



Modes of cannabis administration in the year prior to conception among patients in Northern California

Kelly C. Young-Wolff^{a,b,*}, Sara R. Adams^a, Qiana L. Brown^c, Constance Weisner^{a,b}, Deborah Ansley^d, Nancy Goler^d, Kara R. Skelton^e, Derek D. Satre^{a,b}, Tara R. Foti^a, Amy Conway^d

^a Division of Research, Kaiser Permanente Northern California, Oakland, CA, USA

^b Department of Psychiatry and Behavioral Sciences, Weill Institute for Neurosciences, University of California, San Francisco, CA, USA

^c School of Social Work, Rutgers, The State University of New Jersey, New Brunswick, NJ, USA

^d Regional Offices, Kaiser Permanente Northern California, Oakland, CA, USA

^e Department of Health Sciences, College of Health Professions, Towson University, Towson, MD, USA

ARTICLE INFO

Keywords:

Preconception
Women
Marijuana
Vaping
Blunts
Edibles

ABSTRACT

Cannabis use among individuals before and during pregnancy is increasing alongside the proliferation of new products with various modes of administration. Preconception cannabis use is a strong predictor of prenatal cannabis use. Yet little is known about how individuals administer cannabis during the preconception period, particularly in socioeconomically vulnerable populations. This study examined the prevalence and correlates of modes of cannabis administration (smoke, vape, blunts, edible/oral, dabs/wax, lotion/topical) during the year before conception, among patients who self-reported preconception cannabis use during universal screening in prenatal care. Descriptive statistics included sociodemographic characteristics, preconception cannabis use frequency, and modes of administration. Chi-square tests examined whether mode was associated with sociodemographic characteristics and use frequency. The sample (N = 11,936, screened from February 2020-May 2021) was 59.8% non-White and 26.1% were < 26 years old; 50.7% reported monthly or less, 21.8% weekly, and 27.4% daily preconception cannabis use; 69.7% smoked (any method), 34.5% smoked blunts, 53.4% used edibles/oral, 28.2% vaped, 9.9% used lotion/topical; 54.2% reported 1 mode, 30.4% reported 2 modes, 15.4% reported 3+ modes. Smoking was more common among daily users, younger patients, those with greater neighborhood deprivation, and Black and Hispanic patients, while edibles/oral were more common among ≤ monthly users, older patients, those with less neighborhood deprivation, and Asian patients. Use of other modes also varied by sociodemographic characteristics and use frequency. Research is needed to understand preconception cannabis use in vulnerable subpopulations, continuation of use during pregnancy, and whether health risks associated with preconception and prenatal cannabis use differ by administration mode.

1. Introduction

The prevalence and frequency of cannabis use among pregnant and non-pregnant individuals of reproductive age has increased in recent years (Agrawal et al., 2019; Brown et al., 2017; Volkow et al., 2019). Cannabis use during pregnancy is associated with potential adverse health effects, and the American College of Obstetrics and Gynecology recommends that individuals who are pregnant or contemplating pregnancy discontinue cannabis use (Committee on Obstetric Practice, 2017). Patterns of substance use tend to develop before pregnancy and

nearly all individuals who report using cannabis during pregnancy also report using prior to pregnancy (Skelton et al., 2021; Young-Wolff et al., 2019). Surveillance of preconception cannabis use is critical given that nearly half of pregnancies in the US are unplanned (Finer & Zolna, 2016), and pregnant individuals are particularly at risk for cannabis use during the first trimester (potentially prior to pregnancy recognition) (Volkow et al., 2017).

The legalization of cannabis has led to the proliferation of new cannabis products with various modes of administration (e.g., vaping, ingestion of edible products, dabbing of highly concentrated cannabis

* Corresponding author at: Research Scientist, Division of Research, Kaiser Permanente Northern California, 2000 Broadway, Oakland, CA 94612, USA.

E-mail address: kelly.c.young-wolff@kp.org (K.C. Young-Wolff).

<https://doi.org/10.1016/j.abrep.2022.100416>

Received 11 January 2022; Received in revised form 14 February 2022; Accepted 20 February 2022

Available online 22 February 2022

2352-8532/© 2022 The Authors.

Published by Elsevier Ltd.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

extracts, and use of lotions/topicals) and is associated with greater preconception cannabis use (Borodovsky et al., 2016; Short et al., 2020; Skelton et al., 2021). The likelihood of quitting cannabis use before pregnancy and the potential adverse health effects to infants exposed to cannabis *in utero* might vary depending on maternal mode or combinations of modes of cannabis administration (Barrington-Trimis et al., 2020; Borodovsky et al., 2016; Newmeyer et al., 2017; Young-Wolff et al., 2020). For example, smoked cannabis and use of concentrates among adolescents have been associated with a higher risk of continued use relative to other modes (Barrington-Trimis et al., 2020), and smoked cannabis may carry the greatest risks due to exposure to carbon monoxide (CO) and other harmful by-products of combustion (Newmeyer et al., 2017). Yet, little is known about the prevalence or correlates of different modes of cannabis administration during or before pregnancy. Previous research indicates that smoking is the most common mode of cannabis administration during pregnancy, followed by use of edibles and vaping (Ko et al., 2020; Young-Wolff et al., 2020). However, data on mode of cannabis administration in the preconception period is limited (Young-Wolff et al., 2020) and studies have not described sociodemographic characteristics associated with specific modes of cannabis administration. Further, the prevalence of some modes may have changed in recent years due to the perception of health risk (e.g. deaths due to e-cigarette, or vaping, product use associated lung injury [EVALI]) and the availability of new cannabis products.

To address this knowledge gap, our study examined correlates of different modes of preconception cannabis use among pregnant patients in Northern California who self-reported preconception cannabis use in 2020 and 2021, during which time cannabis was legal for recreational and medical use. We focused on racial/ethnic differences and associations with neighborhood deprivation, to examine use patterns among potentially under-served populations.

2. Methods

Kaiser Permanente Northern California (KPNC) is a multispecialty healthcare system serving > 4 million members who are representative of the Northern California area. As part of a universal screening for substance use conducted at entrance to prenatal care at KPNC, patients are asked to self-report cannabis use during the 12 months prior to pregnancy. The 66,723 patients who were screened between February 2020 (when mode questions were implemented) and May 2021 were eligible for inclusion. A total of 382 screened patients (0.6%) did not answer the question about preconception cannabis use. Among the 12,596 pregnant individuals who endorsed preconception cannabis use (19% of the sample), the 11,936 (95%) who also reported their mode(s) of administration (smoke, vape, blunts [hollowed out nicotine containing cigar wrappers filled with cannabis], edible/oral, dabs/wax, lotion/topicals) were included. Compared to those who reported mode, the 660 individuals (5%) missing mode differed minimally on sociodemographic characteristics (chi-square p-value > 0.05 for age and race/ethnicity; $p = .02$ for Neighborhood Deprivation Index [NDI] but with small actual differences: 4.2% missing mode among least deprived quartile vs. 5.4% missing mode among most deprived). Age, race/ethnicity and NDI (categorized into quartiles with higher values representing greater deprivation) (Messer et al., 2006) were extracted from the electronic health record. The KPNC Institutional Review Board approved this study and waived consent.

We used descriptive statistics to characterize the sample's socio-demographic characteristics, the prevalence and frequency of preconception cannabis use (daily, weekly, monthly or less), mode of administration, and combinations of the four primary modes (smoke, edible/oral, vape, and dabs/wax). We used chi-square tests to examine whether modes were associated with sociodemographic characteristics and cannabis use frequency. Analyses were conducted using SAS version 9.4.

3. Results

The sample ($N = 11,936$) was 59.8% non-White and 26.1% were under 26 years old; 50.7% reported monthly or less, 21.8% weekly, and 27.4% daily preconception cannabis use (Table 1). In terms of modes of administration, 69.7% smoked (any method), 34.5% smoked blunts, 53.4% used edibles/oral, 28.2% vaped, and 9.9% used lotion/topicals (Table 1); 54.2% reported one mode, 30.4% reported two modes, 11.6% reported three modes, and 3.8% reported four modes (Fig. 1). Smoking only (no other modes) was most common (29.4%) followed by edibles only (19.1%), smoking and edibles (16.6%), smoking, edibles, and vaping (7.1%) and smoking and vaping (6.4%).

Younger patients were more likely to smoke (any method), smoke blunts, use dabs/wax, and they had a greater number of administration modes, while older patients were more likely to report using edibles/oral and lotion/topicals (Table 1). Smoking (any method) was most common among Hispanic and Black patients and least common among Asian patients, while smoking blunts was most common among Black patients and least common among non-Hispanic White patients. Edibles/oral were most common among Asian patients and least common among Hispanic and Black patients. Black patients were less likely to vape and Hispanic patients were more likely to use dabs/wax than other groups. Use of lotion/topicals was least common among Black and Asian patients. Finally, Hispanic patients were the most likely and Black patients were the least likely to report more than one mode of administration.

Patients with greater neighborhood deprivation were more likely to smoke (any method), smoke blunts, and use dabs/wax, and less likely to use edibles/oral or vape. Daily preconception cannabis users were more likely to smoke (any method), smoke blunts, vape, use dabs/wax, use lotion/topicals, and use > 1 mode, while monthly or less cannabis users were more likely to use edibles/oral.

4. Discussion

Examination and surveillance of cannabis use practices and modes of administration before pregnancy is an essential aspect of prevention. Using data from a large healthcare delivery system with routine preconception cannabis use screening, we found substantial variation in preconception use and co-use of different cannabis administration modes among patients who self-reported use. While smoking was the most commonly endorsed mode, more than half of individuals with preconception cannabis use reported using edibles, more than a quarter reported vaping, 12% reported using high potency concentrates (dabs/wax), and 10% reported using lotions/topicals. The prevalence of different modes of cannabis in our sample was similar to findings on modes of past-year cannabis administration in a nationally representative US sample of adult women (Steigerwald et al., 2018) with a slightly lower prevalence of smoking and higher prevalence of edible use in the current study.

The proliferation of cannabis administration options in the context of recreational legalization may entail evolving yet rarely studied risks to individuals who are pregnant or contemplating pregnancy (Skelton et al., 2021). In our sample of patients who reported preconception cannabis use in Northern California where cannabis is legal for medical and recreational use, more than a quarter reported using daily and use of more than one mode was common. Notably, daily cannabis users were more likely to report each mode of administration and had a greater number of modes of administration than less frequent users, with the exception that daily users were less likely to use edibles. Based on studies in other populations, edibles are perceived to be less harmful than other modalities (Giombi et al., 2018) and they may be the modality of choice for those who use cannabis on specific occasions (e.g., with friends or at social events) and for reasons of discretion (Reboussin et al., 2019). However, additional research is needed to better understand the higher prevalence of edibles among individuals

Table 1
 Mode of Cannabis Administration Among 11,936 Patients in Kaiser Permanente Northern California Who Self-Reported Cannabis Use in the Year Before Pregnancy, Overall and by Socio-Demographics.

	N (col %)	Mode of cannabis administration, N (row %) ^a						> 1 mode ^d , N (row %)
		Smoke (any method) ^b	Smoke blunts ^c	Edible/oral	Vape	Dabs/wax	Lotion/topicals	
Overall	11,936 (100)	8321 (69.7)	4121 (34.5)	6417 (53.8)	3366 (28.2)	1413 (11.8)	1178 (9.9)	5417 (45.4)
Age categories								
13–20	699 (5.9)	650 (93.0)	516 (73.8)	257 (36.8)	190 (27.2)	243 (34.8)	38 (5.4)	387 (55.4)
21–25	2413 (20.2)	2044 (84.7)	1392 (57.7)	1014 (42.0)	616 (25.5)	576 (23.9)	180 (7.5)	1184 (49.1)
26–34	6536 (54.8)	4364 (66.8)	1879 (28.7)	3667 (56.1)	1924 (29.4)	521 (8.0)	693 (10.6)	2928 (44.8)
>34	2288 (19.2)	1263 (55.2)	334 (14.6)	1479 (64.6)	636 (27.8)	73 (3.2)	267 (11.7)	918 (40.1)
P-value ^e		<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
Race/ethnicity								
Hispanic	3339 (28.0)	2568 (76.9)	1507 (45.1)	1612 (48.3)	986 (29.5)	591 (17.7)	350 (10.5)	1625 (48.7)
Black	1569 (13.1)	1341 (85.5)	987 (62.9)	658 (41.9)	256 (16.3)	155 (9.9)	118 (7.5)	629 (40.1)
Asian/Pacific Islander	1473 (12.3)	843 (57.2)	434 (29.5)	943 (64.0)	472 (32.0)	104 (7.1)	117 (7.9)	651 (44.2)
Other/unknown	755 (6.3)	524 (69.4)	269 (35.6)	427 (56.6)	222 (29.4)	81 (10.7)	90 (11.9)	351 (46.5)
Non-Hispanic White	4800 (40.2)	3045 (63.4)	924 (19.3)	2777 (57.9)	1430 (29.8)	482 (10.0)	503 (10.5)	2161 (45.0)
P-value ^e		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Neighborhood Deprivation Index ^f								
Q1 – least deprived	2579 (21.7)	1461 (56.6)	480 (18.6)	1690 (65.5)	794 (30.8)	155 (6.0)	245 (9.5)	1146 (44.4)
Q2	2858 (24.0)	1912 (66.9)	825 (28.9)	1601 (56.0)	846 (29.6)	308 (10.8)	300 (10.5)	1314 (46.0)
Q3	2997 (25.2)	2182 (72.8)	1111 (37.1)	1494 (49.8)	837 (27.9)	409 (13.6)	304 (10.1)	1353 (45.1)
Q4 – most deprived	3470 (29.1)	2742 (79.0)	1696 (48.9)	1613 (46.5)	879 (25.3)	537 (15.5)	322 (9.3)	1587 (45.7)
P-value ^e		<0.001	<0.001	<0.001	<0.001	<0.001	0.35	0.66
Frequency of use								
Monthly or less	6057 (50.7)	3343 (55.2)	1357 (22.4)	3460 (57.1)	1400 (23.1)	206 (3.4)	526 (8.7)	2032 (33.5)
Weekly	2603 (21.8)	1992 (76.5)	889 (34.2)	1376 (52.9)	801 (30.8)	282 (10.8)	268 (10.3)	1351 (51.9)
Daily	3276 (27.4)	2986 (91.1)	1875 (57.2)	1581 (48.3)	1165 (35.6)	925 (28.2)	384 (11.7)	2034 (62.1)
P-value ^e		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

^a Row percentages do not sum to 100 because more than one mode of administration can be reported.

^b Smoke (using any method) includes all ways of smoking (e.g., joints, bong, pipes, blunts, etc.).

^c If a patient reported blunt use, they were also coded as smoking using any method.

^d More than one mode refers to more than one of the following four primary routes: Smoke (any method), edible/oral, vape, and dabs/wax.

^e P-value are Chi-Square.

^f Patients with missing Neighborhood Deprivation Index were excluded (n = 32).

who use cannabis less frequently.

The high prevalence of blunt smoking among individuals with pre-conception cannabis use (35%) warrants special attention as tobacco is known to adversely affect maternal and fetal health (U.S. Department of Health and Human Services & Office of the Surgeon General, 2002). Co-use of cannabis and tobacco (versus cannabis alone) is associated with greater risk for cannabis use disorders and ongoing long-term cannabis use (Ko et al., 2020; Peters et al., 2012). National data indicate that rates of blunt smoking are increasing over time among reproductive-aged women, and continued surveillance of blunt use in this population is important (Coleman-Cowger et al., 2018). In addition, in clinical settings these individuals could potentially be targeted for additional assistance in quitting cannabis use during pregnancy.

Our study provides the first estimates of characteristics associated with different modes of preconception cannabis administration. Results suggest that mode of administration may be a proxy for socioeconomic status, with smoking and blunt use being more common among populations who face more structural disadvantages (e.g., those with greater neighborhood deprivation, younger patients, and Black and Hispanic patients) and use of edibles and vaping being more common among

those who face fewer structural disadvantages (e.g., those with less neighborhood deprivation, older patients). Future qualitative studies are needed to investigate how price, social, cultural and demographic factors influence individuals' choices about how to administer cannabis, reasons for use, and understanding of health risks.

Individuals tend to develop their substance use patterns prior to pregnancy, and preconception use of cannabis is among the strongest predictors of prenatal cannabis use (Skeltan & Benjamin-Neelon, 2021). Although the psychoactive effects, health risks, and timing and duration of peak effects vary with mode of cannabis administration (Borodovsky et al., 2016; Newmeyer et al., 2017), it is unknown whether the likelihood of quitting cannabis use prior to pregnancy, or the potential adverse health effects to infants exposed to cannabis *in utero* vary depending on maternal mode or combinations of modes of cannabis administration. These questions warrant further investigation. As the diversity of products on the market continues to increase, surveillance of how individuals administer cannabis before and during pregnancy will be critical to inform clinical guidance, public policy and prevention and intervention strategies across diverse populations for reducing harms associated with cannabis use.

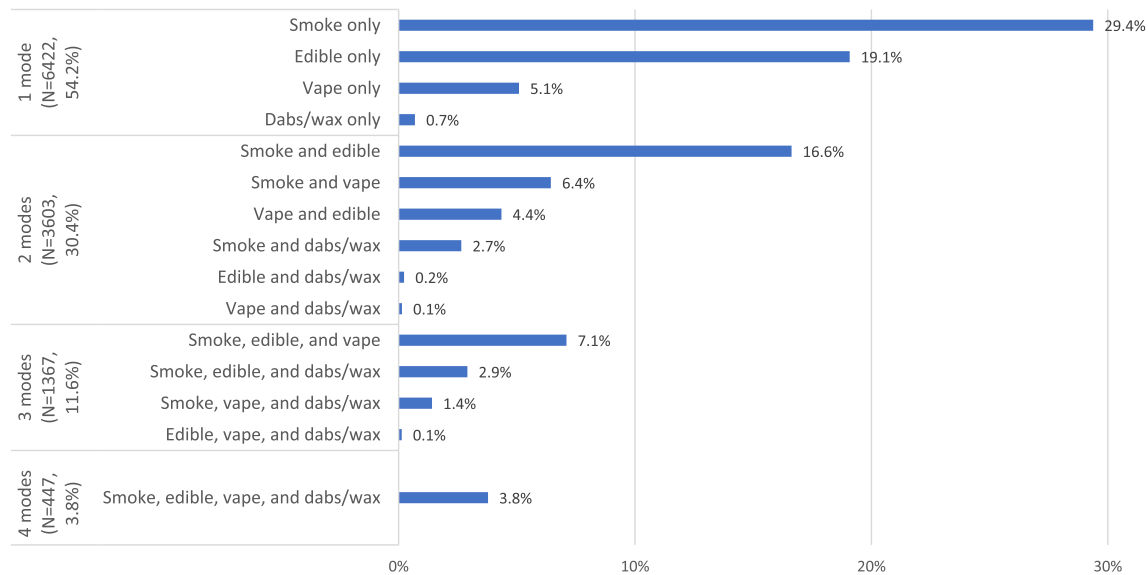


Fig. 1. Number and Combinations of Modes of Cannabis Administration Among 11,839 Patients in Kaiser Permanente Northern California Who Self-Reported Cannabis Use in the Year Before Pregnancy*. * Number of modes includes the following four primary routes: smoke-any, edible/oral, vape, and dabs/wax. Among the 11,936 patients who self-reported cannabis use and mode of administration, 97 patients reported lotion/topicals as their only mode of administration and were excluded.

5. Strengths and limitations

This study is the first to our knowledge to examine factors associated with modes of cannabis administration during the preconception period, including race/ethnicity and levels of neighborhood deprivation, and it employed a very large and diverse sample. However, the sample included patients seeking prenatal care within a large, multispecialty healthcare system in California where cannabis is legal for medical and recreational use, and findings may not generalize to individuals in other states. Further, preconception cannabis use was based on retrospective self-report, we did not have data on reasons for use, and we were unable to ascertain frequency specific to each mode of cannabis administration. Finally, this short communication was designed as a descriptive overview of preconception cannabis modes of administration, and multi-variable analyses were not conducted.

6. Conclusions

Clinicians and healthcare systems should recognize that cannabis use in the period leading up to pregnancy is not limited to smoking and that modes of administration are associated with differences in frequency of use as well as patient sociodemographic characteristics. Health system and public health strategies aimed at understanding and reducing preconception and prenatal cannabis use should include all forms of cannabis use. Future educational efforts may need to be tailored to particular age groups, racial/ethnic groups, and neighborhoods with different preferred modes of administration. Additional research is needed to understand whether the likelihood of quitting cannabis use before pregnancy and the health risks to infants exposed to cannabis *in utero* vary depending on maternal mode(s) of cannabis administration.

7. Contributions

All authors contributed substantially to this work. KYW, QB and SA designed the study. KYW drafted the manuscript and guided interpretation of the results. SA led the data extraction, analysis and edited the paper. All other authors assisted in study design and with editing of the paper.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Agrawal, A., Rogers, C. E., Lessov-Schlaggar, C. N., Carter, E. B., Lenze, S. N., & Gruzca, R. A. (2019). Alcohol, cigarette, and cannabis use between 2002 and 2016 in pregnant women from a nationally representative sample. *JAMA Pediatrics*, 173(1), 95–96. <https://doi.org/10.1001/jamapediatrics.2018.3096>
- Barrington-Trimis, J. L., Cho, J., Ewusi-Boisvert, E., Hasin, D., Unger, J. B., Miech, R. A., & Leventhal, A. M. (2020). Risk of persistence and progression of use of 5 cannabis products after experimentation among adolescents. *JAMA Network Open*, 3(1), Article e1919792. <https://doi.org/10.1001/jamanetworkopen.2019.19792>
- Borodovsky, J. T., Crosier, B. S., Lee, D. C., Sargent, J. D., & Budney, A. J. (2016). Smoking, vaping, eating: Is legalization impacting the way people use cannabis? *International Journal of Drug Policy*, 36, 141–147. <https://doi.org/10.1016/j.drugpo.2016.02.022>
- 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. <https://doi.org/10.1001/jama.2016.17383>
- Coleman-Cowger, V. H., Pickworth, W. B., Lordo, R. A., & Peters, E. N. (2018). Cigar and marijuana blunt use among pregnant and nonpregnant women of reproductive age in the United States, 2006–2016. *American Journal of Public Health*, 108(8), 1073–1075. <https://doi.org/10.2105/AJPH.2018.304469>
- Committee on Obstetric Practice. (2017). Committee Opinion No. 722: Marijuana use during pregnancy and lactation. *Obstetrics and Gynecology*, 130(4), e205–e209. <https://doi.org/10.1097/AOG.0000000000002354>
- Finer, L. B., & Zolna, M. R. (2016). Declines in unintended pregnancy in the United States, 2008–2011. *New England Journal of Medicine*, 374(9), 843–852. <https://doi.org/10.1056/NEJMsa1506575>
- Giombi, K. C., Kosa, K. M., Rains, C., & Cates, S. C. (2018). Consumers' perceptions of edible marijuana products for recreational use: Likes, dislikes, and reasons for use. *Substance Use and Misuse*, 53(4), 541–547. <https://doi.org/10.1080/10826084.2017.1343353>
- Ko, J. Y., Coy, K. C., Haight, S. C., Haegerich, T. M., Williams, L., Cox, S., ... Grant, A. M. (2020). Characteristics of marijuana use during pregnancy - eight states, Pregnancy Risk Assessment Monitoring System, 2017. *MMWR Morbidity and Mortality Weekly Report*, 69(32), 1058–1063. <https://doi.org/10.15585/mmwr.mm6932a2>
- Messer, L. C., Laraia, B. A., Kaufman, J. S., Eyster, J., Holzman, C., Culhane, J., ... O'Campo, P. (2006). The development of a standardized neighborhood deprivation index. *Journal of Urban Health*, 83(6), 1041–1062. <https://doi.org/10.1007/s11524-006-9094-x>
- Newmeyer, M. N., Swortwood, M. J., Abulseoud, O. A., & Huestis, M. A. (2017). Subjective and physiological effects, and expired carbon monoxide concentrations in frequent and occasional cannabis smokers following smoked, vaporized, and oral

- cannabis administration. *Drug and Alcohol Dependence*, 175, 67–76. <https://doi.org/10.1016/j.drugalcdep.2017.02.003>
- Peters, E. N., Budney, A. J., & Carroll, K. M. (2012). Clinical correlates of co-occurring cannabis and tobacco use: A systematic review. *Addiction*, 107(8), 1404–1417. <https://doi.org/10.1111/j.1360-0443.2012.03843.x>
- Reboussin, B. A., Wagoner, K. G., Sutfin, E. L., Suerken, C., Ross, J. C., Egan, K. L., ... Johnson, R. M. (2019). Trends in marijuana edible consumption and perceptions of harm in a cohort of young adults. *Drug and Alcohol Dependence*, 205, Article 107660. <https://doi.org/10.1016/j.drugalcdep.2019.107660>
- Short, V. L., Hand, D. J., Gannon, M., & Abatemarco, D. J. (2020). Maternal characteristics associated with preconception marijuana use. *American Journal of Preventive Medicine*, 59(4), 555–561. <https://doi.org/10.1016/j.amepre.2020.04.010>
- Skelton, K. R., & Benjamin-Neelon, S. E. (2021). Characteristics associated with prenatal cannabis use vary with legality of recreational cannabis. *J. Womens Health (Larchmt)*, 30(11), 1565–1572. <https://doi.org/10.1089/jwh.2021.0155>
- Skelton, K. R., Hecht, A. A., & Benjamin-Neelon, S. E. (2021). Association of recreational cannabis legalization with maternal cannabis use in the preconception, prenatal, and postpartum periods. *JAMA Network Open*, 4(2), e210138. <https://doi.org/10.1001/jamanetworkopen.2021.0138>
- Steigerwald, S., Wong, P. O., Cohen, B. E., Ishida, J. H., Vali, M., Madden, E., & Keyhani, S. (2018). Smoking, vaping, and use of edibles and other forms of marijuana among U.S. adults. *Annals of Internal Medicine*, 169(12), 890–892. <https://doi.org/10.7326/M18-1681>
- U.S. Department of Health and Human Services, & Office of the Surgeon General. (2002). Women and smoking: a report of the Surgeon General. Executive summary. *MMWR Recommendations and Reports*, 51(RR-12), i-iv; 1-13. <https://www.ncbi.nlm.nih.gov/pubmed/12222832>
- Volkow, N. D., Han, B., Compton, W. M., & Blanco, C. (2017). Marijuana use during stages of pregnancy in the United States. *Annals of Internal Medicine*, 166(10), 763–764. <https://doi.org/10.7326/L17-0067>
- Volkow, N. D., Han, B., Compton, W. M., & McCance-Katz, E. F. (2019). Self-reported medical and nonmedical cannabis use among pregnant women in the United States. *JAMA*, 322(2), 167–169. <https://doi.org/10.1001/jama.2019.7982>
- Young-Wolff, K. C., Adams, S. R., Wi, S., Weisner, C., & Conway, A. (2020). Routes of cannabis administration among females in the year before and during pregnancy: Results from a pilot project. *Addictive Behaviors*, 100, Article 106125. <https://doi.org/10.1016/j.addbeh.2019.106125>
- Young-Wolff, K. C., Sarovar, V., Tucker, L. Y., Conway, A., Alexeeff, S., Weisner, C., ... Goler, N. (2019). Self-reported daily, weekly, and monthly cannabis use among women before and during pregnancy. *JAMA Network Open*, 2(7), Article e196471. <https://doi.org/10.1001/jamanetworkopen.2019.6471>