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Substance Use and Utilization of Prenatal and Postpartum Care

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Abstract

Objectives: Prenatal and postpartum care for women with substance use is important due to increased risk of poor health outcomes. The influence of substance use on perinatal care utilization is not well characterized, especially postpartum care. The objective of this study was to examine the effect of substance use during pregnancy on prenatal and postpartum care utilization in a nationally representative sample and to identify maternal characteristics associated with inadequate prenatal and postpartum care among women with substance use.

Methods—PRAMS data (2016–2018) from eight states was used for this study. Logistic regression models adjusted for complex survey weights and confounder variables were used to estimate the odds of not receiving adequate prenatal care and postpartum care. Weighted Rho Scott chi-square tests were used to examine maternal characteristics associated with care utilization among women who reported substance use during pregnancy.

Results—The study included 15,131 women, with 5.3% who reported illicit substance use during pregnancy. In multivariable models, substance use was associated with an increase in the odds of not receiving adequate prenatal care (OR 1.69, CI 1.32, 2.17) and not receiving postpartum care

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(OR: 1.47, CI 1.10, 1.95). Among women who reported substance use, depression and smoking status were associated with not receiving adequate prenatal or postpartum care.

Conclusions—Substance use during pregnancy is independently associated with disparities in prenatal and postpartum care access. Future studies are needed to identify how barriers lead to care inequalities and importantly, to identify strategies to improve care utilization.

Keywords

substance use; pregnancy; prenatal care; postpartum care

Introduction

Reproductive age women are at greater risk of substance use disorders (SUD) than during any other period in their lives,¹ and women with SUD are at increased risk of experiencing pregnancy related morbidity, overdose, cardiovascular complications, and preterm and low birth weight deliveries.^{2–5} Thus, care across the perinatal period (during pregnancy and up to 12 months postpartum) is particularly important for this population. Additionally, it is recommended by the American College of Obstetrics and Gynecology (ACOG) to improve maternal and infant health outcomes because of its tremendous impact on the long-term health of women and their children.⁶ For example, receipt of prenatal care has been associated with a reduction in the risk of newborns having low birth weight.⁷ Specifically, among women with SUD, the receipt of prenatal care has been associated with decreased preterm birth rates, increased birth weight, and decreased risk of overdose postpartum.^{8–11} This may be partially due to increased engagement with healthcare providers during pregnancy and new eligibility for Medicaid due to pregnancy status.¹² Therefore, prenatal care represents a unique opportunity for healthcare providers to screen, manage and provide treatment to women with SUD due to their increased access to and engagement with healthcare during this time.

The postpartum period represents another critical time for many women due to changing hormones; learning to care for a newborn; recovering from childbirth; and additional physical, psychological, and social changes.¹³ ACOG recommends that women have contact with their obstetric care provider within three weeks postpartum and have a comprehensive visit by 12 weeks after delivery. These healthcare visits include social, physical and psychological assessments and education related to parenthood and well-woman care.¹⁴ Unfortunately, the postpartum time-period represents a particularly vulnerable time for women with SUD as several studies have found that around 9–12 months postpartum, women are at the greatest risk of self-harm and overdose and are at an increased risk of postpartum depression.^{11,15–18} Accordingly, receiving health care during the postpartum period is equally as important as the prenatal period for women.

Several studies have demonstrated that pregnant women with SUD are less likely to receive adequate, or indeed any, prenatal care when compared to their peers who do not report substance use^{19–24} and although postpartum care utilization among women with SUD has received significantly less attention in the extant literature, one recent study found that women with SUD were less likely to receive postpartum care when

compared to their peers.²⁵ Barriers to prenatal care utilization include fear of involvement of child protective services and legal ramifications, psychiatric comorbidities, transportation, childcare challenges, incarceration, and lack of trust in the healthcare system.^{20,26,27} During a period when women might need more care, the aforementioned barriers present challenges which could lead to interruptions in care.

Published findings thus far have examined prenatal care of women with SUD based on convenience and/or regional samples, highlighting the need to further characterize prenatal and postpartum care in a nationally representative sample of substance-using women. Because of the limited research attention to the postpartum period, more studies are also needed to examine the effect of substance use on the utilization of postpartum care and to identify predictors of not receiving care during this important time. The purpose of this study was to examine the effect of substance use during pregnancy on prenatal and postpartum care utilization in a nationally representative sample. Additionally, we aimed to identify maternal characteristics associated with inadequate prenatal and postpartum care among women with substance use during pregnancy. We hypothesized, after controlling confounding maternal characteristics, that substance use would be an independent risk factor for not receiving adequate prenatal and postpartum care.

Methods

We used cross-sectional survey data from the 2016–2018 Pregnancy Risk Assessment Monitoring System (PRAMS), a Centers for Disease Control–funded surveillance project based on birth certificate sampling. Each year PRAMS samples between 1,300 and 3,400 women from each participating state utilizing a stratified sampling approach. PRAMS questionnaires include core questions used in all states and standard questions completed by a subset of states. PRAMS survey data are collected using mail or phone surveys within 6 months after delivery and include questions related to experiences across the perinatal time-period. PRAMS also includes data drawn directly from the birth certificate, including maternal age, education, race and ethnicity, insurance type, and enrollment in the Women, Infants, and Children Special Supplemental Nutrition Program (WIC) during pregnancy. (Additional information related to PRAMS questionnaires and survey methods can be accessed at www.cdc.gov/prams).²⁸ Women from states that included data on illicit substance use, prenatal care, postpartum care, and maternal characteristics were included in this study. This study was deemed exempt by the Cincinnati Children’s Hospital Medical Center’s institutional review board.

Our outcome variables included adequacy of prenatal care and attendance at postpartum visit. We defined adequacy of prenatal care based on the Kessner Index, one of the most widely used indices of prenatal care utilization, which accounts for timing of prenatal care utilization, number of visits and gestational age at delivery.^{2,3} The Kessner Index was calculated by PRAMS based on birth certificate data and for this study we used a dichotomized version (adequate vs. intermediate or inadequate). Information from the birth certificate data related to the number of prenatal care visits and when it was initiated is based on medical record data collected by each state. We defined postpartum care utilization as attendance at a postpartum checkup with a healthcare provider. This was based on patient

recall from a yes/no question in the PRAMS survey (“Since your new baby was born, have you had a postpartum checkup for yourself? A postpartum checkup is the regular checkup a woman has about 4–6 weeks after she gives birth.”)

Our primary predictor variable was self-reported use of any of the following substances during pregnancy: cocaine, heroin, amphetamines, and/or marijuana. This variable was based on the PRAMS question, “Did you use any of these drugs when you were pregnant?” followed by a list of possible substances. We included only cocaine, heroin, amphetamines and marijuana because we could define these as illicit substance use. Other options were prescription drugs including opioids and stimulants for which it was not possible to determine if they were being taken as prescribed or misused. Therefore, use of prescription drugs was not considered illicit substance use for this study. Since states have increasingly decriminalized and legalized use of marijuana, we also conducted sensitivity analyses in which we removed marijuana from the illicit substance use variable..

We included covariates to examine potential confounding. Maternal age, parity, self-reported race, self-reported ethnicity (Hispanic or non-Hispanic), education, marital status, insurance type, enrollment in WIC, smoking during the last three months of pregnancy, rural/urban residence and state of residence were drawn from birth certificate variables in the PRAMS dataset. In this study, race was categorized as Hispanic, non-Hispanic White, non-Hispanic American Indian, non-Hispanic Asian, non-Hispanic Black, non-Hispanic Mixed race, or non-Hispanic Other. In the PRAMS survey respondents self-reported race and ethnicity. Respondents were able to select Other race or Mixed Race. Data related to partner abuse prior to and during pregnancy, and depression status, were based on PRAMS survey questions.

Analyses

We used weighted Rao Scott chi-square tests to examine associations between illicit substance use in pregnancy and maternal covariates. In separate models, logistic regression was used to estimate the odds of not receiving adequate prenatal care and not attending a postpartum care visit using weights to account for the PRAMS complex survey design, sampling, noncoverage (delayed processing of birth records which may lead to noncoverage for a specific state, hospital or county) and nonresponse. Additionally, individuals were clustered by state in all adjusted models by using the strata statement. First, we specified unadjusted models to examine the odds of not receiving adequate prenatal care and not attending a postpartum care visit. Next, we adjusted models for potential confounders (maternal age, race/ethnicity, parity, marital status, education, insurance, WIC enrollment, partner abuse, depression, rural/urban residence, state and delivery year) based on prior evidence related to substance use and care utilization.^{24,29–32} In a secondary analysis, among women who self-reported illicit substance use, we examined the same maternal characteristics as potential predictors of not receiving adequate prenatal care and postpartum care in separate logistic regression models. Lastly, we examined all models for potential collinearity of variables (correlation $>.80$) by examining the correlation matrices and examining the variance inflation factor.

Results

The 2016–2018 PRAMS dataset which included questions related to substance use, prenatal and postpartum care and maternal characteristics was comprised of 15,131 women from the following eight states: Missouri (29.9%), Wisconsin (27.6%), Kentucky (14.7%), Kansas (11.4%), West Virginia (7.9%), South Dakota (3.6%), North Dakota (3.0%) and Montana (1.9%). Overall, our sample was mostly non-Hispanic White (77%), married (62%), and had more than a high school education (63%). Illicit substance use was reported by 5.3% of the individuals in this study. Among women with substance use, 92% used marijuana, 15% amphetamines, 9% cocaine, and 9% heroin. Polydrug use, defined as reporting the use of two or more substances captured in this study, was reported in 14% of women with substance use in pregnancy. Several maternal characteristics were associated with substance use in this study (Table 1). Non-Hispanic white and non-Hispanic Black women made up the greatest percentage of women who endorsed illicit substance use within this study. However, when examining use within each group, 12.8% of non-Hispanic American Indian, 12% of non-Hispanic Mixed Race, 8.6% of non-Hispanic Black, 4.9% of non-Hispanic White, 4.2% of non-Hispanic Other race, 3.4% of Hispanic, and 1.1% of non-Hispanic women endorsed use during pregnancy. In our study population, women aged 20–29 and 30–39 represented the greatest proportion of women with use. When examining use within age groups, women less than 20 years of age had the highest percentage of use (9.1%) compared to women aged 20–29 (6.2%), 30–39 (3.7%) and 40 or older (4.4%). Among married women only 2% reported substance use versus 10.6% of unmarried women in the study. Women enrolled in WIC during pregnancy were found to be more likely to use substances (8%) than women not enrolled (3.9%). A total of 14,279 women had data on all covariates included in the multivariable models estimating the odds of not receiving adequate prenatal care. A total of 14,072 women had data on all covariates included in the multivariable models estimating the odds of not receiving postpartum care.

In the unadjusted analysis, women with illicit substance use were 2.88 times (confidence interval [CI] 2.33, 3.56) more likely to not receive adequate prenatal care compared to women who did not report use. This effect was attenuated but remained significant after adjusting the model for maternal age, race/ethnicity, parity, marital status, maternal education, smoking status during pregnancy, insurance type, enrollment in WIC, partner abuse before and during pregnancy, depression during pregnancy, rural/urban residence, state of residence, and delivery year (odds ratio [OR] 1.69, CI 1.32, 2.17; Table 2). The odds of not receiving adequate prenatal care differed by age, race/ethnicity, marital status, education, smoking during pregnancy, insurance, enrollment in WIC, partner abuse prior to pregnancy, antenatal depression, and state of residence (Table 2). For example, non-Hispanic White women were significantly more likely to receive adequate prenatal care than all other groups, with the exception of non-Hispanic Other Race women. After removing marijuana from the illicit substance use variable, women with illicit substance use were 3.70 (CI 2.26, 6.07) times more likely to not receive adequate prenatal care than their counterparts who did not use illicit substances during pregnancy, after adjusting the model for all of the same maternal characteristics as the main model.

Similar results were obtained for the effect of substance use on the odds of not receiving a postpartum care visit. In the unadjusted analysis, women with illicit substance use were 2.67 times (CI 2.08, 3.43) more likely to not receive a postpartum care visit when compared to women who did not report substance use during pregnancy. This effect remained but was attenuated after adjusting for the same maternal characteristics above plus postpartum depression (OR: 1.47, CI 1.10, 1.95; Table 2). The odds of not receiving a postpartum care visit varied by race, ethnicity, parity, maternal education, smoking status, insurance type, antenatal depression, and state of residence. Similar to adequate prenatal care, non-Hispanic American Indian, non-Hispanic Asian, non-Hispanic Black and non-Hispanic Other race women were more likely to not receive adequate postpartum care when compared to non-Hispanic White women. Women without private insurance were approximately 2 times more likely than women with private insurance to not receive a postpartum care visit. After removing marijuana from the illicit substance use variable, the effect of illicit substance use on the odds of receiving a postpartum care visit was no longer significant (OR 1.56 CI: 0.87, 2.80). When examining the correlation matrices for all analyses, there were no variables with $>.80$ correlation and the variance inflation factors ranged from 1.07 to 4.38, with an overall average variance inflation factor of 1.6.

Predictors of Prenatal and Postpartum Care Among Substance Using Women

Among women with illicit substance use during pregnancy, Hispanic (OR: 4.83, CI 1.64, 14.18), non-Hispanic American Indian (OR 7.76, CI 2.32, 25.99) and non-Hispanic Mixed Race (OR 3.03, CI 1.31, 6.94) women were at an increased odds of not receiving adequate prenatal care when compared to non-Hispanic White women. We also observed that women who were unmarried, smoked during pregnancy, had a previous live birth, were exposed to partner abuse prior to pregnancy, or experienced antenatal depression were more likely to not receive adequate prenatal care (Table 3).

Postpartum Care: Among women with substance use during pregnancy, age, smoking, insurance type, depression and urban residence were significant predictors of not receiving postpartum care. For example, women insured through Medicaid were six times more likely than privately insured women to not receive a postpartum care visit (OR: 6.05, CI 2.40, 15.21). Mental health was also found to be an important predictor of care, as women with postpartum depression were three times more likely (OR 3.10, CI 1.72, 5.60) to not receive a postpartum care visit when compared to women without depression (Table 3). When examining the correlation matrices for all analyses, there were no variables with $>.80$ correlation.

Post-Hoc Analysis

In a post-hoc analysis, we examined adequate prenatal care as a predictor of receipt of postpartum care. In a bivariate model, women who did not receive adequate prenatal care were 3.54 times (CI: 3.01, 4.16) more likely to not receive a postpartum care visit. Next when adding adequate prenatal care as a predictor in the multivariable model examining the association between illicit substance use and not receiving postpartum care, adjusted for the same covariates as the main models, women who did not receive adequate prenatal care were 2.08 times (CI 1.73, 2.50) more likely to not receive postpartum care. After

adding adequate prenatal care as a predictor, substance use during pregnancy was no longer associated with an increase in the odds of not receiving postpartum care (OR: 1.34, CI 1.00, 1.79).

Discussion

Substance use during pregnancy has been increasing throughout the United States³³, therefore examining the effect of substance use on care utilization is especially timely. Lack of or inadequate access to care among women with substance use may contribute to maternal and infant health inequalities in this population. In this multi-state population-based sample, women with substance use during pregnancy were less likely to receive adequate prenatal care and postpartum follow up. When removing marijuana from the predictor variable (illicit substance use), the effect of substance use on the odds of not receiving adequate prenatal care doubled, however the odds of postpartum care remained approximately equal, although no longer significant. Additional studies are needed to examine how the type of substance use influences both prenatal and postpartum care.

Disparities in care utilization during the perinatal period represent missed opportunities for women with SUD to receive access to screenings, treatment and care coordination that have the potential to prevent or reduce poor maternal and infant health outcomes associated with SUD. Although we demonstrated disparities in care for both prenatal and postpartum care, the largest difference was observed for prenatal care. Several studies have found women with SUD experience many barriers to prenatal care utilization, such as lack of transportation, childcare needs, fear of child protective services involvement and incarceration.^{26,29} Moreover, a recent qualitative study found women with SUD felt judged and disempowered³⁴ when engaging with healthcare providers during pregnancy and postpartum. Among women with substance use in our study, women of Hispanic ethnicity were nearly five times more likely and non-Hispanic American Indian women were almost 8 times more likely to not receive adequate prenatal care when compared to non-Hispanic White women. A prior study examining perceived discrimination during maternal care demonstrated that Hispanic and Black women were almost three times more likely to report poor treatment during maternal care due to race, language or culture than non-Hispanic White women.³⁵ Studies are needed to examine how poor treatment and discrimination may contribute to disparities in care by race and ethnicity. We also observed an increased odds of not receiving adequate prenatal care among women who smoked, had previous live births, experienced partner abuse prior to pregnancy and reported depression during pregnancy. Additional studies are needed to examine how these maternal characteristics and barriers identified in prior studies intersect and lead to disparities in care.

The lack of studies examining postpartum care among women with SUD represents a major gap in the literature. It is unclear if barriers to prenatal care are the same for postpartum care utilization. Results from our study suggest that among women with substance use, women who were not privately insured were approximately six times more likely to not receive a postpartum care visit. Additionally, women who experienced postpartum depression were also more likely to not receive postpartum care. Exploring the relationship between SUD, insurance status, mental health and access to postpartum care is a direction for future

research. Moreover, evaluating whether mitigation of prenatal care barriers would lead to increased access to postpartum care is needed as we demonstrated in a post-hoc analysis that women who did not receive adequate prenatal care were two times more likely to not receive a postpartum care visit.

The effects of intimate partner violence and depression during the perinatal time period on care utilization are critical findings from this study. The comorbidity of SUD and depression has been extensively studied in the literature³⁶ and is supported in our population-based sample, in which 42% of women using illicit substances reported prenatal depression and 31% reported postpartum depression. In this study we demonstrated that these women were particularly likely not to receive adequate prenatal care or postpartum care. This finding supports the need for studies to identify how to engage women with co-occurring mental health conditions, such as depression and SUD in care across the perinatal time period. This is particularly important during the postpartum period when women are at risk for postpartum depression and psychosis.^{37,38}

The use of a multistate large population-based sample is a major strength of this study. In this sample, 5.3% of women self-reported substance use, which is comparable to prior population-based estimates.³⁹ Results from this study are further strengthened by the use of birth certificate data. Inclusion of potential confounding variables that commonly co-occur with SUD, such as partner abuse and depression is also a major strength of this analysis. However, there are several important limitations of this study. The main exposure, substance use, is based on self-report. Due to stigma and fear of legal concerns pregnant women in particular may underreport illicit use⁴⁰, which would bias our results towards the null. Another issue that may bias our results toward the null is our inability to include prescription opioid misuse in our sample. Opioid misuse is a significant problem among pregnant women however, we were not able to examine its effect on care utilization because the PRAMS study questions did not clearly distinguish appropriate prescription opioid use from prescription opioid misuse. Our inability to capture prescription opioid misuse in our analyses provides an important caveat to our finding of variation in illicit substances during pregnancy by self-reported race and ethnicity, since prior studies have demonstrated that non-Hispanic White women are a high-risk group for using opioids during pregnancy.⁴¹ Thus, our findings regarding variation in illicit substance use by race/ethnicity should be interpreted with caution. Future studies are needed to examine the effect of racism and substance use on the receipt of adequate prenatal care and postpartum care as prior work has demonstrated the importance of examining the intersectionality of racism and health care access and outcomes.^{42–44} Although our analyses accounted for numerous social determinants of health related to health care access, we were not able to examine the effect of area level poverty and deprivation, unreliable transportation, healthcare provider shortages, residential segregation, discrimination or racism. Future studies are needed to examine the influence of these factors on prenatal and postpartum care access for women with a history of substance use during the perinatal time period. Finally, although the PRAMS is a population-based sample, a majority of women in this study were non-Hispanic White and married, so our results may be less generalizable to other groups of women. More diverse population-based datasets are needed to further examine substance use and perinatal

care, particularly since our data support previous research demonstrating racial disparities in receipt of perinatal care.⁴⁵

Conclusion

This population-based analysis demonstrated disparities in perinatal care utilization by substance use status, particularly among women with a history of partner abuse, or depression and Hispanic and non-Hispanic American Indian women. It is essential to better understand the causes of these disparities and to develop effective interventions to improve access and utilization of care, given that perinatal care can act as a gateway to other essential SUD, mental health, and well-woman treatment for this underserved group. Well-designed research is needed to identify structural, individual and community level barriers to both prenatal and postpartum care throughout the United States.

Future studies informed by women with lived experience of SUD during pregnancy may be particularly relevant for identifying relevant barriers and developing patient-centered interventions. This is especially important, as the women with SUD at increased risk of not receiving adequate prenatal and postpartum care in this study have not been well represented by researchers, indicating an urgent need to include their perspectives in future studies. Through well-designed population-based research and the inclusion of representative patient partners, future studies and interventions have the potential to improve prenatal and postpartum care for women with SUD.

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Table 1:
Sample Characteristics by Substance Use CDC PRAMS 2016–18

Maternal Characteristics	Total N=15131	No Substance Use (n=14126)		Substance Use (n=1005)		P Value
		N	Weighted Percent	N	Weighted Percent	
Adequate Prenatal Care						<.0001
No	4238	3745	26.5%	493	49.1%	
Yes	10893	10381	73.5%	512	50.9%	
Postpartum Care						<.0001
No	1795	1523	10.8%	272	27.3%	
Yes	13224	12518	89.2%	724	72.7%	
Race and ethnicity						<.0001
Hispanic	1157	1113	6.9%	44	4.4%	
NH Black	2476	2251	8.44%	225	14.20%	
NH Other	67	65	0.482%	2	0.38%	
NH Asian	557	551	2.96%	6	0.58%	
NH White	8918	8431	77.40%	487	71.05%	
NH American Indian	1128	985	1.19%	143	3.09%	
NH Mixed Race	762	670	2.62%	92	6.35%	
Maternal Age (years)						<.0001
<20	964	870	6.2%	94	9.4%	
20–29	7992	7373	52.2%	619	61.6%	
30–39	5855	5579	39.5%	276	27.5%	
40+	320	304	2.2%	16	1.6%	
Marital Status						<.0001
Not Married	6629	5833	41.3%	796	79.5%	
Married	8486	8281	58.7%	205	20.5%	
WIC during Pregnancy						<.0001
No	8961	8549	61.1%	412	41.5%	
Yes	6019	5439	38.9%	580	58.5%	
Insurance status						<.0001
Medicaid	4159	3690	26.5%	469	47.6%	
None	1787	1595	11.4%	192	19.5%	
Other	1435	1310	9.4%	125	12.7%	
Private	7549	7349	52.7%	200	20.3%	
Maternal Education						<.0001
HS	3997	3602	25.6%	395	39.6%	
Less than HS	1896	1691	12.0%	205	20.5%	
More than HS	9170	8772	62.4%	398	39.9%	
Rural/Urban Residence						0.28
Urban	9772	9107	64.5%	665	66.2%	
Rural	5358	5018	35.5%	340	33.8%	
Tobacco Use Last 3 months of Pregnancy						<.0001

Maternal Characteristics	Total N=15131	No Substance Use (n=14126)		Substance Use (n=1005)		P Value
		N	Weighted Percent	N	Weighted Percent	
No	12720	12231	87.0%	489	49.2%	
Yes	2324	1820	13.0%	504	50.8%	
Nulliparous						0.9
No	9593	8956	63.5%	637	63.4%	
Yes	5525	5157	36.5%	368	36.6%	
Partner Abuse Before Pregnancy						<.0001
No	14579	13719	98.0%	860	87.3%	
Yes	412	287	2.0%	125	12.7%	
Partner Abuse During Pregnancy						<.0001
No	331	13765	98.3%	882	89.8%	
Yes	153	231	1.7%	100	10.2%	
Depression During Pregnancy						<.0001
No	12288	11717	84.0%	571	57.8%	
Yes	2641	2224	16.0%	417	42.2%	
Postpartum Depression						<.0001
No	12634	11945	85.6%	689	69.5%	
Yes	2315	2013	14.4%	302	30.5%	
Delivery Year						0.35
2016	2700	2539	18.0%	161	16.0%	
2017	6781	6319	44.7%	462	46.0%	
2018	5650	5268	37.3%	382	38.0%	
State of Residence						<.0001
Kansas	1917	1808	12.8%	109	10.8%	
Kentucky	1253	1173	8.3%	80	8.0%	
Missouri	2609	2430	17.2%	179	17.8%	
Montana	900	824	5.8%	76	7.6%	
North Dakota	1302	1233	8.7%	69	6.9%	
South Dakota	1996	1884	13.3%	884	11.1%	
Wisconsin	3073	2879	20.4%	7296	19.3%	
West Virginia	2081	1895	13.4%	3428	18.5%	

NH=Non-Hispanic, HS=High School.

Table 2:

Adjusted Odds Ratios for the Relationship Between Substance Use During Pregnancy and Prenatal or Postpartum Care

Variables	Inadequate Prenatal Care Utilization		No Postpartum Care Visit	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Drug Use During pregnancy				
Yes vs No	1.69	1.32, 2.17 ^{***}	1.47	1.10, 1.95 ^{**}
Maternal Age (yrs.)				
<20 vs 20–29	0.87	0.65, 1.16	1.17	0.81, 1.68
30–39 vs 20–29	0.91	0.79, 1.05	0.82	0.66, 1.01
40+ vs 20–29	1.79	1.17, 2.73 ^{**}	1.69	0.97, 2.94
Maternal Race/Ethnicity				
Hispanic vs NH White	1.77	1.41, 4.36 ^{***}	1.24	0.89, 1.72
NH American Indian vs NH White	3.27	2.46, 3.06 ^{***}	2.09	1.46, 2.99 ^{***}
NH Asian vs NH White	2.29	1.72, 3.06 ^{***}	1.69	1.05, 2.72 [*]
NH Black vs NH White	2.15	1.77, 2.61 ^{***}	1.35	1.03, 1.77 [*]
NH Mixed Race vs NH White	1.34	1.01, 1.79 [*]	1.12	0.74, 1.68
NH Other vs NH White	2.13	0.97, 4.68	2.93	1.03, 8.28 [*]
Nulliparous				
No vs Yes	1.10	0.95, 1.28	1.65	1.34, 2.04 ^{***}
Marital Status				
Married vs Not Married	0.73	0.62, 0.86 ^{***}	0.89	0.72, 1.11
Maternal Education				
High School vs More than High School	1.32	1.13, 1.55 ^{***}	1.54	1.23, 1.92 ^{***}
Less than High School vs More than High School	2.02	1.77, 2.73 ^{***}	2.43	1.85, 3.18 ^{***}
Smoking During Last 3 Months of Pregnancy				
Yes vs No	1.25	1.04, 1.50 [*]	1.48	1.18, 1.87 ^{***}
Maternal Insurance				
Medicaid vs Private	1.88	1.56, 2.28 ^{***}	2.09	1.58, 2.76 ^{***}
No Insurance vs Private	2.90	2.37, 3.54 ^{***}	2.82	2.14, 3.72 ^{***}
Other vs Private	1.81	1.41, 2.34 ^{***}	2.20	1.54, 3.15 ^{***}
Enrolled in WIC During Pregnancy				
Yes vs No	0.81	0.69, 0.94 ^{**}	0.87	0.70, 1.07
Husband/Partner Abuse				
During Pregnancy vs No	1.18	0.66, 2.08	0.98	0.49, 1.97
Before Pregnancy vs No	1.97	1.19, 3.26 ^{***}	1.44	0.77, 2.69
Depression				

Variables	Inadequate Prenatal Care Utilization		No Postpartum Care Visit	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Antenatal vs No	1.20	1.02, 1.42 *	1.29	1.03, 1.61 *
Postpartum vs No	--	--	0.79	0.63, 1.00
Rural/Urban Residence				
Rural vs. Urban	1.17	1.01, 1.35 *	1.03	0.85, 1.25
Residential State				
Kansas vs Missouri	0.59	0.48, 0.73 ***	0.82	0.61, 1.10
Kentucky vs Missouri	0.67	0.53, 0.85 ***	0.91	0.66, 1.25
Montana vs Missouri	0.74	0.58, 0.94 *	0.75	0.54, 1.05
North Dakota vs Missouri	1.09	0.87, 1.36	0.88	0.64, 1.22
South Dakota vs Missouri	0.92	0.76, 1.13	0.64	0.48, 0.84 ***
West Virginia vs Missouri	0.92	0.77, 1.11	0.91	0.71, 1.17
Wisconsin vs Missouri	0.65	0.54, 0.78 ***	0.60	0.46, 0.79 ***
Delivery Year				
2016 vs 2018	0.97	0.80, 1.17	1.04	0.81, 1.35
2017 vs 2018	1.11	0.97, 1.28	0.98	0.80, 1.20

^aNH=Non-Hispanic

* = p-value <.05

** = p-value <.01

*** = p-value <.001

Table 3:

Predictors of Inadequate Prenatal Care and Not Receiving Postpartum Care Among Women with Illicit Substance Use During Pregnancy

Variables	Inadequate Prenatal Care Utilization		No Postpartum Care Visit	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Maternal Age (yrs.)				
<20 vs 20–29	0.92	0.39, 2.17	0.85	0.30, 2.40
30–39 vs 20–29	0.62	0.33, 1.18	0.74	0.37, 1.47
40+ vs 20–29	3.07	0.62, 15.18	8.13	2.05, 32.18**
Maternal Race/Ethnicity				
Hispanic vs NH White	4.83	1.64, 14.18**	1.07	0.32, 3.60
NH American Indian vs NH White	7.76	2.32, 25.99***	2.66	0.99, 7.18
NH Asian vs NH White	3.85	0.87, 17.02	NA	NA
NH Black vs NH White	1.29	0.63, 2.63	1.27	0.56, 2.86
NH Mixed Race vs NH White	3.03	1.31, 6.94**	1.11	0.42, 2.97
NH Other vs NH White	NA	NA	NA	NA
Nulliparous				
No vs Yes	2.11	1.20, 3.71**	1.30	0.71, 2.39
Marital Status				
Married vs Not Married	0.44	0.22, 0.87*	1.47	0.74, 2.92
Maternal Education				
High School vs More than High School	0.81	0.46, 1.44	1.06	0.55, 2.04
Less than High School vs More than High School	0.80	0.37, 1.70	0.88	0.39, 2.01
Smoking During Last 3 Months of Pregnancy				
Yes vs No	2.49	1.48, 4.19***	1.85	1.01, 3.40*
Maternal Insurance				
Medicaid vs Private	1.78	0.88, 3.59	6.05	2.40, 15.21***
No Insurance vs Private	1.76	0.80, 3.88	6.69	2.42, 18.46***
Other vs Private	2.00	0.56, 7.09	6.82	1.86, 25.07**
Enrolled in WIC During Pregnancy				
Yes vs No	0.46	0.28, 0.76**	0.77	0.45, 1.34
Husband/Partner Abuse				
During Pregnancy vs No	0.48	0.16, 1.41	2.03	0.60, 6.83
Before Pregnancy vs No	5.43	2.09, 14.11***	0.77	0.27, 1.89
Depression				
Antenatal vs No	1.73	1.04, 2.86*	1.54	0.86, 2.79
Postpartum vs No	NA	NA	3.10	1.72, 5.60***
Rural/Urban Residence				
Rural vs. Urban	0.85	0.46, 1.58	0.45	0.23, 0.87*
Residential State				

Variables	Inadequate Prenatal Care Utilization		No Postpartum Care Visit	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Kansas vs Missouri	0.43	0.18, 0.98*	1.30	0.47, 3.57
Kentucky vs Missouri	0.64	0.25, 1.63	0.80	0.30, 2.14
Montana vs Missouri	0.45	0.17, 1.19	0.52	0.18, 1.53
North Dakota vs Missouri	1.43	0.39, 5.25	1.87	0.43, 8.12
South Dakota vs Missouri	0.33	0.11, 0.95*	1.11	0.45, 2.71
West Virginia vs Missouri	0.49	0.24, 0.99*	1.25	0.59, 2.64
Wisconsin vs Missouri	0.43	0.21, 0.90*	0.59	0.27, 1.30
Delivery Year				
2016 vs 2018	0.90	0.41, 1.97	0.84	0.36, 1.95
2017 vs 2018	0.79	0.48, 1.30	0.75	0.41, 1.39

^aNH=Non-Hispanic

* = p-value <.05

** = p-value <.01

*** = p-value <.001

NA = not available, cell count too small for NH Asian and NH Other, postpartum depression was not modeled as it does not occur until after delivery