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Medicaid expansion in Oregon and postpartum healthcare among people with and without prenatal substance use disorder☆

Sarah C. Haight[a,1,2,*], Jangho Yoon[b,1], Jeff Luck[b], Marie Harvey[b], Carrie Shapiro-Mendoza[a], Rui Li[a,1], Jean Y. Ko[a,c]

[a] Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA, United States
[b] College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, United States
[c] United States Public Health Service, Commissioned Corps, Rockville, MD, United States

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ABSTRACT

Background: People with a maternal substance use disorder (SUD) may experience a lack of access to necessary healthcare and more specifically, postpartum healthcare. It is not known whether increased insurance coverage introduced by Medicaid expansion has improved postpartum healthcare utilization among this population.
Methods: Oregon 2008–2016 birth certificates and Medicaid claims were used to examine whether continuous insurance enrollment and postpartum healthcare utilization increased post-Medicaid expansion in a population with and without SUD (n = 9,337). International Classification of Diseases codes were used to identify deliveries, SUD, and postpartum healthcare. Univariable and multivariable generalized linear regression with standard errors clustered by individual were used to estimate the association between Medicaid expansion and postpartum healthcare utilization, stratified by maternal SUD.
Results: Among the 10.3% with SUD, expansion was not associated with increased continuous enrollment or postpartum healthcare utilization. Among those without SUD, post-expansion deliveries were associated with increased continuous enrollment (+105.0 days; 95% CI=96.9–113.2), total (+4.4; 95% CI=2.9–6.0), postpartum (+0.3; 95% CI=0.2–0.4), inpatient (+0.9; 95% CI=0.7–1.1), outpatient (+2.3; 95% CI=1.4–3.3), office (+0.9; 95% CI=0.2–1.6), and emergency department (+0.3; 95% CI=0.1–0.5) visits. Among deliveries to postpartum people with SUD, 27.2% had opioid use disorder (OUD); expansion was associated with increased OUD medication use (12.0% vs 18.3%) and number of fills (6.7 vs 16.6).
Conclusions: Medicaid expansion in Oregon was only associated with increased Medicaid-financed healthcare utilization for postpartum people without SUD, with the exception of those with OUD, demonstrating the need for assessing various strategies to improve postpartum healthcare utilization.

1. Introduction

As a result of many barriers, individuals with a maternal substance use disorder (SUD) may experience a lack of access to necessary healthcare and more specifically, postpartum healthcare (Hecksher and Hesse, 2009; Krans et al., 2015a; Stone, 2015; Substance Abuse and Mental Health Services Administration (SAMHSA), 2009). In fact, less than half of postpartum people with opioid use disorders (OUD) have been found to receive a postpartum check-up (Parlier et al., 2014). This lack of healthcare utilization can be an issue for people without SUD as well and thus, it is important for postpartum people, regardless of whether they have SUD, to receive continuous, comprehensive care in the postpartum period (American College of Obstetrics and Gynecology (ACOG), 2018; Bennett et al., 2014). For people with SUD, the postpartum

Abbreviations: SUD, substance use disorder; ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; ICD-10-CM, International Classification of Diseases, Tenth Revision, Clinical Modification; CI, confidence interval; NDC, national drug codes; CPT, current procedural terminology.

☆ **Disclaimer**: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

* Corresponding author.
E-mail address: shaight@unc.edu (S.C. Haight).

[1] Affiliation at the time of analysis and manuscript drafting.

[2] **Present Address:** Department of Epidemiology, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, 135 Dauer Drive, Chapel Hill, North Carolina, 27599, USA

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period can be a particularly high-risk time for relapse or overdose and additional services may be needed (American College of Obstetricians and Gynecologists (ACOG), 2017; Substance Abuse and Mental Health Services Administration (SAMHSA), 2018). For example, among individuals with maternal opioid use disorder (OUD), the highest overdose rate was observed in 7–12 months postpartum (Schiff et al., 2018).

A barrier to postpartum care may be lack of insurance coverage or financial constraints (J.N. DiBari et al., 2014). A study in California found that people categorized as low-income (<$20,000) or as Medicaid recipients were three and two times as likely to miss a postpartum care visit than their counterparts, respectively (J.N. DiBari et al., 2014). Eligible persons for Medicaid include those identified as low income, pregnant people and children, or receiving Supplemental Security Income (J.N. Centers for Medicaid and Medicare Services, n.d.). Pregnant people with incomes up to 138% of Federal Poverty Level (FPL) are eligible for Medicaid coverage for pregnancy-related services from conception to 60 days post-delivery (J.N. Centers for Medicaid and Medicare Services, n.d.) the Children's Health Insurance Program (CHIP) covers pregnant people in some states (J.N. Centers for Medicaid and Medicare Services, n.d.). After 60 days, postpartum people may remain eligible for full-scope Medciaid coverage if the family income falls below the threshold for parents, which varies by state (Kaiser Family Foundation, n.d.) and is generally below that of state's income threshold for pregnancy-related coverage (Ranji et al., 2019). Parental income may be disregarded in determining eligibility for a disabled child, but a child's disability alone does not make a parent eligible for Medicaid coverage for the parent (Ranji et al., 2019). As a result, many people became uninsured 60 days after delivering, and a national study noted that more than half of postpartum people covered by Medicaid or CHIP at delivery experienced gaps in coverage in the first six months postpartum (Daw et al., 2017).

Effective January 2014, states could opt to expand Medicaid eligibility, pursuant to the Affordable Care Act, to low-income adults, not previously eligible, with an income up to 138% FPL; as of July 2021, 38 states and the District of Columbia have adopted expanded Medicaid (Kaiser Family Foundation, 2018). As a result, many people in expansion states were able to maintain coverage in the postpartum period beyond 60 days as they satisfied the income requirements outside the pregnancy period. However, another study using 2015–2018 data from 43 states found that post-expansion, approximately one-third of people with a recent live birth remained uninsured before or after pregnancy (Johnston et al., 2021). In Oregon, the setting of the current study, Medicaid expansion was opted-into in January of 2014, expanding coverage from <40% of the FPL for parents to <138% of the FPL for all adults. Of note, approximately 30% of new enrollees were expected to be women of reproductive age (Baicker et al., 2013). Across our study timeframe, Medicaid eligibility for pregnant people in Oregon included those with incomes up to 185% of the FPL (Kaiser Family Foundation (KFF), n.d.).

Increased insurance coverage introduced by Medicaid expansion has been hypothesized to improve healthcare utilization postpartum via its provision of financial coverage for services as a result of maintaining the postpartum coverage (Gibbs et al., 2020a; Gordon et al., 2020a). An Oregon study found that Medicaid expansion may improve preventive healthcare utilization (Gibbs et al., 2020b). Similarly, Medicaid expansion in Colorado was associated with improved postpartum Medicaid coverage stability and greater use of outpatient care in the postpartum period, as compared to Utah, a non-expansion state (Gordon et al., 2020b). This study also concluded that Medicaid expansion may have had a greater impact on people with severe maternal morbidities, (Gordon et al., 2020b) highlighting the importance of considering the effects of Medicaid expansion within populations with additional need for disease management. As such, an analysis of Pennsylvania Medicaid data concluded that Medicaid expansion did not improve rates of postpartum care utilization for people with a diagnosed OUD (Patton et al., 2019). We examine how Medicaid expansion is associated with postpartum healthcare utilization among people with and without a prenatal substance use disorder in Oregon. Due to the concern of the ongoing opioid crisis, (Haight et al., 2019) the healthcare utilization of individuals specifically with OUD were further investigated.

2. Materials and methods

2.1. Study design and sample

The analytic sample included all Medicaid-financed births in Oregon from 2008 to 2016 where the birth certificate was able to be deterministically linked to Medicaid eligibility, healthcare claims, pharmaceutical claims, and death records with the postpartum year occurring entirely either before Medicaid or after Medicaid expansion. *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) and *International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM)* codes were used to identify obstetric deliveries (includes delivery to hospital discharge; Appendix 1) and the obstetric estimate of gestational age obtained from the birth certificate (2003 version) was used to determine the prenatal period. The one-year postpartum period was defined as the 365 days following discharge from delivery hospitalization. Individuals delivering during 2013 were excluded because their one-year postpartum period existed during both pre-Medicaid expansion and post-Medicaid expansion. Of note, there were no exclusions made for potential participants of the Oregon Health Insurance Experiment (Baicker and Finkelstein, 2011). This exclusion and inclusion criteria resulted in a longitudinal cohort of 9337 maternal-infant dyads. There were 7166 individuals with a delivery between 2008 and 2012 and one-year of postpartum healthcare utilization data occurring entirely within the pre-Medicaid expansion window (2008–2013). There were 2171 individuals with a delivery between 2014 and 2015 and one-year postpartum healthcare utilization occurring entirely within the post-Medicaid expansion window (2014–2016).

2.2. Measures

Medicaid claims were used to identify SUD diagnosed during the prenatal or delivery period (referred hereinafter as maternal SUD) using *ICD-9-CM* and *ICD-10-CM* codes for abuse and/or dependence of alcohol, opioid, cannabis, cocaine, amphetamines and other stimulants, hallucinogens, inhalants, sedatives/hypnotics/anxiolytics/psychotropics, and other unspecified substances (Appendix 1). Tobacco use disorder was not included in this definition. Those with diagnoses of OUD were included in analyses investigating opioid-specific outcomes.

Maternal characteristics were identified from the birth certificate and categorized: maternal age at delivery (15–24, 25–34, 35–44 years), race and Hispanic ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic Other/Unknown, Hispanic), highest education level obtained (<high school, high school, and [3]some college), marital status at delivery (married, unmarried), history of previous live births (0, ≥1), trimester of entry into prenatal care (1st; 2nd, 3rd, or none), tobacco use during pregnancy (yes, no), pre-pregnancy and gestational diabetes (yes, no), and pre-pregnancy and gestational hypertension (yes, no). Deaths during pregnancy or the first year postpartum was ascertained from linked death records. Medicaid claims were also used to identify mental health conditions diagnosed during pregnancy or delivery using ICD diagnosis codes for depression, anxiety, or serious mental illness (SMI) (Appendix 1).

Medicaid claims were used to identify Medicaid enrollment prior to pregnancy (record of being eligible and enrolled before becoming pregnant) and days of continuous Medicaid coverage from delivery through the first year postpartum. In calculating days of continuous Medicaid coverage, a gap of two weeks was allowed, which is consistent with a similar study (Patton et al., 2019). Additionally, the following postpartum healthcare utilization variables were identified from Medicaid claims: number of postpartum check-ups, mental health-related healthcare visits, outpatient hospital visits, inpatient hospital admissions, office visits, and emergency department visits. The following variables

were identified using National Drug Codes (NDC) codes from pharmaceutical claims: average number of antidepressant prescription and OUD maintenance medication fills (Appendix 1).

2.3. Statistical analysis

We estimated the prevalence of maternal demographic and clinical characteristics by maternal SUD status. Across SUD status, Chi-squared tests were used to determine differences in the distribution of categorical variables and two sample t-tests were used to compare days of continuous Medicaid enrollment. All univariable and multivariable analyses were stratified by SUD status. The average number of postpartum healthcare visits and pharmaceutical fills were calculated, and two sample t-tests were used to compare these estimates across pre- and post-Medicaid expansion status. Generalized linear regression with standard errors clustered by individual was used to estimate the unadjusted and adjusted differences in the number of postpartum healthcare visits or antidepressant fills between pre- and post-Medicaid expansion deliveries. Multivariable models controlled for maternal characteristics (age, education, pre-pregnancy Medicaid status, race/ethnicity, marital status, parity, trimester of entry into prenatal care, and smoking status during pregnancy), other factors that may impact levels of postpartum care need and utilization (pre-pregnancy diabetes, pre-pregnancy hypertension, gestational diabetes, and gestational hypertension), and diagnosis of mental health conditions during pregnancy or delivery. Multivariate analyses were not performed among individuals with OUD, but use of OUD maintenance medications (e.g. buprenorphine) and quantity of fills were calculated for before and after Medicaid expansion. P-values <0.05 were considered statistically significant. All analyses were performed using SAS 9.4 Statistical Software. All cells with fewer than 10 observations were suppressed to prevent identification.

3. Results

In our population of 9337 people with Medicaid-covered births, 10.3% ($n = 965$) had diagnosed maternal SUD (Table 1). Regarding maternal demographics, the distribution of maternal age, race/ethnicity, education, Medicaid coverage before pregnancy, marital status, parity, trimester of entry into prenatal care, and tobacco use during pregnancy differed by SUD status (P-values < 0.05; Table 1). Regardless of timing related to Medicaid expansion, individuals with SUD were significantly more likely than those without SUD to be covered by Medicaid prior to pregnancy (69.9% vs 56.8%; $P<0.0001$). Regarding medical history and clinical outcomes, the distribution of death during or in the year postpartum, any mental health, depression, anxiety, and SMI diagnoses during the prenatal or delivery period significantly differed by SUD status (P-values < 0.05). Individuals with SUD were significantly more likely than those without SUD to have been diagnosed with any prenatal mental health condition (46.2% vs 15.8%) and more specifically, depression (27.6% vs 9.6%), anxiety (28.3% vs 8.2%), and SMI (17.7% vs 4.9%) (P-values <0.05). Additionally, the average number of days continuously enrolled in Medicaid postpartum was greater among indiviudals with SUD (mean=316.5 days) than those without SUD (mean=208.4 days; $P < 0.01$).

The associations of Medicaid expansion with postpartum healthcare utilization differed between individuals with and without SUD in both univariable and multivariable analyses. In univariable analyses, among individuals with SUD, days of enrollment and healthcare utilization did not statistically differ across Medicaid expansion (Table 2). Conversely, among individuals without SUD, the average number of postpartum check-ups, mental health-related health visits, antidepressant prescription fills, days of continuous Medicaid enrollment, total healthcare visits, outpatient hospital visits, office visits, emergency department visits, and inpatient hospital admissions were all higher among individuals that delivered post-Medicaid expansion (P-values < 0.01; Table 2).

After controlling for potential confounders, among individuals with SUD, there was no difference in days of enrollment or healthcare utilization pre- and post- Medicaid expansion (Table 3). Conversely, among indvidiuals without SUD, those with a delivery post-Medicaid expansion had a higher number of postpartum check-ups (+0.3 checkups; 95% CI: 0.2, 0.4), days of continuous Medicaid enrollment (+105.0; 95% CI: 96.9, 113.2), total healthcare visits (+4.4 visits; 95% CI: 2.9, 6.0), inpatient hospital admissions (+0.9 visits; 95% CI: 0.7, 1.1), outpatient hospital visits (+2.3 visits; 95% CI: 1.4, 3.3), office visits (+0.9 visits; 95% CI: 0.2, 1.6), and emergency department visits (+0.3 visits; 95% CI: 0.1, 0.5) than those with a delivery pre-Medicaid expansion.

Among our sample of 965 individuals with SUD, 262 had a diagnosed OUD (27.2%). For those that delivered pre-Medicaid expansion, the proportion that received some form of medication for OUD in the postpartum period was lower in the pre-expansion period than in the post-expansion period (12.0% vs 18.3%; Table 4). Among those that received treatment, the average number of medication fills was lower in the pre-expansion group (6.7 fills; 95% CI: 4.3, 9.0) than in the post-expansion group (16.6 fills; 95% CI: 5.2, 27.9).

4. Discussion

In this study of 9337 Medicaid-covered deliveries in Oregon from 2008 to 2016, we found that individuals with diagnosed maternal SUD differed from those without a diagnosed SUD in terms of many maternal demographics and co-occurring mental health conditions. After controlling for potential confounders, delivering post-Medicaid expansion was independently associated with increased days of postpartum Medicaid coverage and Medicaid-financed healthcare utilization in the postpartum period, but only among those without a diagnosed SUD. However, our assessment specifically among individuals with OUD revealed that delivering post-Medicaid expansion increased use of medications for opioid use disorder in Oregon. Our finding that delivering post-Medicaid expansion in Oregon was associated with increased coverage and healthcare utilization among individuals without a diagnosed SUD is consistent with the literature showing that Medicaid expansion may improve access to healthcare (Allen et al., 2014; Baicker et al., 2013; Eliason, 2020; Gordon et al., 2020b). This hypothesis is supported by another study comparing Colorado (expansion state) and Utah (non-expansion state), which found that individuals in Colorado had greater improvements in coverage stability and outpatient care in the postpartum period than those in Utah (Gordon et al., 2020b). It is possible that what we observed as increased utilization is actually a result of increased visibility of such utilization, because increases in Medicaid enrollment allow us to observe and quantify care that may have previously been received, but paid for out of pocket or by other payers. For instance, the observed post-Expansion increase in ED utilization among women without SUD may be a reflection of use that would have occurred regardless of expansion, but is quantified in these data because of increased enrollment eligibility. We hypothesize that this possibility likely plays a greater role in the observation of emergency outcomes, like ED visits, than it does for preventative care like postpartum checkups. Unfortunately, these data do not provide the ability to further explore this possibility.

Although Medicaid expansion may increase access to care, it is important to consider subgroups with additional needs like those requiring chronic disease management. We found that delivering post-Medicaid expansion in Oregon did not increase utilization of postpartum care for indviduals with SUD overall, but that those with OUD may have had improved utilization of medications following expansion. Clinical and programmatic efforts to increase maternal care for pregnant and postpartum people with OUD during the post-expansion time period may have contributed to the increased utilization among individuals with OUD in our study (Substance Abuse and Mental Health Services Administration, 2016). The current findings are somewhat consistent with a Pennsylvania study that examined the association between Medicaid expan-

Table 1
Maternal characteristics by maternal substance use disorders among Medicaid-covered deliveries, Oregon 2008–2016.

	Total N (%)	Maternal SUD N (%)	No Maternal SUD N (%)	p-value[1]
Total	9337	965 (10.3)	8372 (89.7)	
Maternal Characteristics				
Maternal age, years				<0.0001
14–24	4301 (48.4)	268 (28.9)	4033 (50.7)	
25–34	4085 (46.0)	567 (61.2)	3518 (44.2)	
35–44	501 (5.6)	91 (9.8)	410 (5.2)	
Maternal race/ethnicity				<0.0001
Non-Hispanic White	6539 (70.4)	642 (66.9)	5897 (70.8)	
Non-Hispanic Black	457 (4.9)	51 (5.3)	406 (4.9)	
Hispanic	1295 (13.9)	117 (12.2)	1178 (14.1)	
Other[2]	999 (10.8)	149 (15.5)	850 (10.2)	
Highest education level obtained				<0.0001
<High School	2585 (29.2)	345 (37.5)	2240 (28.3)	
High School Degree	3497 (39.5)	313 (34.1)	3184 (40.2)	
[3]Some College	2767 (31.3)	261 (28.4)	2506 (31.6)	
Medicaid enrollment before pregnancy				<0.0001
Yes	4722 (58.3)	642 (69.9)	4080 (56.8)	
No	3375 (41.7)	277 (30.1)	3098 (43.2)	
Marital status				<0.0001
Married	2533 (28.5)	172 (18.6)	2361 (29.7)	
Unmarried	6344 (71.5)	753 (81.4)	5591 (70.3)	
Previous live births				<0.0001
0	2448 (27.6)	145 (15.7)	2303 (29.1)	
≥1	6426 (72.4)	780 (84.3)	5646 (71.0)	
Trimester of entry into prenatal care				<0.0001
1st	6500 (69.6)	583 (60.4)	5917 (70.7)	
2nd, 3rd, or none	2837 (30.4)	382 (39.6)	2455 (29.3)	
Tobacco use during pregnancy				<0.0001
Yes	3458 (39.3)	562 (61.8)	2896 (36.8)	
No	5331 (60.7)	348 (38.2)	4983 (63.2)	
Pre-pregnancy diabetes				0.3108
Yes	121 (1.4)	16 (1.7)	105 (1.3)	
No	8770 (98.6)	911 (98.3)	7859 (98.7)	
Gestational diabetes				0.5136
Yes	522 (5.9)	50 (5.4)	472 (5.9)	
No	8369 (94.1)	877 (94.6)	7492 (94.1)	
Pre-pregnancy hypertension				0.8147
Yes	192 (2.2)	21 (2.3)	171 (2.2)	
No	8699 (97.8)	906 (97.7)	7793 (97.9)	
Gestational hypertension				0.1086
Yes	463 (5.2)	38 (4.1)	425 (5.3)	
No	8428 (94.8)	889 (95.9)	7539 (94.7)	
Any mental health diagnosis during pregnancy or delivery				<0.0001
Yes	1769 (19.0)	446 (46.2)	1323 (15.8)	
No	7568 (81.1)	519 (53.8)	7049 (84.2)	
Depression during pregnancy or delivery				<0.0001
Yes	1068 (11.4)	266 (27.6)	802 (9.6)	
No	8269 (88.6)	699 (72.4)	7570 (90.4)	
Anxiety during pregnancy or delivery				<0.0001
Yes	961 (10.3)	273 (28.3)	688 (8.2)	
No	8376 (89.7)	692 (71.7)	7684 (91.8)	
Serious mental illness (SMI) during pregnancy or delivery				<0.0001
Yes	584 (6.3)	171 (17.7)	413 (4.9)	
No	8753 (93.8)	794 (82.3)	7959 (95.1)	
		Mean (SD)	Mean (SD)	p-value
Average # of continuously enrolled days in postpartum period	219.6 (159.7)	316.5 (93.3)	208.4 (161.9)	<0.0001

[1] Assessed with Pearson Chi-Square Test.
[2] Includes Asian, American Indian, Alaskan Native, Native Hawaiian, Pacific Islander.

sion and postpartum health care utilization among postpartum people with OUD and found no increases in postpartum healthcare utilization like postpartum check-ups or contraception, but that a lower proportion were covered at 300 days postpartum pre-expansion compared to post-expansion (81% vs. 87%) (Patton et al., 2019). It is possible that the individuals in our study with SUD experienced increased utilization of substance-use related care, as evident by the observed increase medications for persons with OUD, but not general postpartum healthcare. Another study investigated the association between Medicaid expansion in Oregon in a general (not postpartum) population with OUD and found increased utilization of psychosocial and pharmacological services after expansion.(McCarty et al., 2019) In our study, we did not observe an increase in outcomes after Medicaid expansion for individuals with SUD. This lack of an increase may be partially explained by the baseline characterstics of this population prior to Medicaid expansion. Of note, levels of continuous enrollment prior to expansion were very high in the individuals with SUD with average continuous coverage of nearly a year, indicative of a population that meets eligibility criteria for reasons outside of pregnancy (e.g., low-income, disability). Further, compared to those without SUD, those with SUD were more likely to have baseline

Table 2
Postpartum healthcare utilization among Medicaid-covered deliveries before and after Medicaid expansion, Oregon 2008–2016 (n = 9337).

	Maternal SUD (n = 965)		No Maternal SUD (n = 8372)	
	Pre-Medicaid Expansion	Post-Medicaid Expansion	Pre-Medicaid Expansion	Post-Medicaid Expansion
Average number of:	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Postpartum check-ups	1.3 (1.2, 1.3)	1.3 (1.2, 1.4)	**0.8 (0.8, 0.8)**	**1.2 (1.2, 1.3)**
Mental health-related visits	2.1 (1.7, 2.6)	2.5 (1.9, 3.2)	**0.5 (0.4, 0.5)**	**0.9 (0.7, 1.0)**
Antidepressant prescription fills	2.1 (1.8, 2.4)	1.9 (1.5, 2.2)	**0.9 (0.8, 0.9)**	**1.1 (1.0, 1.3)**
Days of continuous Medicaid enrollment	310.5 (302.2, 318.7)	326.2 (318.5, 333.8)	**178.4 (174.4, 182.3)**	**317.7 (313.2, 322.2)**
Total healthcare visits	48.8 (44.6, 53.0)	44.0 (39.0, 49.0)	**17.9 (17.2, 18.6)**	**27.0 (25.7, 28.4)**
Inpatient hospital admissions	5.0 (4.4, 5.6)	5.3 (4.6, 6.1)	**2.5 (2.4, 2.6)**	**4.0 (3.8, 4.2)**
Outpatient hospital visits	17.7 (15.6, 19.9)	15.7 (13.1, 18.2)	**7.4 (7.0, 7.8)**	**11.2 (10.3, 12.1)**
Office visits	23.7 (20.8, 26.6)	20.5 (16.9, 24.1)	**7.1 (6.8, 7.4)**	**10.4 (9.8, 11.0)**
Emergency department visits	2.3 (2.0, 2.7)	2.5 (2.0, 3.0)	**0.9 (0.8, 0.9)**	**1.4 (1.3, 1.6)**

Boldface indicates two-sample t-test significant at $P < 0.05$.

Table 3
Independent association between Medicaid expansion and postpartum healthcare utilization among Medicaid-covered deliveries, Oregon 2008–2016 (n = 9337).

Difference (post- vs pre-) in the average number of	Maternal SUD (n = 965)		No Maternal SUD (n = 8372)	
	Unadjusted mean difference(95% CI)	Adjusted mean difference(95% CI)	Unadjusted mean difference(95% CI)	Adjusted mean difference(95% CI)
Postpartum check-ups	0.0 (−0.2, 0.2)	0.1 (−0.3, 0.4)	**0.4 (0.4–0.5)**	**0.3 (0.2, 0.4)**
Mental health-related visits	0.4 (−0.6, 1.4)	0.5 (−1.3, 2.2)	**0.4 (0.2, 0.6)**	0.1 (−0.1, 0.2)
Antidepressant prescription fills	−0.3 (−1.0, 0.4)	−0.2 (−1.2, 0.9)	**0.1 (0.1, 0.4)**	0.1 (−0.2, 0.1)
Days of continuous Medicaid enrollment	15.7 (−0.1, 31.5)	16.3 (−11.8, 44.5)	**139.3 (131.4, 147.2)**	**105.0 (96.9, 113.2)**
Total healthcare visits	−4.8 (−13.5, 3.9)	−8.5 (−24.3, 7.3)	**9.1 (7.6, 10.6)**	**4.4 (2.9, 6.0)**
Inpatient hospital visits	0.3 (−0.9, 1.5)	0.2 (−1.7, 2.2)	**1.5 (1.3, 1.6)**	**0.9 (0.7, 1.1)**
Outpatient hospital visits	−2.1 (−6.4, 2.3)	−2.5 (−10.4, 5.4)	**3.8 (2.9, 4.7)**	**2.3 (1.4, 3.3)**
Office visits	−3.2 (−9.2, 2.9)	−6.2 (−17.6, 5.2)	**3.3 (2.6, 3.9)**	**0.9 (0.2, 1.6)**
Emergency department visits	0.2 (−0.6, 0.9)	0.0 (−1.4, 1.4)	**0.5 (0.4, 0.7)**	**0.3 (0.1, 0.5)**

Boldface indicates difference significant at $P < 0.05$.
[1]Generalized linear regression adjusted for age, education, pre-pregnancy Medicaid status, race/ethnicity, marital status, parity, month of entry into prenatal care, smoking status during pregnancy, pre-pregnancy or gestational diabetes or hypertension, and diagnosis of mental health condition during pregnancy.

Table 4
Postpartum OUD maintenance medication fills[1] among Medicaid-covered deliveries to postpartum people with OUD before and after Medicaid expansion, Oregon 2008–2016 (n = 262).

	Pre-Medicaid Expansion (n = 158) N (%)	Post-Medicaid Expansion (n = 104) N (%)
Filled an OUD maintenance medication	19 (12.0)	19 (18.3)
	Mean (95% CI)	Mean (95% CI)
Number of OUD maintenance medication fills	6.7 (4.3, 9.0)	16.6 (5.2, 27.9)

[1] See Appendix 1 for codes used to identify OUD maintenance medication.

comorbidities (co-substance use and mental health conditions) and potentially as a result, utilize more healthcare prior to expansion. Given these characterstics, a lack of insurance coverage may have been less of an issue in this sample and in turn, Medicaid expansion may have had less of an opportunity to increase coverage or utilization. However, insurance coverage is just one of many possible barriers postpartum people with or without SUD may face in accessing care (J.N. Dibari et al., 2014; Kroelinger et al., 2019; Rodin et al., 2019).

The ACOG committee on obstetric practice has described the need for continued healthcare throughout the postpartum period, regardless of SUD status, (American College of Obstetrics and Gynecology (ACOG), 2018) which is consistent with previous study findings (Tully et al., 2017). Continued interactions with the healthcare system in the postpartum period can help with postpartum depression referral and treatment, breastfeeding support, contraception and birth spacing needs, chronic disease management, and adjusting to changes in sleep and fatigue (American College of Obstetricians and Gynecologists (ACOG), 2018; Stumbras et al., 2016). Additional clinical considerations for postpartum care for individuals with SUD include coordination of substance use treatment, information about breastfeeding contraindications, proper pain management, and support pertaining to related infant outcomes like neonatal abstinence syndrome. (Krans et al., 2015b) Research has shown strategies for improving access to and utilization of comprehensive postpartum care for individuals with SUD may include a reduction of stigma and fear regarding legal ramifications of substance use during the pregnant and parenting periods, and transportation and child care assistance (American College of Obstetricians and Gynecologists (ACOG), 2017; Gopman, 2014). Furthermore, Terplan et al. found that an improvement in person-centered SUD treatment may limit some barriers like fragmented care (Terplan et al., 2015). A few studies have found decreased substance use and increased adherence to care with these types of facilities (Andrews et al., 2011; Ashley et al., 2003).

This study is subject to a few limitations. First, the study relies on administrative data and diagnosis and procedure codes from Medicaid records. Fear of legal ramifications for the use of substances during pregnancy or the involvement of child protective services may have influenced provider screening practices or patient disclosure of substance use, but this likely did not have a large effect as Oregon did not have any punitive policies in place across the study period (Guttmacher Institute, 2022, 2000). The bundled codes for postpartum visits may overestimate postpartum care and ICD codes may not be representative of all substance use disorders, mental health conditions, or healthcare received outside of Medicaid; thus, estimates may be biased. The transition from ICD-9-CM to ICD-10-CM, which increased the number of codes for maternal opioid-related diagnoses, may have also affected results as previous research has shown, (Hirai et al., 2021) but the impact of this transition on documentation of postpartum healthcare is unknown. Last, all healthcare utilizataion reported can only reflect care financed by

Medicaid, rather than actual care received. However, the dataset is also a strength as the linkage of multiple data sources provided information on many confounders and allowed for follow-up of postpartum healthcare utilization and maternal deaths. Of note, some birth certificate measures (e.g. chronic or pregnancy-induced conditions) may have poor sensitivity (Martin et al., 2013). Second, results may not be generalizable to individuals on private insurance and in other states. Of note, the prevalence of maternal SUD in our sample at 10% was relatively higher than reported rates of 5.7% in a 2020 national sample of pregnant people covered by Medicaid (Medicaid and CHIP Payment and Access Commission (MACPAC), 2020). Further, in Oregon, covered benefits may differ by eligibility pathway (e.g., full-scope Medicaid, pregnancy-related Medcaid, or via the Oregon Health Insurance Experiment) (Baicker and Finkelstein, 2011). Third, given public health outreach and policy changes related to pregnant and postpartum people with substance use disorders, (Guttmacher Institute, 2020) analyses may not reflect post-2016 postpartum healthcare utilization. Fourth, we lack a comparison group without Medicaid expansion to control for the historical trend of postpartum healthcare utilization over time. Because this analysis is a simple pre-/post- design, we can only interpret findings as associations. Fifth, our outcome of interest, Medicaid-financed postpartum healthcare, included a mix of potentially desirable (e.g. postpartum check-up) and undesirable (e.g. ED visit) outcomes, representating a theoretically heterogenous outcome. Related, we were unable to tease apart whether a lack of increase in postpartum healthcare is due to lack of access or a reduction in need. Last, while we were interested in further exploring the association between Medicaid expansion and OUD-related healthcare utilization specifically among postpartum people with OUD, we lacked the proper sample size to perform multivariate analyses.

Our study showed that among Medicaid-covered deliveries in Oregon, those delivering post-Medicaid expansion without diagnosed maternal SUD showed an increase in days covered by Medicaid postpartum and a corresponding increase in Medicaid-financed postpartum healthcare utilization, while individuals with SUD did not. Findings among those with SUD may be partially explained by higher rates of pre-expansion Medicaid coverage and healthcare utilization and reflect the potential need for additional support beyond insurance coverage. However, Medicaid expansion was associated with improved utilization of OUD medications among postpartum people with OUD. Improved substance use and mental health screening, linkage to and continuity of care, and additional supportive resources are strategies that may result in improved utilization of postpartum care for individuals with SUD (Kroelinger et al., 2019). Assessing strategies intended to reduce barriers to postpartum care, other than Medicaid expansion, may identify opportunities to increase postpartum healthcare utilization for all people.

Contributors

SCH conceptualized and designed the study, analyzed and interpreted data, and drafted, revised, and finalized the manuscript for submission. JY conceptualized and designed the study, coordinated data acquisition, created the analytic dataset, and critically reviewed and provided edits in preparation for submission. JL and MH are the principal investigators of the study from which data were acquired and was instrumental in the acquisition of the data for this project; they also critically reviewed the manuscript in preparation for submission; CSM contributed to the design and acquisition of the data, critically reviewed the manuscript, and provided edits that contributed to the interpretation of the data. RL assisted in policy-related methodology, contributed to the interpretation of the data, and critically reviewed and provided edits for the manuscript. JYK conceptualized and designed the study, coordinated data acquisition, and drafted, revised, and finalized the manuscript for submission. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Declaration of Competing Interest

None.

Appendix 1. *ICD-9-CM, ICD-10-CM,* and CPT codes from Medicaid claims

	ICD-9-CM (Diagnosis Codes)	*ICD-10-CM* (Diagnosis Codes)
Alcohol use disorder	303.00–303.02, 303.90–303.92, 305.00–305.02	F10.10, F10.120-F10.121, F10.129, F10.14, F10.150-F10.151, F10.159, F10.180F10.182, F10.188, F10.19, F10.20, F10.220-F10.221, F10.229-F10.231, 10.239, F10.24, F10.250-F10.251, F10.259, F10.26-F10.27, F10.280-F10.282, F10.288, F10.29
Amphetamine or other stimulant use disorder	304.40–304.42, 305.70–305.72	F15.10, F15.120-F15.122, F15.129, F15.14, F15.150-F15.151, F15.159, F15.180-F15.182, F15.188, F15.19-F15.20, F15.220-F15.222, 15.229, F15.23-F15.24, F15.250-F15.251, F15.259, F15.280-F15.282, F15.288, F15.29
Cannabis use disorder	304.30–304.32, 305.20–305.22	F12.10, F12.120-F12.122, F12.129, F12.150-F12.151, F12.159, F12.180, F12.188, F12.19-F12.20, F12.220-F12.222, F12.229, F12.23, F12.250-F12.251, F12.259, F12.280, F12.288, F12.29
Cocaine use disorder	304.20–304.22, 305.60–305.62	F14.10, F14.120-F14.122, F14.129, F14.14, F14.150-F14.151, F14.159, F14.180-F14.182, F14.188, F14.19-F14.20, F14.220-F14.222, F14.229, F14.23-F14.24, F14.250-F14.251, F14.259, F14.280-F14.282, F14.288, F14.29
Hallucinogen use disorder	304.50–304.52, 305.30–305.32	F16.10, F16.120-F16.122, F16.129, F16.14, F16.150-F16.151, F16.159, F16.180, F16.183, F16.188, F16.19-F16.20, F16.220-F16.221, F16.229, F16.24, F16.250-F16.251, F16.259, F16.280, F16.283, F16.288, F16.29
Opioid use disorder	304.00–304.02, 304.70–304.72, 305.50–305.52	F11.10, F11.120-F11.122, F11.129, F11.14, F11.150-F11.151, F11.159, F11.181-F11.182, F11.188, F11.19-F11.20, F11.220-F11.222, F11.229, F11.23-F11.24, F11.250-F11.251, F11.259, F11.281-F11.282, F11.288, F11.29
Sedative, hypnotic, anxiolytic, or psychotropic use disorder	304.10–304.12, 305.40–305.42, 305.80–305.82	F13.10, F13.120-F13.121, F13.129, F13.14, F13.150-F13.151, F13.159, F13.180-F13.182, F13.188, F13.19-F13.20, F13.220-F13.221, F13.229-F13.232, F13.239, F13.24, F13.250-F13.251, F13.259, F13.26-F13.27, F13.280-F13.282, F13.288, F13.29

(*continued on next page*)

Other/unspecified substance use disorder	304.60–304.62, 305.90–305.92, 304.80–304.82, 304.90–304.92	F19.10, F19.120-F19.122, F19.129, F19.14, F19.150-F19.151, F19.159, 19.16-F19.17, F19.180-F19.182, F19.188, F19.19-F19.20, F19.220-F19.222, F19.229-F19.232, F19.239, F19.24, F19.250-F19.251, F19.259, F19.26-F19.27, F19.280-F19.282, F19.288, F19.29, F18.10, F18.120-F18.121, F18.129, F18.14, F18.150-F18.151, F18.159, F18.17, F18.180, F18.188, F18.19-F18.20, F18.220-F18.221, F18.229, F18.24, F18.250-F18.251, F18.259, F18.27, F18.280, F18.288, F18.29
Depression	296.20–296.26, 296.30–296.36, 296.82, 298.0, 300.4, 309.0, 309.1, 309.28, 311	F32.0-F32.5, F32.9, F33.0-F33.3, F33.9, F33.41-F33.42, F32.3, F32.8, F33.3, F34.1, F43.21, F43.23, F32.9
Anxiety	300.00–300.02, 300.09, 300.20–300.23, 300.29, 300.7, 308.0–308.4, 308.9, 309.21, 309.81	F40.01-F40.02, F40.9-F40.10, F40.218, F40.240-F40.241, F40.8, F41.0-F41.1, F41.8-F41.9, F43.0, F43.10, F43.12, F45.21-F45.22, R45.7, F93.0,
Serious Mental Illness (SMI)	295.00–295.95, 296.00–296.06, 296.10–296.16, 296.40–296.46, 296.50–296.56, 296.60–296.66, 296.7, 296.80–296.89, 296.99, 297.0–297.3, 297.8–297.9, 298.09–298.9	F20.0-F20.3, F20.5, F20.81, F20.89, F20.9, F21, F22, F23, F24, F25.0-F25.9, F28, F29, F30.10-F30.9, F31.0-F31.9, F34.0-F34.1, F34.81, F34.89, F34.9, F39

	ICD-9-CM Procedure Codes	*ICD-10-CM* Procedure Codes	CPT Codes
Mental health-related health visits	94.2x, 94.3x, 94.41–94.44, 94.49, 94.51–94.52, 94.55–94.59	GZ3x, GZ5x, GZ6x, GZ7x, GZHx	90,832–90,834, 90,836–90,838, 96,152–96,154, 90,804–90,815, 90,845, 90,846, 90,847, 90,849, 90,853, 90,857
Postpartum check-up	V24.1, V24.2	Z39.1, Z39.2	59,400, 59,410, 59,510, 59,515, 59,610, 59,614, 59,618, 59,622, 59,430, 99,501

	Pharmaceutical Claims
Opioid use disorder maintenance prescription fills	545,696,325- 545,696,326, 353,560,605- 353,560,607, 590,110,750- 590,110,752, 590,110,757- 590,110,758, 651,620,415- 651,620,416, 545,696,408, 422,910,174- 422,910,175, 593,850,014, 593,850,016, 636,294,028, 636,295,074, 004,061,923- 004,061,924, 000,935,720- 000,935,721, 551,544,962, 000,540,176- 000,540,177, 002,283,153, 002,283,156, 005,170,725, 545,696,578, 636,294,092, 634,810,161, 634,810,207, 634,810,348, 634,810,519, 634,810,685, 634,810,820, 634,810,952, 503,830,924, 503,830,930, 004,092,012, 420,230,179, 216,950,515, 124,960,757, 493,490,421, 493,490,554, 521,250,649, 521,250,678, 000,935,378- 000,935,379, 636,294,034, 503,830,287, 503,830,294, 541,230,114, 541,230,914, 541,230,929, 541,230,957, 541,230,986, 548,685,707, 548,685,750, 002,283,154- 002,283,155, 000,540,188- 000,540,189, 003,780,923- 003,780,924, 545,696,399, 124,961,202, 124,961,204, 124,961,208, 124,961,212, 353,560,004, 557,000,147, 430,630,184, 680,840,738, 680,840,977, 678,770,116, 178,563,555, 131,070,088- 131,070,089, 636,293,771, 636,293,788, 619,190,670, 529,590,386, 529,590,435, 353,560,834- 353,560,835, 499,990,839, 499,990,963, 004,060,527, 004,060,540, 004,061,510, 004,062,540, 004,065,755, 004,065,771, 004,066,974, 004,068,725, 637,390,006, 674,570,217, 430,630,222, 552,890,814, 548,684,948, 548,685,701, 000,540,391- 000,540,392, 000,543,553, 000,544,218, 000,544,219, 000,544,538, 000,544,570 000,544,571, 000,548,553- 000,548,556, 165,900,689, 425,490,577- 425,490,578, 666,890,694- 666,890,695, 666,890,711- 666,890,712, 666,890,810, 666,890,898,
Mental health-related prescription fills	Tricyclic Antidepressants, Benzodiazepines, Monoamine Oxidase Inhibitors, Monoamine Oxidase Type B Inhibitors, Serotonin Reuptake Inhibitors, Serotonin Uptake Inhibitors, Atypical Antipsychotic, Norepinephrine Uptake Inhibitors, Serotonin and Norepinephrine Reuptake Inhibitors, Cytochrome P450 2D6 Inhibitors, Aminoketone, Dopamine Uptake Inhibitors, Increased Dopamine Activity, Increased Norepinephrine Activity. List of NDC codes available upon request.

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; *ICD-10-CM* = International Classification of Diseases, Tenth Revision, Clinical Modification; CPT = Current Procedural Terminology; NDC = National Drug Codes

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