Short communication

Trends in marijuana use among pregnant women with and without nausea and vomiting in pregnancy, 2009–2016

Kelly C. Young-Wolff[a,b,*], Varada Sarovar[a], Lue-Yen Tucker[a], Lyndsay A. Avalos[a],
Stacey Alexeeff[a], Amy Conway[c], Mary Anne Armstrong[a], Constance Weisner[a,b],
Cynthia I. Campbell[a,b], Nancy Goler[d]

[a] *Division of Research, Kaiser Permanente Northern California, 2000 Broadway, Oakland, CA 94612, USA*
[b] *Department of Psychiatry, University of California, San Francisco, 401 Parnassus Avenue, San Francisco, CA 94143, USA*
[c] *Early Start Program, Kaiser Permanente Northern California, 1950 Franklin, Oakland CA 94612, USA*
[d] *Regional Offices, Kaiser Permanente Northern California, 1950 Franklin, Oakland CA 94612, USA*

A R T I C L E I N F O

A B S T R A C T

Background: Cross-sectional studies indicate an elevated prevalence of prenatal marijuana use in women with nausea and vomiting in pregnancy (NVP). However, it is unknown whether differences in marijuana use by NVP status have persisted over time as marijuana becomes more acceptable and accessible and prenatal use increases overall. We compared trends in prenatal marijuana use by NVP status in the first trimester of pregnancy using data from Kaiser Permanente Northern California's (KPNC) large healthcare system.
Methods: The sample comprised KPNC pregnant women aged ≥12 who completed a self-administered questionnaire on marijuana use and a urine toxicology test for cannabis during standard prenatal care from 2009 to 2016. The annual prevalence of marijuana use via self-report or toxicology by NVP status was estimated using Poisson regression with a log link function, adjusting for sociodemographics and parity. We tested for linear trends and differences in trends by NVP.
Results: Of 220,510 pregnancies, 38,831 (17.6%) had an NVP diagnosis. Prenatal marijuana use was elevated each year among women with NVP. The adjusted prevalence of use increased significantly from 2009 to 2016 at an annual rate of 1.086 (95%CI = 1.069–1.104) among women with NVP, from 6.5% (95%CI = 5.7%–7.2%) to 11.1% (95%CI = 0.2%–12.0%), and 1.069 (95%CI = 1.059–1.080) among women without NVP, from 3.4% (95%CI = 3.2%–3.7%) to 5.8% (95%CI = 5.5%–6.1%). Trends did not vary by NVP status.
Discussion: The prevalence of prenatal marijuana use has remained elevated over time among women with NVP. Clinicians should ask pregnant patients about their reasons for marijuana use and treat NVP with evidence-based interventions.

1. Introduction

Marijuana is a commonly used drug during pregnancy, and its use has increased among pregnant women in recent years (Brown et al., 2017; Young-Wolff et al., 2017). While more research is needed (Goler et al., 2018), there are significant concerns about the potential risks of prenatal marijuana use, and national guidelines strongly recommend that clinicians screen for and advise against marijuana use in pregnancy (Committee on Obstetric Practice, 2017; Metz and Borgelt, 2018; National Academies of Sciences Engineering and Medicine and Health and Medicine Division, 2017; Ryan et al., 2018; Volkow et al., 2017a).

Marijuana has antiemetic properties, and prenatal marijuana use is most prevalent in the first trimester of pregnancy when nausea and vomiting in pregnancy (NVP) peaks (Volkow et al., 2017b). Available data from a small number of studies suggest that pregnant women may use marijuana to self-medicate their NVP symptoms. Cross-sectional data from 2009 to 2011 from the Hawaii Pregnancy Risk Assessment Monitoring System (PRAMS) indicated that self-reported prenatal marijuana use was higher among those with (3.7%) versus without (2.3%) severe self-reported NVP (Roberson et al., 2014). Similarly, our study of California women screened for prenatal marijuana use by self-report and urine toxicology tests using combined data from 2009 to 2016 found that first trimester marijuana use was elevated among those with severe (11.3%) and mild (8.4%) versus no NVP (4.5%) (Young-

Table 1

Characteristics of 220,510 Pregnancies in Kaiser Permanente Northern California by Nausea and Vomiting in Pregnancy (NVP) Status in the First Trimester of Pregnancy, 2009–2016.

Characteristics	Total N = 220,510 N (%)	NVP N = 38,831 (17.6%) N (%)	No NVP N = 181,679 (82.4%) N (%)	P-value
Age (years)				< .0001
12–17	2,177 (1.0)	373 (1.0)	1,804 (1.0)	
18–24	30,880 (14.0)	7,011 (18.1)	23,869 (13.1)	
25–34	139,044 (63.1)	24,742 (63.7)	114,302 (62.9)	
≥ 35	48,409 (22.0)	6,705 (17.3)	41,704 (23.0)	
Age (years)				< .0001
Mean (SD)	30.3 (5.5)	29.4 (5.4)	30.5 (5.5)	
Race/ethnicity				< .0001
White	83,110 (37.7)	13,654 (35.2)	69,456 (38.2)	
Black	12,127 (5.5)	3,181 (8.2)	8,946 (4.9)	
Hispanic	58,545 (26.6)	10,826 (27.9)	47,719 (26.3)	
Asian	37,125 (16.8)	5,631 (14.5)	31,494 (17.3)	
Other/Unknown	29,603 (13.4)	5,539 (14.3)	24,064 (13.3)	
Median household income ($)				< .0001
< $52,442	55,083 (25.0)	10,708 (27.6)	44,375 (24.4)	
$52,442– < $71,585	55,072 (25.0)	9,919 (25.5)	45,153 (24.9)	
$71,585– < $94,083	55,095 (25.0)	9,269 (23.9)	45,826 (25.2)	
≥ $94,083	55,080 (25.0)	8,901 (22.9)	46,179 (25.4)	
Unknown	180 (0.1)	34 (0.1)	146 (0.1)	
Median household income				< .0001
Mean (SD)	75,347 (30,874)	73,061 (30,233)	75,835 (30,879)	
Parity				< .0001
0	76,941 (34.9)	12,105 (31.2)	64,836 (35.7)	
≥ 1	118,809 (53.9)	22,886 (58.9)	95,923 (52.8)	
Unknown	24,760 (11.2)	3,840 (9.9)	20,920 (11.5)	
Marijuana Use in Year Prior to Pregnancy				< .0001
Yes	18,259 (8.3)	3,862 (10.0)	14,397 (7.9)	
No	201,864 (91.5)	34,879 (89.8)	166,985 (91.9)	
Unknown	387 (0.2)	90 (0.2)	297 (0.2)	
Prenatal Marijuana Use				< .0001
Yes	11,645 (5.3)	3,397 (8.8)	8,248 (4.5)	
No	208,865 (94.7)	35,434 (91.3)	173,431 (95.5)	

ANOVA tests were used to compare group means and chi-square tests were used to compare frequencies/proportions. Age group, race/ethnicity, median neighborhood household income, and parity were extracted from the electronic health record. Marijuana use in the year prior to pregnancy was based on a self-reported questionnaire in the first trimester of pregnancy as part of standard prenatal care. Prenatal marijuana use was based on a positive self-report and/or a positive toxicology screening for marijuana in the first trimester of pregnancy conducted as part of standard prenatal care (at approximately 8 weeks gestation).

Wolff et al., 2018). Results from two smaller surveys indicated that most pregnant women (96%) with ongoing prenatal marijuana use reported using marijuana to self-medicate nausea (Mark et al., 2017), and a majority (92%) of those who used it for this purpose rated it as effective in treating NVP (Westfall et al., 2009).

As public acceptance and availability of marijuana increase overall (Azofeifa et al., 2016; Hartig and Geiger, 2018), pregnant women may be increasingly using marijuana for a variety of reasons unrelated to NVP (e.g., anxiety, pain, recreation). Understanding whether prenatal marijuana use has remained elevated among pregnant women with NVP in recent years is critical and of growing importance, as this information can be used by clinicians to better tailor discussions with pregnant patients and to inform interventions and education programs to reduce prenatal marijuana use.

The current study extended our previous work using data from a large California healthcare system with universal screening for prenatal marijuana use via self-report and urine toxicology from 2009 to 2016 and is the first study to examine trends in prenatal marijuana use separately for women with and without clinical NVP diagnoses.

2. Methods

2.1. Study sample

Kaiser Permanente Northern California (KPNC) is a multispecialty healthcare system serving > 4 million racially and socio-economically diverse members representative of the Northern California population

(Gordon, 2013, 2015; Selby et al., 2005; Terhune, 2013). Standard prenatal care includes universal drug screening by self-report (via a self-administered questionnaire) and urine toxicology testing at approximately 8 weeks gestation. The study sample comprised 184,581 KPNC pregnant women aged 12 and older who were screened for marijuana use in the first trimester from 2009 to 2016, with a total of 220,510 pregnancies (33,030 women (17.9%) had > 1 pregnancy). The KPNC institutional review board approved and waived consent for this study.

2.2. Measures

Prenatal marijuana use was defined as screening positive for marijuana by self-report and/or a positive toxicology test during the first trimester of pregnancy. Confirmatory tests were performed for all positive toxicology tests. NVP was defined as any ICD-9 or ICD-10 NVP diagnostic code in the electronic health record (EHR) during the first trimester of pregnancy. The relevant codes found in our sample included: 536.2, 643.00, 643.03, 643.10, 643.13, 643.80, 643.90, 643.93, 787.01, 787.02, 787.03, G43.A0, O21.0, O21.1, O21.9, R11.0, R11.10, R11.11, and R11.2. Data on age (12–17, 18–24, 25–34, ≥ 35), race/ethnicity (White, Black, Hispanic, Asian, other/unknown), median neighborhood household income quartiles (< $52,442, $52,442-< $71,585, $71,585– < $94,083, ≥ $94,083), parity (0, ≥ 1), and self-reported marijuana use during the year before pregnancy were extracted from the EHR.

2.3. Statistical analysis

We modeled the prevalence of prenatal marijuana use annually by NVP status using Poisson regression with a log link function controlling for age, race/ethnicity, median neighborhood household income, prenatal marijuana use screening year, and parity. We estimated the covariate-adjusted prevalence using the direct method, standardized to the total study sample population across all years. We modeled linear trends of marijuana use and NVP by including a linear term for calendar year in the Poisson regression model, and we tested for statistical significance using a Wald test. We modeled marijuana use trends by NVP status by including cross product terms for year by NVP status in the Poisson regression model, and we tested for significance of trend differences using a Wald test. We repeated these analyses for self-report and toxicology results separately. Next, we additionally adjusted for self-reported marijuana use during the year before pregnancy to examine how results were affected by pre-pregnancy marijuana use.

3. Results

The sample (N = 220,510) was 37.7% White, 26.6% Hispanic, 16.8% Asian, 5.5% Black, and 13.4% other; 1.0% were aged 12–17, 14.0% 18–24, 63.1% 25–34 and 22.0% ≥35. The average median neighborhood household income was $75,347 (SD ± $30,874), 53.9% had parity ≥1, and 8.3% self-reported marijuana use in the year before pregnancy (Table 1). The prevalence of prenatal marijuana use was 5.3%. Among those who screened positive, 13.7% were positive on self-report only, 58.5% on toxicology only, and 27.7% on both self-report and toxicology. Women with NVP (17.6% of the sample) were younger, more likely to be Black, less likely to be Asian, with lower income, greater parity, and a greater likelihood of marijuana use both in the year before pregnancy and during pregnancy than those without NVP. The adjusted prevalence of NVP increased from 2009 to 2016 at an annual rate of 1.027 (95%CI = 1.022–1.032, $P < .0001$) from 14.1% (95%CI = 13.7%–14.6%) to 17.8% (95% CI = 17.4%–18.3%).

After adjusting for age, race/ethnicity, median neighborhood household income, and parity, the prevalence of prenatal marijuana use from 2009 to 2016 increased significantly from 6.5% (95%CI = 5.7%–7.2%) to 11.1% (95%CI = 10.2%–12.0%) among women with NVP and from 3.4% (95%CI = 3.2%–3.7%) in 2009 to 5.8% (95%CI = 5.5%–6.1%) in 2016 among women without NVP (Fig. 1). Use increased at an annual rate of 1.086 for women with NVP (95%CI = 1.069–1.104, $P < .0001$) and 1.069 for women without NVP (95%CI = 1.059–1.080, $P < .0001$). The annual rate of increase was estimated to be 1.016 times faster for women with versus without NVP, which was not a statistically significant difference (95%CI = 0.997–1.035, $P = .09$). Stratified analyses by screening method (self-report versus toxicology) found a similar pattern of results (Supplemental Fig. 1a and b).

After adjusting for self-reported marijuana use during the year prior to pregnancy, the pattern of results was similar with increases at an annual rate of 1.035 (95%CI = 1.016–1.045, $P < .0001$) among those with NVP and 1.028 (95%CI = 1.019–1.037, $P < .0001$) among those without NVP. The annual rate of increase was 1.003 times faster for women with versus without NVP, which was not a statistically significant difference (95%CI = 0.986–1.019, $P = .77$).

4. Discussion

In a large diverse sample of pregnant women in California with universal screening for marijuana use via self-report and urine toxicology testing as part of standard prenatal care, women with NVP had a higher prevalence of prenatal marijuana use than those without NVP each year from 2009 to 2016. The adjusted prevalence of prenatal marijuana use increased at a similar rate regardless of NVP status, increasing from 6.5% to 11.1% among women with NVP and from 3.4%

to 5.8% among those without NVP.

The elevated prevalence of marijuana use across years among pregnant women with NVP is notable. Although national clinical management guidelines indicate that NVP can be successfully treated with dietary and lifestyle modifications and safe medically recommended interventions (Committee on Practice Bulletins-Obstetrics, 2018), pregnant women may instead choose to use marijuana to self-medicate NVP symptoms. Despite potential risks and national guidelines that advise strongly against marijuana use in pregnancy (Committee on Obstetric Practice, 2017), pregnant women perceive a lack of evidence about the harms of prenatal marijuana use (Jarlenski et al., 2016), and some believe there is little-to-no harm in using marijuana during pregnancy (Ko et al., 2015; Saint Louis, 2017). Women report searching online and seeking advice about prenatal marijuana use from friends, describing stories of others who used marijuana throughout pregnancy without apparent negative effects (Jarlenski et al., 2016). Further, online media and marijuana dispensaries are touting marijuana as a harmless and effective treatment for NVP, which may contribute to elevated use among women with NVP. For example, a systematic content analysis of online media items about prenatal and postpartum marijuana use identified using Google Alerts between 2015 and 2017 indicated that more than one-quarter of online media items mentioned the treatment of NVP as a health benefit of marijuana use (Jarlenski et al., 2018). Further, in a recent study of marijuana dispensaries in Colorado, 69% of dispensaries recommended marijuana products to treat NVP in the first trimester of pregnancy, and 36% of dispensaries endorsed the safety of marijuana use in pregnancy (Dickson et al., 2018).

In the current study and in the Hawaii PRAMS (Roberson et al., 2014), women with NVP were also more likely than those without NVP to self-report marijuana use in the year before pregnancy. Thus, it is possible that marijuana use before pregnancy is related to increased risk of NVP. For example, withdrawal from marijuana among women who stop using it when they learn they are pregnant might lead to or worsen NVP symptoms, increasing the likelihood of an NVP diagnosis. However, we found a similar pattern of results after adjusting for marijuana use in the year prior to pregnancy, suggesting that pre-pregnancy use does not fully account for the elevated prenatal marijuana use associated with NVP. Additional research is needed to understand whether the relationship between marijuana use and NVP is bidirectional.

Importantly, although the prevalence of prenatal marijuana use was higher each year among women with NVP, use also increased significantly over time among women without a diagnosis of NVP. This suggests that milder NVP symptoms that do not come to the attention of the healthcare system or factors other than NVP are also likely contributing to rising use of marijuana in pregnancy. With legalization of marijuana for recreational use in California in 2018, rates of prenatal marijuana use may increase even more rapidly in the future.

4.1. Limitations

Our sample included KPNC women who were screened for marijuana use in the first trimester of pregnancy. Findings may not generalize to women without healthcare or to those who enter prenatal care late. Provider diagnoses of NVP may not capture mild NVP. Further, our self-reported measure of marijuana use in pregnancy does not differentiate prenatal use before versus after women realized they were pregnant. While cannabis metabolites are detectable in urine for approximately 30 days, this varies with marijuana potency and heaviness of use, and toxicology tests may have picked up pre-pregnancy use in a small number of cases. Finally, our study did not examine whether frequency of marijuana use varies with NVP status, which is an important question for future studies.
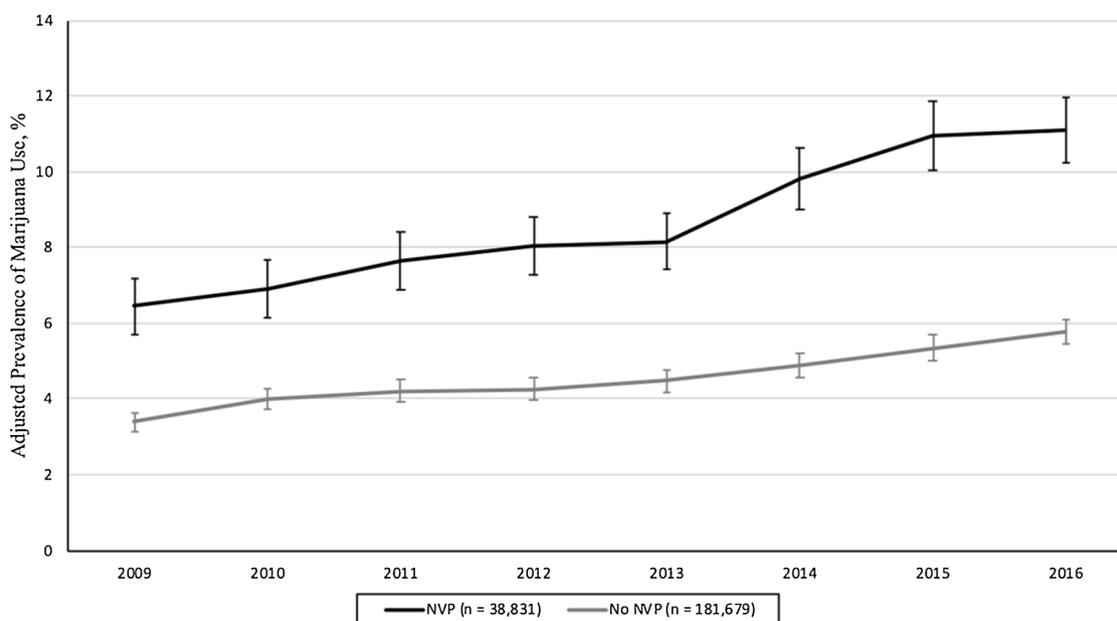
Fig. 1. Adjusted Prevalence of Marijuana Use Among 220,510 Pregnant Women in Kaiser Permanente Northern California by Nausea and Vomiting in Pregnancy (NVP) Status in the First Trimester of Pregnancy, 2009–2016.

Results were based on positive self-report and/or positive toxicology screening in the first trimester of pregnancy as part of standard prenatal care (at approximately 8 weeks gestation). Poisson regression models by NVP controlled for age group, race/ethnicity, median neighborhood household income, and parity (extracted from the electronic health record). Error bars indicate 95% CIs of the adjusted prevalences. The median (range) sample size for women with and without NVP was 4,892 (4,385–5,451) and 21,980 (21,614–23,606), respectively.

4.2. Conclusions

The prevalence of prenatal marijuana use from 2009 to 2016 among women in a large California healthcare system was consistently and significantly elevated among women with NVP. Future research is needed to tease apart the direction of the relationship between NVP and prenatal marijuana use and to better understand the short- and long-term effects on the developing fetus. If pregnant women use marijuana to treat NVP, clinicians could prioritize connecting these patients with NVP treatments medically recommended by national clinical management guidelines (Committee on Practice Bulletins-Obstetrics, 2018). Additionally, if marijuana use causes or worsens NVP (e.g., via nausea induced by marijuana withdrawal), clinicians could provide education that NVP symptoms may remit for some heavier users after a period of marijuana abstinence. Regardless, as prenatal marijuana use is rising regardless of NVP status, clinicians should educate all prenatal patients about the uncertain effects of marijuana use in pregnancy and encourage them to abstain from using marijuana during the perinatal period.

Contributors

All authors assisted in the conceptualization and design of the study. Young-Wolff and Sarovar conducted the literature searches and summaries of previous related work. Tucker and Sarovar extracted the data needed for the study, and Sarovar and Alexeeff undertook the statistical analysis. Young-Wolff wrote the first draft of the manuscript, which was revised and edited by all authors. All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2018.12.009.

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