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Oregon 2016-2020 Pregnancy Risk Assessment Monitoring System (PRAMS) Survey Analysis: Association between Postpartum Cannabis Use and Breastfeeding Duration Among Washington County Mothers.

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Oregon 2016-2020 Pregnancy Risk Assessment Monitoring System (PRAMS) Survey Analysis: Association between Postpartum Cannabis Use and Breastfeeding Duration Among Washington County Mothers.

By

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2021

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Background: Conflicting study results and limitations of prior study designs have made it difficult to determine the impact of postpartum marijuana use on breastfeeding duration.

Research Aims: (1) Report demographics of Washington County, Oregon mothers who used marijuana 0 – 6 months postpartum; (2) to examine the association between postpartum marijuana use and breastfeeding duration.
Methods: Secondary cross-sectional survey data collected between 2016 and 2020 by the Organ Health Authority were analyzed using R studio. Analytic sample consisted of 25,059 (weighted) mothers who participated in the 2016 – 2020 Oregon Pregnancy Risk Assessment Monitoring System (PRAMS) survey. Chi-square analyses were conducted to understand the differences in breastfeeding duration based on select demographic criteria. The association of postpartum marijuana use on breastfeeding duration (defined as breastfeeding or providing expressed milk to an infant for at least 3 months) was evaluated using logistic regression modeling and adjusted odds ratios (aOR).

Results: The total number of participants on the analytic sample for this study was n=25059. Among women in our study sample n = 20596 (82.2%) breastfed for ≥3 months. Among mothers who breastfed for ≥3months, 2.7% (n=547) self-reported postpartum marijuana use. After controlling for postpartum depression, mother's race/ethnicity, mothers age, and postpartum cigarette use, no association between postpartum marijuana use and breastfeeding duration was found. Women who experienced postpartum depression breastfed less when compared to women who did not experience postpartum depression (aOR= 0.4493, CI [0.24, 0.85]).

Conclusion: There was no association between postpartum marijuana use and breastfeeding duration among women in our sample; however postpartum depression was associated with breastfeeding duration ≤3months. Further programmatic interventions should focus on increasing rates of breastfeeding among women who experience postpartum depression. Future surveillance planning should make significant efforts towards developing methods for collecting data from non-respondents.

Keywords: Postpartum marijuana use, Breastfeeding duration, PRAMS

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Introduction

Guidelines set by leading health authorities on nutrition and maternal child health advise against the use of marijuana or any products containing tetrahydrocannabinol (THC) or cannabidiol (CBD) during pregnancy and lactation. The Centers for Disease Control and Prevention (CDC) acknowledge that the body of research which examines the impact of marijuana use on breastfeeding behavior and breastmilk quality is limited, and as a result conclusive determination cannot yet be made about the impact of marijuana use during breastfeeding (CDC, 2022). Although the American Academy of Pediatrics (AAP) discourages the use of marijuana during pregnancy, the organization notes that before making recommendations to patients, maternal health care provides must weigh the benefits of breastfeeding against the potential and unknown risk of marijuana use and vice versa [2]. The American Congress of Obstetricians and Gynecologists (ACOG) provides similar guidance, stating that due to limited data evaluating the impact of marijuana use on infants who are breastfeeding, health care providers should discourage the use of marijuana among women who are planning to breastfeed or are currently breastfeeding [3]. Despite current recommendations and guidelines for breastfeeding, some mothers and families face challenges when weighing the benefits and risks of breastfeeding while consuming substances such as marijuana.

The World Health Organization (WHO) recommends infants breastfeed exclusively for the first six months of life, and to continue providing breastmilk to children aged 6-23 months [4]. The American Academy of Pediatrics (AAP), the Centers for Disease Control and Prevention (CDC), and the U.S Dietary Guidelines for Americans give similar breastfeeding recommendations as the WHO, stating infants younger than 6 months should only drink

breastmilk, and breastfeeding should continue until the infant is 2 years old [5–7]. Breastfeeding is known to provide long-term and short-term health benefits to both infants and mothers [8]. Studies show that infants who breastfeed have stronger immune systems, report less ear infections and gastrointestinal infections, while mothers who breastfeed have a decreased risk of breast cancer and diabetes [9–11]. Understanding how postpartum marijuana use impacts breastfeeding duration is a pressing public health issue because of the adverse maternal and infant health outcomes associated with reduced breastfeeding duration.

Marijuana use during pregnancy varies based on social, community, relational, and individual factors [12]. Studies that examine the impact of postpartum marijuana use on breastfeeding duration show mixed findings [13–15]. Estimates from previous population-based studies looking at self-reports and provider estimates of postpartum marijuana use among mothers also range widely, from 4.7% to 15% prevalence [16–18]. Recent studies have yet to consider the changing landscape of marijuana law and policy between states. Current study methodology use national-level analyses which homogenizes risk factors across U.S. geographies whose marijuana legislation, policies, and regulation are not the same [19]. For example, data collected in states where medical use and recitational use of marijuana is legal should not be combined with states where only medical use is legal [20]. Comparing prevalence estimates between two different legal landscapes may provide spurious associations and further confounds associations between our exposure and outcome (e.g., breastfeeding duration and marijuana use).

The disparate legal marijuana landscape across the U.S may partly be contributing to the range of reported postpartum marijuana use. For example, the illegal status of marijuana within a given state might make mothers less likely to truthfully report their use because of negative beliefs about the potential consequences of reporting their use.

We believe that understanding if county-level trends follow national increases in prevalent marijuana use among women who are breastfeeding of public health importance given that maternal health outcomes are known to vary geographically due to local context. Geographical differences in health outcomes are well documented when comparing state and national trends [21]. However, county-level estimates concerning marijuana use among breastfeeding mothers are not widely available but are necessary to inform localized community-based harm reduction strategies and could allow public health agencies to increase the impact of targeted programming efforts [22]. We propose a county-level analysis as an alternative approach to national and state-level analyses. For this study, we focus on Washington County as our geography of interest. Washington County provides a unique opportunity to study local changes in marijuana use because Oregon has maintained the same recreational and medical marijuana polices during the collection of 2016 - 2020 PRAMS data [23,24]. Our approach, which uses county-level data, will allow us to measure and compare marijuana use among breastfeeding mothers at the community level within Washington County, Oregon. The objective of this study is to examine the association between self-reported postpartum marijuana use and breastfeeding duration of ≥3 months.

Background

According to the CDC Breastfeeding Report Card, between 2016 and 2020 rates of exclusive breastfeeding through 3 months in the U.S. slightly rose from 44.4% to 46.9%, while rates of exclusive breastfeeding through 6 months in the U.S. rose from 22.3% to 25.6%. During the same time period the state of Oregon saw exclusive breastfeeding rates through 3 months rise from 52.9% to 65.8% and rates of rates of exclusive breastfeeding through 6 months increase from 30.6% to 35.6% [25–27]. Among Oregon PRAMS participants, self-reported postpartum marijuana use increased from 10.8% to 13.5% between 2018 and 2019 then decreased to 10.9% in 2020 [28–30]. Studies looking at maternal marijuana use during the breastfeeding period focus primarily on the biochemistry of THC, the impact THC has on milk production and quality, and how THC is passed to the infant through breastmilk and in utero [2,31–33]. The exact mechanisms underlying maternal marijuana use during the breastfeeding period are difficult to determine because several biologic, sociologic, psychologic, behavioral, and environmental factors contribute to marijuana use during breastfeeding [12]

Postpartum marijuana use varies based on social, community, relational, and individual factors [12]. Findings from population-based studies looking at self-reported postpartum marijuana use and breastfeeding duration and initiation among mothers' range widely and are conflicting [17,18,34,35]. Discrepancies between research findings could be attributed to variation in methodological approaches, the population and geography being studied, or period of study data. To demonstrate this point, I will compare a few of the most cited studies that paved the way for further exploration on postpartum marijuana use and breastfeeding. In Researchers from University of Californian Merced looked at the

perceptions of marijuana use among men and women living in a majority Latino community in California [34]. Although scientific evidence looking at differences in neurologic development between infants who were exposed to THC via breastmilk and infants who were not exposed is sparce and conflicting [31,36,37]. Over 60% of respondents from the in the study agreed that marijuana use during the lactation period posed a risk to the baby and could lead to learning challenges, decreased IQ, brain damage, and THC addiction [34]. Survey results showed that 15% of respondents had used marijuana in the past 6 months. The survey also found that 10.7% of women reported using while breastfeeding and 9.1% of men reported that their partners used while breastfeeding. However, researchers report that these results suggest participants might have been unwilling to answer this question [34].

Coy et al were also interested in understanding the perceptions and attitudes mothers held about marijuana use while breastfeeding. This study looked at the perception of marijuana use during pregnancy among PRAMS participants from Alaska, Illinois, Maine, New Mexico, New York, Pennsylvania, and West Virginia. These states were selected because PRAMS surveys from these states included questions about marijuana use during pregnancy and met the response rate criteria for analysis. In this study Coy et al. compared the beliefs of women who used marijuana postpartum and found that the percentage of women who initiated and breastfed for >12 weeks varied based on safety beliefs. Among women who used but didn't not believe it was safe to breastfeed, 29.9% did not initiate (n=46) compared to 12.2% of women who felt it was safe (n=14). Only 19.3% of women (n=37) who believed it was not safe to breastfed while using marijuana breastfed for >12 weeks when compared to 54.2% of women (n=48) who believed that it was safe. Women who believed that it was

safe to breastfeed while using were 1.22 times more likely to initiate breastfeeding and 1.57 times more likely to have breastfed for more than 12 weeks when compared to initiation and duration among women who used but didn't not believe it was safe to breastfeed while using.

In another study researchers used 2017 Pregnancy Risk Assessment Monitoring System (PRAMS) data from three states (Alaska, Hawaii, and Vermont) to estimate the prevalence of postpartum marijuana use among all survey participants, and the association between breastfeeding behaviors and mothers safety perceptions of postpartum marijuana use during periods of breastfeeding [35]. Ko et al. (2021) calculated marginal proportions using logistic models to estimate adjusted prevalence ratios (aPR) then compared the association between postpartum marijuana use among moms who did and did not initiate breastfeeding and evaluated breastfeeding duration between these groups at >12 weeks compared to breastfeeding duration at ≤ 12 weeks. Ko et al. (2021) found that among women who reported postpartum marijuana use, 46.5% (n= 139; 95% CI 36.3% 56.9%) reported that they were currently breastfeeding. After adjusting for maternal age, race/ethnicity, education, marital status, federal poverty level, postpartum depression, physical abuse by husband or partner during pregnancy, postpartum cigarette smoking, and being discouraged from breastfeeding while using marijuana by a prenatal care provider, the study found that there was no significant association between postpartum marijuana use and breastfeeding initiation (aPR = 1.02, 95% CI [0.96, 1.08]) or duration of >12 weeks (aPR = 1.04; CI [.90, 1.21]). Findings suggested no difference in breastfeeding initiation and duration of > 12 weeks between women who used marijuana in the postpartum period and women who did not use marijuana in the postpartum period.

The study by Ko et al. (2018) uses similar methodology as Coy et al. (2021) when examining the impact of postpartum marijuana use on breastfeeding behaviors. Ko et al. (2018) used PRAMS 2009 – 2011 data from three states (Alaska, Hawaii, Vermont) to describe the correlation between postpartum marijuana use and breastfeeding duration. Alaska, Hawaii, and Vermont were selected because they each collected optional data on marijuana use and they all met the annual response rate threshold of 50% between 2009 and 2011. Researchers restricted their sample to singleton births without birth defects who had complete information on birthweight and gestational age for a sample size of 4,969. The weighted prevalence of state-specific estimates found that postpartum use of marijuana among participants in Alaska was 6.8% (95% CI: 5.6%–8.3%), 6.7% (95% CI: 5.9%–7.7%) for Vermont, and 2.8% (95% CI: 2.3 – 3.4) for Hawaii. This multiyear cross-sectional study reported postpartum marijuana users were significantly more likely to breastfeed for <8 weeks compared to their non-marijuana using counterparts (34.9% vs. 18.1%; $p < 0.001$) [38]. These findings raise concerns regarding the potential impact postpartum marijuana use has on breastfeeding duration. Ko et al. (2018) findings showed that women living in Alaska and Vermont from 2009 – 2011 who engaged in postpartum marijuana use were more likely to breastfeed for less than 8 weeks comparted to those who did not use marijuana postpartum.

Another study by Crume et al. (2018) found similar findings as Ko et al. (2018) despite assessing different populations at different periods of time. Crum et al. (2018) looked at the association between breastfeeding duration and initiation among mothers who engaging in postpartum marijuana use. Researchers implemented logistic regression modeling to measure the differences in marijuana use based on maternal breastfeeding practices among

PRAMS participants in Colorado during 2014 - 2015. The study found that 87.4% (95% CI, 54.9%-72.9%) of women who used marijuana during the early postnatal period reported ever having breastfed compared to 93.9% (95% CI, 92.6%-94.9%) of women who did not use marijuana during the early postnatal period [39]. The same study also found that 57.6% (95% CI, 47.4%-67.2%) of women who used marijuana during the early postnatal period breastfed for ≥ 9 weeks compared to 78.7% (95% CI, 76.6%-80.6%) of women who did not use marijuana during the early postnatal period. According to these results, women who used marijuana during the early postnatal period were less likely to report having ever breastfeed compared to women who did not use marijuana during the postnatal period. Additional findings show that women who use marijuana during the early postnatal period were less likely to have breastfeed for 9 weeks or longer when compared to women who did not use during the postnatal period.

The studies conducted by Ko et al., Coy et al., Cameron et al., and Crum et al., all focused on state level data. County-level estimates concerning postpartum marijuana use among breastfeeding mothers are not widely available but are necessary to inform localized community-based harm reduction strategies, communication, and targeted programing efforts. Additionally, county level analysis could allow public health agencies to increase the impact of local targeted programming efforts. Going forward, researchers should commit to using a uniformed list of definitions and measurements for breastfeeding duration, breastfeeding initiation, marijuana use, frequency, and other variables of interest. This will ensure that each study is conducted under a unified framework for analysis. The purpose of this study is to determine if the odds of breastfeeding for at least 3 months among Washington County, Oregon women who have initiated breastfeeding and self-report

postpartum marijuana use differ from Washington County, Oregon women who have initiated breastfeeding and self-report no postpartum marijuana use.

Methods

Design

This study was conducted as a secondary data analysis using Oregon Pregnancy Risk Assessment Monitoring System (OPRAMS). OPRAMS is a population based, cross-sectional, retrospective, self-reported survey developed and implemented through collaborative efforts between the Oregon Health Authority Public Health Division (OHAPHD) and the Centers for Disease Control and Prevention (CDC). OPRAMS is funded through a cooperative agreement between the OHAPHD and the CDC. The CDC provides base funding, standardization of data collection methods, technical support & data management, and overall project direction. The Oregon Health Authority Public Health Division (OHAPHD) implements all data collection protocol, modifies the questionnaire based on current health trends, and supports on the ground logistics. In depth information on PRAMS methodology has been previously reported [40].

Sample

The OHAPHD surveys between 1000 and 3000 women of any age who have recently had a live birth within the study year and is a resident of Oregon. Mothers were surveyed when their infant is between 2 – 6 months old. Once eligibility was determined, mothers were mailed a survey packet 2 – 6 months after the birth. Mothers who did not reply to the first mailer were sent two additional follow up survey pacts based on continued nonresponse.

Mothers who were still unable to be reached by mail were contacted via telephone. In depth information on PRAMS sampling and data collection methodology has been previously reported [40].

Our study sample included mothers aged 18 years and older who were surveyed between 2016 – 2020, who were residents of Washington County, Oregon at the time of birth, had complete responses for the postpartum marijuana use survey question, had an infant that was at least 3 months or older, and self-reported having had initiated breastfeeding. Based on these inclusion criteria our unweighted sample consisted of 1469 mothers (weighted sample 25059). See Figure 1 for inclusion and exclusion criteria.

Measurement Definitions & Rationale

Postpartum marijuana use was defined as the use of marijuana or hash in any form by the mother any time after a live birth. Phase 8 OPRAMS survey asks, "During any of the following time periods, did you use marijuana or hash in any form? For each time period, check "No" if you did not use then or "Yes" if you did." Respondents were then given three time periods, (1) during the 12 months before I got pregnant, (2) During my most recent pregnancy, (3) Since my new baby was born. All mothers who responded "Yes" to the question, "since my new baby was born" were determined to have used marijuana in the postpartum period.

Breastfeeding was defined as feeding an infant breastmilk directly from body or expressed breastmilk.

Breastfeeding duration ≥3 months was defined as feeding breastmilk or expressed milk to an infant for at least 3 months.

Breastfeeding initiation was defined as mothers who had ever breastfed their baby or fed their baby expressed milk.

Maternal age was set to 18+ because some PRAMS questions related to breastfeeding were not asked to underaged mothers. Age categories consisted of 18-28, 29-35, and 36+. Mothers under the age of 18 were excluded from the study sample.

Race/Ethnicity were categorized as Asian Pacific Islander (API), Black, Other-non-white, White, Hispanic, and Non-Hispanic. API consists of respondents who self-reported their race as Asian or Hawaiian. Black consists of respondents who self-reported their race as African American. Other-non-white consists of respondents who self-reported their race as Other-non-white, American Indian, or Mixed Race. Hispanic consists of respondents who self-reported their ethnicity as Hispanic. Non-Hispanic consists of respondents who self-reported their identity as non-Hispanic.

Postpartum depression was defined as feelings of intense sadness, anxiety, and or tiredness that persist for several weeks after a mother has given birth. PRAMS used questions from the Patient Health Questionnaire-2 (PHQ-2) depression model which is a validated tool used to screen for symptoms of depression [41–43].

Postpartum cigarette use was defined as the use of any cigarette or tobacco product by a mother 0 – 8 months after she has given birth.

Data Analysis

Survey weights were added to the analytic data set to yield accurate population estimates for the main parameters of interest, account for sampling design, non-coverage, and non-response. Prevalence estimates of postpartum marijuana use were based on the overall analytic sample. Chi-square tests were done to describe the differences in sociodemographic characteristics and breastfeeding duration based on post-partum marijuana use. To analyze the impact of postpartum marijuana, use on breastfeeding duration ≥3months, a binomial logistic regression model was used to estimate adjusted odds ratios (aOR). Adjusted models controlled for postpartum depression, mother's race/ethnicity, mothers age, and postpartum cigarette use. Variables incorporated in adjusted models were selected a priori, then stepwise logistic regression was run. Analysis was conducted using R Studio 4.2.3. All reported values are weighted.

Results

The total number of participants in the analytic sample consists of 1469 unweighted observations and 25059 weighted (Table 1). All table values are weighted. Demographic characteristics include maternal age, race, ethnicity, postpartum cigarette use, and postpartum depression. The largest maternal age group was women aged 29 – 35 years, with 49% of total observations, and the smallest maternal age group was mothers age 36+ years which represented 18.7% of total observations (Table 1). The largest racial group in our sample was White women 18778 (74.9%) and the smallest racial group was Black women 733 (2.9%). In our study sample, 2613 (10.4%) of women report experiences of postpartum depression. The prevalence of postpartum marijuana use among mothers in our sample is 3.3% (n=829) (Table 2). When assessing postpartum marijuana use based on key demographic factors the data show that use is highest among women who are younger, non-

Hispanic, and White (Table 2). Postpartum cigarette use is more prevalent among women who used marijuana postpartum when compared to women who did not use marijuana postpartum. However, differences in postpartum cigarette use between women who used and women who did not use marijuana postpartum was not significant (Table 4). Among women in our study sample n = 20596 (82.2%) breastfed for ≥3 months (Table 3). After assessing breastfeeding duration based on key demographic factors the data show that prevalence of women who breastfed for ≥3 months is lowest among women age 36+ years, Black women, Hispanic women, and women who experienced postpartum depression (Table 3.)

Among mothers who breastfed for ≥3months, 2.7% (n=547) self-reported postpartum marijuana use. After controlling for postpartum depression, mother's race/ethnicity, mothers age, and postpartum cigarette use, there was no evidence showing that mothers who use marijuana in the postpartum period are more or less likely to breastfeed for ≥3months months when compared to women who did not use marijuana in the postpartum period (aOR= 0.5769, CI [0.22, 1.5], p= 0.263) (Table 4). However, adjusted models do show a relationship between postpartum depression and breastfeeding duration. Women who experienced postpartum depression breastfed less when compared to women who did not experience postpartum depression (aOR= 0.4493, CI [0.24, 0.85], p= 0.014) (Table 4).

Discussion

Among mothers who report breastfeeding for ≥3months, 2.7% (n=547) use marijuana postpartum compared to use among mothers who report <3months 1.1% n=282. This study finds that there is no association between postpartum marijuana use and breastfeeding

duration of ≥3 months. Our findings are similar to a previous study by Coy et al., who found no association between postpartum marijuana use and breastfeeding duration of >12 weeks [17]. Our results conflict with findings from Ko et al., and Crume et al., who found that there was an association between postpartum marijuana use and breastfeeding for <8 weeks [38,39]. Differences in how breastfeeding duration is defined across each study could be contributing to mixed research findings.

There is no definitive evidence on the impact of marijuana use on breastfeeding. However, THC is detectable in breastmilk [44] which is why ACOG, CDC, and AAP recommends that clinical providers counsel women who are planning to become pregnant or are already pregnant about their marijuana use, and suggest that these women should abstain or significantly reduce their use of marijuana until more is known [1,3,5].

Our study shows that postpartum marijuana use is highest among non-Hispanic White women aged 18 – 28; our findings were similar to other studies which also found that use was highest among younger mothers [17,34,35,38,39,45] and women who were non-Hispanic White [38,45]. Our findings conflict with another study which found postpartum marijuana use being highest among non-Hispanic Black women [46]. Our study shows use marijuana treads among young non-Hispanic White women that are similar to national trends between 2016 and 2020 (2016 [10.2 million (70.6%); 2017 [11.4 million (70.2%); 2018 [12.2 million (70.0%); 2019 [13.8 million (70.7%)]; 2020 [14.4 million (69.8%)). We find that between 2016 and 2020, Washington County, Oregon county level estimates of postpartum marijuana use follow similar trends of high use rates among 18 – 28-year-old non-Hispanic White women seen in national marijuana use data reports by the National Survey on Drug Use and Health (NSDUH) between 2016 and 2020 (2016 [10.2 million

(70.6%); 2017 [11.4 million (70.2%); 2018 [12.2 million (70.0%); 2019 [13.8 million (70.7%)]; 2020 [14.4 million (69.8%)) [21,47–51]. However, NSDUH data reports do not distinguish temporality of maternal marijuana use based on pregnancy status and the data set only provides estimates at the state and national level.

Uniformity in variable definition and measurements could allow for more consistent results across studies and provide less ambiguity in study findings. Topics for future studies include how breastfeeding behavior differs between women who have been diagnosed with cannabis use disorder (CUD) and casual cannabis users, how various dose-frequency and route of administration impact the production and quality of breastmilk, how cannabis product labeling impacts cannabis use among pregnant women, and how THC impacts the quality of certain types of breastmilk (colostrum, transitional milk, mature milk, foremilk, hindmilk) [52]. It is well known that THC, the psychoactive active compound found in marijuana is lipid soluble. The half-life duration of THC is about 67 days [53] and can vary depending on substance potency, a person's metabolism, percentage of body fat, activity level, and frequency of use. Toxicology studies reported that THC is excreted into breastmilk and can remain present between three days and six weeks depending on the quantity and frequency of use [54–56]. Studies have found that short term and long term exposure to THC decreases the production of prolactin and oxytocin production [33,57,58]. Prolactin and oxytocin have been found to be directly linked to breastfeeding function [58]. Prolactin sends signals to the body to grow and further develop mammary tissue. Prolactin is also responsible for telling the alveoli to begin milk production. As prolactin levels increase more milk is produced which is central in maximizing the health potential of the infant and mother. Oxytocin plays a key role in signaling to the myoepithelial cells around

the alveoli to contract, which allows the milk to fill the ducts. As mother and baby become bonded though regular skin-to-skin contact during feeding, the oxytocin reflex automatically responds to the mother seeing and smelling her baby or hearing her baby cry. When the mother experiences pain or emotional dysregulation the oxytocin reflex can become impeded and lead to limited or no milk flow [59].

Strengths & Limitations

The use of PRAMS data is a major strength of this study. PRAMS survey data is linked to state birth certificate registry, allowing for more accurate figures for the infant's date of birth, mother's residence, and maternal demographic data (e.g… race, age, ethnicity). PRAMS also provides county level data that allows researchers to use the most relevant data to investigate marijuana use before, during, and after pregnancy at more granular geographic levels.

Research informed by this study must consider the limitations of this study. First, limitations in the PRAMS survey data did not allow for questions related to the frequency of use during pregnancy and postpartum [60]. Second, data on postpartum marijuana use is self-reported. Due to the sensitive nature of marijuana use during any stage of pregnancy and the potential consequences that could follow a mother's admission of substance use during pregnancy, desirability bias has likely led to underestimation of the prevalence of postpartum marijuana use. Underestimation of postpartum marijuana use can cause bias results in favor of the null specifically that post-partum marijuana has no impact on breastfeeding duration, due to the misclassification of exposure group. Third, if a mother cannot be contacted during the survey period PRAMS does not have a mechanism to collect data from non-respondents.

Underestimates of postpartum marijuana use could be likely because PRAMS might be missing a large group of mothers who are most at risk. The survey methods used to collect PRAMS data (mailing surveys and phone calls) might unintentionally exclude mothers who don't have a stable address, a secure phone number, or are transient. Fourth, combining data taken over multiple years might lead to overestimates when conducting an analysis using PRAMS data because PRAMS sampling methodology is meant to create a representative sample where each mother sampled in a given year is supposed to represent a percentage of the total mothers who have recently had a live birth who share similar demographics as her [40]. Finally, missing variables were delt with using listwise deletion. This approach can increase the magnitude of selection bias because missingness may not have been random.

This study adds important information to the growing body of public health knowledge on postpartum marijuana use and breastfeeding duration by providing a county level approach using PRAMS data. It is important to understand county level trends because although recreational and medical marijuana use has been legalized in a state that does not mean county level use among breastfeeding women within a legal state is the same. The use of county level analysis provides public health professionals with the ability to better understand postpartum marijuana use and breastfeeding duration in communities where mothers are overlooked. Future data collection systems should consider a multisectoral collaboration between PRAMS, birth centers, child protective services, law enforcement, lactation services, and substance use treatment centers as an approach to reach non-respondents. Furthermore, findings from county level studies like this one can be used to support community-based harm reduction programing implemented by local health departments and community partners.

Conclusion

Results from these analyses are based on 2016 – 2020 PRAMS data from Washington County, Oregon. These data show us that postpartum marijuana use is associated with postpartum cigarette use. Future studies related to marijuana use and breastfeeding behavior and duration should consider factors like frequency and dose of substance use, history of substance use, use behavior among social networks, and poly-substance use. Additionally, postpartum marijuana use was not independently associated breastfeeding duration of ≥3 months. However, breastfeeding duration is associated with experiences of postpartum depression [38]. Current literature looking at the association of breastfeeding duration and postpartum depression have determined that an association exists but a consensus on the direction of this relationship has not been made among researchers [61–64]. Based on our findings we believe that programs which support women during the postpartum period should incorporate targeted breastfeeding interventions for women who are experiencing postpartum depression. Finally, continued surveillance of marijuana used and breastfeeding behavior among women who are pregnant and who have recently given birth is vital. Surveillance planning should put an emphasis on collecting data on non-response participants and develop methods for reaching this unserved population.

Abbreviations

AAP: American Academy of Pediatrics

ACOG: American Congress of Obstetricians and Gynecologists

API: Asian Pacific Islander

CBD: Cannabidiol

CDC: Centers for Disease Control and Prevention

OPRAMS: Oregon Pregnancy Risk Assessment Monitoring System

OHAPHD: Oregon Health Authority Public Health Division (OHAPHD)

PRAMS: Pregnancy Risk Assessment Monitoring System

THC: Tetrahydrocannabinol

WHO: World Health Organization

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Table 1. Demographics of Washington County, Oregon Mothers who Initiated Breastfeeding — Oregon Pregnancy Risk Assessment Monitoring System 2016 - 2020

Characteristics	Total Study Population (n = 25,059)
Maternal Age in Years	
18 - 28	8102 (32.3%)
29 -35	12276 (49.0%)
36+	4681 (18.7%)
Infant Age ≥3 months	
Yes	24351 (97.2%)
No	708 (2.8%)
Race	
Asian Pacific Islander	4175 (16.7%)
Other-non-White	1372 (5.5%)
Black	733 (2.9%)
White	18778 (74.9%)
Ethnicity	
Hispanic	6218 (24.8%)
Non-Hispanic	18841 (75.2%)
Smoked Cigarettes Post-partum	
Yes	533 (2.1%)
No	24526 (97.9%)
Postpartum Depression	
Yes	2613 (10.4%)
No	22445 (89.6%)

*** County level estimates are based on a survey-weighted approach. Weighting protocol and methods can be found here [65]**
***Asian Pacific Islander = Mothers who self-reported their race as Asian (n= 4,700) or Hawaiian (n=12)**
***Other-non-white = Mothers who self-reported their race as other-non-white (n= 288), American Indian (n=105), or Mixed Race (n=1,700)**
*** Mothers who self-report never having initiated breastfeeding were dropped from the analytic sample (n = 135)**
*** Mothers who had children who were not at least 3 months of age were dropped from the analytic sample (n=928)**
*** Mothers whose self-reported age was less than 18 were dropped from the analytic sample (n=542)**
*** Infants who were not ≥3months were dropped from the study population and are not included in the n=25,059.**

Table 2. Postpartum Marijuana use among Washington County, Oregon Mothers Stratified by All Demographic Characteristics — Oregon Pregnancy Risk Assessment Monitoring System 2016 - 2020

Characteristics	Women who use marijuana post-partum n = 829 (3.3%)	Women who did not marijuana post-partum n=24,230(96.7%)	P
Age in years			0.219
18 - 28	462 (55.7%)	7641 (31.5%)	
29 -35	265 (32.0%)	12011 (49.6%)	
36+	102 (12.3%)	4579 (18.9%)	
Race			0.002
Asian Pacific Islander	52 (6.3%)	4123 (17.0%	
Other-non-White	122 (14.7%)	1251 (5.2%)	
Black	10 (1.2%)	723 (3.0%)	
White	644 (77.7%)	18134 (74.8%)	
Ethnicity			0.732
Hispanic	184 (22.2%)	6035 (24.9%)	
Non-Hispanic	645 (77.8%)	18196 (75.1%)	
Smoked Cigarettes Post-partum			0.066
Yes	274 (33.1%	258 (1.1%)	
No	554 (66.8%)	23972 (98.9%)	
Postpartum Depression			0.370
Yes	149 (18.0%)	2465 (10.2%)	
No	680 (82.0%)	21766 (89.8%)	

* **County level estimates are based on a survey-weighted approach, p values use the Bayes significance levels for the null hypothesis of no difference between groups. Weighting protocol and methods can be found here [65]**
* **Differences between marijuana use based on race are statistically significant at the 0.05 level.**
* **Differences between breastfeeding duration based on race are statistically significant at the 0.05 level.**
* **Difference between breastfeeding duration based on experience of postpartum depression are statistically significant at the 0.05 level.**

Table 3. Breastfeeding Duration among Washington County, Oregon mothers who initiated breastfeeding, Stratified by All Demographic Characteristics — Oregon Pregnancy Risk Assessment Monitoring System 2016 - 2020

Characteristics	Women who initiated breastfeeding and breastfed ≥3 months n = 20596 (82.2%)	Women who initiated breastfeeding and breastfed ≤ 3 months n = 4463 (17.8%)	P
Age in years			0.103
18 - 28	6253 (30.4%)	1850 (41.5%)	
29 -35	10463 (50.8%)	1812 (40.6%)	
36+	3880 (18.8%)	801 (17.9%)	
Race			0.007
Asian Pacific Islander	3667 (17.8%)	508 (11.4%)	
Other-non-White	1139 (5.5%)	234 (5.2%)	
Black	645 (3.1%)	88 (2.0%)	
White	15145 (73.5%)	3633 (81.4%)	
Ethnicity			0.088
Hispanic	4857 (23.6%)	1361 (30.5%)	
Non-Hispanic	15739 (76.4%)	3102 (69.5%)	
Smoked Cigarettes Post-partum			0.101
Yes	329 (1.6%)	203 (4.5%)	
No	20267 (98.4%)	4259 (95.4%)	
Postpartum Depression			0.013
Yes	1839(8.9%)	755 (16.9%)	
No	18757 (91.1%)	3688 (82.6%)	

* **County level estimates are based on a survey-weighted approach, p values use the Bayes significance levels for the null hypothesis of no difference between groups. Weighting protocol and methods can be found here [65].**
* **Differences between marijuana use based on race are statistically significant at the 0.05 level.**
* **Differences between breastfeeding duration based on race are statistically significant at the 0.05 level.**
* **Difference between breastfeeding duration based on experience of postpartum depression are statistically significant at the 0.05 level.**

Table 4. Breastfeeding Duration ≥3 months among Washington County, Oregon mothers who initiated breastfeeding, & Postpartum Marijuana use - Oregon

Covariate	n	Adjusted Odds Ratio	95% Confidence Interval	P-value
Postpartum marijuana use				
Yes	547	0.5769	(0.22, 1.5)	0.263
No	20049	**REF**	**REF**	**REF**
Age in years				
18 – 28	8102	REF	REF	REF
29 -35	12276	1.4333	(0.84, 2.45)	0.186
36+	4681	1.2214	(0.64, 2.30)	0.543
Maternal Race				
Asian Pacific Islander	4175	0.9417	(0.35, 1.39)	0.843
Other-non-White	1372	0.7046	(0.28, 1.10)	0.311
Black	733	**REF**	**REF**	**REF**
White	18778	0.5598	(0.51, 1.73)	0.093
Ethnicity				
Hispanic	6218	0.8269	(0.51, 1.34)	0.434
Non-Hispanic	18841	**REF**	**REF**	**REF**
Smoked Cigarettes Post-partum				
Yes	533	0.5433	(0.14, 2.15)	0.386
No	24526	**REF**	**REF**	**REF**
Experienced Postpartum Depression				
Yes	2613	0.4493	(024, 0.85)	0.014
No	22445	**REF**	**REF**	**REF**

*** County level estimates are based on a survey-weighted approach, p values use the Bayes significance levels for the null hypothesis of no difference between groups. Weighting protocol and methods can be found here [65]**

Figure 1.

Exclusion Criteria	Inclusion Criteria
1. Pregnancies that do not end with a live birth	1. Infants who have died after live birth
2. Out-of-state births	2. Birth records missing address information or other key birth certificate information (no including mother's name
3. In-state live births to non-Oregon residents	3. In-state live births to Oregon residents
4. Non-Washington County residents	4. Washington County residents
5. Incomplete birth record (missing mother's name, zip code, infants birth date)	5. Complete birth record
6. Birth records processed more than 6 months after live birth	6. Birth records process between 0 and 6 months after live birth
7. Infant < 3 months old	7. Infants ≥ 3 months of age not exceeding 6 months.
8. Mothers under the age of 18	8. Mothers 18 years of age and older
9. Mothers who had missing data for race, age, ethnicity, breastfeeding duration, breastfeeding initiation, postpartum cigarette use, postpartum depression, or postpartum marijuana use variables.	9. Mothers who had complete data for race, age, ethnicity, breastfeeding duration, breastfeeding initiation, postpartum cigarette use, postpartum depression, or postpartum marijuana use.