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# Breastfeeding Initiation and Continuation Among Women with Substance and Tobacco Use During Pregnancy: Findings from the Pregnancy Risk Assessment Monitoring System 2016–2018

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## Abstract

**Background and Aims:** Substance and tobacco use is associated with poor maternal and child health outcomes. Although these have each been linked to lower breastfeeding rates when examined separately, studies have yet to examine how the combination of tobacco and other substance use influences breastfeeding initiation and continuation. The aim of this study was to examine how the combination of smoking tobacco and use of illicit substances influences the odds of breastfeeding initiation and continuation.

**Materials and Methods:** This retrospective cohort study ( $n=15,634$ ) used survey data from the 2016–2018 Centers for Disease Control and Prevention (CDC) Pregnancy Risk Assessment Monitoring System from eight US states to examine the association of tobacco and illicit substance use with breastfeeding initiation and continuation ( $\geq 6$  weeks). The odds of breastfeeding initiation and continuation for individuals with and without prenatal tobacco and illicit substance use, adjusting for maternal and infant characteristics, were estimated using weighted, multivariable logistic regression models.

**Results:** The combination of prenatal tobacco and illicit substance use was associated with a 42% reduction in the odds of initiating breastfeeding (adjusted odds ratio [aOR] 0.58 [95% confidence interval, CI 0.39–0.87]) and a 39% reduction in the odds of breastfeeding for at least 6 weeks (aOR 0.61 [95% CI 0.41–0.92]) when compared with those without tobacco and substance use.

**Conclusion:** The odds of breastfeeding initiation and continuation are significantly lower among individuals with both prenatal tobacco and illicit substance use. Future studies are needed to identify barriers to breastfeeding within this population, to inform patient-centered interventions aimed at overcoming these barriers.

**Keywords:** substance use, breastfeeding, tobacco, maternal child health

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## Introduction

**P**RENATAL SUBSTANCE USE, including tobacco use, is a significant public health challenge that is associated with poor maternal and child health outcomes.<sup>1–3</sup> In the United States, up to 17% of pregnant people smoke tobacco cigarettes, 6% use illicit substances, and 5% use multiple substances (polysubstance use).<sup>4–6</sup> Polysubstance use among pregnant people often includes tobacco and another substance, such as cannabis.<sup>7</sup> Studies have consistently demonstrated that people who used tobacco products in the perinatal time period are significantly less likely than their peers to breastfeed their newborns.<sup>8</sup> Similarly, prior research, with the exception of one study, has demonstrated that people with either cannabis or opioid use had lower breastfeeding initiation rates and shorter duration of breastfeeding when compared with their peers without these exposures.<sup>9</sup>

Although tobacco and illicit substance use have each been linked to lower breastfeeding rates when examined separately, population-based studies have yet to examine how the combination of tobacco smoking and illicit substance use influences breastfeeding initiation and continuation. Therefore, the objective of this study was to determine the extent to which people with both illicit substance use and tobacco smoking during pregnancy initiate breastfeeding and continue through at least 6 weeks postpartum compared with those without these exposures during pregnancy. We hypothesized that people with illicit substance use and tobacco smoking during pregnancy would be less likely to initiate breastfeeding and less likely to sustain breastfeeding at least 6 weeks postpartum than their peers who did not use tobacco or other substances.

## Materials and Methods

Data from the Centers for Disease Control and Prevention (CDC)-funded Pregnancy Risk Assessment Monitoring System (PRAMS) 2016–2018 survey were used to create the analytic dataset for this study. Approximately 1,300–3,400 postpartum individuals from each PRAMS state are enrolled annually based on stratified sampling methods using birth certificate data. All participating states administer the core questionnaire, and a subset of states administers additional state-specific questionnaires using CDC and/or state-developed questions.<sup>10</sup> Individuals with data on substance use during pregnancy and breastfeeding were eligible for this study. Individuals were excluded if not living with their infant or if their infant was not alive at the time of interview. Due to the deidentified nature of this dataset, this study was deemed exempt by the Institutional Review Board.

Breastfeeding initiation and continuation were the main outcomes of interest for this study. Breastfeeding initiation (yes/no) was based on data drawn from the birth certificate. Breastfeeding continuation was defined as breastfeeding for at least 6 weeks postpartum. A binary continuation variable was based on two PRAMS variables. First, individuals were asked, “Are you currently breastfeeding or feeding pumped milk to your new baby?” If their response was no, then they were asked “How many weeks did you breastfeed or feed pumped milk to your baby?” If individuals reported they were currently breastfeeding, then the duration of breastfeeding was based on the age of their infant at the time of survey completion.

All individuals in this study were surveyed at least 6 weeks postpartum. Individuals who reported <6 weeks of breastfeeding were coded as no for the breastfeeding continuation variable.

The combination of illicit substance use and tobacco smoking during pregnancy was the primary predictor variable for this study. Tobacco smoking during pregnancy was based on birth certificate data available within the PRAMS survey. Individuals who self-reported the use of marijuana, heroin, cocaine, and/or amphetamines based on the following PRAMS question, “Did you use any of these drugs when you were pregnant?” were considered to have used an illicit substance during pregnancy. A four-level categorical variable was created to classify the following types of substance use during pregnancy: (1) the combination of illicit substance use and tobacco smoking, (2) illicit substance use alone, (3) tobacco smoking alone, and (4) neither smoking tobacco nor illicit substance use.

Race; ethnicity; maternal age at delivery; maternal education; marital status; insurance type; Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) enrollment; state; rural residence; nulliparity; partner abuse; depression; gestational high blood pressure; gestational diabetes; body mass index; and low birth weight/preterm birth were extracted from PRAMS survey data and included as covariates in this study.

## Analyses

Weighted Rao-Scott Chi-Square tests were used to examine the association between maternal and infant characteristics and breastfeeding initiation. Unadjusted and adjusted weighted logistic regression models were used to estimate the extent to which combinations of illicit substance use and tobacco smoking affected the odds of breastfeeding initiation and continuation. Based on prior literature, adjusted models included the following covariates: race, ethnicity, maternal age at delivery, maternal education, marital status, insurance type, WIC enrollment, state, rural residence, nulliparity, partner abuse, depression, gestational high blood pressure, gestational diabetes, body mass index, and low birth weight/preterm birth.<sup>11,12</sup>

Guidance related to breastfeeding differs by substance<sup>13</sup>; therefore, in unadjusted sensitivity analyses we examined the odds of breastfeeding initiation and continuation by each substance alone (tobacco smoking, heroin, amphetamines, cocaine, marijuana). PRAMS survey weights were included in all analyses to account for PRAMS complex survey design. All analyses were completed in SAS 9.4.<sup>14</sup>

## Results

A total of 108,110 individuals were included in the 2016–2018 PRAMS survey. Kansas, Kentucky, Missouri, Montana, North Dakota, South Dakota, Wisconsin, and West Virginia included survey questions related to illicit substance use during pregnancy and breastfeeding ( $n = 16,947$ ). Among participants from these states, 15,987 had data on illicit substance use during pregnancy and breastfeeding initiation and continuation data. After excluding individuals who were not living with their infant or whose infant was not alive at the time of interview, 15,634 individuals were included in this study (weighted  $n = 626,970$ ). Of these, 13,060 initiated

TABLE 1. ASSOCIATION OF MATERNAL AND INFANT CHARACTERISTICS WITH BREASTFEEDING INITIATION

<i>Variable</i>	<i>Weighted frequency</i>	<i>Did not breastfeed (weighted %)</i>	<i>Initiated breastfeeding (weighted %)</i>
<b>Race and ethnicity<sup>a</sup></b>			
Hispanic	43,373	9.00	91.00
Non-Hispanic American Indian	7,790	24.14	75.86
Non-Hispanic Asian	17,572	14.14	85.86
Non-Hispanic Black	58,222	22.34	77.66
Non-Hispanic Mixed Race	17,279	14.73	85.27
Non-Hispanic Other	3,405	2.95	97.05
Non-Hispanic White	473,702	13.85	86.15
<b>Maternal age<sup>a</sup></b>			
<20 Years	33,866	22.72	77.28
20–29 Years	328,706	15.80	84.20
30–39 Years	247,963	11.42	88.58
≥40 Years	12,691	15.74	84.26
<b>Marital status<sup>a</sup></b>			
Married	390,479	9.31	90.69
Not married	232,504	22.97	77.03
<b>Participation in WIC during pregnancy<sup>a</sup></b>			
Yes	213,901	24.02	75.98
No	402,565	9.30	90.70
<b>Maternal insurance<sup>a</sup></b>			
Medicaid	144,549	26.62	73.38
No insurance	77,567	17.32	82.68
Other	36,439	11.30	88.70
Private	357,959	9.06	90.94
<b>Maternal education<sup>a</sup></b>			
< High school	65,604	29.50	70.50
High school	165,939	22.92	77.08
> High school	389,408	8.30	91.70
<b>Geographic region<sup>a</sup></b>			
Urban	419,052	13.36	86.64
Rural	204,092	16.63	83.37
<b>Nulliparity<sup>a</sup></b>			
No	393,503	16.51	83.49
Yes	228,945	10.89	89.11
<b>Partner abuse before/during pregnancy<sup>b</sup></b>			
No	611,926	14.27	85.73
Yes	7,910	22.14	77.86
<b>Perinatal depression<sup>a</sup></b>			
No	584,863	14.02	85.98
Yes	37,975	20.58	79.42
<b>Year of delivery</b>			
2016	141,611	14.79	85.21
2017	247,034	14.45	85.55
2018	234,582	14.19	85.81
<b>State<sup>a</sup></b>			
Kansas	64,411	9.35	90.65
Kentucky	92,462	19.61	80.39
Missouri	195,414	14.61	85.39
Montana	10,933	6.22	93.78
North Dakota	19,638	11.99	88.01
South Dakota	21,485	9.25	90.75
Wisconsin	172,997	11.63	88.37
West Virginia	45,887	26.35	73.65
<b>Exposed (illicit substance use and tobacco smoking)<sup>a</sup></b>			
Not exposed	525,982	11.57	88.43
Illicit substance only	17,426	17.49	82.51
Tobacco smoking only	64,555	33.19	66.81
Tobacco smoking + illicit substance	15,264	30.13	69.87

(continued)

TABLE 1. (CONTINUED)

Variable	Weighted frequency	Did not breastfeed (weighted %)	Initiated breastfeeding (weighted %)
Tobacco smoking during pregnancy <sup>a</sup>			
No	543,407	11.76	88.24
Yes	79,819	32.61	67.39
Cannabis use during pregnancy <sup>a</sup>			
No	592,766	14.00	86.00
Yes	30,461	22.85	77.15
Cocaine use during pregnancy <sup>b</sup>			
No	620,555	14.37	85.63
Yes	2,623	29.19	70.81
Amphetamine use during pregnancy <sup>b</sup>			
No	619,152	14.33	85.67
Yes	4,010	29.34	70.66
Heroin use during pregnancy <sup>c</sup>			
No	620,940	14.42	85.58
Yes	2,226	17.48	82.52
Gestational diabetes <sup>b</sup>			
Yes	43,685	18.07	81.93
No	578,076	14.09	85.91
Hypertension during pregnancy <sup>b</sup>			
Yes	58,195	18.61	81.39
No	563,567	13.93	86.07
Maternal body mass index <sup>a</sup>			
Underweight (<18.5)	47,712	16.73	83.27
Normal (18.5–24.9)	269,717	11.96	88.04
Overweight (25.0–29.9)	87,812	14.38	85.62
Obese (30.0+)	202,154	16.70	83.30
Preterm birth and/or low birth weight <sup>c</sup>			
No	556,749	14.09	85.91
Yes	622,725	17.30	82.70

Total weighted sample size = 622,496 (column totals not equal to 622,496 indicate missing data). Total unweighted sample size = 15,542.

<sup>a</sup> $p < 0.001$ , <sup>b</sup> $p < 0.05$ , <sup>c</sup> $p < 0.01$ .

WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

breastfeeding and were included in the analysis of breastfeeding continuation (weighted  $n = 533,292$ ). The associations between maternal characteristics and breastfeeding initiation are summarized in Table 1. Of note, demographic factors, such as younger age, enrollment in WIC, and public insurance, were associated with not initiating breastfeeding.

#### Breastfeeding initiation

In the unadjusted analysis, individuals with both tobacco smoking and illicit substance use (odds ratio [OR] 0.30, 95% confidence interval [CI] 0.21–0.43), those who only smoked tobacco (OR 0.26, 95% CI 0.22–0.31), and those who only used illicit substances (OR 0.62, 95% CI: 0.43–0.88) had lower odds of initiating breastfeeding than their peers who neither smoked tobacco nor used illicit substances during pregnancy. In the final model, after adjusting for maternal and infant characteristics, the combination of smoking and substance use (OR 0.58, 95% CI 0.39–0.87) and tobacco use alone (OR 0.53, 95% CI 0.43–0.65) were associated with a decrease in the odds of breastfeeding initiation. Results are summarized in Table 2.

In sensitivity analyses by substance use type, smoking tobacco during pregnancy was associated with the greatest

decrease in the odds of breastfeeding initiation (OR: 0.28, 95% CI 0.23–0.32) followed by use of amphetamines (OR 0.39, 95% CI 0.21–0.72) and marijuana (OR 0.55, 95% CI 0.42–0.72).

#### Breastfeeding continuation

When examining the association between tobacco smoking and substance use during pregnancy and continuation of breastfeeding at least 6 weeks, the results were similar to those observed with breastfeeding initiation. In the unadjusted model, among individuals who initiated breastfeeding, those who smoked tobacco (OR 0.35, 95% CI 0.29–0.43) and individuals who used a combination of tobacco and substances (OR 0.36, 95% CI 0.24–0.52) were less likely to continue breastfeeding for at least 6 weeks when compared with their peers who did not have this exposure. After adjusting the model for maternal and infant characteristics, tobacco smoking alone (OR 0.58, 95% CI 0.46–0.73) and the combination of tobacco and illicit substance use (OR 0.61, 95% CI 0.41–0.92) were associated with a 40–42% decrease in the odds of continuing to breastfeed for at least 6 weeks, when compared with peers who neither smoked nor used illicit substances.

TABLE 2. ODDS OF BREASTING INITIATION AND CONTINUATION BY TOBACCO AND SUBSTANCE USE DURING PREGNANCY

	<i>Breastfeeding initiation</i>		<i>Breastfeeding continuation</i>	
	<i>Model 1 OR (95% CI)</i>	<i>Model 2 aOR (95% CI)</i>	<i>Model 3 OR (95% CI)</i>	<i>Model 4 aOR (95% CI)</i>
Smoking and substance use during pregnancy				
Illicit substance versus none	0.62 (0.43–0.88) <sup>a</sup>	0.79 (0.53–1.16)	0.85 (0.61–1.19)	1.23 (0.84–1.81) <sup>b</sup>
Smoke only versus none	0.26 (0.22–0.31) <sup>b</sup>	0.53 (0.43–0.65) <sup>b</sup>	0.35 (0.29–0.43) <sup>b</sup>	0.58 (0.46–0.73) <sup>b</sup>
Smoke and illicit substance versus none	0.30 (0.21–0.43) <sup>b</sup>	0.58 (0.39–0.87) <sup>a</sup>	0.36 (0.24–0.52) <sup>b</sup>	0.61 (0.41–0.92) <sup>c</sup>

Models 1 and 3: Unadjusted. Models 2 and 4: Adjusted for race, ethnicity, maternal age at delivery, maternal education, marital status, insurance type, WIC enrollment, state, rural residence, nulliparous, partner abuse, depression, gestational high blood pressure, gestational diabetes, body mass index, low birth weight/preterm birth.

<sup>a</sup> $p < 0.01$ , <sup>b</sup> $p < 0.001$ , <sup>c</sup> $p < 0.05$ .

aOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

In unadjusted sensitivity analyses by type of substance, tobacco smoking during pregnancy was associated with the greatest decrease in the odds of continuing to breastfeed (OR: 0.22, 95% CI 0.18–0.26), followed by amphetamines (OR: 0.41, 95% CI 0.20, 0.86) and cannabis (OR 0.37, 95% CI 0.28–0.47). These results are shown in Table 3.

## Discussion

Findings from this study demonstrate that individuals who use a combination of tobacco and other substances during pregnancy were less likely to initiate breastfeeding and continue breastfeeding for at least 6 weeks after delivery when compared with their peers without use. In sensitivity analyses, we found that breastfeeding outcomes varied by type of substance used, with tobacco smoking, amphetamine, and marijuana use associated with the lowest odds of breastfeeding initiation and continuation.

Although it is well established that people who smoke during pregnancy are less likely to breastfeed than those who do not smoke, due to recommendations to encourage breastfeeding among those who smoke and to discourage breastfeeding among people who use illicit substances, we had anticipated substance use would have a greater effect on the odds of breastfeeding initiation and continuation than tobacco.

On the contrary, our analysis shows a greater effect of tobacco use alone than substance use alone. A possible explanation could be underreporting of illicit substance use. Due to stigma associated with substance use during pregnancy, pregnant people are particularly likely to underreport their use, and in this study, substance use was self-reported. Underreporting of use would bias the results toward the null, as those with actual substance use would be misclassified as no substance use.

Future studies are needed to examine predictors of breastfeeding among people who used tobacco and illicit substances during pregnancy. Broad guidelines that recommend against breastfeeding among those who use illicit substances may partially explain the lower odds of breastfeeding among those who reported substance use. However, this does not explain the association between tobacco use and breastfeeding, as overall, this population is encouraged to breastfeed. Furthermore, some organizations, such as the Academy of Breastfeeding Medicine (ABM), provide guidance by specific substances and do not consider cannabis a contradiction to breastfeeding, citing lack of evidence that exposure to marijuana through breast milk leads to poor child health outcomes. Despite this, we found evidence that the odds of initiating and continuing breastfeeding for individuals using marijuana were similar to those using other types of drugs.

This study represents one of the first to examine the effect of the combination of tobacco and illicit substance use on the odds of breastfeeding initiation and continuation rates in a multistate, population-based sample. PRAMS included data on multiple types of illicit substances and important confounders, which improved our ability to examine these relationships. Despite these strengths, there are important limitations to consider when interpreting the results of this study. Due to limitations of the dataset, we were not able to account for all substances, including alcohol and opioids other than heroin, as these data are not available for many of the survey respondents. Furthermore, both substance use and breastfeeding continuation variables were based on self-reported data, increasing the risk of recall and social desirability bias.

## Conclusion

People with perinatal smoking and/or other substance use are at increased risk of not initiating breastfeeding and of early breastfeeding cessation. Future studies are needed to

TABLE 3. THE ODDS OF BREASTFEEDING INITIATION AND CONTINUATION BY SUBSTANCE TYPE

	<i>OR for breastfeeding initiation (95% CI)</i>	<i>OR for breastfeeding continuation (95% CI)</i>
Tobacco versus no smoking	0.28 (0.23–0.32) <sup>a</sup>	0.22 (0.18–0.26) <sup>a</sup>
Heroin use versus no heroin use	0.80 (0.34–1.87)	0.55 (0.22–1.38)
Amphetamine use versus no amphetamine	0.40 (0.23–0.75) <sup>b</sup>	0.41 (0.20–0.86) <sup>c</sup>
Cocaine use versus no cocaine	0.41 (0.17–1.01)	0.42 (0.17–1.05)
Marijuana versus no marijuana use	0.55 (0.42–0.72) <sup>a</sup>	0.37 (0.28–0.47) <sup>a</sup>

<sup>a</sup> $p < 0.001$ , <sup>b</sup> $p < 0.01$ , <sup>c</sup> $p < 0.05$ .

CI, confidence interval; OR, odds ratio.

examine how breastfeeding guidelines and hospital policies affect the rate of breastfeeding initiation and continuation among people who used substances during pregnancy and postpartum, especially for populations that use substances that are not a contradiction to breastfeeding. Breastfeeding support coupled with substance treatment during the perinatal time period has the potential to impact maternal and infant health for this population, although more research is needed to understand the benefits and risks of breastfeeding in this population.

### Authors' Contributions

N.N. and L.K. led and contributed to the study design, analysis, and article writing. K.G., C.W., T.E.F., and S.W. contributed to the study design and article writing.

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None of the authors has relevant conflict of interests to disclose.

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