Contraceptive uptake in postpartum people with and without opioid use disorder and opioid use with co-occurring substance use

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HIGHLIGHTS

- Postpartum contraceptive uptake is low among people with and without OUD.
- People with OUD vs no OUD had lower uptake of highly effective vs no contraception.
- People with poly-substance use vs no SUD had lower uptake of any contraception.
- Highly effective method uptake was lowest with poly-substance use vs no SUD.

ARTICLE INFO

ABSTRACT

Background: Using contraception to delay pregnancy allows people with opioid use disorder (OUD) to choose when they are ready to continue their families. Yet, postpartum contraceptive uptake among people with OUD has not been well characterized.

Methods: Analyses used 73,811 pregnancy episodes among 61,221 people (2016–2021) from the St. Louis University-SSM Virtual Data Warehouse. OUD was defined from the year prior and through pregnancy. Contraceptive uptake was defined within 90-days after delivery. We used Generalized Estimating Equations-type multinomial logit models to assess association of OUD +/- co-occurring substance use disorders (SUDs) with any contraception (yes/no) and type of contraception (effective – pills, patch, ring, injection; or highly effective – long-acting reversible, LARC methods [intrauterine device, implant] and sterilization).

Results: The sample was 66.0 % white and average age was 27.7 years (±5.6). 32.5 % of pregnancies were followed by contraception initiation, 2.3 % had an OUD diagnosis, and 1.3 % OUD with co-occurring SUD. There was no association between OUD and postpartum contraception receipt, but OUD was associated with decreased highly effective compared to effective method initiation (aOR=0.76; 95 % CI: [0.64–0.91]). OUD plus co-occurring SUD was associated with decreased uptake across all contraception types (aOR=0.81[0.70–0.93]), specifically, highly-effective methods (aOR=0.48[0.38–0.61]).

Conclusions: Overall postpartum contraception uptake among people with OUD is comparable to uptake in the non-OUD population. People with OUD plus co-occurring SUDs are particularly unlikely to receive contraception. The reasons people choose contraceptive methods are complex and may differ by SUD severity. More information is needed to understand factors that impact postpartum contraception initiation.

1. Introduction

The postpartum time period is a high-risk time for poor health outcomes in women with opioid use disorder (OUD). After giving birth, new mothers often struggle to navigate physical recovery, endocrine changes, sleep disruption, newborn care, and changed family and social relationships often feeling unprepared for childcare and are uncertain of how to seek help (Martin et al., 2022; Tully et al., 2017). Furthermore, a substantial proportion of women do not attend at least one postpartum visit (Attanasio et al., 2022). Against this backdrop, the postpartum period can be especially difficult for people with OUD, as return to use and treatment discontinuation rates are known to surge after delivery (Forray et al., 2015; Jagodzinski and Fleming, 2007; Wilder et al., 2015). Moreover, overdose deaths are one of the leading preventable causes of death during pregnancy and in the postpartum period (Han et al., 2023). In fact, overdose mortality rates have been found to be higher among people between 43 and 365 days postpartum compared to those pregnant at the time of death or within 42 days of delivery (Bruzelius and Martins, 2022). These disturbing trends highlight the critical period after delivery for women with SUD.

Among postpartum people with SUDs such as OUD, unintended pregnancy is common. Studies have shown that unintended pregnancy rates are as high as 80–90 % in samples of birthing people with SUDs (Black and Day, 2016; Heil et al., 2011), with comparable percentages of pregnancies mistimed (34 %), unwanted (27 %), and ambivalent (26 %). Research has shown that short interpregnancy intervals, often a consequence of unplanned pregnancy, are prevalent (approximately 30 %) among postpartum people with SUDs (Loree et al., 2018). The World Health Organization (WHO) recommends an interpregnancy interval of at least 2 years in order to optimize maternal and infant outcomes (Heller et al., 2016) and has noted that contraceptive information and services are fundamental to the health and human rights of all people (World Health Organization, 2024). While recent publications have called into question the causal relationship between interpregnancy interval and adverse outcomes (Klebanoff, 2017), most data from observational studies in the United States would suggest a modest increase in risk of adverse outcomes associated with intervals of less than 18 months and more significant risk of adverse outcome with intervals of less than 6 months between birth and the start of the next pregnancy (Louis et al., 2019; Regan et al., 2020). Nonetheless, the potential risks of short interpregnancy windows (DeFranco et al., 2007; Smith et al., 2003; Stamilio et al., 2007) may be even higher in women with SUDs, who are at elevated baseline risk for adverse pregnancy outcomes spanning preterm birth, intrauterine growth restriction, placental abruption, blood transfusion, neonatal death (Maeda et al., 2014) and maternal morbidity (Jarlenski et al., 2020).

Unfortunately, there are gaps in our understanding of how OUD may influence postpartum uptake of contraception compared to peers without OUD (Terplan et al., 2015). While postpartum contraception uptake is effective in optimizing interpregnancy intervals, prior research using Pennsylvania Medicaid data has shown that overall postpartum contraception uptake is low in the 90 days after delivery for women with OUD, with 74.5 % not starting any method, 18.1 % receiving an effective method (oral contraceptive pill, patch, vaginal ring, or progesterone injection), and 7.4 % receiving a highly-effective method (long-acting reversible contraception including intrauterine devices or implants and permanent sterilization procedures) (Krans et al., 2018). Furthermore, to the best of our knowledge, there are few clinical studies evaluating how postpartum contraception uptake may be impacted by the use of multiple substances, specifically opioids in addition to non-opioid substances such as alcohol, methamphetamines/cocaine, and sedative/hypnotics, with the majority of papers focused on individuals with single addictive disorders rather than OUD and co-occurring disorders (Krans et al., 2018; Shelton et al., 2022; Stone et al., 2020). This is important as the opioid overdose crisis in the US has evolved to become an epidemic of co-occurring disorders, with opioids most commonly misused with other drugs like alcohol, methamphetamines, cocaine, and sedatives rather than alone (Lin and Saitz, 2021; Mattson et al., 2021). Moreover, there has been a substantial increase in death rates due to illicit drug combinations since the start of the opioid epidemic (Rawy et al., 2024). With SUDs often treated as a single category, (Best et al., 2021; Gilmartin et al., 2021), research is needed to understand OUD plus other substance use and contraception uptake. In the present study, we sought to compute the rate of postpartum contraception initiation associated with OUD and OUD plus additional SUDs including alcohol, cannabis, stimulants (cocaine and methamphetamines), or sedative/hypnotics and compare rates to the general healthcare population using a large Midwestern and Southern electronic health record database.

2. Materials and methods

2.1. Subjects

Data were obtained from the St. Louis University-SSM (SLU-SSM) Healthcare System's Virtual Data Warehouse (VDW). The VDW contains de-identified electronic health record data and was created per specifications of the Health Care Systems Research Network (www.hcsrn.org). The VDW captures academic and non-academic ambulatory and inpatient clinical encounters for > 5 million patients from birth to > 90 years old, starting 1/1/2008 and is updated monthly. The SLU-SSM health care system is a Catholic healthcare system ranked among the top 40 largest healthcare systems in the US (Dyrd, 2020) and includes rural and urban settings from the St. Louis, Missouri metropolitan area, mid-Missouri, southern Illinois, Oklahoma City and surrounding metropolitan area and southern Wisconsin. VDW variables are created from ICD-9 and ICD-10 diagnostic codes, Current Procedural Terminology (CPT) codes, pharmacy orders, laboratory orders and results, vital signs, provider and clinic type, and demographics. The Saint Louis University Institutional Review Board reviewed research using the VDW as exempt because all data is historical and de-identified.

2.2. Eligibility criteria

There were 4,018,066 patients of all ages and sex with an encounter in the VDW from 1/1/2016–12/31/2021. There were 65,773 women with 79,491 pregnancy episodes during the observation period identified using ICD-9 or −10 procedure codes and CPT codes for delivery (See e-Table 1). We excluded 2,555 patients without at least one outpatient encounter in the year prior to the onset of pregnancy through the delivery date. Onset of pregnancy was calculated using established methods (Margulis et al., 2015; Palmsten et al., 2013), where the start date was −270 days from delivery dates without preterm birth and −245 days for deliveries where a preterm birth was indicated. Derivation of the analytic sample is shown in Fig. 1.

2.3. Measures

The primary exposure was diagnosis of OUD determined by the presence of at least one ICD-9 or −10 diagnostic code for opioid abuse or dependence, which we refer to as OUD going forward, from the year prior to the start of pregnancy through the delivery date (see e-Fig. 1 for study design). ICD-9 and −10 codes utilize the stigmatizing term "abuse" rather than "use disorder" (Volkow et al., 2021). While we did not distinguish between OUD diagnoses made in the year prior to pregnancy versus during pregnancy in analyses, research suggests that the prevalence of OUD-related adverse events, such as overdose, are similar in the 1 year prior to pregnancy and first trimester of pregnancy, meaning a person who is symptomatic with OUD during pregnancy is likely to have been symptomatic the year prior to pregnancy (Schiff et al., 2018). A secondary exposure was used to define poly-substance use disorders, which were categorized as: 1) OUD only; 2) OUD + a

co-occurring substance use (alcohol, cannabis, stimulant, or sedative use disorder); 3) Other substance use disorder, but no OUD; 4) no substance use disorder.

The primary outcome was initiation of a contraceptive method in the 90 days after delivery. Contraceptive methods were determined using ICD9/10 V and Z diagnostic codes, CPT codes, and prescription orders. A secondary outcome characterized contraceptive methods by effectiveness (Kotha et al., 2019; Krans et al., 2018; World Health Organization Department of Reproductive Health and Research WHO/RHR and Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs CCP, 2018). Effective methods include oral contraception, medroxyprogesterone injection, vaginal ring, and contraceptive patch (effective to 1–9 pregnancies per 100 women with regular use). Highly effective methods include long-acting reversible contraception (LARC; copper and progesterone intrauterine device and contraceptive implant) and female sterilization (effective to <1 pregnancy per 100 women with regular use). See e-Table 1 for code lists.

Sociodemographic covariates included age at delivery date (12–19, 20–34, ≥35), race (white, black, other), Hispanic ethnicity and neighborhood socioeconomic status (nSES). The nSES was computed by linking a patient's 5-digit home zip code to 5-year estimates from the American Community Survey for percent of households with income below poverty, annual income below $35,000, and those receiving public assistance; percent of adult males 20–64 not in the labor force; percent of adults 25 years and older without a high school diploma or equivalent; and median household income and value of single family homes (Roblin, 2013). A standardized nSES score was assigned to all US zip codes using a principal components analysis, where a higher score indicates lower nSES. The distribution of scores among all US zip codes was used to define high nSES (at or below the median) vs. low.

Other covariates were measured from the year prior to the start of pregnancy through delivery date by the presence of at least one ICD9/10 diagnostic code. The following co-occurring substance and mental health disorders were included because they may predict lower contraception uptake (Odette et al., 2023): nicotine dependence, insomnia, any anxiety disorder, mood disorder, and other substance use disorder (stimulant, sedative, alcohol, cannabis). We also controlled for individual pain conditions (arthritis, back pain, chronic pain, fibromyalgia, headache, muscle pain, neuropathy) that may influence opioid prescribing and may be related to OUD risk (Hser et al., 2017). See

e-Table 1 for code lists.

2.4. Analytic approach

All analyses were conducted using SAS v9.4 (SAS Institute, Cary, NC) at an alpha=0.05. All analyses conducted at the pregnancy episode level used robust, sandwich-type variance estimation to account for pregnancy episodes clustered within patients. Bivariate associations of patient-level demographics and pregnancy episode associated comorbidities by OUD status were assessed with chi-square tests. Demographic and comorbidities by OUD diagnosis status were assessed with chi-square tests. Generalized Estimating Equations (GEE)-type multinomial logit models assessed the association of OUD and receipt of any contraception (among the entire sample) and contraception by type among those starting contraception (highly effective versus none and effective versus none) in the 90 days after delivery with odds ratios and 95 % confidence intervals in crude and models adjusted for demographic and co-occurring disorders. In secondary analyses, GEE-type multinomial logit models were used to estimate the association between poly-substance use disorders, defined as OUD plus co-occurring SUD, and receipt of any contraception and contraception by method in crude and adjusted models.

3. Results

There were 61,221 women with 73,811 pregnancy episodes from 2016 to 2021. Of the eligible pregnancy episodes 72,494 (98.2 %) had an ambulatory visit during pregnancy. See Table 1 for overall and OUD vs. no OUD comparisons of demographic and comorbidity-related characteristics. About two-thirds of patients were White, 26.4 % were Black, 6.0 % were Hispanic, and 81.9 % had a single pregnancy episode. Comparing patients with OUD to patients without, a significantly greater proportion were White while fewer were Hispanic or had a high nSES. Among all pregnancy episodes, 2.3 % (n=1694) were identified as having OUD in the year prior to pregnancy through delivery date. Of these 1,694 pregnancy episodes where OUD was indicated, 1,272 (75.1 %) had an OUD diagnosis <u>only</u> occurring during pregnancy, 314 (18.5 %) had an OUD diagnosis occurring in <u>both</u> the year prior to pregnancy and during pregnancy, and 108 (6.4 %) had an OUD diagnosis occurring <u>only</u> in the year prior to pregnancy. In terms of OUD
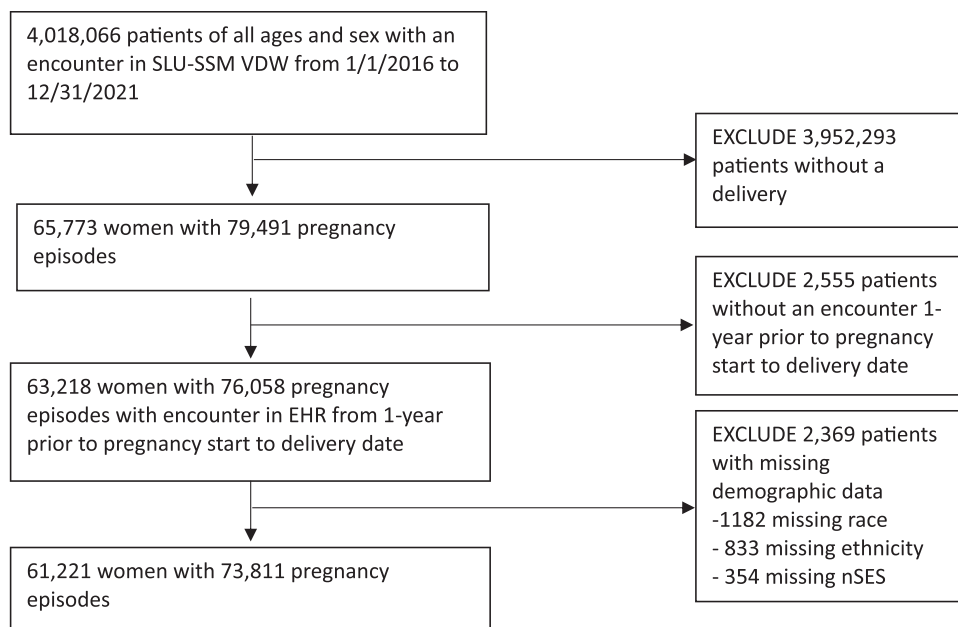


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│ 4,018,066 patients of all ages and sex    │
│ with an encounter in SLU-SSM VDW from     │
│ 1/1/2016 to 12/31/2021                    │
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              │                    ┌────────────────────────────┐
              │───────────────────▶│ EXCLUDE 3,952,293 patients │
              │                    │ without a delivery         │
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│ 65,773 women with 79,491 pregnancy        │
│ episodes                                  │
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              │───────────────────▶│ EXCLUDE 2,555 patients     │
              │                    │ without an encounter 1-    │
              │                    │ year prior to pregnancy    │
              ▼                    │ start to delivery date     │
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│ 63,218 women with 76,058 pregnancy        │
│ episodes with encounter in EHR from 1-    │  ┌───────────────────────────┐
│ year prior to pregnancy start to delivery │  │ EXCLUDE 2,369 patients     │
│ date                                      │  │ with missing               │
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              ▼                                 │ - 354 missing nSES         │
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│ 61,221 women with 73,811 pregnancy        │
│ episodes                                  │
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Fig. 1. Derivation of analytic sample.

Table 1

Sample characteristics among 61,221 women with 73,811 pregnancy episodes 1/1/16–12/31/21.

	Unique patients – n=61,221	Non-OUD patients (n=59,736)	OUD patients (n=1,485)	p-value
Race				<.0001
White	40422 (66.0)	39343 (65.9)	1079 (72.7)	
Black	16137 (26.4)	15765 (26.4)	372 (25.1)	
Other	4662 (7.6)	4628 (7.8)	34 (2.3)	
Hispanic ethnicity	3699 (6.0)	3673 (6.2)	26 (1.8)	<.0001
High Neighborhood SES	29081 (47.5)	28407 (47.6)	674 (45.4)	.099
# pregnancy episodes				.0002
1	50129 (81.9)	48915 (81.9)	1214 (81.8)	
2	9746 (15.9)	9526 (16.0)	220 (14.8)	
3	1210 (2.0)	1169 (2.0)	41 (2.8)	
4–5	136 (0.2)	126 (0.2)	10 (0.7)	
	Pregnancy episodes – n=73,811	Non-OUD episodes (n=72,117)	OUD episodes (n=1694)	p-value
Age (range=12–60)				<.0001
Age 12–19	4870 (6.6)	4846 (6.7)	24 (1.4)	
Age 20–34	59800 (81.0)	58440 (81.0)	1360 (80.3)	
Age ≥35	9141 (12.4)	8831 (12.2)	310 (18.3)	
Preterm delivery	8374 (11.3)	8051 (11.2)	323 (19.1)	<.0001
Nicotine dependence	12141 (16.4)	10831 (15.0)	1310 (77.3)	<.0001
OUD	1694 (2.3)	—	—	—
Any other SUD[a]	6968 (9.4)	5943 (8.2)	1025 (60.5)	<.0001
Alcohol use disorder	645 (0.9)	510 (0.7)	135 (8.0)	<.0001
Stimulant use disorder	1468 (2.0)	843 (1.2)	625 (36.9)	<.0001
Sedative use disorder	255 (0.4)	64 (0.1)	191 (11.3)	<.0001
Cannabis use disorder	5809 (7.9)	5171 (7.2)	638 (37.7)	<.0001
OUD polysubstance[b]				—
None	66174 (89.6)	—	—	
Other SUD, no OUD	5943 (8.1)	—	—	
OUD only	669 (0.9)	—	—	
OUD + other	1025 (1.4)	—	—	
Arthritis	8006 (10.8)	7708 (10.7)	298 (17.6)	<.0001
Back/neck pain	11308 (15.3)	10931 (15.2)	377 (22.3)	<.0001
Chronic pain	1981 (2.7)	1807 (2.5)	174 (10.3)	<.0001
Fibromyalgia	347 (0.5)	313 (0.4)	34 (2.0)	<.0001
Headache	11712 (15.9)	11354 (15.7)	358 (21.1)	<.0001
Muscle pain	9657 (13.1)	9286 (12.9)	371 (21.9)	<.0001
Neuropathy	1111 (1.5)	1062 (1.5)	49 (2.9)	<.0001
Insomnia	1039 (1.4)	914 (1.3)	125 (7.4)	<.0001
Anxiety disorder	9928 (13.5)	9043 (12.5)	885 (52.2)	<.0001
Mood disorder	10207 (13.8)	9195 (12.7)	1012 (59.7)	<.0001
Outcome				
Start contraception 0–90 days after delivery	23982 (32.5)	23438 (32.5)	554 (32.1)	.742
Type of contraception				.150
None	49829 (67.5)	48679 (67.5)	1150 (67.9)	
Effective[c]	15498 (21.0)	15125 (21.0)	373 (22.0)	
Highly effective[d]	8484 (11.5)	8313 (11.5)	171 (10.1)	

[a] Any substance use disorder=alcohol, cannabis, stimulant, or sedative use disorder.

[b] OUD + other = OUD + alcohol, cannabis, stimulant, or sedative (may be OUD + a single or multiple other SUD);Other + no OUD (may be multiple other)

[c] Highly effective methods include long-acting reversible contraception (LARC; copper and progesterone intrauterine device and contraceptive implant) and female sterilization

[d] Effective methods include oral contraception, medroxyprogesterone injection, vaginal ring, and contraceptive patch.

polysubstance use, 1.4 % had OUD + another SUD, 0.9 % had OUD only, and 8.1 % had another SUD without OUD. Among episodes with an OUD diagnosis compared to those without, there was a greater prevalence of age≥35 years old, any other SUD, and co-occurring pain, anxiety, and mood disorders. In Table 1, only one-third (32.5 %) of pregnancies were followed by the start of contraception within 90 days after delivery, with no difference by OUD status. In terms of contraception initiation by method effectiveness, 11.5 % of pregnancies were followed by starting highly effective contraception and 21.0 % effective, with no difference by OUD status.

Table 2 shows adjusted odds ratios (aOR) models for main and secondary exposures and outcomes. While there is no relationship between OUD diagnosis and initiation of *any* contraception in the 90 days after delivery (aOR= 0.91 [0.81–1.02]) or initiation of effective methods versus no method (aOR=1.01 [0.88–1.15]), OUD was related to a decreased likelihood of starting highly effective vs. no contraception (aOR=0.76 [0.64–0.91]). People with poly-substance use disorders, defined as OUD + co-occurring SUD, compared to no OUD were less likely to initiate *any* birth control method within 90 days after delivery (aOR=0.81 [0.70–0.93]) and had an even smaller likelihood of initiating highly effective contraception (aOR=0.48 [0.38–0.61]) than those with OUD alone. Having any SUD, not including OUD, was also associated with a reduction in the uptake of highly effective contraceptive methods compared to no SUD (aOR=0.74 [0.67–0.82]). Full models including aOR for all covariates are shown in e-Table 2 and e-Table 3.

4. Discussion

In this analysis of electronic health record data from birthing people in a large multi-state hospital system in the Southern and Midwestern US, people with OUD initiated any contraceptive method in the 90 days after delivery at the same rate as those without OUD (32.1 % versus 32.5 %). However, people with OUD were less likely to begin highly effective contraceptive methods, including LARC methods and sterilization procedures, than people without OUD. Importantly, poly-substance use, defined as OUD plus at least one co-occurring diagnosis

Table 2

Relationship of OUD [a] +/- co-occurring SUD [b] and starting any contraception and by method effectiveness within 90 days, adjusted GEE-type [c] multinomial logit models, 1/1/16–12/31/21.

	Adjusted Model 1	Adjusted Model 2	Adjusted Model 3
	Any contraception vs. none OR (95 % CI)	Highly effective[e] vs. none OR (95 % CI)	Effective[f] vs. none OR (95 % CI)
OUD			
No OUD	1.00	1.00	1.00
OUD	0.91 (0.81–1.02)	0.76 (0.64–0.91)	1.01 (0.88–1.15)
Polysubstance			
No SUD	1.00	1.00	1.00
Other SUD,[d] no OUD	0.95 (0.89–1.01)	0.74 (0.67–0.82)	1.06 (0.98–1.13)
OUD alone	0.99 (0.94–1.17)	0.89 (0.70–1.14)	1.05 (0.86–1.28)
OUD + co-occurring SUD	0.81 (0.70–0.93)	0.48 (0.38–0.61)	1.03 (0.88–1.21)

*See Full models in Supplemental Information

[a] OUD: opioid use disorder

[b] SUD: substance use disorder

[c] GEE: Generalized Estimating Equations

[d] Other SUD: alcohol, cannabis, stimulant, or sedative use disorder

[e] Highly effective methods include long-acting reversible contraception (LARC; copper and progesterone intrauterine device and contraceptive implant) and female sterilization

[f] Effective methods include oral contraception, medroxyprogesterone injection, vaginal ring, and contraceptive patch.

of alcohol, cannabis, stimulant, or sedative use disorder, was associated with lower uptake of *all* contraceptive methods with the highest reduction in uptake of highly effective methods.

While uptake of postpartum contraception was low among the entire sample of birthing people, rates were slightly higher than those reported in Krans et al.'s retrospective cohort study, where 25.5 % of postpartum women with OUD with Pennsylvania Medicaid initiated an effective or highly effective contraceptive method (Krans et al., 2018). One explanation for this difference may be that our sample included only birthing people engaged in care during the one year prior to conception, representing a population who has the ability to seek treatment. The present analysis does not include people with OUD and poly-substance use who were not engaged in the healthcare system in the one year prior to conception, possibly leading to an overestimation of the true population level uptake of postpartum contraception. Nonetheless, numerous barriers to obtaining postpartum contraception exist that range from financial barriers (perceived cost of contraception and appointments) to health system barriers (method or appointment unavailability, lack of clinician training) to personal barriers (contraceptive misinformation, confusion about the optimal interpregnancy interval, societal or relationship pressure to have multiple children, prioritizing newborn over attending appointments)(Freeman-Spratt et al., 2023). Notably, women with OUD, both with and without co-occurring use of other substances, experience significant challenges in the postpartum period related to SUD treatment discontinuation (Wilder et al., 2015), mental health symptoms, and return to substance use (Stewart et al., 2023) that may serve as additional barriers to accessing postpartum contraception.

Health inequities are exacerbated among people with poly-substance use, who are less likely than their peers without co-occurring use disorders to receive the standard of care for OUD treatment (Ford et al., 2021; Xu et al., 2022). This may be duein partto clinician stigma that is driven by patient complexity, fear of diversion, and risk of overdose among patients who use multiple substances that likely influence treatment decisions (Shearer et al., 2024). This is especially alarming given that multiple substances are commonly involved in both non-fatal overdoses and drug-induced deaths among pregnant people (Charles et al., 2023; Smid et al., 2019). Importantly, people with poly-substance use may receive the greatest benefit from evidence-based treatment, as there is evidence that MOUD may also decrease use of other substances (Ahmadi and Razeghian Jahromi, 2017; Food and Drug Administration, 2017).

Despite recent efforts to provide more comprehensive reproductive health care (Barber and Terplan, 2023; Heuser et al., 2017), barriers to care persist that place postpartum people with poly-substance use at heightened risk of not engaging in postpartum services, including initiating contraception. For example, birthing people without consistent care or more sporadic healthcare encounters centered around points of high need, such as an overdose or delivery, may be less likely to return to a postpartum visit to receive a contraceptive method (Wouk et al., 2021). They also may not have the continuity of consistent prenatal care where clinician education about pregnancy spacing and birth control options are often discussed. For those with inconsistent or late initiation into prenatal care, the need to prioritize more pressing medical concerns may contribute to lack of discussion about postpartum contraception. For example, prevalence of postpartum contraceptive use, including of highly effective methods, has been found to be highest when contraceptive counseling was provided both during pregnancy and after delivery (Zapata et al., 2015). Finally, mothers' perceptions of discrimination at the time of delivery, has been found to be associated with significantly lower postpartum visit attendance (Wouk et al., 2021). While current literature has largely focused on insurance- and race-based discrimination, the discrimination and stigma experienced by birthing people with SUD is well established (Weber et al., 2021) and likely contributes to lower engagement in postpartum care and uptake of contraception which may be even more pronounced in people who use multiple substances. Future research should examine the role of method

cost in postpartum contraceptive initiation given the heterogeneity of insurance coverage by women during pregnancy and after birth (Ranji et al., 2022; Sobel et al., 2018).

Many women, including those with OUD (Krans et al., 2022), may prefer to initiate contraception immediately postpartum and prior to hospital discharge in the form of the contraceptive implant, IUD, or Depo Provera injection. However, systemic barriers often exist (Holden et al., 2018; Hurley et al., 2020; Rodriguez et al., 2023), and patients with limited interactions with the healthcare system may be less likely to accept a contraceptive method due to skepticism and mistrust in a hospital setting with clinicians with whom they do not have an established relationship. However, in this analysis, only 5.1 % of the sample received a contraceptive method within 4 days of delivery, and the rate was higher among those with OUD versus without (6.5 % versus 5.0 %, p=0.007). These findings are consistent with those of Krans et al. in their prospective clinical trial where women with SUD were more likely to choose immediate postpartum contraception implant insertion compared to women with no SUD (2022). Future studies should include assessment of uptake of all forms of immediate postpartum contraception methods as well as postpartum women who had less access to care than in the present study.

Of people who initiated a postpartum contraceptive method, approximately 10 % underwent a sterilization procedure with approximately 75 % occurring within the first 4 days following delivery. Other parts of the country have observed higher rates of postpartum sterilization, such as Pennsylvania (20 % of postpartum contraception) (Krans et al., 2018), but up to date national estimates are lacking. Looking specifically at Catholic hospitals, an analysis using data from five states identified that prevalence of female sterilization for people who delivered at a Catholic hospital was 51 % lower than that of people delivering at a non-Catholic hospital (adjusted prevalence ratio: 0.49; 95 % confidence interval: 0.37–0.65) (Menegay et al., 2022). One explanation for this finding offered by the authors is that sterilization procedures may bedifficult to access outside of the delivery hospital. However, in this analysis there were no differences identified in uptake of highly-effective contraception defined as female/male sterilization, intrauterine device, implant, injectable, oral contraception, patch, or ring by hospital type. Taking into account a history of reproductive coercion that disproportionately impacts women of color and those with lower socioeconomic status (Patel, 2017), is important in understanding access to desired contraceptive methods, including permanent methods. Currently, for people with Medicaid insurance who desire permanent sterilization, a thirty-day waiting period between the time of written informed consent and the procedure is required. While this policy was originally intended to prevent reproductive coercion and sterilization regret, it now serves as a policy-level barrier to autonomously desired care for low-income women (Amalraj and Arora, 2022) that is not experienced by those with private insurance who are not subject to these same regulations (Borrero et al., 2014).

Finally, study findings should be interpreted in light of ongoing political barriers to accessing reproductive healthcare and SUD treatment, particularly for individuals from disadvantaged communities who already face numerous structural and systemic barriers to accessing health care (Resneck, 2022). For example, the synergistic harms of criminalized substance use and heavily surveilled pregnancy are exacerbated by the legal restrictions placed on fundamental reproductive rights by the Dobbs decision (Carroll et al., 2023). On one hand, fear of child welfare involvement actively deters pregnant and parenting people from seeking SUD treatment (Atkins and Durrance, 2020), and on the other hand, pregnancy is a known barrier to evidence-based treatment for SUDs. Following the Dobbs decision, ongoing legal efforts to undermine contraceptive access are underway with concern that communities of color and people in low-income households will experience disproportionate challenges in accessing contraception (Salganicoff and Ranji, 2023)

4.1. Limitations

This study has several limitations. First, use of electronic health record data from individuals from the Midwestern and Southern United States may limit generalizability of the findings to other geographic regions. There may be misclassification of the OUD exposure, which was measured from one year prior to the start of pregnancy through the delivery date. The OUD diagnosis may not have been captured in the medical record during this time frame. Also, while 77.2 % of pregnancy episodes had an associated ambulatory outpatient visit in the 90 days after delivery, estimates of contraception initiation may be biased if people sought postpartum contraceptive services outside of the healthcare system where they delivered. In addition, while pharmacy orders for contraceptive methods serve as a proxy for contraception initiation, prescription fills and actual use of a method cannot be captured with EHR data. Research findings from the SLU-SSM Virtual Data Warehouse, which are drawn from patient encounters in a Catholic healthcare system, may limit generalizability to other healthcare systems in the US. Finally, last menstrual period, parity, and the use of non-prescribed contraceptive methods are not captured in the dataset. People may consistently utilize a barrier method, like condoms, or have a partner with a vasectomy which would not place them at increased risk of short pregnancy interval.

4.2. Conclusions

In analysis of a large Midwestern and Southern health care system, rates of postpartum contraception uptake are low overall. People with poly-substance use disorders are less likely to initiate any postpartum contraceptive method compared to people with no SUD. People with OUD alone and poly-substance use are less likely to initiate a highly effective contraceptive method in the postpartum period, with the greatest reduction among those with poly-substance use. Clinicians who care for women with OUD alone and with co-occurring SUD have the opportunity to engage in discussions about postpartum contraception that uses a reproductive justice approach helping women consider their reproductive wishes within the context of established perinatal and maternal risk factors.

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Data statement

Authors intend to provide relevant code on written reasonable request.

Data sharing agreement

Relevant code and data can be shared on written reasonable request.

Dissemination declaration

Dissemination to study participants and patient organizations is not possible or applicable due to the de-identified nature of our data.

Presentations

(1) Presented at The Institute of Clinical and Translational Sciences Big Data Research Symposium, The Advanced Health Data Institute, Saint Louis University and Washington University, Louis, MO. September 13, 2023. Oral presentation, and (2) Dine with Data webinar, AHEAD Institute at Saint Louis University, February 21, 2024, virtual presentation.

CRediT authorship contribution statement

Jennifer K. Bello: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Conceptualization. **Jeannie Kelly:** Writing – review & editing. **Richard A. Grucza:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Kevin Y. Xu:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Conceptualization. **Joanne Salas:** Writing – review & editing, Funding acquisition, Formal analysis, Data curation.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Jennifer K. Bello reports financial support was provided by National Institutes of Health. Jennifer K. Bello reports a relationship with National Institutes of Health that includes: funding grants. Richard Grucza reports a relationship with National Institutes of Health that includes: funding grants. Richard Grucza reports a relationship with Arnold Ventures LLC that includes: funding grants. Richard Grucza reports a relationship with Janssen Pharmaceuticals Inc that includes: consulting or advisory. Richard Grucza reports a relationship with National Institutes of Health that includes: consulting or advisory. Jennifer K. Bello reports a relationship with National Institutes of Health that includes: consulting or advisory. Jeannie Kelly reports a relationship with National Institutes of Health that includes: funding grants. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.dadr.2024.100248.

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