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Differences in outpatient, emergency, and inpatient use among pregnant women with a substance-related diagnosis

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Abstract

Background: As a vulnerable population, pregnant women with a substance-related diagnosis (SRD; i.e., substance use, misuse, dependence) may utilize healthcare disproportionately.

Objective: The primary goal of this study was to evaluate the differences in use of outpatient clinical visits, emergency department visits, and inpatient days in the hospital among women with and without an SRD during the antepartum period.

Study Design: This retrospective study retrieved electronic health record data on women (ages 18–44 years) who delivered a single live or stillbirth at 20 weeks' gestation from April 1st, 2012–September 30th, 2019. Imbalance in measured maternal sociodemographic and obstetrical characteristics between those with and without an SRD was attenuated using propensity score matching on key demographic characteristics (e.g., age), yielding a matched 1:1 sample. Unadjusted and adjusted logistic regression was used to determine the association between having an SRD and outpatient visits, emergency visits, and inpatient days.

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Results: From the total sample (n=16,770), the matched cohort consisted of 1,986 deliveries. Of these, most were White (51.0%) or of mixed or other race (31.1%). The mean age was 29.8 (standard deviation [SD] =5.6). An SRD was identified in 993 (50% due to matching) women. Those with an SRD were more likely to have 10 outpatient visits compared to women without an SRD (AOR = 1.81 [95% CI, 1.44–2.28], p-value = <0.0001). Alcohol-, opioid-, and a stimulant-related diagnoses were independently associated with 10 outpatient visits (AOR = 3.16 [95% CI: 1.67–6.04], p-value = 0.0005; AOR = 3.02 [95% CI: 1.79–5.09], p-value = <0.0001; AOR = 2.18 [95% CI: 1.39–3.41], p-value = 0.0007). Women with an SRD were more likely to have 1 emergency visit compared to women without an SRD (AOR = 1.36 [95% CI, 1.00–1.85], p-value = <0.0001). Opioid-, stimulant-, and nicotine-related diagnoses were independently associated with 1 emergency visits (AOR = 2.28 [95% CI: 1.09–4.77], p-value = 0.0287; AOR = 2.01 [95% CI: 1.07–3.78], p-value = 0.0301; AOR = 3.38 [95% CI: 1.90–6.02], p-value = <0.0001). Women with an SRD were more likely to have 3 inpatient days compared to women without an SRD (AOR = 1.69 [95% CI: 1.07–2.67], p-value = 0.0256). Opioid-, stimulant-, and nicotine-related diagnosis were independently associated with 3 inpatient days (AOR = 3.52 [95% CI: 1.42–8.75], p-value = 0.0067; AOR = 3.51 [95% CI: 1.31–9.34], p-value = 0.0123; AOR = 2.74 [95% CI: 1.11–6.73], p-value = 0.0285).

Conclusion: Women with an SRD during the antepartum period who delivered a single live or stillbirth at 20 weeks' gestation are experiencing fewer outpatient visits, more emergency department visits, and more inpatient days compared to women without an SRD. The type of SRD (e.g., alcohol, opioids, stimulants, nicotine) is associated with different patterns of healthcare use. The results from this study reinforce the need to identify SRDs in pregnant women early to minimize disproportionate healthcare service utilization through intervention and treatment.

Keywords

alcohol use; cannabis use; electronic health record data; emergency department; healthcare service utilization; inpatient; nicotine use; opioid use; outpatient; pregnancy; stimulant use; substance-related diagnosis; substance use; substance use disorder

Introduction:

Utilization of healthcare services is essential for pregnant women.¹ Pregnant women with a substance-related diagnosis (SRD; i.e., substance use, misuse, or dependence) are a vulnerable population that may disproportionately use healthcare services and resources. Research suggests that limited and disrupted prenatal care, psychiatric comorbidities (e.g., anxiety), prenatal substance use, and environmental stressors (e.g., unsteady home) are associated with adverse maternal outcomes (e.g., preeclampsia, gestational hypertension, severe maternal morbidity [SMM]).^{2,3} Attending prenatal visits decreases the risk of both adverse obstetric and birth outcomes (e.g., prematurity, fetal demise, and post neonatal mortality and neuropsychiatric impairments).^{4–7} Increased emergency department (ED) use and hospitalizations suggests worsening medical need.

Pregnant women with an SRD face multiple intersecting barriers that can impact their health and healthcare service utilization (HSU). For example, pregnant women who use substances face barriers to seeking prenatal care, including late-term discovery, navigating

health insurance and accessing care, physicians unwilling to initiate treatment for substance use, fear of involvement with Child Protective Services (CPS), and incarceration.⁸ Women presenting for primary or prenatal care may not self-identify as being at-risk for SRDs⁹ and may experience concerns of mistrust in their providers.¹⁰ However, when universal screening is adopted, pregnant women tend to disclose more information regarding their substance use.^{11,12} Often there is minimization, especially with nicotine, but research indicates that they are more likely to disclose their substance use if asked in a non-judgmental way and in states without mandatory reporting.^{13–15} Even with mandatory reporting, there is evidence of some physician bias towards which patients are reported to the state and for which substances.^{13–15}

Research has shown that patients with a substance use disorder (SUD) have fewer outpatient visits,¹⁶ more ED visits,^{17–20} and more inpatient days in the hospital compared to patients without a SUD.^{21,22} However, research on the prevalence and association of SRDs by type (e.g., alcohol, opioids, stimulants, nicotine, cannabis) and outpatient visits, ED visits, and inpatient days in the hospital among pregnant women is limited. Pregnant women with an SRD are a vulnerable population who may be experiencing disproportionate HSU compared to pregnant women without an SRD. In order to address this gap in the literature, a retrospective cohort study of pregnant women was conducted to evaluate independent associations between SRDs and HSU in a large healthcare system. We hypothesized that pregnant women with SRDs, as compared to those without, would have fewer outpatient visits, more ED visits, and more inpatient days in the hospital.

Methods

Study Participants and Procedures

This Institutional Review Board approved retrospective study used de-identified and secure electronic health record (EHR) data on nulliparous women (age 18–44 years) who delivered their first single live or stillbirth at 20 weeks' of gestation at a large health system in Southern California from April 1st, 2012 through September 30th, 2019 (7.5 years of available data). Approximately 3,000 deliveries occur here annually. International Classification of Diseases, 10th edition (ICD-10) codes were used to identify women for the study (Table A).²³ Data were collected from the antepartum (up to 42 weeks before delivery) through the postpartum (4 weeks after delivery) periods (total 46 weeks) in order to complete a thorough assessment of HSU during this time. Only primigravida women were included in this study due to potential differences in HSU among multigravida women. For example, research has shown that primigravida women may be more likely to experience higher rates of pregnancy related hypertension,²⁴ preterm labor,²⁴ and caesarean delivery²⁵ compared to multigravida women, which may result in differences in HSU.

Measures

HSU was defined by the number of outpatient visits, ED visits, and inpatient days during the perinatal period using admissions and discharge dates. Outpatient visits included all ambulatory care such as primary care, prenatal obstetric, and psychiatric visits. Lab visits (e.g., blood draws) were not included. Visits to the ED during labor which resulted in a

delivery were not included in the ED visits variable. Inpatient hospital visits were measured by the number of days women who presented for delivery stayed in the hospital during the perinatal period at any time.¹⁰ A dichotomous summary variable was also created for outpatient visits (i.e., ≤ 10 visits vs. > 10 visits), ED visits (i.e., ≥ 1 visits vs 0 visits), and inpatient days (i.e., ≥ 3 visits vs. < 3 visits). These summary variables were determined by existing groups identified in the literature and by reviewing the distribution of the data to establish cut off points. Although ≤ 10 visits vs. > 10 visits has been used in previous research,²⁶ an additional group (≤ 15 visits vs. > 15 visits) was created based off of the distribution of the data and reported in the supplemental material.

The primary predictor variable was any SRD (yes/no; ICD-10 codes F10.xx-F19.xx) during the antepartum to postpartum period. To prevent confounding associated with substance use after delivery, SRDs that were only identified during the postpartum period were excluded from the analysis. The secondary predictor variables included an SRD for alcohol (yes/no), opioids (yes/no), stimulants (i.e., cocaine, methamphetamine; yes/no), nicotine (yes/no), and cannabis (yes/no). In the individual analyses by substance type, the groups were not mutually exclusive. For example, a patient with an alcohol-related diagnosis may also have a co-occurring tobacco-related diagnosis.

Covariates included age at delivery, race (American Indian/Alaskan Native, Native Hawaiian or Other Pacific Islander, Asian, Black, White, and other or mixed race), and Hispanic/Latina ethnicity. Self-reported race (e.g., Black, White) and ethnicity (e.g., Hispanic/Latina, African American, Caucasian) are separate categories in this EHR. Those who selected “Unknown or choose not to disclose” were categorized as missing. Other covariate variables included marital status (single, divorced/separated/widowed, or married), and body mass index (BMI) at delivery. Health insurance type at delivery was identified as private (e.g., commercial, managed care), public (e.g., Medicaid), and no insurance. The private insurance group could also have public insurance. The public insurance group did not have private insurance.

Serious mental illness (SMI; e.g., schizophrenia, bipolar disorder, major depressive symptoms) is defined by the National Institute of Mental Health (NIMH) as a mental, behavioral, or emotional disorder that results in serious functional impairment.²⁷ Summary variables for SMI (yes/no) and non-SMI (any other mental illness [e.g., anxiety] which is not included in the SMI category; yes/no) were created. A summary variable for pre-existing health condition included anemia, cardiovascular disease, non-gestational diabetes, cancer, kidney failure, hypertension, lupus erythematosus, epilepsy, pulmonary disease, human immunodeficiency virus, acquired immunodeficiency syndrome, hepatitis C virus, and tuberculosis.²⁸ ICD-10 codes available upon request.

Statistical Analysis

Encounter dates related to pregnancy, diagnoses, and health visits from the EHR were used to calculate time from a diagnosis to delivery and timing of HSU outcomes. Descriptive and inferential statistics were used to determine the sample characteristics and the relationship between having an ICD-10 code for an SRD (yes/no) and the HSU outcomes. The HSU

outcome variables were first analyzed as continuous variables (i.e., number of outpatient visits, ED visits, and inpatient days) and then as categorical variables (i.e., 10 visits outpatient visits, 1 visits ED visits, and 3 inpatient days). Analysis of variance (ANOVA) was used for continuous data and Chi-squared (X^2) tests of significance was used for categorical data. To determine the effect and magnitude of the associations, unadjusted odds ratios (ORs) were calculated. Due to the large sample size ($n = 16,770$), most of the comparisons in the bivariate analysis revealed significant differences associated with HSU outcomes. Propensity score matching (PSM) was used to account for the potential imbalance and confounding across maternal sociodemographic and obstetrical characteristics using variables found to impact HSU in pregnant women.¹¹ Women with and without an SRD were matched by age and BMI at delivery, delivery year (2012–2019), and pre-existing health condition (yes/no).^{29–31} Although research has shown that mental illness also impacts HSU,³² we explored the roles of SMI and non-SMI as a predictor in the analysis due to the high co-occurrence with SRDs and did not include it in the PSM procedure. The final PSM procedure yielded a matched 1:1 sample of 1,986 (993 with an SRD and 993 without an SRD).¹² Standardized mean difference was used to assess the balance of the covariate distributions between the groups. After creating a 1:1 (SRD yes vs. no SRD) sample, we controlled for confounders found to be significant with HSU in the bivariate analysis (i.e., race, Hispanic ethnicity, health insurance type, non-serious mental illness) and included them in the multivariable logistic regression models to determine whether SRDs were associated with each of the HSU continuous and categorical variables. Standardized betas (β), standard errors (SE [β]), adjusted odds ratios (AOR), and the respective CIs and p-value were reported. All of the analytical steps were repeated for each substance type. In addition, individual groups for each categorical HSU outcome (e.g., only those with 10 outpatient visits) and two additional groups (i.e., only those with 15 visits, only those with > 15 visits) were created to examine the number of visits in each group by SRD (yes/no). The mean, SD, β , SE, and p-value s were reported for each. The analyses were conducted with SAS 9.4 (SAS Institute).

Results

Sample Characteristics

There were 16,770 deliveries with an ICD-10 code for a single delivery at 20 weeks' gestation from April 1st, 2012 to September 30th, 2019. In the entire unmatched sample, an SRD was identified in 1,026 (6.1%) women with a delivery. During the perinatal period, 5,538 (33.0%) had 10 outpatient clinical visits (all outpatient visits mean = 15.8, standard deviation [SD] = 11.1, range = 0–87), 1,682 (10.0%) had 1 ED visits (all ED visits mean = 0.31, SD = 1.13, range = 0–31), and 405 (2.4%) had 3 inpatient days (all inpatient days mean = 0.26, SD = 0.77, range = 0–10; Table B).

In the matched sample ($n = 1,986$), an SRD was identified in 993 (50.0% due to matching) women (Table 1). Of these, an SRD for alcohol (5.0%), opioids (10.0%), stimulants (13.7%), nicotine (16.1%), and cannabis (16.3%) were reported. The majority were White (51.0%) or of mixed or other race (31.1%; Table 1). Those who reported Hispanic/Latina ethnicity made up 35.7% of the sample. Those who reported Black or Asian race made

up 10.0% and 6.6% of the sample respectively. The mean age was 29.8 (SD = 5.6, range 18–44 years of age). Most were married (47.4%) or single (48.4%), had a mean BMI of 32.7 (SD = 7.5, range = 14.4–74.0), and private health insurance (66.1%). SMI and non-SMI were documented for 8.2% and 32.7% respectively. Pre-existing health conditions were documented for 49.1% due to matching.

Correlates of HSU

In the matched sample, 722 (36.4%) had ≤ 10 outpatient clinical visits (all outpatient visits mean = 15.4, SD = 11.3, range = 0–87), 264 (13.3%) had ≤ 1 ED visits (all ED visits mean = 0.48, SD = 1.16, range = 0–31), 100 (5.0%) had ≤ 3 inpatient days, (all inpatient days mean = 0.45, SD = 1.04, range = 0–10; Table 2). When analyzed by individual HSU groups, the mean number of outpatient visits were significantly lower for those with an SRD who had ≤ 10 outpatient visits (4.11 ± 3.69 vs. 4.79 ± 3.68 , p-value = 0.0143) and ≤ 15 outpatient visits (6.68 ± 5.17 vs. 8.18 ± 5.04 , p-value = <0.0001 ; Table C). The mean number of inpatient days were significantly higher for those with an SRD who had < 3 inpatient days (0.32 ± 0.74 vs. 0.24 ± 0.65 , p-value = 0.0110; Table C).

Compared to women without an SRD, women with an SRD were more likely to have fewer outpatient visits ($\beta = -0.131$, p-value = <0.0001 ; Figure 1) and have ≤ 10 outpatient clinical visits compared to >10 outpatient clinical visits (AOR = 1.81 [95% CI, 1.44–2.28], p-value = <0.0001). Alcohol-, opioid-, and a stimulant-related diagnoses were independently associated with ≤ 10 outpatient clinical visits (AOR = 3.16 [95% CI: 1.67–6.04], p-value = 0.0005; AOR = 3.02 [95% CI: 1.79–5.09], p-value = <0.0001 ; AOR = 2.18 [95% CI: 1.39–3.41], p-value = 0.0007; Table 3).

Compared to women without an SRD, women with an SRD were more likely to have more ED visits ($\beta = 0.049$, p-value = 0.0373; Figure 2) and ≤ 1 ED visits compared to 0 ED visits (AOR = 1.38 [95% CI, 1.00–1.85], p-value = <0.0001). Opioid-, stimulant-, and nicotine-related diagnoses were independently associated with ≤ 1 ED visits (AOR = 2.28 [95% CI: 1.09–4.77], p-value = 0.0287; AOR = 2.01 [95% CI: 1.07–3.78], p-value = 0.0301; AOR = 3.38 [95% CI: 1.90–6.02], p-value = <0.0001 ; Table 3).

Compared to women without an SRD, women with an SRD were more likely to have more inpatient days ($\beta = 0.059$, p-value = 0.0158; Figure 2), and ≤ 3 inpatient days compared to < 3 (AOR = 1.69 [95% CI: 1.07–2.67], p-value = 0.0256). Opioid-, stimulant-, and nicotine-related diagnoses were independently associated with ≤ 3 inpatient days (AOR = 3.52 [95% CI: 1.42–8.75], p-value = 0.0067; AOR = 3.51 [95% CI: 1.31–9.34], p-value = 0.0123; AOR = 2.74 [95% CI: 1.11–6.73], p-value = 0.0285; Table 3).

Discussion

Principal Findings

Within a large matched pregnancy cohort in a healthcare system that provides tertiary care and is a referral system for other providers in the community, women with an SRD during the antepartum period were more likely to have fewer outpatient clinical visits, more ED visits, and more inpatient days in the hospital compared to women without an SRD.

Some of the findings from this study are consistent with a 2003–2007 study, which found that women with a SUD (a type of SRD) accounted for 5.5% (n= 20,707) of the sample (total n=375,851) and used the ED and were hospitalized more often compared to women who did not have a SUD.⁶ However, the women in the previously mentioned study represented higher rates of ED visits (38.3% vs 16.0%) and hospitalizations (24% vs 11.2%) compared to the women in this study. This may be due to differences in the samples (ages 15–49 in Massachusetts with a clinically diagnosed SUD vs. ages 18–44 in Southern California with any SRD). Despite these differences, the results from both studies represent disproportionate ED visits and inpatient days in the hospital among women with an SRD. Research also suggests that pregnant women utilizing the ED are less likely to access and receive sufficient prenatal care. In one study, ED visits during pregnancy were a marker for late entry for prenatal care and were also strongly associated with substance use.³⁴ In another study, women with mental health disorders (e.g., depression, SUD) used the ED during the postnatal period for psychiatric and obstetrical reasons more often than women without mental health disorders.³⁵ A 2021 study found that pregnant women with an SRD were nearly two times more likely to have SMM.³ SMM refers to 21 life-threatening labor and delivery outcomes that result in adverse consequences to a women’s health (e.g., blood transfusion/hemorrhage, hysterectomy, eclampsia) which lead to higher rates of ED visits and hospitalizations.

Research on healthcare use among pregnant women with specific SRDs (e.g., alcohol, opioids, stimulants, nicotine, cannabis) in the United States is limited. In the current study, women with an alcohol-related diagnosis during the antepartum period had significantly fewer outpatient visits compared to those without an alcohol-related diagnosis. There was no significant difference between ED visits and hospitalizations. To our knowledge, there are no studies that have investigated the direct relationship between an alcohol-related diagnosis and HSU among pregnant women. A study investigating singleton live births in California from 2007–2012 found that smoking, alcohol or other drug dependence, and residing in a rural county were significantly associated with an increased risk of late prenatal care.³⁶ Unfortunately, the individual difference between alcohol and other substances were not reviewed. Unlike the previous study, there was no significant association between a nicotine-related diagnosis and outpatient visits. The difference observed in our study may be related to how smoking was measured. The ICD-10 codes that were used to identify a nicotine-related diagnosis represent use, misuse, and dependence of nicotine use, which goes beyond the “smoking” (yes/no) category. In addition, our study measured any outpatient visit, which include prenatal visits. A 2012 study demonstrated that pregnant women who smoke and also use substances are at increased risk of serious complications during pregnancy which is consistent with results from our study demonstrating that nicotine is associated with greater number of inpatient days.³⁷

Women with an opioid-related diagnosis during the antepartum period had fewer outpatient visits and more ED visits and hospitalizations compared to women without an opioid-related diagnosis. Pregnancy is a unique opportunity to identify opioid problems and facilitate treatment using medications for opioid use disorder (MOUD; e.g., methadone, buprenorphine), harm reduction services (e.g., syringe services), and to coordinate care among specialists, behavioral health, and social services.³⁸ After delivery, women with

an opioid-related diagnosis may benefit from postpartum support services including SUD treatment and neonates may benefit from treatment for neonatal opioid withdrawal syndrome (NOWS) if necessary.³⁸ As discussed in the limitations, the data used in this study does not identify pregnant women in treatment using MOUD. It is possible that patients in this study may be receiving care outside of the healthcare system. Additional research on how to reduce ED visits and hospitalizations among pregnant women with an opioid-related diagnosis is needed to improve maternal and neonatal outcomes.^{39–41}

Women with a stimulant-related diagnosis during the antepartum period had fewer outpatient visits and more ED visits and hospitalizations compared to women without a stimulant-related diagnosis. Among pregnant women who use substances, stimulant use (e.g. cocaine, methamphetamine) has been shown to be a leading cause of antepartum hospitalizations,⁴² and is associated with increased risk of hemorrhage and preeclampsia.⁴³ One study investigating trends in hospitalizations among pregnant women who use stimulants from 1998–2004 found that medical complications were more common in women with an amphetamine-related diagnosis compared to the non-SRD group.³⁵ In addition, vasoconstrictive effects such as cardiovascular disorders and hypertension complicating pregnancy were more common in the pregnant women with an amphetamine-related diagnosis compared to a cocaine-related diagnosis.

Clinical and Research Implications

The results of this study reinforce a need to increase the engagement of pregnant women with SRDs in outpatient visits and reduce the number of ED and inpatient days. Excess utilization of ED visits and hospitalizations may result in unnecessary services that cause an increase in hospital costs.¹⁶ Early screening and treatment can decrease the risk of serious maternal and neonatal complications. However, factors such as stigma, fear, and under-reporting of substance use during pregnancy serve as barriers to ideal treatment.⁴⁴ Fewer than half of the states in the US have funded drug treatment programs for pregnant women.⁴⁵ Creating safe and destigmatizing clinical environments for pregnant women with SRDs, mental illness, and pre-existing health conditions will aid in addressing the potential risks that were identified in this paper. Because women with an SRD during the antepartum period may be engaging with the health system in different capacities, non-judgmental questions regarding substance use should be posed during outpatient, ED, and hospitalizations often and be specifically related to substances such as alcohol, opioids, stimulants, and nicotine.

Future studies should investigate the psychosocial barriers (e.g., domestic abuse, transportation) that may inhibit access to prenatal care.⁴⁶ It would also be helpful to qualitatively capture the experiences and perspectives of pregnant women with an SRD who are engaging in the health system in different capacities. Research on the HSU of women who choose to terminate their pregnancies and multiparous women would also be useful. Future research should investigate differences in HSU by substance type (e.g., alcohol, opioids, stimulants) in different populations of pregnant women and a focus on polysubstance use should be included to better identify pregnant women in need of intervention and treatment.

Strengths and Limitations

This study is strengthened by a large sample size over 7.5 years, and the utilization of robust methodology. This study is limited by using ICD-10 codes for health-related diagnoses, which could have involved misclassification bias, unmeasured confounding (e.g., current treatment for SRD, MOUD, pregnancy intention), eligibility changes over time (e.g., discontinued substance use after a SRD), and missing data (e.g., polysubstance substance use that is not accounted for).^{47,48} To mitigate these concerns, we used robust matching techniques, only selected women with an SRD from conception to 42 weeks' gestation, and eliminated anyone with an SRD after delivery. Without a universal screening for substance use in our health system, SRDs are likely underreported. However, those who are identified with ICD-10 diagnostic codes for SRDs are likely identified because they exhibit acute problematic symptoms. As such, these diagnostic codes are likely a marker that the patient's presentation is significant enough to warrant designation by providers. Generalizability between SRD and HSU in this study is limited by the restriction to one large health system in Southern California and the low proportion of non-White (e.g., Black) subjects in this region. However, this study included a relatively large proportion of Black women (10%) for the region due to matching. It was not possible to differentiate between prenatal visits and general outpatient visits because prenatal visits are not clearly labeled in the EHR. However, it is clear that women with an SRD had fewer outpatient visits and more ED visits and inpatient days in the hospital compared to women without an SRD, indicating that these women are likely not accessing essential prenatal healthcare services in the same capacity.

Conclusion

Women with an SRD during the antepartum period had fewer outpatient clinical visits, more ED visits, and more inpatient days in the hospital compared to women without an SRD. Alcohol-, opioid-, and stimulant-related diagnoses were independently associated with 10 outpatient clinical visits. Opioid-, stimulant-, and nicotine-related diagnoses were independently associated with 1 ED visits and 3 inpatient days. These results indicate a need to identify women with SRDs early in their pregnancy to minimize disproportionate healthcare use through intervention and treatment. Future studies should focus on identifying modifiable barriers to treatment for pregnant women with SRDs such as stigma and logistical barriers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Conflict of Interest/Disclosure Statement and Funding Support:

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Highlights:

- Pregnant women with a substance-related diagnosis were more likely to have fewer outpatient visits, more emergency visits, and more inpatient days in the hospital compared to pregnant women without a substance-related diagnosis.
- Alcohol-, opioid-, and a stimulant-related diagnoses were associated with 10 outpatient visits.
- Opioid-, stimulant-, and nicotine-related diagnoses were associated with 1 emergency visits and 3 inpatient days.
- A cannabis-related diagnosis was not associated with any change in outpatient, emergency, or inpatient use.

Condensation:

Women with a substance-related diagnosis during the antepartum period had fewer outpatient visits, and more emergency visits and inpatient days compared to women without a substance-related diagnosis.

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AJOG at a glance:

- B.** Why was the study conducted?
- To evaluate the differences in healthcare service utilization (HSU) among pregnant women with and without substance-related diagnoses (SRD).
- C.** What are the key findings?
- Women with an SRD during the antepartum period were more likely to have fewer outpatient visits, and more emergency visits and inpatient days compared to women without an SRD.
 - Alcohol-, opioid-, and stimulant-related diagnoses were associated with 10 outpatient visits.
 - Opioid-, stimulant-, and nicotine-related diagnoses were associated with 1 emergency visits and 3 inpatient days.
 - Cannabis-related diagnosis was not associated with any change in HSU.
- D.** What does this study add to what is already known?
- Different types of SRD (i.e., alcohol, opioids, stimulants, nicotine) are associated with different types of service utilization.

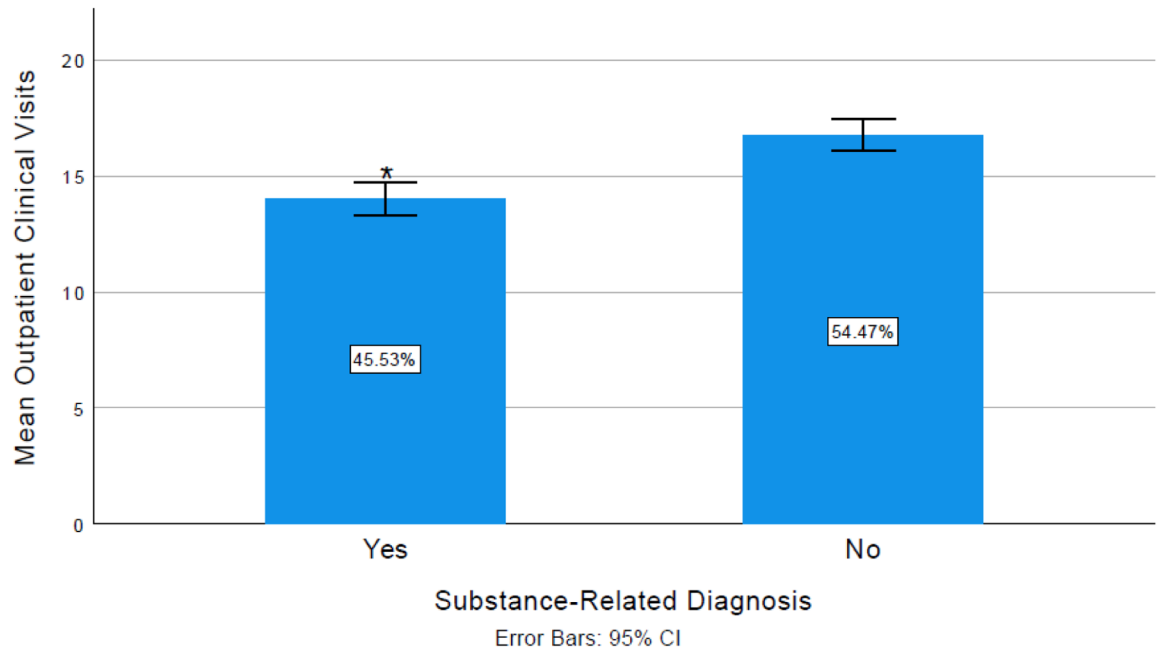


Figure 1. Outpatient clinical visits in women with and without a substance-related diagnosis who delivered a single live birth or stillbirth at 20 weeks of gestation from April 1, 2012, to September 30, 2019

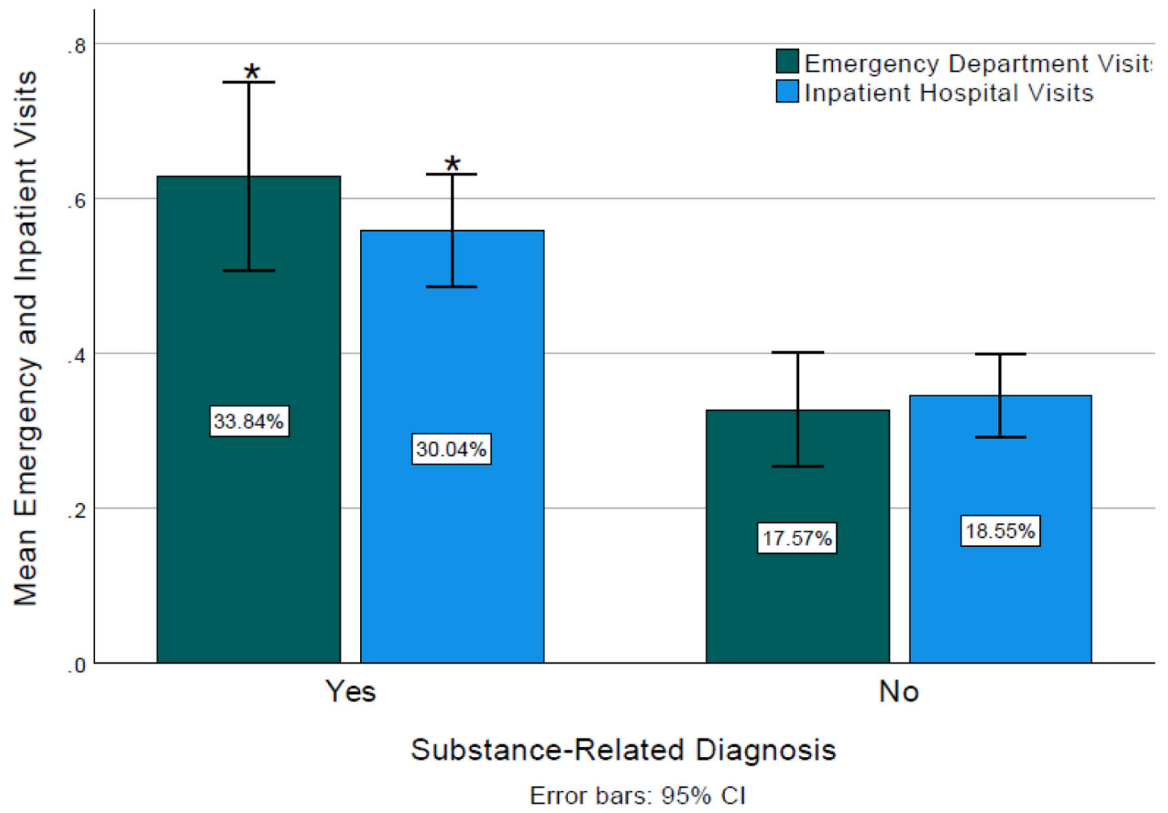


Figure 2. Emergency department and inpatient hospital visits in women with and without a substance-related diagnosis who delivered a single live birth or stillbirth at 20 weeks of gestation from April 1, 2012, to September 30, 2019

Table 1:

Demographic and health-related characteristics in a matched sample of women who delivered their first single live or stillbirth at 20 weeks of gestation with and without a substance-related diagnosis from a large healthcare system's electronic health record from April 1st, 2012-September 30th, 2019 (n= 1,986).

Parameter	Total	Substance-Related Diagnosis	No Substance-Related Diagnosis
All	1,986 (100.0)	993 (50.0)	993 (50.0)
Age at delivery (range 18–44; M ± SD)	29.8 ± 5.6	29.8 ± 5.9	29.9 ± 5.4
Race (n [%])			
American Indian or Alaska Native	11 (0.6)	7 (0.7)	4 (0.4)
Native Hawaiian or Other Pacific Islander	13 (0.7)	7 (0.7)	6 (0.6)
Asian	127 (6.6)	30 (3.1)	97 (10.1)
Black	194 (10.0)	140 (14.4)	54 (5.6)
Other or Mixed Race	601 (31.1)	247 (25.5)	354 (36.8)
White	986 (51.0)	539 (55.6)	447 (46.5)
Hispanic/Latina (n [%])	701 (35.7)	308 (31.5)	393 (39.9)
Marital status (n [%])			
Single	959 (48.4)	649 (65.6)	310 (31.3)
Divorced/separated/widowed	82 (4.1)	64 (6.5)	18 (1.8)
Married	939 (47.4)	276 (27.9)	663 (66.9)
Body mass index at delivery (M ± SD)	32.7 ± 7.5	32.6 ± 7.6	32.7 ± 7.3
Health insurance (n [%])			
No insurance	212 (10.7)	98 (9.9)	114 (11.5)
Public	462 (23.3)	236 (23.8)	226 (22.8)
Private	1,312 (66.1)	659 (66.4)	653 (65.8)
Serious mental illness (n [%])	162 (8.2)	140 (14.1)	22 (2.2)
Non-serious mental illness (n [%])	649 (32.7)	453 (45.6)	196 (19.7)
Pre-existing health condition (n [%])	976 (49.1)	488 (50.0)	488 (50.0)

Variable totals may not sum to column totals due to missing data.

Table 2:

Matched adjusted analysis of healthcare utilization and substance-related diagnosis among women with a documented delivery from a large healthcare system's electronic health record from April 1st, 2012-September 30th, 2019 (n= 1,986).

Parameter	Total	Substance-Related Diagnosis	No Substance-Related Diagnosis	Adjusted Odds Ratio 95% (0)/ β	χ^2/SE	P
All (n [%])	1,986 (100.0)	993 (50.0)	993 (50.0)			
All outpatient visits (range 0–87; M \pm SD)	15.4 \pm 11.3	14.0 \pm 11.6	16.8 \pm 11.6	–0.131	0.540	<0.0001
All outpatient visits (n [%])						
10 visits	722 (36.4)	430 (43.3)	292 (29.4)	1.81 (1.44–2.28)	26.22	<0.0001
> 10 visits	1,264 (63.7)	563 (56.7)	701 (70.6)	—		
All emergency visits (range 0–31; M \pm SD))	0.48 \pm 1.6	0.63 \pm 2.0	0.33 \pm 1.18	0.049	0.076	0.0373
All emergency visits (n [%])						
1 visits	264 (13.3)	162 (16.3)	102 (10.3)	1.36 (1.00–1.85)	3.76	<0.0001
0 visits	1,722 (86.7)	831 (83.7)	891 (89.7)	—		
All inpatient days (range 0–10; M \pm SD)	0.45 \pm 1.04	0.56 \pm 1.17	0.34 \pm 0.87	0.059	0.051	0.0158
All inpatient days (n [%])						
3 days	100.0 (5.0)	69 (7.0)	31 (3.1)	1.69 (1.07–2.67)	4.98	0.0256
< 3 days	1,886 (95.0)	924 (93.0)	962 (96.9)	—		

* 4 deliveries did not have pre-delivery inpatient days in the hospital listed in the electronic medical record. Adjusted = controlling for all of the sociodemographic and health variables that were significantly associated with the HSU outcomes in the bivariate analysis. CI = confidence interval, β = beta coefficient, SE = standard error

Table 3:

Demographic and health-related characteristics in a matched sample of women who delivered their first single live or stillbirth at 20 weeks of gestation with and without a substance-related diagnosis by substance type from a large healthcare system's electronic health record from April 1st, 2012-September 30th, 2019 (n= 1,986).

Parameter	Adjusted Odds Ratio 95% (CI)	χ^2	P
10 outpatient visits			
Alcohol-related diagnosis	3.16 (1.67–6.04)	12.17	0.0005
Opioid-related diagnosis	3.02 (1.79–5.09)	17.20	<0.0001
Stimulant-related diagnosis	2.18 (1.39–3.41)	11.43	0.0007
Cannabis-related diagnosis	1.32 (0.90–1.94)	2.05	0.1520
Nicotine-related diagnosis	1.24 (0.85–1.82)	1.21	0.2698
1 emergency visits			
Alcohol-related diagnosis	0.75 (0.22–2.53)	0.22	0.6369
Opioid-related diagnosis	2.28 (1.09–4.77)	4.78	0.0287
Stimulant-related diagnosis	2.01 (1.07–3.78)	4.71	0.0301
Cannabis-related diagnosis	0.76 (0.43–1.15)	0.93	0.3341
Nicotine-related diagnosis	3.38 (1.90–6.02)	17.07	<0.0001
3 inpatient days*			
Alcohol-related diagnosis	1.03 (0.27–4.02)	0.00	0.9619
Opioid-related diagnosis	3.52 (1.42–8.75)	7.35	0.0067
Stimulant-related diagnosis	3.51 (1.31–9.34)	6.27	0.0123
Cannabis-related diagnosis	1.29 (0.52–3.23)	0.31	0.5802
Nicotine-related diagnosis	2.74 (1.11–6.73)	4.80	0.0285

* 4 deliveries did not have pre-delivery inpatient days in the hospital listed in the electronic medical record. Each variable was assessed individually in matched 1:1 groups by substance type (i.e., alcohol, opioids, stimulants, cannabis, nicotine). Adjusted = controlling for all of the sociodemographic and health variables that were significantly associated with the HSU outcomes in the bivariate analysis.