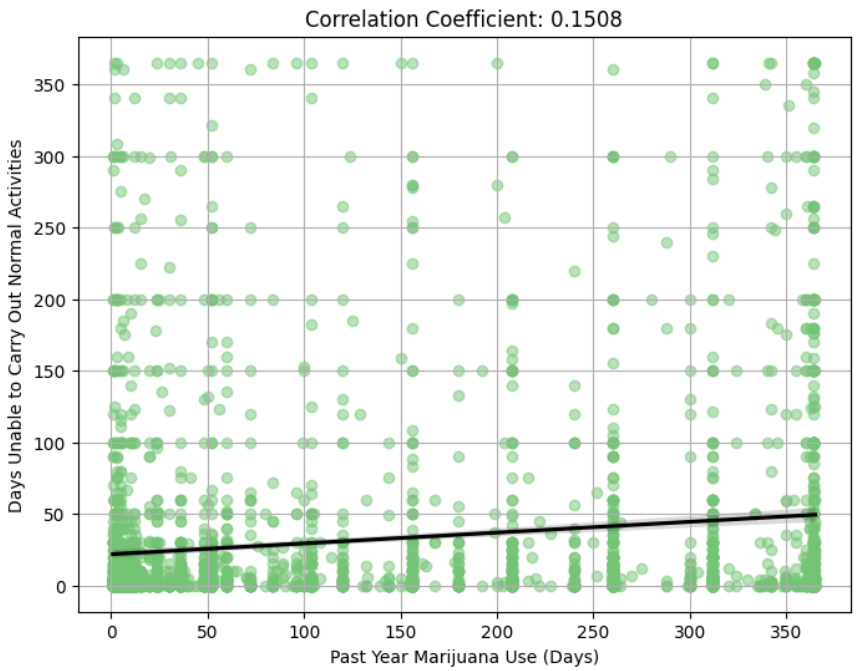

Figure 6: Days unable to carry out normal activities during past 12 months

In the presented scatterplot, the correlation coefficient of 0.15 suggests a positive correlation between the number of days individuals are unable to carry out normal activities and the past year frequency of marijuana use. While this correlation is not particularly strong, it does indicate that as participants consume more marijuana, there is a tendency for an increase in the number of days where they struggle to handle normal activities.

Difficult in participating social activities: In the next social connection factors, we observe whether the frequency of marijuana use influences the difficulty individuals face in participating in social activities, such as visiting friends, going to parties, or attending church (**Figure 7**). The variable used for this analysis is coded as IMPSOC, which assesses the difficulty level of participating in these activities. The variable's responses range from 1 to 4, with 1 indicating the lowest level of difficulty (no difficulty) and 4 representing the highest difficulty level (severe difficulty).

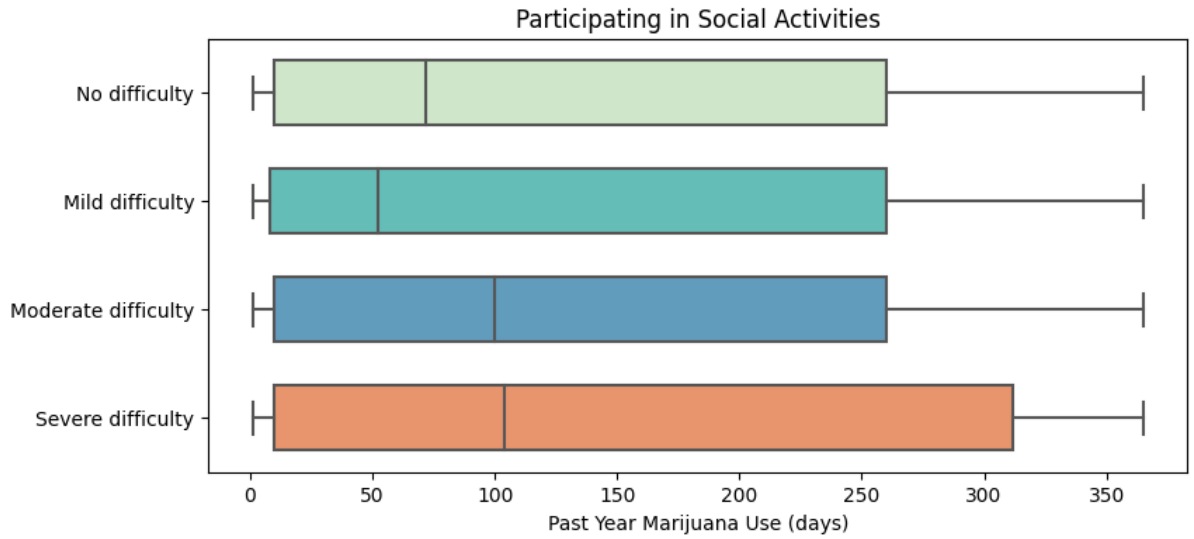

Figure 7: Social activities participation affected by marijuana use

As shown on Figure 6, the two lowest level "no difficulty" and "mild difficulty" have smaller median of past year marijuana use than the two highest level "moderate difficult" and "severe difficulty". In more specifically, people who meet "severe difficulty" in participating social activities even has 75th percentile (Q3) reach more than 300 days of marijuana use in the past year, whereas individuals in other difficulty levels all hover around 250 days. This result indicates that the people who feel heavily difficulty of participating in social activities has associate with using higher amount of marijuana.

To further scrutinize this relationship, we conducted two similar statistical tests: *Spearman's Correlation (ρ)* and *Kendall's Tau (τ)*. These tests has same purpose to determine whether there is a statistically significant correlation between the difficulty level of social activities (an ordinal variable) and the frequency of past-year marijuana use (a continuous variable). Both Spearman's Correlation and Kendall's Tau are suitable and effective for analyzing this relationship, considering the two variable's characteristics. These tests will not only reveal the presence of correlation but also provide insights into the strength and direction of that correlation, if it exists.

The statistical results indicate a Spearman's correlation coefficient of 0.0379 with a p-value of 2.0220e-02 and a Kendall's Tau correlation of 0.0292 with a p-value of 1.9710e-02. Since both p-values are smaller than 0.05, there is statistical evidence supporting a correlation between the difficulty level in participating in social activities and the frequency of marijuana use in the past year. Furthermore, the positive correlation coefficients for both Spearman and Kendall suggest that as participants have more days of consuming marijuana, they are likely to experience more difficulty in participating in social activities.

Arguments/Conflict with Family or Friend: In our examination of social connections, the final factor we consider is the relationship with family or friends. Utilizing the conflict variable (code UDMJWORKPRB), which inquires whether participants have had arguments with family or friends worsened by marijuana use over the past 12 months, we employ a box plot to visually assess its relationship with the frequency of marijuana consumption in the past year.

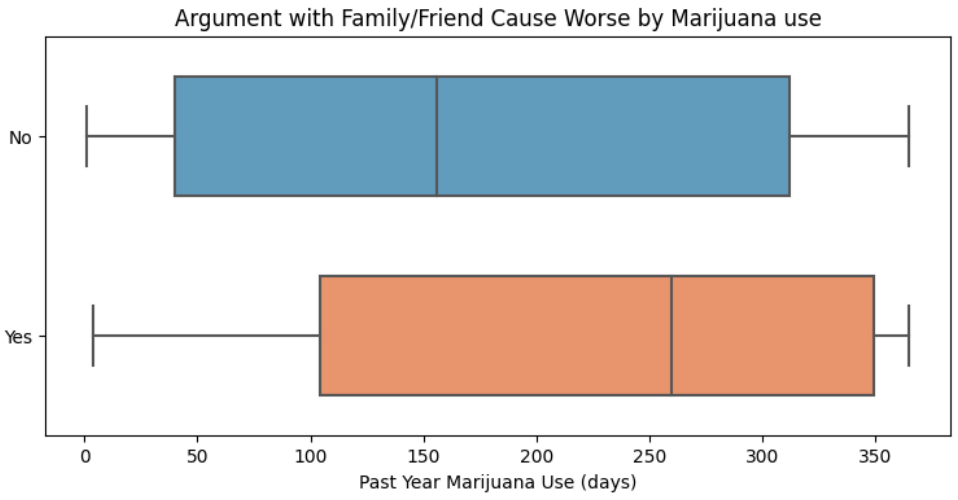

Figure 8: Argument with family/friend cause worsed by marijuana use

When considering conflicts with family or friends worsened by marijuana use, individuals who responded "Yes" (indicating such conflicts) have a median of around 250 days of marijuana use in the past year. In contrast, participants who responded "No" (indicating no conflicts with family or friends worsened by marijuana use) have a significantly lower

median of approximately 150 days of marijuana consumption. Therefore, **Figure 8** illustrates a established link that the higher frequency of marijuana use may cause worsed the relationships with family and friends. For social bonding,

5. Discussion

In our research, which centers on mental health and marijuana use in young adults aged 18 to 25 in the year 2021, we have identified two main key points. Firstly, concerning the relationship between marijuana users and non-users, non-users exhibit better emotional health performance (**Table 1**, **Figure 1** & **Appendix**) and overall well-being (**Figure 2**). Under special circumstances such as the COVID-19 pandemic, non-users also experience fewer mental health impacts than marijuana users (**Figure 3**).

Secondly, concerning marijuana consumption among marijuana users, there is a significant association between experiencing long-lasting mental health issues and consuming more marijuana (**Figure 4**). Additionally, for individuals attempting to cut down or quit marijuana use, the more days they have used marijuana, the more likely they are to encounter withdrawal symptoms (substance disorder) related to mental health (**Figure 5**). In terms of social bonding, there is a slight positive correlation between the frequency of marijuana use and the number of days individuals are unable to handle normal activities related to mental health (**Figure 6**). Furthermore, those who consume more marijuana also find it more challenging to participate in social activities (**Figure 7**). They are also more likely to experience arguments or conflicts worsened with family or friends, attributable to marijuana use (**Figure 8**).

Our research, therefore, adds a piece to the larger picture concerning the intricate relationship between mental health issues and marijuana use in young adults. In response to the motivations behind marijuana use (Christine et al., 2006; Patrick et al., 2011b), our study provides an additional perspective on the potential consequences for mental health,

particularly when consumption marijuana is at a higher level. However, it's important to note that our analysis is confined to the year 2021, with a focus on mental health and age variables. To gain a more comprehensive understanding, further research is warranted, exploring additional years and considering other demographic factors such as race, gender, education, and even examining state policies to discern their potential contributions to the significant rise in marijuana use and mental health issues over the past decades.

6. Appendix

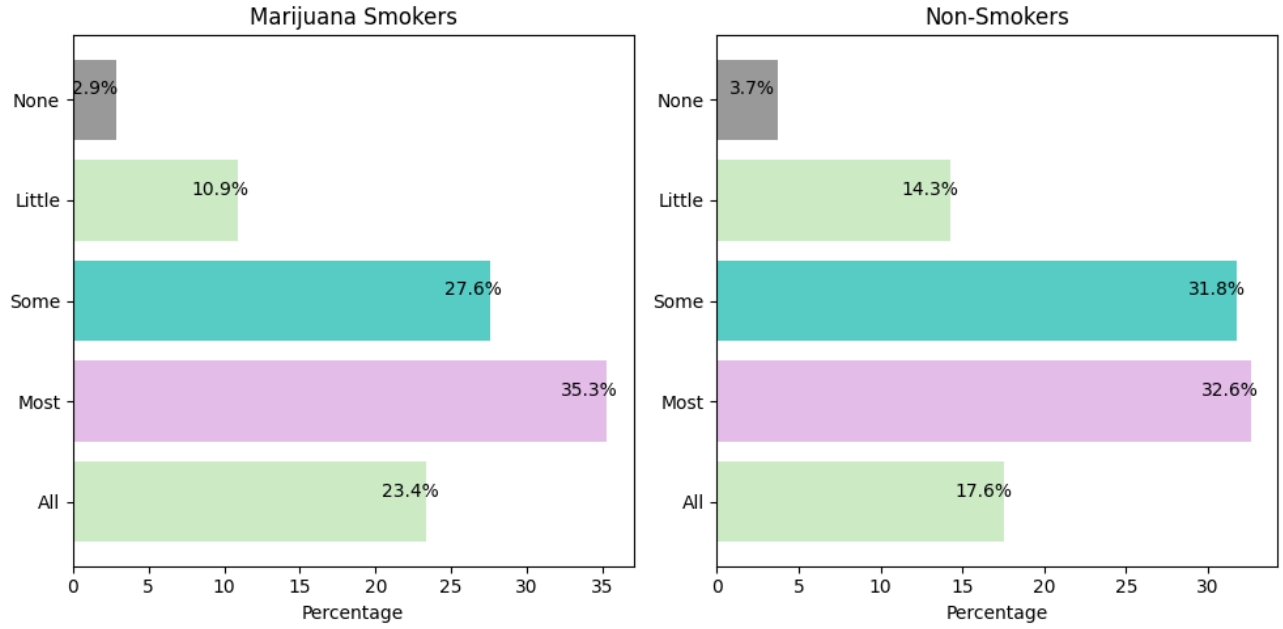

Figure 1.2: Feeling Nervous between marijuana users and non-users

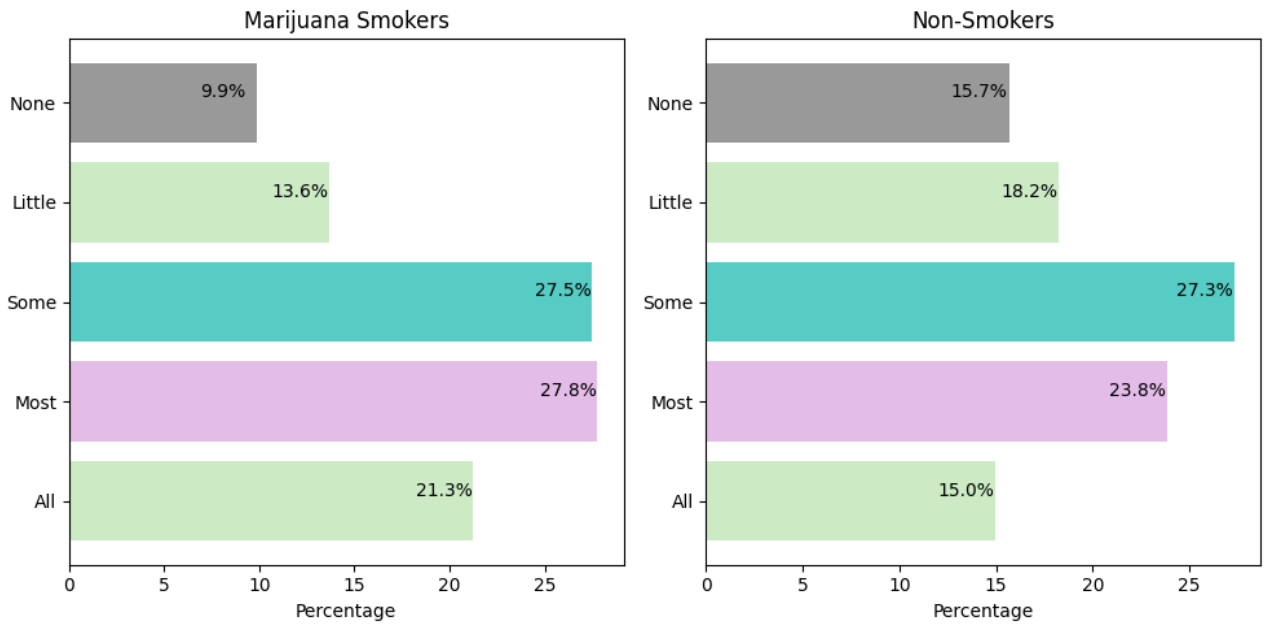

Figure 1.3: Feeling Hopeless between marijuana users and non-users

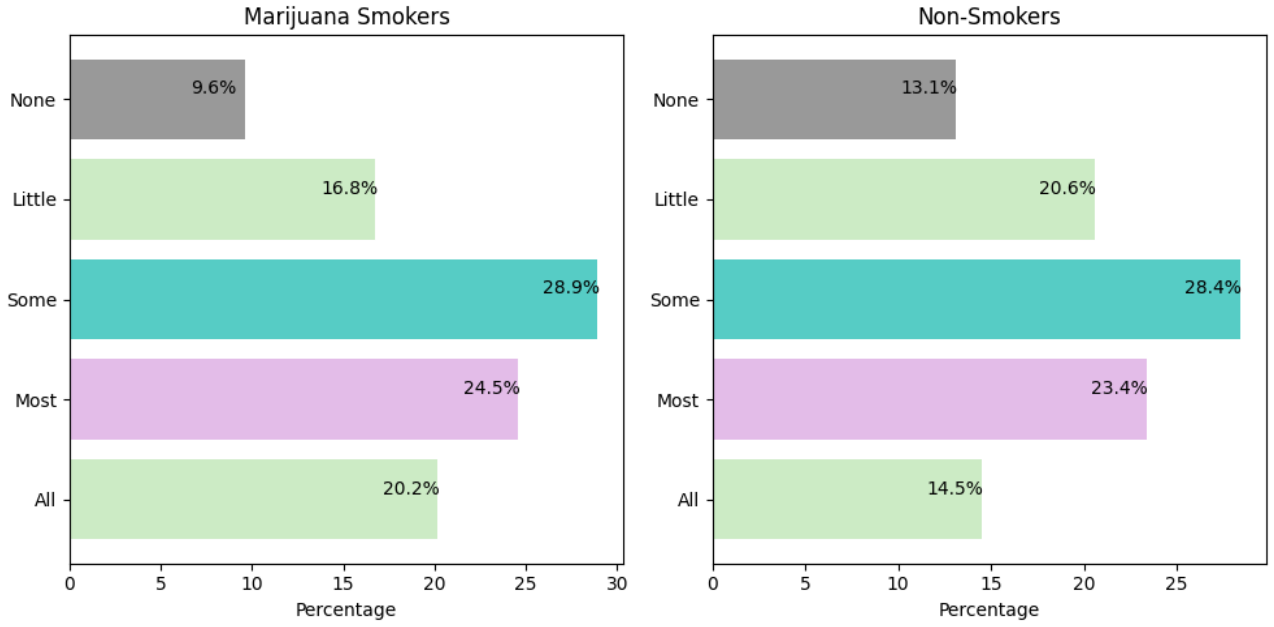

Figure 1.4: Feeling Restless between marijuana users and non-users

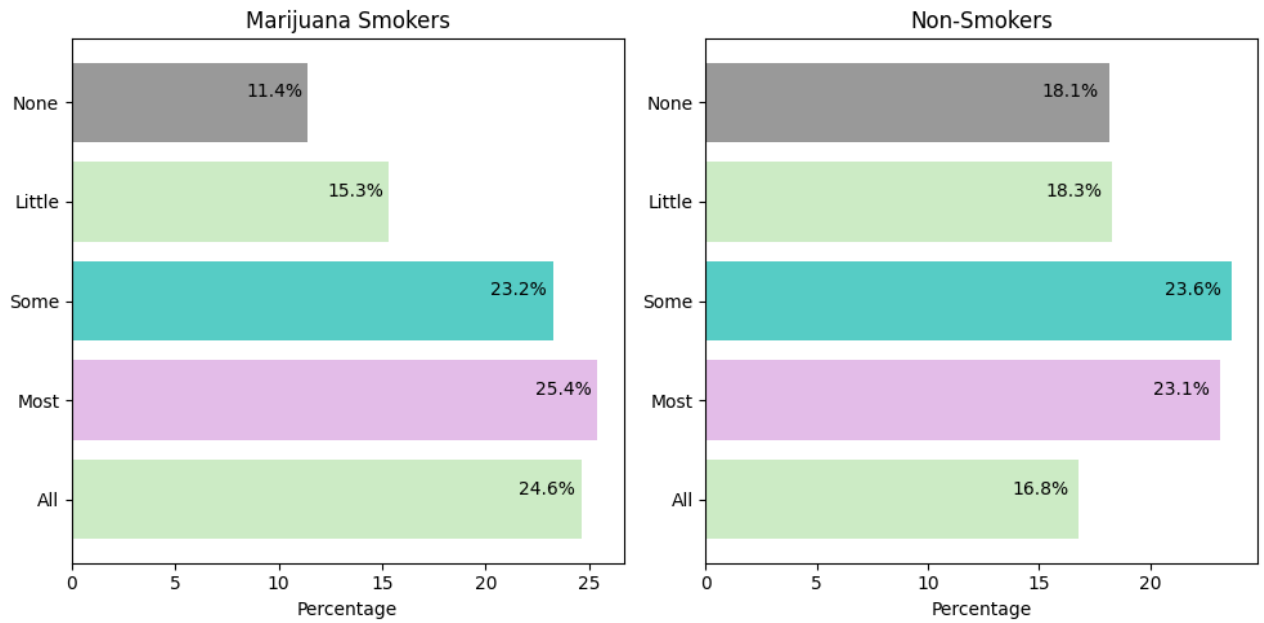

Figure 1.5: Feeling Down On Yourself between marijuana users and non-users

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