

# ScholarWorks@GSU

## The Relationship between Marijuana Use and Menstrual Health among US Females within the General Fertility Bracket

Authors	Abdulrahman, Jamaldeen
Citation	Abdulrahman, Jamaldeen. "The Relationship between Marijuana Use and Menstrual Health among US Females within the General Fertility Bracket." Thesis, Georgia State University, 2023. <a href="https://doi.org/10.57709/36492145">https://doi.org/10.57709/36492145</a>
DOI	<a href="https://doi.org/10.57709/36492145">https://doi.org/10.57709/36492145</a>
Download date	2026-04-15 20:30:20
Link to Item	<a href="https://hdl.handle.net/20.500.14694/9865">https://hdl.handle.net/20.500.14694/9865</a>

**TITLE OF THESIS:**

The Relationship between Marijuana Use and Menstrual Health among US Females within the  
General Fertility Bracket

**Student's Name:**

Jamaldeen Abdulrahman

Fall, 2023

**Thesis Committee:**

Barbara Yankey, PhD

Committee Chair

Solomon I. Okosun, PhD

Committee Member

## **ABSTRACT**

**Introduction:** The escalating prevalence of marijuana use among women of reproductive age in the United States has raised concerns about its potential impact on reproductive health. The World Health Organization identifies cannabis as the most widely cultivated, trafficked, and abused illicit drug globally, with around 147 million individuals, constituting approximately 2.5% of the world's population, admitting to annual cannabis consumption. In the U.S. marijuana use is decriminalized in most States and holds the distinction of being the most frequently used psychoactive substance, emphasizing the urgency of investigating its impact on reproductive health among the population.

**Aim:** Menstrual irregularities can be a sign of reproductive health challenges. The aim of this thesis is to investigate the association between marijuana use and menstrual irregularities (as a proxy for reproductive health) among U.S. women aged 20 to 44 years.

**Methods:** The analysis employs descriptive statistics and logistic regression ( $\alpha = 0.05$ ) using data from the National Health and Nutrition Examination Survey (NHANES) 2017-2018. Menstrual irregularities, defined as the absence of regular periods in the past 12 months, serve as the main dependent variable, while marijuana use, characterized by monthly use for a year, is the primary independent variable. Control variables include demographic factors, alcohol use, cigarette smoking, drug use, moderate physical activity, hormone use, contraceptive use, and treatment for pelvic inflammation.

**Results:** In this study, compared to their counterparts, we find that the adjusted odds ratio for marijuana use was 3.91 (95% CI: 0.59 – 25.96,  $p = 0.158$ ), suggesting an increased likelihood of menstrual irregularities among individuals who reported marijuana use, although the association did not reach statistical significance. We also find a positive association, and inconsistent relationships between marijuana use and other factors of reproductive health (ever being pregnant, diabetes in pregnancy, and ever having a cesarean section), though not statistically significant. Marijuana use could have a complex relationship with reproductive health factors including menstrual health that cannot be explained by cross-sectional studies alone.

**Conclusion:** The findings of the logistic regression model, involving 913 females, indicate that we do not have sufficient evidence to reject the null hypothesis, suggesting that, in this specific model, marijuana use may not be statistically significantly related to menstrual irregularities among the 913 females in the study. This non-significant association raises the possibility of a more intricate relationship between marijuana use and reproductive health factors, particularly menstrual health, which may extend beyond the scope of cross-sectional studies. The complexity of these associations underscores the need for comprehensive and longitudinal investigations to better elucidate the potential impact of marijuana use on menstrual patterns and other reproductive health outcomes. In summary, our study underscores the intricacies involved in understanding the relationship between marijuana use and menstrual irregularities, emphasizing the limitations of cross-sectional approaches in capturing the multifaceted nature of this connection.

**The Relationship between Marijuana Use and Menstrual Health among US Females within  
the General Fertility Bracket**

**An Examination of NHANES Data 2017 -2018**

**by**

**Jamaldeen Abdulrahman**

**BSPH, GEORGIA STATE UNIVERSITY**

(List other degrees awarded in the same format)

A Thesis Submitted to the Graduate Faculty  
of Georgia State University in Partial Fulfillment

of the

Requirements for the Degree

**MASTER OF PUBLIC HEALTH**

Under the direction of Dr. **Barbara Yankey, Dr. Solomon Ike Okosun,**

ATLANTA, GEORGIA

30303

APPROVAL PAGE

**The Relationship between Marijuana Use and Menstrual Health among US Females within  
the General Fertility Bracket**

**by**

**Jamaldeen Abdulrahman**

**Approved by:**

**Barbara Yankey, PhD**

Committee Chair

**Solomon Ike Okosun, PhD**

Committee Member

6<sup>th</sup> December 2023

## Acknowledgments

I would like to express my deepest gratitude to the following individuals and organizations for their invaluable support and assistance in the completion of this thesis:

1. **My Advisor:** I am profoundly grateful to my thesis advisor, **Dr. Yankey**, for her unwavering guidance, patience, and expertise. Her mentorship was instrumental in shaping the direction of this research.
2. **My Committee Members:** I extend my appreciation to the members of my thesis committee, **Dr. Okosun**, for his insightful feedback and constructive criticism, which significantly improved the quality of this work.
3. **Family and Friends:** I am grateful to my family and friends for their unwavering encouragement, patience, and understanding during this challenging academic journey. Their moral support was indispensable.
4. **Institutional Support:** I thank Georgia State University for providing access to resources, facilities, and the academic environment necessary for the successful completion of this thesis.
5. **Library and Support Staff:** The librarians and support staff were indispensable in assisting me with literature searches and document retrieval.
6. **Mentors and Professors:** I am thankful to all the professors and mentors who have influenced my academic and intellectual growth over the years.
7. **Colleagues and Classmates:** My sincere appreciation goes to my classmates and colleagues for the insightful discussions, encouragement, and shared experiences throughout my academic journey.

8. **Dedication:** I dedicate this thesis to my parents, whose memory continues to inspire and motivate me.

9. **Others:** I apologize if I inadvertently missed anyone who contributed to this research.

Your support is equally valued and appreciated.

Thank you all for your unwavering support, and I am truly fortunate to have had the privilege of working with each one of you. Your contributions have been vital to the completion of this thesis.

Jamaldeen Abdulrahman

**Thesis Title: The Relationship between Marijuana Use and Menstrual Health among US Women within the General Fertility Bracket.**

Fall, 2023

## Author's Statement Page

In presenting this thesis as a partial fulfillment of the requirements for an advanced degree from Georgia State University, I agree that the Library of the University shall make it available for inspection and circulation by its regulations governing materials of this type. I agree that permission to quote from, copy from, or publish this thesis may be granted by the author or, in his/her absence, by the professor under whose direction it was written, or in his/her absence, by the Associate Dean, School of Public Health. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation that involves potential financial gain will not be allowed without written permission of the author.

Jamaldeen Abdulrahman

Signature of Author

## **Notice to Borrowers**

All these deposited in the Georgia State University Library must be used by the stipulations described by the author in the preceding statement.

The Author of this Thesis is:

**Jamaldeen Abdulrahman**

161 Norwood Avenue, NE

Atlanta, GA 30317

The Chair of the committee for this Thesis is:

**BARBARA A YANKEY**

Institute of Public Health

616 Urban Life Building

Atlanta, GA 30303

Users of this thesis who are not regularly enrolled as students at Georgia State University are required to attest to acceptance of the preceding stipulation by signing below. Libraries borrowing this thesis for the use of their patrons are required to see that each user records the information requested.

# Table of Contents

<b>ABSTRACT</b> .....	<b>1</b>
<b>I INTRODUCTION</b> .....	<b>3</b>
OVERVIEW OF THE RESEARCH TOPIC.....	3
PREVALENCE OF MARIJUANA USE AMONG WOMEN OF REPRODUCTIVE AGE .....	4
PHYSIOLOGICAL EFFECTS OF MARIJUANA ON THE MENSTRUAL CYCLE.....	5
ENDOCANNABINOID SYSTEM AND MENSTRUAL HEALTH .....	5
SOCIAL DETERMINANTS AND MARIJUANA USE PATTERNS.....	6
LIFESTYLE AND HEALTH BEHAVIORS.....	8
CONTRACEPTION AND HORMONE USE.....	9
<b>PURPOSE AND PREMISES FOR THE HYPOTHESIS</b> .....	<b>9</b>
PREMISES FOR THE HYPOTHESES: .....	10
<b>II LITERATURE REVIEW</b> .....	<b>10</b>
<b>III METHODOLOGY</b> .....	<b>16</b>
METHODOLOGICAL CHALLENGES.....	16
<b>DATA AND METHODS</b> .....	<b>18</b>
DATA.....	18
STATISTICAL ANALYSIS: .....	20
PARTICIPANTS: .....	20
INCLUSION AND EXCLUSION CRITERIA: .....	20
DEPENDENT AND INDEPENDENT VARIABLES: .....	20
CONTROL VARIABLES: .....	20
<b>HYPOTHESIS</b> .....	<b>21</b>
<b>IV RESULTS</b> .....	<b>21</b>
BASELINE CHARACTERISTICS OF STUDY POPULATION .....	21
UNADJUSTED ANALYSIS OF REPRODUCTIVE HEALTH FACTORS VS. MARIJUANA USE .....	22
MULTIVARIATE LOGISTIC REGRESSION.....	23
<b>V DISCUSSION</b> .....	<b>25</b>
<b>LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH</b> .....	<b>27</b>
<b>VI CONCLUSION</b> .....	<b>28</b>
<b>TABLES</b> .....	<b>29</b>
TABLE 1 A: DESCRIPTIVE STATISTICS OF PARTICIPANTS.....	29
TABLE 1B: DESCRIPTIVE STATISTICS OF PARTICIPANTS .....	30
TABLE 2: UNADJUSTED ANALYSIS (REPRODUCTIVE HEALTH FACTORS VS. MARIJUANA USE.....	31
TABLE 3A: MULTIVARIATE LOGISTIC REGRESSION FOR MENSTRUAL IRREGULARITIES AND MARIJUANA USE CONTROLLING FOR FACTORS LISTED IN THE MODEL.....	31
TABLE 3B: MULTIVARIATE LOGISTIC REGRESSION FOR EVER BEING PREGNANT AND MARIJUANA USE CONTROLLING FOR FACTORS LISTED IN THE MODEL.....	32
TABLE 3C: MULTIVARIATE LOGISTIC REGRESSION FOR DIABETES IN PREGNANCY AND MARIJUANA USE CONTROLLING FOR FACTORS LISTED IN THE MODEL.....	34
TABLE 3D: MULTIVARIATE LOGISTIC REGRESSION FOR CESAREAN SECTION AND MARIJUANA USE CONTROLLING FOR FACTORS LISTED IN THE MODEL. ....	35
<b>FIGURES</b> .....	<b>36</b>

FIGURE 1: BAR CHART FOR MARIJUANA USE BY RACE .....36  
FIGURE 2: BAR CHART FOR A) CURRENT SMOKING, B) DRUG USE AND MENSTRUAL IRREGULARITIES .....37  
FIGURE 3: BOX PLOT SHOWING MEDIAN AGE AT MARIJUANA USE AND FREQUENCY OF USE VS IRREGULAR PERIODS.....38  
**REFERENCES:.....39**

---

**The Relationship between Marijuana Use and Menstrual Health among US Females within  
the General Fertility Bracket - An Examination of NHANES Data 2017 -2018**

**by**

**Jamaldeen Abdulrahman**

Student BSPH/MPH Fall 2023

GEORGIA STATE UNIVERSITY

## Abstract

**Introduction:** The escalating prevalence of marijuana use among women of reproductive age in the United States has raised concerns about its potential impact on reproductive health. The World Health Organization identifies cannabis as the most widely cultivated, trafficked, and abused illicit drug globally, with around 147 million individuals, constituting approximately 2.5% of the world's population, admitting to annual cannabis consumption. In the U.S. marijuana use is decriminalized in most States and holds the distinction of being the most frequently used psychoactive substance, emphasizing the urgency of investigating its impact on reproductive health among the population.

**Aim:** Menstrual irregularities can be a sign of reproductive health challenges. The aim of this thesis is to investigate the association between marijuana use and menstrual irregularities (a proxy for reproductive health) among U.S. women aged 20 to 44 years.

**Methods:** The analysis employs descriptive statistics and logistic regression ( $\alpha = 0.05$ ) using data from the National Health and Nutrition Examination Survey (NHANES) 2017-2018. Menstrual irregularities, defined as the absence of regular periods in the past 12 months, serve as the main dependent variable, while marijuana use, characterized by monthly use for a year, is the primary independent variable. Control variables include demographic factors, alcohol use, cigarette smoking, drug use, moderate physical activity, hormone use, contraceptive use, and treatment for pelvic inflammation.

**Results:** In this study, compared to their counterparts, we find that the odds ratio for marijuana use (Yes vs. No) was 3.91 (95% CI: 0.59 – 25.96,  $p = 0.158$ ), suggesting an increased likelihood of menstrual irregularities among individuals who reported marijuana use, although the

association did not reach statistical significance. a non-significant positive association, and inconsistent relationships between marijuana use and other factors of reproductive health (ever being pregnant, diabetes in pregnancy, and having a cesarean section). Marijuana use could have a complex relationship with reproductive health factors including menstrual health that cannot be explained by cross-sectional studies alone.

**Conclusion:** the findings of the logistic regression model, involving 913 females, indicate that we do not have sufficient evidence to reject the null hypothesis, suggesting that, in this specific model, marijuana use may not be significantly related to menstrual irregularities among the 913 females in the study. This non-significant association raises the possibility of a more intricate and nuanced relationship between marijuana use and reproductive health factors, particularly menstrual health, which may extend beyond the scope of cross-sectional studies. The complexity of these associations underscores the need for comprehensive and longitudinal investigations to better elucidate the potential impact of marijuana use on menstrual patterns and other reproductive health outcomes. In summary, our study underscores the intricacies involved in understanding the relationship between marijuana use and menstrual irregularities, emphasizing the limitations of cross-sectional approaches in capturing the multifaceted nature of this connection.

# I Introduction

## Overview of the research topic

The link between marijuana usage and menstrual irregularities in women of reproductive age has gained growing recognition in recent times. This examination of the current body of literature seeks to uncover possible links between the consumption of marijuana and outcomes related to menstrual health. It aims to illuminate a subject that, despite its significance for women's reproductive health, has received insufficient research attention thus far. The illicit use of marijuana is highly prevalent in the United States (Azofeifa et al., 2016; Schauer et al., 2015). Notably, there is a rising trend of concurrent marijuana and tobacco use, with approximately 5% of U.S. adults reporting co-use in the past month (Schauer et al., 2015). This trend is expected to persist and possibly intensify as an increasing number of states legalize marijuana for both medicinal and recreational purposes, with more states likely to follow suit in the foreseeable future (Hall and Lynskey, 2016; Hall and Weier, 2015; Schauer et al., 2015).

Despite this evolving landscape, the public health implications of this heightened acceptability and use of marijuana, especially among women, remain to be fully understood. Understanding the intricate dynamics of the menstrual cycle and its potential interactions with marijuana use is essential for comprehending its impact on female reproductive health. Indeed, a regular menstrual cycle is a crucial indicator of a healthy reproductive system in individuals with female anatomy. It signifies that the various hormonal and physiological processes necessary for fertility and overall reproductive health are functioning correctly.

## Prevalence of Marijuana Use Among Women of Reproductive Age

The prevalence of marijuana use among women of reproductive age in the United States has become a matter of increasing concern, with a significant uptick in both prevalence and societal acceptance over the years. According to the World Health Organization (WHO), cannabis is the "most widely cultivated, trafficked, and abused illicit drug" globally, with approximately 2.5% of the global population, or 147 million individuals, acknowledging annual cannabis consumption (WHO, 2023). In the United States, marijuana has claimed the title of the most frequently used controlled or psychoactive substance, with an estimated 48.2 million people, signifying an astonishing prevalence rate of approximately 50% in 2019 (CDC, 2023). Recent data reveals that 9.9% of women within this age demographic reported current marijuana use (Ewing et al., 2020).

The National Institute on Drug Abuse (NIDA) reports a substantial increase in marijuana use among young adults in recent years, with the prevalence of past-year marijuana use reaching 43% in 2021, up from 34% in 2016 and 29% in 2011. Additionally, the proportion of young adults reporting past-month marijuana use increased to 29% in 2021, compared to 21% in 2016 and 17% in 2011. Daily marijuana use also exhibited a notable increase, with 11% of young adults reporting daily use in 2021, compared to 8% in 2016 and 6% in 2011 (NIDA, 2022). The prevalence of self-reported, past-month marijuana use among US adult pregnant women witnessed an increase from 2.4% to 3.9% between 2002 and 2014 (Brown et al., 2017). Ko et al. (2015) provided aggregated data from 2007 to 2012, revealing that 3.9% of pregnant women and 7.6% of nonpregnant reproductive-aged women reported past-month marijuana use. These statistics illustrate the upward trend in marijuana use among young adults, emphasizing the

importance of examining its potential implications, particularly regarding menstrual health and reproductive outcomes.

### Physiological Effects of Marijuana on the Menstrual Cycle

The menstrual cycle, a hallmark of female physiology, is intricately governed by sex hormones and marked by two primary phases: the follicular phase and the luteal phase. The cycle commences with the onset of menstruation, initiating the follicular phase. Over approximately 10 days, estradiol levels rise, followed by a surge in luteinizing hormone (LH) that triggers ovulation. Ovulation typically occurs at the midpoint of the menstrual cycle, leading to the onset of the luteal phase. The luteal phase is characterized by a peak in progesterone and a secondary peak in estradiol (Strauss and Barbieri, 2013). Understanding the intricate dynamics of the menstrual cycle and its potential interactions with marijuana use is essential for comprehending its impact on female reproductive health.

Existing research has offered preliminary insights into the physiological effects of marijuana on the menstrual cycle. Notably, studies suggest a potential association between marijuana use and menstrual cycle disruptions (K., 2016). These disruptions may manifest as anovulatory cycles, where ovulation does not occur, or alterations in the lengths of menstrual cycle phases, particularly the luteal phase. Anovulatory cycles and irregularities in the length of the luteal phase are crucial components of menstrual health, as they can impact fertility and overall reproductive well-being.

### Endocannabinoid System and Menstrual Health

Research has suggested that chronic exposure to cannabinoids, the active compounds in marijuana, can exert significant effects on the female reproductive system. These effects encompass delayed sexual maturation, menstrual cycle disruption, depressed ovarian follicular

maturation, and reduced serum concentrations of luteinizing hormone (LH) and sex hormones (Walker et al., 2019; Bari et al., 2011). The endocannabinoid system, which interacts with cannabinoids, plays a pivotal role in regulating these processes within female reproductive tissues (Walker et al., 2019; Bari et al., 2011). Such disruptions in the menstrual cycle can have profound implications for women's reproductive health and may affect their ability to conceive.

### Social Determinants and Marijuana Use Patterns

Marijuana use patterns are intricately connected to various social determinants, the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. Beyond the physiological implications, factors such as age, education, marital status, and income play pivotal roles in shaping marijuana use patterns and, consequently, menstrual health outcomes. The interaction of these social determinants with marijuana use is complex, requiring a nuanced understanding to comprehensively assess the intricate relationship between marijuana use and menstrual irregularities among women of reproductive age. Recognizing and studying these interactions is crucial for the development of effective public health strategies and interventions.

Social determinants exert a substantial influence on both marijuana use patterns and menstrual health outcomes, presenting a complex interplay that necessitates thorough examination. Age, education, marital status, income, and concurrent substance use are pivotal social factors that can shape these dynamics. Younger women may exhibit heightened susceptibility to marijuana experimentation or regular use, highlighting the significance of age-related variations in marijuana use concerning menstrual health (Hathaway et al., 2011). Educational attainment plays a role in influencing marijuana use behavior, with higher education levels potentially associated with distinct usage patterns (Lemstra et al., 2008). Marital status,

specifically being married or cohabiting, may introduce variations in substance use patterns, requiring examination of its influence on menstrual health outcomes (Lam et al., 2017). Income, a key component of socioeconomic status (SES), can impact both marijuana use patterns and access to healthcare resources, underscoring the importance of addressing income disparities in understanding health disparities.

In addition to these social determinants, various factors contribute to the complexity of the relationship between social context and marijuana use. SES, encompassing income and education, significantly influences marijuana use, as adolescents from lower SES backgrounds demonstrate a higher likelihood of engaging in both alcohol and marijuana use (Lemstra et al., 2008). Neighborhood environment further shapes marijuana use, with a higher neighborhood unemployment rate enhancing adolescent risk for marijuana use initiation (Tucker et al., 2013). Social support and peer influence emerge as critical determinants, with individuals influenced by friends and acquaintances more likely to engage in marijuana use (Lam et al., 2017). Cultural factors, such as norms and values, contribute to the acceptability and prevalence of marijuana use, introducing variations across different cultural groups (Hathaway et al., 2011). Public policies and legalization status play a significant role, impacting public beliefs about marijuana and its patterns of use (Steigerwald et al., 2020). Access to healthcare services, affected by cannabis legalization, influences marijuana use patterns, emphasizing the need to consider healthcare access in the context of marijuana use (Hawley et al., 2020). Stress and mental health issues are associated with increased marijuana use, underlining the importance of addressing mental health within the marijuana use context (Hyman and Sinha, 2009).

These social determinants and contextual factors collectively shape marijuana use patterns, emphasizing the intricate web of influences that must be considered in prevention and

intervention strategies. It is crucial to tailor interventions to address the unique needs of different populations based on their social determinants and to consider the multifaceted nature of the relationship between social context and marijuana use.

### Lifestyle and Health Behaviors

In a study conducted by Chauhan et al. (2021), the association between lifestyle factors and menstrual problems, as well as the treatment-seeking behavior for such problems among adolescent girls, was examined. The study, based on a sample of 12,707 adolescent girls aged 10-19, found that approximately 11% of these girls experienced menstrual problems, with nearly one-third of them seeking treatment. Several lifestyle factors were associated with menstrual problems, including severe depressive symptoms, substance use, and a lack of physical activity. Interestingly, adolescent girls from the richest wealth quintile were less likely to report menstrual problems but were significantly more likely to seek treatment for these issues compared to their less affluent counterparts. This suggests a complex interplay between socioeconomic status and treatment-seeking behavior for menstrual problems among adolescent girls. The study underscores the importance of enhancing health education on puberty and menstruation, particularly in rural areas, to improve the overall management of menstrual problems in this population (Chauhan et al., 2021).

Akhila, G., Shaik, A., and Kumar, R. D. (2020) conducted a study that emphasizes the significance of a regular menstrual cycle in indicating a healthy reproductive system. The study highlights that menstrual problems can have far-reaching effects, impacting not only individual women but also families and even the broader social and national economy. The menstrual cycle was discussed, encompassing the two 14-day phases, and the normal age range for menarche, which typically occurs between 10 and 16 years, with a standard rhythm of 28 days, including 4–

6 days of bleeding. The study identified various menstrual disorders such as Amenorrhea, Oligomenorrhoea, Polymenorrhea, Menorrhagia, and Hypomenorrhea, which can significantly affect the quality of life for young adult women. Moreover, the research underlines the impact of lifestyle factors, including obesity, consumption of junk food, stress, physical inactivity, and skipping breakfast, in contributing to irregular menstruation patterns in reproductive-age females (Akhila, Shaik, & Kumar, 2020). Understanding these relationships is crucial for addressing menstrual irregularities and promoting reproductive health among women.

### Contraception and Hormone Use

Mendelson et al. (1986) found that smoking a single 1-gram marijuana cigarette containing 1.8% delta 9-tetrahydrocannabinol (THC) induced a significant 30% suppression of plasma luteinizing hormone levels in women during the luteal phase of the menstrual cycle ( $p < .02$ ). In contrast, no luteinizing hormone suppression was observed in the same women after smoking a placebo marijuana cigarette under double-blind conditions. These findings suggest that marijuana, or THC within it, may have adverse effects on reproductive function during the luteal phase of the menstrual cycle due to gonadotropin inhibition (Mendelson et al., 1986). The findings of this study have significant implications for reproductive health, particularly during the luteal phase of the menstrual cycle. The observed suppression of luteinizing hormone levels due to marijuana smoking suggests that marijuana, or THC within it, may adversely affect reproductive function in women. Luteinizing hormone is a crucial hormone involved in the regulation of the menstrual cycle and ovulation. Its suppression may disrupt the normal hormonal balance required for successful reproduction.

### Purpose and Premises for the Hypothesis

The purpose of this study is to contribute to the growing body of knowledge on the impact of marijuana use on the menstrual health of women in their general fertility bracket. By investigating these research questions and hypotheses, we aim to provide evidence-based insights that can inform public health strategies, healthcare practices, and personalized reproductive health guidance for this demographic. Understanding the nuances of this relationship is essential for promoting women's overall reproductive well-being and making informed decisions regarding marijuana use in the context of reproductive health.

### Premises for the Hypotheses:

1. Chronic marijuana use is associated with an increased likelihood of menstrual irregularities, including anovulatory cycles and changes in luteal phase length.
2. Women who use marijuana regularly will exhibit more significant menstrual health disruptions compared to those who do not use marijuana, even when controlling for alcohol and tobacco use.
3. Marijuana use is likely to impact contraceptive practices, with an increased prevalence of non-hormonal methods and a decreased use of hormonal contraception among women who consume marijuana.
4. Sociodemographic factors significantly interact with marijuana use patterns and may contribute to varying menstrual health outcomes among women of reproductive age.

## II Literature Review

Ryan et al. (2021) conducted a pioneering study titled "The effects of delta-9-tetrahydrocannabinol exposure on female menstrual cyclicity and reproductive health in rhesus macaques" in *F&S Science*. This research provides valuable insights into the impact of delta-9-

tetrahydrocannabinol (THC), the principal psychoactive compound in marijuana, on female reproductive health. The primary objective of Ryan et al.'s study was to examine the effects of delta-9-tetrahydrocannabinol (THC) exposure on female menstrual cyclicity and reproductive health in rhesus macaques. This research sought to elucidate the relationship between THC, a commonly used substance, and its potential impact on the menstrual cycle and broader reproductive health in a controlled animal model. The study was meticulously designed and executed. Rhesus macaques, serving as a suitable animal model, were exposed to THC, and various reproductive health parameters were closely monitored. The research encompassed controlled conditions, ensuring the reliability and accuracy of the findings. This involved careful control over THC dosage and duration of exposure. The research by Ryan et al. (2021) revealed substantial and noteworthy findings. It was observed that delta-9-tetrahydrocannabinol (THC) exposure had a discernible impact on menstrual cyclicity and reproductive health in rhesus macaques. Notably, THC exposure led to disruptions in menstrual cyclicity and alterations in reproductive hormone levels. These outcomes point to the potential of THC to influence female reproductive health.

Lammert et al. (2018) conducted a secondary subgroup analysis, aiming to explore the impact of co-using marijuana and tobacco on the menstrual cycle in comparison with females who only use tobacco among individuals seeking tobacco treatment. The study addressed the potential influence of marijuana co-use on the menstrual cycle, specifically focusing on the length of the luteal phase. The primary objective of this secondary subgroup analysis was to investigate the menstrual cycle in females who co-use marijuana and tobacco and compare it with the menstrual cycle in females who only use tobacco. The researchers sought to determine if there were any significant differences in the length of the luteal phase, with a specific focus on

the potential impact of marijuana co-use. The study included female participants aged 18 to 50 years, all of whom reported having regular menstrual cycles and indicated co-use of marijuana and tobacco. These participants were matched in a 1:3 ratio by age to a control group consisting of individuals who exclusively used tobacco. The length of the follicular and luteal phases of the menstrual cycle was assessed using First Response Urine LH tests. To determine differences in phase lengths between the two groups, the researchers employed Wilcoxon 2-sample t-tests.

The analysis included thirteen women who co-used marijuana and tobacco, along with thirty-nine women who exclusively used tobacco. The study's participants were primarily Caucasian (67%) and had a daily cigarette consumption of  $12.6 \pm 5.2$  (SD). The primary finding of this analysis was a significant difference in the length of the luteal phase between the two groups. Females who co-used marijuana and tobacco exhibited a notably shorter luteal phase ( $11.4 \text{ days} \pm 2.2$  [SD]) compared to females who only used tobacco ( $16.8 \text{ days} \pm 11.3$  [SD];  $P = 0.002$ ). However, no significant differences were observed in the lengths of the follicular phase or the overall menstrual cycle. The study's results suggest that females who co-use marijuana and tobacco may experience a shortened luteal phase in comparison to females who solely use tobacco. This finding underscores the potential impact of marijuana co-use on the menstrual cycle, particularly in the luteal phase. However, it is essential to note that these results are preliminary, and further investigations are warranted to gain a deeper understanding of how marijuana use may influence the menstrual cycle and potentially affect smoking outcomes.

Ewing et al. (2020) conducted an extensive study aimed at examining the prevalence of current marijuana use among women of reproductive age. Their study design encompassed a cross-sectional approach that included a large sample of women, providing a comprehensive snapshot of marijuana use in this demographic. The researchers collected data and utilized

statistical analyses to derive meaningful insights. The study by Ewing et al. (2020) unearthed critical findings concerning the relationship between marijuana use and menstrual health. Specifically, they reported that among women of reproductive age, 9.9% of participants reported current marijuana use. While this finding primarily pertains to marijuana use, it highlights the substantial prevalence of marijuana consumption in a critical demographic. The prevalence of marijuana use among women of reproductive age, as evidenced by the study, underscores the importance of investigating the potential consequences of marijuana use on menstrual irregularities. These findings suggest that marijuana use is a notable factor in this demographic, and further research is essential to understand its impact on menstrual health. This knowledge can significantly contribute to women's reproductive well-being and public health initiatives.

Bari et al. (2011) conducted a comprehensive study, examining the manifold actions of endocannabinoids on both female and male reproductive events. The research design involved a meticulous review of existing literature and the synthesis of available data to elucidate the impact of endocannabinoids, particularly delta-9-tetrahydrocannabinol (THC), the primary psychoactive constituent of marijuana, on reproductive health. The study by Bari et al. (2011) provided valuable insights into the multifaceted actions of endocannabinoids on reproductive events. Of particular significance were the negative effects of marijuana, or *Cannabis sativa* extract, on reproductive health. Chronic exposure to THC appeared to impair human reproductive potential by disrupting menstrual cycle regulation. Bari et al. (2011) found that marijuana use, primarily due to THC's interaction with the endocannabinoid system, may have a detrimental impact on the processes involved in reproduction. This includes the release of crucial hormones such as follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which play essential roles in menstrual cyclicality, ovulation, and overall menstrual health. The study's findings underscore the

significance of examining the effects of marijuana on menstrual irregularities, shedding light on potential disruptions within the reproductive system. This research contributes to the broader understanding of how marijuana use may influence female reproductive health, making it an important topic for future studies and public health discussions.

Brents L. K. (2016) conducted an in-depth study that examined the intricate relationship between marijuana, the endocannabinoid system, and the female reproductive system. The study employed a rigorous research design involving extensive literature reviews and data synthesis to understand the physiological and molecular interactions between marijuana and female reproductive health. The study by Brents (2016) revealed crucial findings on the interplay between marijuana and the female reproductive system. Brents discovered that chronic exposure to cannabinoids, primarily found in marijuana, might lead to a series of adverse effects on the female reproductive system. These effects encompassed delayed sexual maturation, menstrual cycle disruption, suppression of ovarian follicular maturation, and reductions in serum concentrations of luteinizing hormone (LH) and sex hormones. The findings from Brent's (2016) research underscore the significance of investigating the effects of marijuana use on menstrual health. Chronic exposure to marijuana's cannabinoids demonstrated a range of potential menstrual irregularities, affecting aspects of the menstrual cycle that are essential for fertility and overall reproductive health. This study contributes significantly to the growing body of knowledge regarding marijuana's impact on the female reproductive system, urging further research and broader public health discussions.

Polycystic Ovary Syndrome (PCOS) is a complex endocrine disorder affecting women of reproductive age, characterized by a spectrum of symptoms including irregular menstrual cycles, hyperandrogenism, and polycystic ovaries. Among the various factors associated with PCOS,

insulin resistance has emerged as a key player in understanding the relationship between metabolic disturbances and infertility in affected women. Infertility, according to the Centers for Disease Control and Prevention (CDC), is "defined as not being able to get pregnant (conceive) after one year (or longer) of unprotected sex. Because fertility in women is known to decline steadily with age, some providers evaluate and treat women aged 35 years or older after 6 months of unprotected sex" (CDC, 2023). The interplay between insulin resistance and infertility in PCOS women has been the subject of significant research. Insulin resistance, a hallmark of PCOS, results in elevated insulin levels as the body attempts to compensate for reduced insulin sensitivity. This hyperinsulinemia not only contributes to metabolic dysregulation but also exerts a direct influence on ovarian function.

Dipanshu and Chakravorty's (2015) study investigated the intricate relationship between insulin resistance, vitamin D status, and infertility in PCOS women. Their findings underscored the potential role of insulin resistance in disrupting normal ovarian function and contributing to fertility challenges. In particular, the study highlighted how hyperinsulinemia can stimulate the ovaries to produce excess androgens, leading to anovulation and menstrual irregularities. The intricate relationship between insulin resistance and infertility in women with Polycystic Ovary Syndrome (PCOS) has been a topic of significant research (Dipanshu & Chakravorty, 2015). Hyperinsulinemia, a characteristic feature of PCOS, has been found to disrupt normal ovarian function, contributing to menstrual irregularities and fertility challenges. This hyperinsulinemia not only stimulates the ovaries to produce excess androgens but also leads to systemic inflammation and metabolic disturbances, exacerbating reproductive issues in PCOS women.

A study conducted by researchers at the Oregon Health & Science University (OHSU) in 2021 found a notable association between chronic THC (the psychoactive component of

marijuana) exposure and ovulatory dysfunction in nonhuman primates (OHSU News, 2021). This research examined the effects of marijuana use on ovulation, a critical aspect of female reproductive health. The findings from this study underscore the potential disruptions to the ovulatory process caused by chronic marijuana use.

Moreover, a comprehensive review published in *Contemporary OB/GYN* in 2021 by JO Lo delves into the broader effects of marijuana use on female reproductive health (Lo, 2021). This review reveals that marijuana use can exert adverse effects on several key components of reproductive health, including sex hormones, ovulation, and menstrual cyclicality. While the review did not find a significant association with every aspect of reproductive health, it underscores the need for continued research and awareness regarding the potential influence of marijuana on fertility. These studies collectively emphasize the importance of understanding the potential consequences of chronic marijuana use on female reproductive health. They underscore the complexity of this relationship and highlight the need for further research to provide a comprehensive understanding of how marijuana use may impact fertility and menstrual function.

### III Methodology

#### Methodological Challenges

The prevalence of marijuana use has grown, yet the literature provides conflicting evidence regarding its impact on reproductive health, with human studies often being observational, retrospective, and confounded by self-report and polysubstance use (Ryan et al., 2021). Nonetheless, this limited evidence suggests adverse effects on both male and female reproductive health (Ryan et al., 2021). A recurring challenge in the research is the small sample sizes, compromising generalizability. Methodological issues related to confounding and potential biases further complicate interpretation (Lo JO, 2022). These limitations emphasize the need for

more extensive investigations into the relationship between marijuana use and menstrual irregularities. Comprehensive research is needed to better understand the intricate relationship between marijuana use and menstrual irregularities. Such investigations should consider factors like potency, frequency of use, and potential confounding variables such as alcohol and tobacco use. Furthermore, studies should explore the mechanisms through which cannabinoids impact reproductive hormones, menstrual cyclicity, and ovulation, along with their implications for fertility (Caitlin Dunne, 2019).

As marijuana use continues to rise and cannabis legalization becomes more widespread, it's imperative to gain a nuanced understanding of its effects on menstrual health and overall reproductive well-being. This research area holds significant relevance for healthcare providers, women seeking to conceive, pregnant and lactating individuals, and those nearing the end of their reproductive years. Despite the widespread use of marijuana, existing literature on its impact on menstrual health is notably limited. Research has predominantly concentrated on the effects of cannabis during pregnancy and breastfeeding, with relatively little exploration of its influence on fertility and menstrual regularity among women in their general fertility bracket. This gap is of particular concern given the potential consequences of menstrual irregularities on overall reproductive health. An intriguing aspect of this conversation is the relationship between marijuana use and menstrual health, a topic that remains relatively underexplored. Existing research on the subject is limited in number, characterized by small sample sizes, and plagued by methodological challenges related to confounding and other potential biases. This substantial research gap has, regrettably, hindered our understanding of the potential long-term effects of marijuana use on women's reproductive health, particularly concerning menstrual irregularities.

## Data and Methods

### Data

In this research, we employ a diverse dataset from NHANES, which encompasses several key data sources to investigate the intricate relationship between marijuana use and menstrual health among women within the general fertility bracket. The National Health and Nutrition Examination Survey (NHANES) is a comprehensive program conducted by the National Center for Health Statistics (NCHS) under the umbrella of the Centers for Disease Control and Prevention (CDC) to assess the health and nutritional status of individuals across the United States. NHANES, which originated in the early 1960s and evolved into a continuous program in 1999, distinguishes itself by seamlessly integrating interviews and physical examinations. Each year, it scrutinizes a nationally representative sample of approximately 5,000 individuals across the country, with 15 designated counties receiving visits annually. NHANES conducts interviews using the Computer-Assisted Personal Interviewing-CAPI (interviewer administered) system. Persons aged 16 years and older and emancipated minors are interviewed directly. Interviews are done in respondents' homes and mobile examination centers. NHANES surveys employ a multi-stage, stratified sampling design to ensure a representative sample of the U.S. population. Participants are selected through household interviews and physical examinations conducted in mobile examination centers. The surveys include both cross-sectional and longitudinal components, allowing for the examination of health trends over time.

We analyze data from the National Health and Nutrition Examination Survey (NHANES) which is a program of the National Centre for Health Statistics (NCHS) under the Centers for

Disease Control and Prevention (CDC). We conducted a cross-sectional study using NHANES 2017-2018 data. We merged Demographics, Examination, Questionnaire, and Laboratory data.

Demographic data - serves as the foundation for understanding the socio-economic and personal characteristics of our study participants. This includes information on age, educational attainment, marital status, and economic well-being, measured by the Income to Poverty Ratio (PIR).

Further insights into the participants' health are derived from the “examination data”, focusing on body measures. These physical assessments provide vital metrics, such as height, weight, waist circumference, and body mass index (BMI), which are fundamental in evaluating the overall physical health of women.

The “questionnaire data” within NHANES offers a comprehensive view of the participants' lives. It covers a wide range of topics, including alcohol use, drug use (with particular emphasis on marijuana consumption), reported medical conditions, physical activity levels, smoking habits (specifically cigarette use), reproductive health status, and more. This multifaceted questionnaire data will be pivotal in assessing the relationship between marijuana use and menstrual health, while also allowing for the control of numerous confounding variables.

Lastly, “laboratory data”, such as insulin levels and biochemistry profiles, are harnessed to gain an objective understanding of the physiological well-being of the study participants. These laboratory measures encompass a spectrum of biological markers, including those related to glucose metabolism, lipid profiles, and other biochemical indicators, providing valuable insights into the participants' health status.

By synthesizing and analyzing these diverse data sources, we aim to offer a comprehensive understanding of how marijuana use may impact menstrual health among women in the general fertility bracket while accounting for demographic, physical, lifestyle, and physiological variables.

### Statistical Analysis:

We will conduct descriptive and logistic regression analysis using IBM SPSS Statistics 29.

The significance level is set at  $\alpha = 0.05$

### Participants:

- Female respondents aged 20 – 44 years provided valid responses regarding “Marijuana use”, and “Menstrual Irregularities,”.

### Inclusion and Exclusion Criteria:

- Participants in the study are females 20 years to 44 years.
- Exclusion criteria include women who have had a hysterectomy, or oophorectomy.

### Dependent and Independent Variables:

- The main dependent variable is “Menstrual Irregularities,” defined as having regular periods in the past 12 months.
- The main independent variable is “Used marijuana every month for a year.”

### Control Variables:

- The control variables included demographics (age, education, marital status, poverty income ratio), stress, alcohol use, tobacco smoking, hormone use, and contraceptive methods.
- These control variables will help account for potential confounding factors and allow for a more nuanced analysis of the relationship between marijuana use and menstrual health.

## Hypothesis

**Hypothesis:** Tetrahydrocannabinol (THC) has been shown in animal models to affect the levels of levels of Luteinizing Hormones (LH), Follicle stimulating hormones (FSH), and prolactin with delayed ovulation. We propose that based on this, marijuana use may be associated with menstrual irregularities among females.

**Null hypothesis:** Marijuana use and menstrual irregularities are not related.

**Alternative hypothesis:** Marijuana use and menstrual irregularities are related.

## IV Results

### Baseline Characteristics of Study Population

All the participants were females (100%), with a notable percentage holding a college degree or above (27.4%) **Table 1A**. Regarding race, 30.4% identified as Non-Hispanic Whites. Marital status varied, with 41.1% reporting being married. In terms of reproductive health, 5.4% experienced menstrual irregularities in the past 12 months, while 5.0% were pregnant. A significant portion (72.3%) had been pregnant at some point, and 10.3% tried to conceive for a year. Additionally, 6.4% sought medical advice due to difficulty getting pregnant. The use of birth control pills was reported by 65.8%, while 3.4% used hormonal treatments. Six percent had a history of treatment for pelvic inflammatory disease (PID), and 21.1% had undergone a cesarean section. These statistics provide a comprehensive overview of the demographic and reproductive health characteristics of the study participants. lifestyle and health factors among the participants showed that approximately 23.9% reported using marijuana every month for a year, while 55.8% had ever used marijuana or hashish. Lifetime cigarette smoking was reported by 29.5%, with 14.2% identified as current smokers. Additionally, 11.0% acknowledged drug use. In terms of alcohol consumption, 10.8% reported never using alcohol, 23.5% reported

drinking at least once a week, and the majority (65.7%) consumed alcohol 2-3 times a month in the past year.

The sample, comprising 913 individuals, exhibited a broad age range from 20 to 44 years, with a mean age of 32.0 years ( $\pm 7.1$ ) **Table 1B**. Participants reported initiating marijuana use between ages 11 and 40, with an average age of 19.1 years ( $\pm 4.7$ ). The income-to-poverty ratio ranged from 0 to 5, with a mean of 2.3 ( $\pm 1.6$ ). On average, participants consumed 2.3 alcoholic drinks per day ( $\pm 1.8$ ), and insulin levels ranged from 1.4 to 98.0 uU/mL, with a mean of 13.9 ( $\pm 13.5$ ). Body Mass Index (BMI) varied from 14.8 to 66.2, with a mean of 30.2 ( $\pm 8.8$ ). Minutes of moderate recreational activity ranged from 10 to 420, with a mean of 57.8 minutes ( $\pm 47.0$ ).

### Unadjusted Analysis of Reproductive Health factors Vs. Marijuana Use

The unadjusted analysis explored the association between reproductive health factors and marijuana use, presenting odds ratios, 95% confidence intervals, and p-values for each variable **Table 2**. The odds ratio for menstrual irregularities was 1.16 (95% CI: 0.60 – 2.23,  $p = 0.665$ ), suggesting a slight increase in the likelihood of menstrual irregularities among individuals using marijuana, although the association did not reach statistical significance. Similarly, ever being pregnant showed an odds ratio of 1.08 (95% CI: 0.76 – 1.52,  $p = 0.676$ ), indicating no significant association with marijuana use. Diabetes in pregnancy and having a cesarean section also demonstrated odds ratios of 1.10 (95% CI: 0.64 – 1.90,  $p = 0.731$ ) and 1.22 (95% CI: 0.79 – 1.89,  $p = 0.376$ ) respectively, with neither variable reaching statistical significance.

## Multivariate Logistic Regression

In examining the association between menstrual irregularities and marijuana use while controlling for various factors **Table 3A**. The odds ratio for marijuana use (Yes vs. No) was 3.91 (95% CI: 0.59 – 25.96,  $p = 0.158$ ), suggesting an increased likelihood of menstrual irregularities among individuals who reported marijuana use, although the association did not reach statistical significance. Other variables in the model included education level, the ratio of family income to poverty, age, race (Non-Hispanic White vs. Other), marital status (Married vs. other categories), current smoking status, drug use, frequency of alcohol use, minutes of moderate recreational activity, insulin levels, body mass index, ever taken birth control, and ever used female hormones. Among these, age demonstrated a  $p$ -value of 0.058, indicating a marginally significant association, with an odds ratio of 0.89 (95% CI: 0.78 – 1.00). Insulin levels also showed a  $p$ -value of 0.039, with an odds ratio of 0.93 (95% CI: 0.87 – 1.00).

In exploring the relationship between ever being pregnant and marijuana use while controlling for various factors **Table 3B**. The odds ratio for marijuana use (Yes vs. No) was 1.43 (95% CI: 0.53 – 3.85,  $p = 0.481$ ), suggesting no statistically significant association with ever being pregnant. However, education level showed a strong association, with an odds ratio of 4.07 (95% CI: 1.94 – 8.55,  $p < 0.001$ ), indicating that individuals with higher education levels were more likely to report ever being pregnant. Additionally, the ratio of family income to poverty demonstrated a statistically significant association, with an odds ratio of 1.44 (95% CI: 1.02 – 2.04,  $p = 0.040$ ), suggesting that higher income levels relative to the poverty threshold were associated with an increased likelihood of ever being pregnant. Age exhibited a significant negative association (odds ratio = 0.78, 95% CI: 0.71 – 0.86,  $p < 0.001$ ), indicating a decrease in

the odds of ever being pregnant with increasing age. Marital status (Married vs. other categories) also showed significance, with an odds ratio of 3.82 (95% CI: 1.29 – 11.37,  $p = 0.016$ ), suggesting that married individuals were more likely to report ever being pregnant.

The results of the multivariate logistic regression analysis examined the relationship between diabetes in pregnancy and marijuana use while controlling for various factors (**Table 3C**). The odds ratio for marijuana use (Yes vs. No) was 0.20 (95% CI: 0.01 – 2.88,  $p = 0.236$ ), indicating no statistically significant association with diabetes in pregnancy. Education level showed an odds ratio of 1.93 (95% CI: 0.82 – 4.57,  $p = 0.132$ ), suggesting a non-significant positive association, while the ratio of family income to poverty exhibited an odds ratio of 0.83 (95% CI: 0.43 – 1.60,  $p = 0.572$ ), indicating no significant association. Age demonstrated an odds ratio of 0.94 (95% CI: 0.82 – 1.07,  $p = 0.366$ ), implying no significant association with diabetes in pregnancy. Race (Non-Hispanic White vs. Other) showed an odds ratio of 2.30 (95% CI: 0.37 – 14.37,  $p = 0.374$ ), indicating no statistically significant association. Similarly, marital status (Married vs. other categories) showed an odds ratio of 0.97 (95% CI: 0.15 – 6.32,  $p = 0.970$ ), suggesting no significant association. Current smoking status, drug use, frequency of alcohol use, minutes of moderate recreational activity, insulin levels, and body mass index also did not show statistically significant associations with diabetes in pregnancy.

The outcomes of the multivariate logistic regression explored the relationship between having a cesarean section and marijuana use while adjusting for various factors (**Table 3D**). The odds ratio for marijuana use (Yes vs. No) was 2.14 (95% CI: 0.59 – 7.81,  $p = 0.247$ ), indicating no statistically significant association with cesarean section. Education level showed an odds ratio of 1.07 (95% CI: 0.59 – 1.93,  $p = 0.836$ ), implying no significant association. The ratio of family income to poverty exhibited an odds ratio of 0.99 (95% CI: 0.63 – 1.58,  $p = 0.978$ ),

indicating no significant association with cesarean section. Age demonstrated an odds ratio of 1.03 (95% CI: 0.95 – 1.12,  $p = 0.467$ ), suggesting no significant association. Race (Non-Hispanic White vs. Other) displayed an odds ratio of 0.44 (95% CI: 0.12 – 1.58,  $p = 0.206$ ), indicating no statistically significant association. Similarly, marital status (Married vs. other categories), current smoking status, drug use, frequency of alcohol use, minutes of moderate recreational activity, insulin levels, body mass index, ever taken birth control, ever use female hormones, and treated for pelvic infection did not exhibit statistically significant associations with cesarean section.

## V Discussion

The study provides a detailed analysis of key variables related to gender, education, race, marital status, reproductive health, and lifestyle factors among 913 female participants. Notably, 27.4% had a college degree or above, 30.4% identified as non-Hispanic whites, and 41.1% were married. Reproductive health findings revealed that 5.4% experienced menstrual irregularities in the past year, 5.0% were pregnant, and 72.3% had been pregnant. Additionally, 65.8% used birth control pills, and 23.9% reported marijuana use every month for a year. Cigarette smoking, drug use, and alcohol consumption patterns were also explored, with 14.2% identified as current smokers.

The multivariate logistic regression analysis focused on the association between menstrual irregularities and marijuana use while controlling for various factors. Although not statistically significant, the odds ratio for marijuana use (Yes vs. No) was 3.91 (95% CI: 0.59 – 25.96,  $p = 0.158$ ), suggesting an increased likelihood of menstrual irregularities among marijuana users. Age and insulin levels exhibited marginal significance. Exploring the

relationship between marijuana use and ever being pregnant revealed an odds ratio of 1.43 (95% CI: 0.53 – 3.85,  $p = 0.481$ ), with education level, income, age, and marital status significantly associated with pregnancy experiences. The analysis on diabetes in pregnancy and cesarean section did not show significant associations with marijuana use.

Considering the broader context, Corsi et al. (2021) identified gaps in understanding the risks of cannabis use on female reproductive health, aligning with our non-significant findings. Noteworthy is the consistent but non-significant reduction in odds of diabetes in pregnancy among marijuana users. Ryan et al.'s research underlines THC's impact on menstrual cyclicality, supporting our non-significant findings on menstrual irregularities. Brents et al. (2016) further elaborate on the complex relationship between marijuana, the endocannabinoid system, and the female reproductive system, providing a theoretical framework for our findings. The study acknowledges limitations, such as reported bias and cross-sectional data, suggesting the need for future research with improved methodologies, including longitudinal studies and THC measurement, to better understand these intricate associations. Overall, this study underscores the intricate nature of associations between marijuana use and reproductive health, emphasizing the need for further research in this multifaceted context.

The study also unveiled significant variations in marijuana use prevalence across different racial groups, with non-Hispanic whites, non-Hispanic blacks, and multiracial individuals exhibiting high rates (**Figure 1**). Conversely, non-marijuana users were predominantly reported among non-Hispanic Asians. The statistical challenges related to Asians were navigated by comparing non-Hispanic whites against all other racial categories. The analysis brought to light notable differences in marijuana use prevalence based on smoking and

drug use patterns (**Figure 2**). Those who smoke demonstrated a higher prevalence of marijuana use, emphasizing the interconnected nature of these behaviors. A similar trend was observed among individuals who use drugs, highlighting the need for a comprehensive understanding of various substance use patterns for effective public health interventions and policies.

The exploration of the relationship between marijuana use patterns and menstrual irregularities revealed intriguing patterns (**Figure 3**). Individuals using marijuana once per month reported no regular periods in the past 12 months, suggesting a potential link between monthly marijuana use and menstrual irregularities. Additionally, those using marijuana 1-2 times a week exhibited the lowest median age of initiating regular use, emphasizing the frequency-age initiation association. Conversely, individuals with regular periods reported a higher median age of initiating marijuana use regularly, especially among those using once a month. This nuanced interplay between menstrual regularity and the age of marijuana use initiation adds complexity to our understanding of these associations, prompting further investigation.

## Limitations and Suggestions for Future Research

While providing valuable insights into the demographic factors influencing menstrual irregularities among a diverse sample of 913 females aged 20 to 44 in the United States, this study acknowledges several limitations. The cross-sectional design hinders the establishment of causal relationships, and reliance on self-reported data introduces potential recall bias. Despite the robust sample size and detailed examination of demographics, the exclusion of certain confounding variables, such as dietary habits and stress levels, poses a limitation. The study's focus on a specific demographic group may limit generalizability, urging future research to incorporate longitudinal designs, objective data validation measures, and explore additional

factors influencing menstrual health. The positive association between birth control pill use and menstrual irregularities warrants further exploration, emphasizing the need for comprehensive investigations into the nuanced interactions between substance use, BMI, race, and menstrual irregularities. While the study's strengths lie in its diverse sample and utilization of NHANES data, challenges in handling Asians as a separate category may impact racial comparisons. These findings underscore the complex relationship between marijuana use and menstrual irregularities, emphasizing the necessity for sophisticated study designs and a focus on specific demographic groups in future research.

## VI Conclusion

In conclusion, the findings of the logistic regression model, involving 913 females, indicate that we do not have sufficient evidence to reject the null hypothesis, suggesting that, in this specific model, marijuana use may not be significantly related to menstrual irregularities among the 913 females in the study. This non-significant association raises the possibility of a more intricate and nuanced relationship between marijuana use and reproductive health factors, particularly menstrual health, which may extend beyond the scope of cross-sectional studies. The complexity of these associations underscores the need for comprehensive and longitudinal investigations to elucidate better the potential impact of marijuana use on menstrual patterns and other reproductive health outcomes. In summary, our study underscores the intricacies involved in understanding the relationship between marijuana use and menstrual irregularities, emphasizing the limitations of cross-sectional approaches in capturing the multifaceted nature of this connection.

## Tables

Table 1A: Descriptive statistics of participants

<b>Variable</b>	<b>Sample Size</b>	<b>Percentage, %</b>
Gender, Females	913	100.0
College graduate or above	250	27.4
Race, Non-Hispanic Whites	278	30.4
Married	375	41.1
<b><u>Reproductive Health</u></b>		
Menstrual Irregularities in the past 12 month, Yes	49	5.4
Pregnant, Yes	46	5.1
Ever been Pregnant, Yes	660	72.3
Tried to be pregnant for a year, Yes	94	10.3
Saw a doctor, unable to be pregnant	58	6.4
Birth Control Pill use, Yes	599	65.8
Hormone use, Yes	31	3.4
Ever treated for PID, Yes	55	6.1
Ever had a caesarean section	211	50.5
<b>Lifestyle and Health Factors</b>		
Used marijuana every month for a year	218	23.9
Marijuana use, Yes	498	55.8
Smoked 100 cigs lifetime, Yes	269	29.5
Current Smokers	130	14.2
Drug use	98	11.0

**Past year Alcohol use**

Never	87	10.8
At least once a week	190	23.5
At most 2 -3 times a month	530	65.7

Table 1B: Descriptive Statistics of Participants

<b>Variables</b>	<b>Sample Size</b>	<b>Min - Max</b>	<b>Mean ± SD</b>
Age, years	913	20 – 44	32.0± 7.1
Age in years when first tried marijuana	218	11 – 40	19.1± 4.7
Income to poverty ratio	812	0 – 5	2.3 ±1.6
Average # of Alcohol Drinks per day	718	1 – 15	2.3 ±1.8
Insulin (uU/mL)	413	1.4 – 98.0	13.9±13.5
Body Mass Index	909	14.8 – 66.2	30.2 ±8.8
Minutes moderate recreational	408	10 – 420	57.8± 47.0

Table 2: Unadjusted Analysis (Reproductive Health factors Vs. Marijuana Use)

<b>Variables</b>	<b>Odds Ratio</b>	<b>95% Confident Interval</b>	<b>P-Value</b>
Menstrual Irregularities	1.16	0.60 – 2.23	0.665
Ever being pregnant	1.08	0.76 – 1.52	0.676
Diabetes in pregnancy	1.10	0.64 – 1.90	0.731
Had caesarean section	1.22	0.79 – 1.89	0.376

Table 3A: Multivariate Logistic Regression for menstrual irregularities and Marijuana use controlling for factors listed in the model.

<b>Variables</b>	<b>Odds Ratio</b>	<b>95% Confident Interval</b>	<b>P-Value</b>
Marijuana Use, Yes vs no	3.91	0.59 – 25.96	0.158
Education on increasing level	1.20	0.39 – 3.69	0.749
Ratio of family income to poverty	0.94	0.46 – 1.94	0.869
Age, years	0.89	0.78 – 1.00	0.058
Race, Non-Hispanic White vs Other	7.44	0.73 – 75.87	0.090
Married vs other categories	0.14	0.01 – 1.64	0.116
Current smoke vs not	152	0.16 – 14.90	0.719
Drug use, Yes vs no	0.73	0.06 – 8.23	0.797

Frequency alcohol use	2.45	0.70 – 8.65	0.163
Mins of moderate recreational activity	1.01	0.99 – 1.03	0.581
Insulin (microunits/ml)	0.93	0.87 – 1.00	0.039
Body mass index, kg/m2	1.09	0.96 – 1.22	0.207
Ever taken birth control, Yes vs No	0.67	0.05 – 8.67	0.757
Ever use female hormones, Yes vrs No	2.79	0.11 – 73.58	0.538

Table 3B: Multivariate Logistic Regression for Ever being Pregnant and Marijuana use controlling for factors listed in the model.

<b>Variables</b>	<b>Odds Ratio</b>	<b>95% Confident Interval</b>	<b>P-Value</b>
Marijuana Use, Yes vs. no	1.43	0.53 – 3.85	0.481
Education on increasing level	4.07	1.94 – 8.55	<0.001
Ratio of family income to poverty	1.44	1.02 – 2.04	0.040
Age, years	0.78	0.71 – 0.86	<0.001

Race, Non-Hispanic White			
vs Other	1.15	0.44 – 2.99	0.781
Married vs other categories	3.82	1.29 – 11.37	0.016
Current smoke vs not	0.62	0.13 – 3.09	0.563
Drug use, Yes vs no	0.99	0.24 – 4.15	0.990
Frequency alcohol use	1.03	0.47 – 2.28	0.939
Mins of moderate			
recreational activity	1.01	0.99 – 1.02	0.337
Insulin (microunits/ml)	1.00	0.96 – 1.04	0.882
Body mass index, kg/m <sup>2</sup>	1.01	0.95 – 1.07	0.700
Ever taken birth control, Yes			
vs No	3.87	1.18 – 12.80	0.026
Ever use female hormones,			
Yes vs. No	0.29	0.02 – 4.63	0.382

---

Table 3C: Multivariate Logistic Regression for Diabetes in Pregnancy and Marijuana Use controlling for factors listed in the model.

<b>Variables</b>	<b>Odds Ratio</b>	<b>95% Confident Interval</b>	<b>P-Value</b>
Marijuana Use, Yes vs No	0.20	0.01 – 2.88	0.236
Education on increasing level	1.93	0.82 – 4.57	0.132
Ratio of family income to poverty	0.83	0.43 – 1,60	0.572
Age, years	0.94	0.82 – 1.07	0.366
Race, Non-Hispanic White vs Other	2.30	0.37 – 14.37	0.374
Married vs other categories	0.97	0.15 – 6.32	0.970
Current smoke vs not	2.95	0.33 – 26.67	0.335
Drug use, Yes vs No	1.78	0.10 – 32.38	0.699
Frequency alcohol use Mins of moderate recreational activity	0.37	0.07 – 2.07	0.259
Insulin (microunits/ml)	1.00	0.98 – 1.01	0.566
Body mass index, kg/m2	0.93	.82 – 1.06	0.287
	1.10	0.93 – 1.30	0.253

Table 3D: Multivariate Logistic Regression for cesarean section and Marijuana use controlling for factors listed in the model.

<b>Variables</b>	<b>Odds Ratio</b>	<b>95% Confident Interval</b>	<b>P-Value</b>
Marijuana Use, Yes vs No	2.14	0.59 – 7.81	0.247
Education on increasing level	1.07	0.59 – 1.93	0.836
Ratio of family income to poverty	0.99	0.63 – 1.58	0.978
Age, years	1.03	0.95 – 1.12	0.467
Race, Non-Hispanic White vs Other	0.44	0.12 – 1.58	0.206
Married vs other categories	1.18	0.28 – 5.06	0.824
Current smoke vs not	1.91	0.28 – 12.95	0.510
Drug use, Yes vs No	0.66	0.13 – 3.48	0.625
Frequency alcohol use Mins of moderate recreational activity	2.23	0.83 – 5.98	0.112
Insulin (microunits/ml)	1.01	0.99 – 1.02	0.335
Body mass index, kg/m2	1.02	0.94 – 1.09	0.695
Ever taken birth control, Yes vs No	1.01	0.91 – 1.11	0.871
	2.12	0.37 – 12.36	0.402

Ever use female hormones,

Yes vs No                      0.32                      0.02 – 5.36                      0.430

Ever treated for pelvic

infection, Yes vs No                      1.45                      0.10 – 20.88                      0786

---

## Figures

Figure 1: Bar Chart for Marijuana Use by Race.

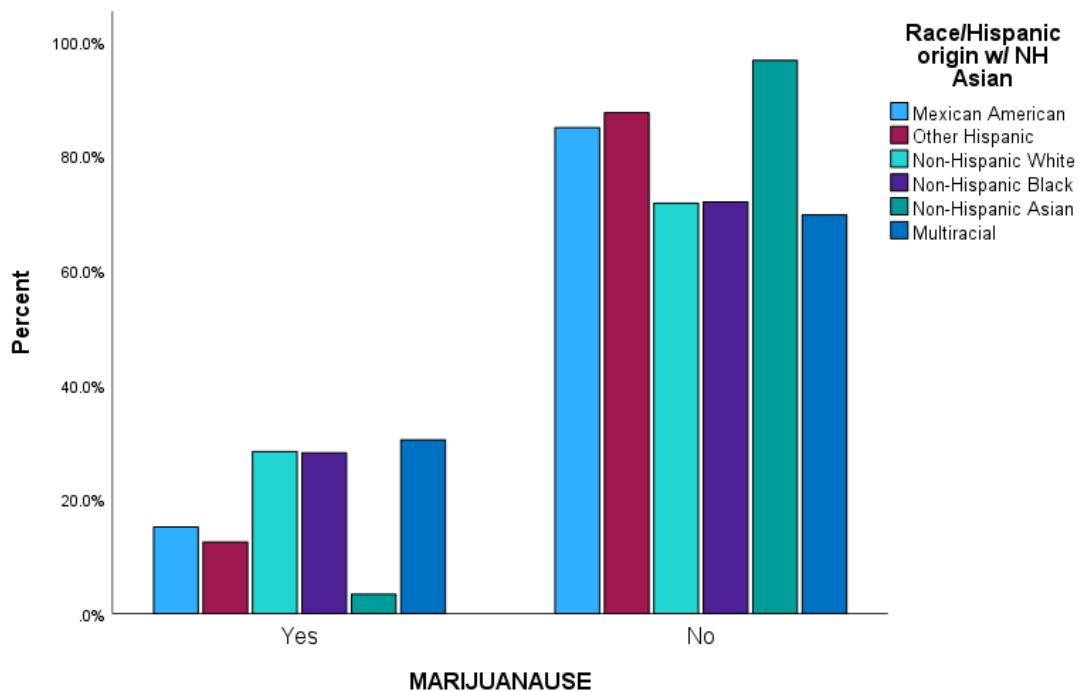
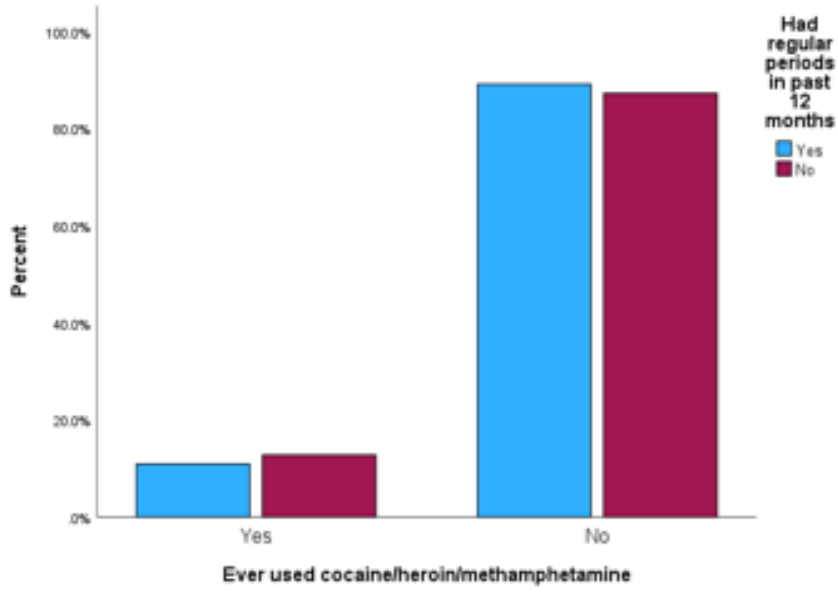


Figure 2: Bar Chart for A) Current Smoking, B) Drug Use and Menstrual Irregularities

A)



B)

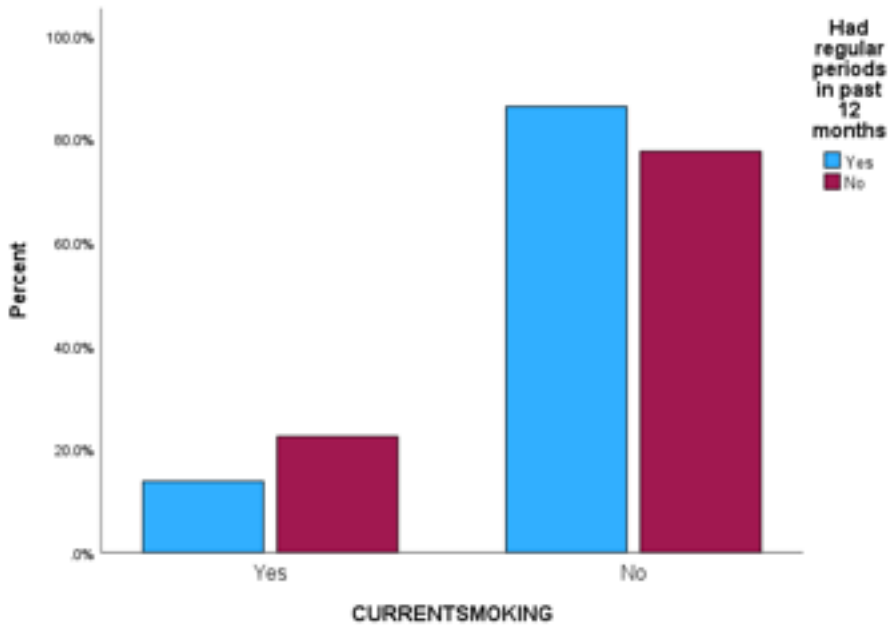
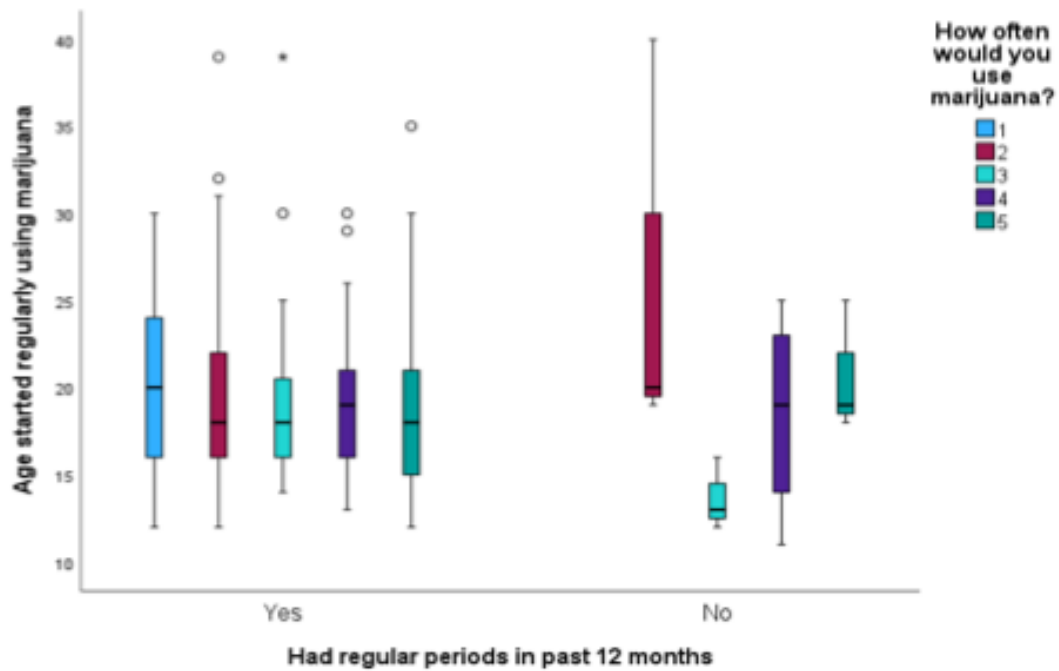


Figure 3: Box Plot showing median Age at Marijuana use and Frequency of Use vs Irregular Periods



- 1 - Once per month
- 2 - 2-3 times per month
- 3 - 4-8 times per month (about 1-2 times per week)
- 4 - 9-24 times per month (about 3-6 times per week)
- 5 - 25-30 times per month (one or more times per day)

## References:

- Azofeifa A, Mattson ME, Schauer G, Lyerla R, McAfee T, & Grant A. (2017, June 21). *National estimates of marijuana use and related indicators – a national survey on drug use and health, United States, 2002–2014*. Centers for Disease Control and Prevention. <https://www.cdc.gov/mmwr/volumes/65/ss/ss6511a1.htm#suggestedcitation>
- Brents L. K. (2016). Marijuana, the Endocannabinoid System, and the Female Reproductive System. *The Yale journal of biology and medicine*, 89(2), 175–191.
- Bari M, Battista N, Pirazzi V, Maccarrone M. The manifold actions of endocannabinoids on female and male reproductive events. *Front Biosci (Landmark Ed)*. 2011 Jan 1;16(2):498-516.
- Brawley, T. (2021, July 20). *Chronic marijuana use alters the female reproductive system and may impact successful conception*. OHSU News. <https://news.ohsu.edu/2021/07/20/chronic-marijuana-use-alters-female-reproductive-system-may-impact-successful-conception>
- Brown, Q. L., Sarvet, A. L., Shmulewitz, D., Martins, S. S., Wall, M. M., & Hasin, D. S. (2017). Trends in Marijuana Use Among Pregnant and Nonpregnant Reproductive-Aged Women, 2002-2014. *JAMA*, 317(2), 207–209.
- Chauhan, S., Kumar, P., Patel, R., Srivastava, S., Simon, D. J., & Muhammad, T. (2021). Association of lifestyle factors with menstrual problems and its treatment-seeking behavior among adolescent girls. *Clinical Epidemiology and Global Health*, 12, 100905.
- Cerdá, M., Wall, M., Feng, T., Keyes, K. M., Sarvet, A., Schulenberg, J., O'Malley, P. M., Pacula, R. L., Galea, S., & Hasin, D. S. (2017). Association of State Recreational

- Marijuana Laws With Adolescent Marijuana Use. *JAMA pediatrics*, 171(2), 142–149.  
<https://doi.org/10.1001/jamapediatrics.2016.3624>
- Centers for Disease Control and Prevention. (2021, June 8). *Data and Statistics*. Centers for Disease Control and Prevention. <https://www.cdc.gov/marijuana/data-statistics.htm>
- Centers for Disease Control and Prevention. (2023, April 26). *Infertility*. Centers for Disease Control and Prevention. <https://www.cdc.gov/reproductivehealth/infertility/index.htm>
- Caitlin Dunne. (n.d.). The effects of cannabis on female and male reproduction. *BCMJ*, vol. 61, no. 7, September 2019.
- Corsi, D. J., Murphy, M. S., & Cook, J. (2021). The effects of cannabis on female reproductive health across the life course. *Cannabis and Cannabinoid Research*, 6(4), 275-287.
- DeSilver, D. (2013, June 3). *Nearly half of adults say they've tried marijuana, but not recently*. Pew Research Center. <https://www.pewresearch.org/short-reads/2013/06/03/more-than-a-third-of-adults-say-theyve-tried-pot-but-not-recently/>
- Ewing, A. C., Schauer, G. L., Grant-Lenzy, A. M., Njai, R., Coy, K. C., & Ko, J. Y. (2020). Currently, marijuana is used among women of reproductive age. *Drug and alcohol dependence*, 214, 108161.
- Hathaway, A. D., Comeau, N. C., & Erickson, P. G. (2011). Cannabis normalization and stigma: Contemporary practices of moral regulation. *Criminology & Criminal Justice*, 11(5), 451-469.
- Hawley, P., Gobbo, M., & Afghari, N. (2020). The impact of legalization of access to recreational Cannabis on Canadian medical users with Cancer. *BMC health services research*, 20(1), 977. <https://doi.org/10.1186/s12913-020-05756-8>.

- Hyman, S. M., & Sinha, R. (2009). Stress-related factors in cannabis use and misuse: implications for prevention and treatment. *Journal of substance abuse treatment*, 36(4), 400–413. <https://doi.org/10.1016/j.jsat.2008.08.005>
- Hall, W., & Lynskey, M. (2016). Evaluating the public health impacts of legalizing recreational cannabis use in the United States. *Addiction (Abingdon, England)*, 111(10), 1764–1773. <https://doi.org/10.1111/add.13428>
- Hall, W., & Weier, M. (2015). Assessing the public health impacts of legalizing recreational cannabis use in the USA. *Clinical pharmacology and therapeutics*, 97(6), 607–615. <https://doi.org/10.1002/cpt.110>
- Ko, J. Y., Farr, S. L., Tong, V. T., Creanga, A. A., & Callaghan, W. M. (2015). Prevalence and patterns of marijuana use among pregnant and nonpregnant women of reproductive age. *American journal of obstetrics and gynecology*, 213(2), 201.e1–201.e10.
- Lammert, S., Harrison, K., Tosun, N., & Allen, S. (2018). Menstrual Cycle in Women Who Co-use Marijuana and Tobacco. *Journal of addiction medicine*, 12(3), 207–211. <https://doi.org/10.1097/ADM.0000000000000387>
- Lemstra, M., Bennett, N. R., Neudorf, C., Kunst, A., Nannapaneni, U., Warren, L. M., Kershaw, T., & Scott, C. R. (2008). A meta-analysis of marijuana and alcohol use by socioeconomic status in adolescents aged 10-15 years. *Canadian journal of public health = Revue canadienne de sante publique*, 99(3), 172–177. [DOI: 10.1007/BF03405467]
- Lo JO, Hedges JC, Girardi G. Impact of cannabinoids on pregnancy, reproductive health, and offspring outcomes. *Am J Obstet Gynecol*. 2022 Oct;227(4):571-581. doi:

10.1016/j.ajog.2022.05.056. Epub 2022 May 31. PMID: 35662548; PMCID:  
PMC9530020

National Health and Nutrition Examination Survey (NHANES). National Health and Nutrition Examination Survey (NHANES) - Healthy People 2030. (n.d.).

<https://health.gov/healthypeople/objectives-and-data/data-sources-and-methods/data-sources/national-health-and-nutrition-examination-survey-nhanes>

NIDA. 2022, August 22. Marijuana and hallucinogen use among young adults reached an all-time high in 2021. Retrieved from <https://nida.nih.gov/news-events/news-releases/2022/08/marijuana-and-hallucinogen-use-among-young-adults-reached-all-time-high-in-2021> on 2023, October 6

*Marijuana addiction statistics [2023]: Usage & abuse rates.* NCDAS. (2023, January 1).

<https://drugabusestatistics.org/marijuana-addiction/#:~:text=Approximately%20half%20of%20Americans%2C%20some,marijuana%20on%20a%20monthly%20basis.>

Mendelson, J. H., Mello, N. K., Ellingboe, J., Skupny, A. S., Lex, B. W., & Griffin, M. (1986).

Marihuana smoking suppresses luteinizing hormone in women. *Journal of Pharmacology and Experimental Therapeutics*, 237(3), 862-866.

Ryan, K. S., Bash, J. C., Hanna, C. B., Hedges, J. C., & Lo, J. O. (2021). Effects of marijuana on reproductive health: preconception and gestational effects. *Current opinion in endocrinology, diabetes, and obesity*, 28(6), 558–565.

Ryan, K. S., Mahalingaiah, S., Campbell, L. R., Roberts, V. H. J., Terrobias, J. J. D., Naito, C. S., Boniface, E. R., Borgelt, L. M., Hedges, J. C., Hanna, C. B., Hennebold, J. D., & Lo, J. O. (2021). The effects of delta-9-tetrahydrocannabinol exposure on female menstrual

cyclicity and reproductive health in rhesus macaques. *F&S science*, 2(3), 287–294.

<https://doi.org/10.1016/j.xfss.2021.05.001>

Sakai, H., & Ohashi, K. (2013). Association of menstrual phase with smoking behavior, mood, and menstrual phase-associated symptoms among young Japanese women smokers. *BMC women's health*, 13, 10. <https://doi.org/10.1186/1472-6874-13-10>

Schauer, G. L., Berg, C. J., Kegler, M. C., Donovan, D. M., & Windle, M. (2015). Assessing the overlap between tobacco and marijuana: Trends in patterns of co-use of tobacco and marijuana in adults from 2003–2012. *Addictive Behaviors*, 49, 26–32.

<https://doi.org/10.1016/j.addbeh.2015.05.012>

Steigerwald, S., Cohen, B. E., Vali, M., Hasin, D., Cerda, M., & Keyhani, S. (2020). Differences in Opinions About Marijuana Use and Prevalence of Use by State Legalization Status. *Journal of addiction medicine*, 14(4), 337–344. [DOI: 10.1097/ADM.0000000000000593]

Strauss, J. F., Barbieri, R. L., Dokras, A., Williams, C. J., & Williams, S. Z. (Eds.). (2023). *Yen & Jaffe's Reproductive Endocrinology-E-Book: Physiology, Pathophysiology, and Clinical Management*. Elsevier Health Sciences.

Tucker, J. S., Pollard, M. S., de la Haye, K., Kennedy, D. P., & Green, H. D., Jr (2013).

Neighborhood characteristics and the initiation of marijuana use and binge drinking. *Drug and alcohol dependence*, 128(1-2), 83–89.

<https://doi.org/10.1016/j.drugalcdep.2012.08.006>

United Nations Office on Drugs and Crime (UNODC). World Drug Report 2017 – United Nations Office on Drugs and Crime. 2017.

World Health Organization. (n.d.). *Cannabis*. World Health Organization.

<https://www.who.int/teams/mental-health-and-substance-use/alcohol-drugs-and-addictive-behaviours/drugs-psychoactive/cannabis>

Walker OS, Holloway AC, Raha S. The role of the endocannabinoid system in female reproductive tissues. *J Ovarian Res.* 2019 Jan 15;12(1):3. doi: 10.1186/s13048-018-0478-9. PMID: 30646937; PMCID: PMC6332911.