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Postpartum Persistent Opioid Use After Opioid Exposure for Childbirth

Meredith Matone, DrPH, MHS, Max Jordan Nguemeni Tiako, MD, MS, Doug Strane, MPH, Xianqun Luan, MS, and Zachary Meisel, MD, MPH

OBJECTIVE: To assess the association between opioid exposure in the childbirth period and persistent postpartum opioid use and to evaluate whether there are differential associations based on specific medication exposure.

METHODS: Retrospective cohort study that used 2015–2021 Pennsylvania Medicaid claims of women aged 19–50 years with vaginal or cesarean delivery and Medicaid

enrollment for at least 10 months during the postpartum year. Primary exposure was filled opioid prescription from 7 days before delivery to 8 weeks after delivery (childbirth period). The main outcome measure was *persistent postpartum opioid use*, defined as either a diagnosis of opioid use disorder or at least one filled opioid prescription in two or more calendar quarters from 8 weeks to 14 months postpartum. Multivariable logistic regression analyses included demographic information, mental health and behavioral comorbidities, obstetric trauma, and pre-existing pain conditions with subgroup analysis of the prepregnancy opioid-naïve population.

RESULTS: Of 286,003 births in the Pennsylvania Medicaid program, 172,839 met inclusion criteria (patient demographics: 41,628 Black [24.1%], 102,733 White [59.4%], 26,841 Hispanic [15.5%], mean age at delivery 26.9 years). Childbirth opioid exposure was present in 25% of births (n=43,263). The prevalence of persistent postpartum opioid use was 5.7% (n=9,876). Transition to postpartum persistent use occurred in 7.9% of patients with childbirth opioid exposure and in 4.5% of those without (adjusted odds ratio [aOR] 1.88, 95% CI, 1.79–1.96). Among 132,941 births to opioid-naïve people, 2.6% of patients developed postpartum persistent opioid use; the adjusted odds were higher among those exposed during childbirth compared with those unexposed (aOR, 2.66; 95% CI, 2.49–2.85). The risk of persistent use was highest with tramadol exposure: 30.9% of people exposed to tramadol transitioned to persistent use compared with 7.3% of those exposed to oxycodone (tramadol vs oxycodone: aOR 4.58; 95% CI, 3.87–5.43).

CONCLUSION: Opioid use for childbirth pain management was associated with persistent postpartum use, including among opioid-naïve patients and those without pre-existing pain conditions. These findings support clinical practice guidelines that balance effective postpartum pain management with minimizing opioid-related risks and underscore the importance of postpartum care coordination.

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Positionality statement: The team includes individuals who identify across multiple race and gender identities. The lead author has lived experience as a birthing person treated with opioid pain management for obstetric interventions, including cesarean delivery. These experiences directly informed this research inquiry. Other study team members include physicians who have prescribed opioids for pain management in emergency department and obstetric clinical settings and also treated patients with persistent opioid use and opioid use disorder in these settings. Both have extensive experience providing care for individuals who have public insurance. The study team is also inclusive of individuals who have supported family members with substance use disorder and as partners of those with birthing and postpartum experiences. Collectively, the study team does not have recent lived experience with income or disability status associated with public assistance/Medicaid enrollment. Our team biases related to the target population of this research were explored in team meetings, in our writing, and through review of the literature on structural racism and obstetric literature on individuals marginalized by income and race and ethnicity. This work seeks to promote equitable care delivery.

Each author has confirmed compliance with the journal's requirements for authorship.

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The current postpartum health care context in the United States includes low rates of attendance at clinically recommended postpartum follow-up visits, limited deployment of robust models of postpartum care coordination, and high incidence of maternal morbidity, particularly mental health morbidity.¹ Disruptions in health care utilization after delivery are particularly risky because the postpartum period is subject to the new onset and exacerbations of pre-existing mental and physical health conditions.² Yet, engagement in postpartum care has been well-documented as poor in the United States, even among women with chronic health conditions or complicated pregnancies, and especially among those affected by racial and structural disenfranchisement.^{3,4} In response, the American College of Obstetricians & Gynecologists endorsed comprehensive care, extended duration of care, and care coordination in its revisions to postpartum care guidelines in 2018.⁵ The continued profound influence of the opioid crisis on maternal morbidity and mortality has underscored the importance of new models of care delivery in the postpartum period. Substance use was determined to be a contributor to more than one quarter of pregnancy-related deaths nationally.⁶

Overall, 80–90% of women who undergo cesarean delivery, along with an estimated 12% of women with vaginal delivery, receive a prescription of opioid analgesics at discharge.^{7–9} Women have reported receiving prescriptions of opioids in excess of what they required to alleviate pain, and many do not dispose of excess opioids, heightening risk of inappropriate use.^{7,8} Conversely, for some, childbirth includes the risk of undertreated pain, which, in some contexts, has been associated with prolonged opioid use.¹⁰

Existing literature suggests an association between pain management in childbirth and persistent opioid use.^{9,11,12} To date, there is limited understanding of: 1) the nature of this relationship in the context of the worsening opioid crisis, 2) the association of pre-existing patient characteristics such as prior opioid use and transitions to persistent use after childbirth, and 3) differential medication-specific risks for persistent use. By using a population-based statewide sample of publicly insured women, this study examines the transition to postpartum persistent opioid use after opioid exposure for childbirth-related pain management, accounting for prior opioid use and pre-existing pain conditions, and examines associations across specific opioid medications.

METHODS

This retrospective cohort study used 2015–2021 Pennsylvania Medicaid eligibility and claims data.

The sample includes women with Medicaid insurance who had vaginal or cesarean deliveries of liveborn neonates in Pennsylvania between 2015 and 2021. Eligibility criteria included: 1) age 19–50 years at the time of childbirth; 2) enrolled in Medicaid for at least 10 months during the postpartum year (to ensure adequate ascertainment of opioid use); 3) nonmissing data on race, ethnicity, and residence area (identified from Medicaid eligibility file); and 4) no diagnoses of cancer or sickle cell disease in the year before childbirth. Deliveries were identified by International Classification of Diseases, Ninth and Tenth Revision (ICD-9, ICD-10) codes within Medicaid claims.¹³ The observation window specified four periods: pre-pregnancy year (24–13 months before delivery); pregnancy year (12 months–8 days before delivery); childbirth period (7 days before to 2 months after delivery), and postpartum year (3–14 months after delivery).

The primary outcome was a composite metric termed postpartum persistent opioid use, defined as either a diagnosis of opioid use disorder (OUD) in the postpartum year or a new high-risk opioid prescription. High-risk opioid prescription was defined as one or more filled opioid prescriptions during at least two distinct calendar quarters between 3 and 14 months postpartum, consistent with other studies.^{14,15} In a sensitivity analysis, high-risk prescribing was alternatively defined as one or more filled opioid prescriptions in each of 3 consecutive months to assess a therapeutic regimen consistent with transition to long-term opioid therapy.¹⁶ Opioid prescriptions included oxycodone, hydrocodone, codeine, tramadol, hydromorphone, morphine, fentanyl, and other combinations identified using GC3 therapeutic class codes (Hierarchical Ingredient Code) in pharmacy claims (codes H3A, H3H, H3M, H3N, H3R, H3U, H3X) (Appendix 1, available online at <http://links.lww.com/AOG/E421>). Opioid use disorder diagnoses were identified using ICD-9 (304.0X, 304.7X, and 305.5X) and ICD-10 codes (F11.1X, F11.2X, F11.9X) in inpatient, outpatient, and professional claims.

The primary exposure was a filled medical opioid prescription during the *childbirth period*, defined as 7 days before delivery through 2 months after delivery. This window captures the acute peripartum phase and the postpartum period during which routine obstetric follow-up occurs to ascertain childbirth-related pain management. Notably, delivery-related injectable and intravenous anesthetics were not assessed in this study. A sensitivity analysis compared individual opioid medications with oxycodone, the most filled opioid in the childbirth period. For the

6% of patients with multiple opioid medication types in the exposure period, the medication type (eg, oxycodone) with the most refills was assigned to each patient. If two medications had the same number of refills, the one with the last refill was assigned.

Covariates included demographic information, mental health or behavioral comorbidities, obstetric anal sphincter injury, and pre-existing pain conditions. Demographic factors included maternal age and race and ethnicity. Race was included as a potential confounder and was included in separate stratification modeling because research has established differential pain management (exposure) and opioid use (outcome) across racial and ethnic groups, with Black women experiencing disproportionate undermanagement of pain¹⁷ and a notable rise in opioid overdose.¹⁸ We identified diagnoses of comorbid mental health or behavioral disorders that were documented in the medical claims during the prepregnancy and pregnancy periods, including depression, bipolar disorder, nicotine dependence, anxiety, and posttraumatic stress disorder, using ICD-9 and ICD-10 codes (Appendix 2, available online at <http://links.lww.com/AOG/E421>). Obstetric anal sphincter injury was identified if an individual had claim with a diagnosis code for third- or fourth-degree perineal laceration occurring during childbirth period.¹⁹ Pre-existing pain conditions were observed in medical claims in the prepregnancy and pregnancy periods using a framework of ICD-9 and ICD-10 diagnostic clusters representing common pain conditions.²⁰ The presence of pain conditions was modeled using a binary (yes or no).

Descriptive statistics were used to compare characteristics of the target population and the final study sample and to characterize the prevalence of opioid prescriptions across defined time periods. Bivariate analyses assessed the relation of childbirth-related opioid exposure and postpartum persistent opioid use. Multivariable logistic regression models estimated the association of childbirth-related opioid exposure with postpartum persistent opioid use, adjusting for clinical and demographic confounders. Stratified models by race and ethnicity were performed to assess whether there was a differential association by racial or ethnic group. A prespecified subgroup analysis examined births among individuals who were *opioid naïve* in the prepregnancy and pregnancy periods, defined as individuals who had neither a filled opioid prescription nor a diagnosis for OUD in the prepregnancy and pregnancy periods. A sensitivity analysis also reviewed births with childbirth periods (7 days before delivery to 2 months after delivery) that

occurred before March 2020 via subgroup analysis to assess for potential bias introduced during the coronavirus disease 2019 (COVID-19) pandemic.

Results from logistic regressions are presented as odds ratios with 95% CIs. Tests were 2-sided, and significance was set at a 5.0% level. Analyses were conducted using SAS 9.4. This study was approved by the Institutional Review Board of the Children's Hospital of Philadelphia.

RESULTS

Overall, there were 286,003 births available in the Pennsylvania Medicaid data from 2015 to 2021; the primary study sample consisted of 172,839 births that met study inclusion criteria (Fig. 1). Table 1 describes the characteristics of the overall study sample and the subgroup sample used in secondary analyses. A comparison of baseline characteristics between individuals who were and were not included is presented in Appendix 3 (available online at <http://links.lww.com/AOG/E421>).

The primary exposure of interest, opioid exposure in the childbirth period, was present in 25% of births (n=43,263). Overall, 9,876 (5.7%) of the study sample experienced postpartum year persistent opioid use. Among this group, high-risk opioid prescription (2 or more calendar quarters) was more prevalent as the defining characteristic of postpartum persistent

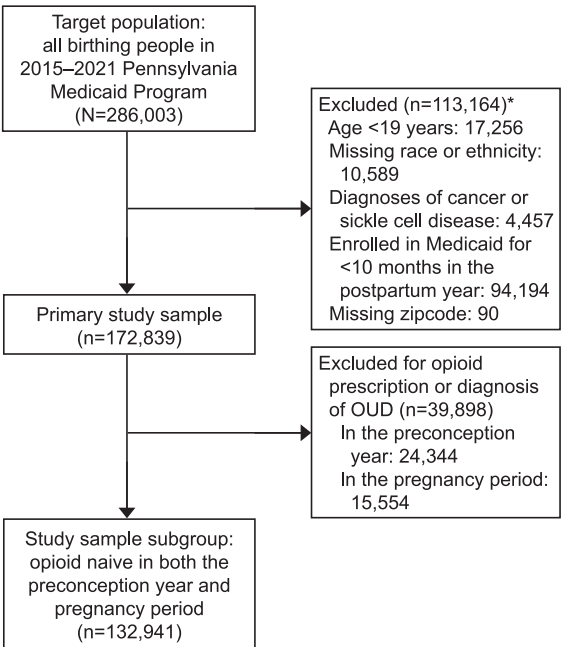


Fig. 1. Cohort flow diagram. OUD, opioid use disorder. *Items not mutually exclusive.

Matone. Postpartum Persistent Opioid Use. *Obstet Gynecol* 2026.

Table 1. Target Population and Study Sample Characteristics*

Characteristic	Birthing People Who Met the Inclusion Criteria (N=172,839 Births) [†]	Opioid Naïve in the Prepregnancy and Pregnancy Years (n=132,941 Births) ^{‡, §}
Age at delivery (y)	26.9±5.34	26.7±5.38
Race		
Additional races	21,911 (12.7)	18,223 (13.7)
American Indian or Alaskan Native	624 (0.4)	478 (0.4)
Asian	5,612 (3.3)	5,154 (3.9)
Black or African American	41,628 (24.1)	32,770 (24.7)
Native Hawaiian or other Pacific Islander	331 (0.2)	301 (0.2)
White	102,733 (59.4)	76,015 (57.2)
Ethnicity		
Hispanic	26,841 (15.5)	21,943 (16.5)
Non-Hispanic additional races	10,936 (6.3)	9,678 (7.3)
Non-Hispanic Black	40,094 (23.2)	31,555 (23.7)
Non-Hispanic White	94,968 (55.0)	69,765 (52.5)
Medicaid enrollment in the prepregnancy year [§]		
9 mo or less	98,410 (56.9)	83,750 (63.0)
10–12 mo	74,429 (43.1)	49,191 (37.0)
Medicaid enrollment in the postpartum year [§]		
9 mo or less	0 (0.0)	0 (0.0)
10–12 mo	172,839 (100)	132,941 (100)
Diagnosis of OUD [§]		
In the prepregnancy year	1,611 (0.9)	0 (0.0)
In the pregnancy year	4,904 (2.8)	0 (0.0)
In the postpartum year	4,042 (2.3)	412 (0.3)
Filled opioid prescriptions [§]		
In the prepregnancy year	22,929 (13.3)	0 (0.0)
In the pregnancy year	18,140 (10.5)	0 (0.0)
In the childbirth period	43,263 (25.0)	29,921 (22.5)
In the postpartum year	30,792 (17.8)	20,073 (15.1)
Obstetric anal sphincter injury [¶]		
No	171,436 (99.2)	131,827 (99.2)
Yes	1,403 (0.8)	1,114 (0.8)
Urbanity of residence		
Urban	132,033 (76.4)	102,830 (77.4)
Rural	40,806 (23.6)	30,111 (22.7)
Missing	0 (0.0)	0 (0.0)
Diagnoses in prepregnancy and pregnancy years [§]		
Depression		
No	157,383 (91.1)	123,588 (93.0)
Yes	15,456 (8.9)	9,353 (7.0)
Bipolar		
No	166,715 (96.5)	129,479 (97.4)
Yes	6,124 (3.5)	3,462 (2.6)
Nicotine dependence		
No	158,871 (91.9)	125,288 (94.2)
Yes	13,968 (8.1)	7,653 (5.8)
PTSD		
No	171,245 (99.1)	132,093 (99.4)

(continued)

Table 1. Target Population and Study Sample Characteristics* (continued)

Characteristic	Birthing People Who Met the Inclusion Criteria (N=172,839 Births) [†]	Opioid Naïve in the Prepregnancy and Pregnancy Years (n=132,941 Births) ^{†, §}
Anxiety		
Yes	1,594 (0.9)	848 (0.6)
No	157,424 (91.1)	123,880 (93.2)
Pre-existing pain condition [¶]		
Yes	15,415 (8.9)	9,061 (6.8)
No	170,271 (98.5)	131,889 (99.2)
Yes	2,568 (1.5)	1,052 (0.8)

OD, opioid use disorder; PTSD, posttraumatic stress disorder.

Data are mean±SD or n (%).

* Identified using International Classification of Diseases and Current Procedural Technology codes for vaginal and cesarean deliveries during January 1, 2015–December 31, 2021, in Pennsylvania Medicaid claims data.

[†] Inclusion criteria: had no diagnoses of cancer or sickle cell disease during the observation window surrounding childbirth, age 19–50 years, race and ethnicity not missing or unknown, enrolled in Medicaid for at least 10 months in the postpartum year.

[‡] Opioid naïve: no opioid prescription filled and no diagnosis of OUD.

[§] Prepregnancy year: 24–13 months before delivery; pregnancy year: 12 months–8 days before delivery; childbirth period: 7 days before delivery to 2 months after delivery; postpartum year: 3–14 months after delivery.

^{||} Obstetric anal sphincter injuries (at least one claim with a diagnosis code for third- or fourth-degree perineal laceration occurring during birth).¹⁹

[¶] Pain conditions included abdominal and bowel pain; back pain; fibromyalgia; headache; limb or extremity pain, joint pain and nonsystemic, noninflammatory arthritic disorders; musculoskeletal chest pain; neck pain; neuropathy; orofacial, ear, and temporomandibular disorder pain; urogenital, pelvic, and menstrual pain; and systemic disorders or diseases causing pain.²⁰

use (n=5,834, 3.4%) than OUD (n=4,042, 2.3%) (Table 2). Transition to postpartum persistent use occurred in 7.9% of patients with childbirth opioid exposure and in 4.5% of those without childbirth opioid exposure (unadjusted odds ratio 1.88, 95% CI, 1.80–1.96). The odds of postpartum persistent use between patients with childbirth-period opioid exposure compared with those without exposure remained robust in multivariable modeling (adjusted odds ratio [aOR] 1.88, 95% CI, 1.79–1.96) (Table 2). Appendix 4 (available online at <http://links.lww.com/AOG/E421>) presents a sensitivity analysis of primary analytic model that includes individuals with missing or unknown race or ethnicity data.

Incidence of postpartum persistent use was highest among non-Hispanic White patients (11.5% among those exposed to childbirth opioids and 7.0% for those unexposed); however, the association of childbirth opioid exposure and postpartum persistent use was weakest in this group (aOR 1.80, 95% CI, 1.71–1.89). Although Non-Hispanic Black and Hispanic patients had highest odds of transition to persistent use after childbirth opioid exposure (aOR 2.16, 95% CI, 1.92–2.43; and aOR 2.13, 95% CI, 1.82–2.49, respectively), the incidence of postpartum persistent use was less than half that of non-Hispanic White patients among these groups (5.3% and 4.6%, respectively) (Table 3).

A subgroup analysis on the population of birthing people with no observed opioid exposure or related diagnoses in the prepregnancy year and the pregnancy year (opioid naïve) included 132,941 births. Postpartum persistent opioid use was present in 2.6% of these births (4.7% among patients with childbirth opioid exposure and 1.9% of those without exposure). In multivariable modeling, the aOR of postpartum persistent use among childbirth-exposed individuals compared with unexposed individuals was 2.66 (95% CI, 2.49–2.85) (Table 2).

Oxycodone was the most commonly filled opioid in the childbirth period (n=33,267), followed by hydrocodone (n=4,636), and codeine (n=2,823). Filled prescriptions for tramadol (n=734), hydro-morphine (n=647), morphine (n=433), other miscellaneous opioids (n=416), and fentanyl (n=307) were less common. The aOR of postpartum persistent opioid use among patients exposed to oxycodone compared with those who were not exposed to childbirth opioids was 1.59 (95% CI, 1.51–1.67; 7.3% vs 4.8%). The odds of postpartum persistent use were highest among patients exposed to tramadol in the childbirth period. Compared with oxycodone (7.3%), 30.9% of tramadol-exposed patients transitioned to persistent postpartum use (tramadol vs no opioids: aOR 7.27, 95% CI, 6.15–8.59; tramadol vs oxycodone: aOR 4.58, 95% CI, 3.87–5.43). Other

Table 2. Incidence and Odd Ratios of Postpartum Persistent Opioid Use Among Patients Who Were Exposed to Childbirth-Period Opioids Compared With Those Who Were Not Exposed, Pennsylvania, 2015–2021

	No Postpartum Persistent Use	Postpartum Persistent Use			OR (95% CI)	aOR (95% CI)*
		High-Risk Opioid Prescription (2 or More Calendar Quarters)	Diagnosis of OUD	Total		
Primary study sample (N=172,839 births)						
No	123,482 (90.9)	2,724 (2.0)	3,444 (2.5)	6,168 (4.5)	1.88 (1.80–1.96)	1.88 (1.79–1.96)
Yes	39,481 (84.2)	3,110 (6.6)	598 (1.3)	3,708 (7.9)		
Opioid-naïve subgroup (n=132,941 births) [†]						
No	101,693 (96.2)	1,649 (1.6)	321 (0.3)	1,970 (1.9)	2.67 (2.49–2.86)	2.66 (2.49–2.85)
Yes	28,695 (90.6)	1,388 (4.4)	94 (0.2)	1,482 (4.7)		

Data are n (row %) unless otherwise specified.

OUD, opioid use disorder; OR, odds ratio; aOR, adjusted odds ratio.

* The aOR is presented for the multivariable regression model that included risk factors and potential confounders. Covariates included prepregnancy opioid use, age at delivery, race, ethnicity, obstetric anal sphincter injuries, pre-existing (pregnancy or pregnancy) pain condition, pre-existing (pregnancy or pregnancy) depression, bipolar disorder, posttraumatic stress disorder, anxiety, and nicotine dependence.

[†] Opioid-naïve status was assigned to individuals with no opioid prescription fills or OUD diagnoses in the prepregnancy year (24–13 months before delivery) and in the pregnancy year (12 months–8 days before delivery).

Table 3. Incidence and Odd Ratios of Postpartum Persistent Opioid Use Among Patients Who Were Exposed to Childbirth-Period Opioids Compared With Those Who Were Not Exposed, by Race and Ethnicity, Pennsylvania 2015–2021

Race and Ethnicity	Childbirth-Period Opioid Exposure	No Postpartum Persistent Opioid Use	Persistent Postpartum Opioid Use	Postpartum Persistent Use	
				OR (95% CI)	aOR (95% CI)
Hispanic	No	20,224 (97.9)	417 (2.0)		
	Yes	5,912 (95.4)	288 (4.6)	2.36 (2.03–2.75)	2.13 (1.82–2.49)
Non-Hispanic Black	No	29,078 (97.6)	701 (2.4)		
	Yes	9,765 (98.4)	550 (5.3)	2.34 (2.08–2.62)	2.16 (1.92–2.43)
Non-Hispanic other race [†]	No	8,389 (98.4)	136 (1.6)		
	Yes	2,339 (97.0)	72 (3.0)	1.90 (1.42–2.54)	1.95 (1.45–2.63)
Non-Hispanic White	No	65,791 (93.1)	4,914 (7.0)		
	Yes	21,465 (88.5)	2,798 (11.5)	1.75 (1.66–1.83)	1.80 (1.71–1.89)

Data are n (row %) unless otherwise specified.

OR, odds ratio; aOR, adjusted odds ratio.

*The aOR is presented for the stratified multivariable regression models that included risk factors and potential confounders. Covariates included prepregnancy year opioid use, age at delivery, obstetric anal sphincter injuries, pre-existing (pregnancy or pregnancy) pain condition, pre-existing (pregnancy or pregnancy) depression, bipolar disorder, posttraumatic stress disorder, anxiety, and nicotine dependence.

[†] Non-Hispanic other race includes American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, and system-reported other.

opioid medications had elevated odds of a comparable magnitude when compared with oxycodone (aOR of approximately 2.5) (Table 4). Among the subgroup of patients who were opioid naïve in the prepregnancy and pregnancy periods, all trends were consistent.

Within the study sample, 1,186 (0.7%) individuals had 3 consecutive months of opioid fills in the postpartum period. The aOR for postpartum persistent opioid use (3 consecutive months for patients with childbirth-period opioid exposure vs those with-

out childbirth-period opioid exposure) was 8.76 (95% CI, 7.63–10.05) (Appendix 5, available online at <http://links.lww.com/AOG/E421>).

There were 87,603 births in the study sample before the beginning of the COVID-19 pandemic in March 2020. Postpartum persistent opioid use was present in 10.7% among patients with childbirth opioid exposure and in 5.7% of those without childbirth opioid exposure (aOR 2.01, 95% CI, 2.00–2.21) (Appendices 6 and 7, available online at <http://links.lww.com/AOG/E421>).

Table 4. Incidence and Odd Ratios of Postpartum Persistent Opioid Use, by Primary Opioid Prescription Medication, Pennsylvania, 2015–2021

Opioid Exposure in Childbirth Period	No Postpartum Persistent Use	Postpartum Persistent Use		
		High-Risk Opioid Prescription (2 or More Calendar Quarters)	Diagnosis of OUD	Total
Primary opioid prescription medication†				
No opioid prescription	123,315 (75.8)	2,818 (46.5)	3,443 (85.2)	6,261 (62.0)
Oxycodone	30,833 (19.0)	2,026 (33.4)	408 (10.1)	2,434 (24.1)
Hydrocodone	4,020 (2.5)	542 (8.9)	74 (1.8)	616 (6.1)
Codeine	2,508 (1.5)	286 (4.7)	29 (0.7)	315 (3.1)
Tramadol	507 (0.3)	201 (3.3)	26 (0.6)	227 (2.3)
Hydromorphone	568 (0.4)	59 (1.0)	20 (0.5)	79 (0.8)
Morphine	377 (0.2)	44 (0.7)	12 (0.3)	56 (0.6)
Other opioid	345 (0.2)	54 (0.9)	17 (0.4)	71 (0.7)
Fentanyl	264 (0.2)	30 (0.5)	13 (0.3)	43 (0.4)

Opioid Exposure in Childbirth Period	Odds of Postpartum Persistent Use (Ref: No Opioid)		Odds of Postpartum Persistent Use (Ref: Oxycodone)	
	OR (95% CI)	aOR (95% CI)*	OR (95% CI)	aOR (95% CI)*
Primary opioid prescription medication†				
No opioid prescription	Ref	Ref	0.64 (0.61–0.68)	0.63 (0.60–0.66)
Oxycodone	1.55 (1.48–1.63)	1.59 (1.51–1.67)	Ref	Ref
Hydrocodone	3.02 (2.76–3.3)	2.69 (2.45–2.94)	1.94 (1.77–2.13)	1.69 (1.54–1.87)
Codeine	2.47 (2.19–2.79)	2.64 (2.33–2.98)	1.59 (1.41–1.8)	1.66 (1.46–1.89)
Tramadol	8.82 (7.53–10.34)	7.27 (6.15–8.59)	5.67 (4.83–6.67)	4.58 (3.87–5.43)
Hydromorphone	2.74 (2.16–3.47)	2.77 (2.17–3.54)	1.76 (1.39–2.24)	1.75 (1.37–2.24)
Morphine	2.93 (2.21–3.88)	2.48 (1.84–3.33)	1.88 (1.42–2.5)	1.56 (1.16–2.11)
Other opioid	4.05 (3.14–5.24)	3.64 (2.78–4.76)	2.61 (2.01–3.38)	2.29 (1.75–3.01)
Fentanyl	3.21 (2.32–4.43)	2.63 (1.88–3.69)	2.06 (1.49–2.86)	1.66 (1.18–2.33)

Data are n (column %) unless otherwise specified; Ref, reference.

OUD, opioid use disorder; OR, odds ratio; aOR, adjusted odds ratio.

* The aOR is presented for the multivariate regression model that included risk factors and potential confounders. Covariates included prepregnancy year opioid use, age at delivery, race, ethnicity, obstetric anal sphincter injuries, pre-existing (pregnancy or pregnancy) pain condition, pre-existing (pregnancy or pregnancy) depression, bipolar disorder, posttraumatic stress disorder, anxiety, and nicotine dependence. The first model used no prescription opioids in the childbirth period as referent category. The second model used oxycodone (selected as most prevalent medication) as referent.

[†] For the 6% of patients with multiple opioid medication types in the exposure period, the medication type with the most refills in the observation period (eg, oxycodone) was assigned to each patient. If two medications had the same number of refills, the medication with the last refill was assigned.

DISCUSSION

Among 172,839 births between 2015 and 2021 in a single state's Medicaid program, we observed a population prevalence of postpartum persistent opioid use of 5.7%, or more than 1 in every 20 births. We found the odds of postpartum persistent use to be nearly twofold higher among patients with opioid prescription fills in the childbirth period compared with those without. We noted this specific association between childbirth opioid exposure and postpartum persistent use to be robust to adjustment for obstetric anal sphincter injury, and potential confounders of pre-existing opioid use, OUD, mental and behavioral health conditions,^{21–23} and pain conditions. In fact, this study found this association to be stronger among patients with no observed history of opioid use.

Postpartum onset risk for OUD has been a limited focus of clinical guidelines to date. In the current postpartum care paradigm, which typically ends 6–8 weeks postpartum, this population is likely to be missed by any routine screening for substance use.^{24,25} Importantly, research has demonstrated that most maternal overdose deaths occur in the postneonatal window.²⁶ The clinically significant population prevalence of postpartum persistent use found in this study highlights the urgency of health system and payer policies that facilitate implementation of 2018 American College of Obstetricians & Gynecologists recommendations.⁵ Moreover, the well-documented barriers to medications for OUD^{13,27–29} that persist for pregnant and postpartum people must be urgently remedied.

This study advances the existing literature that has identified the presence of postpartum opioid prescription fills across vaginal and cesarean deliveries.^{9,11} Research in the Tennessee Medicaid program identified persistent use in the postpartum period at 0.67% overall with association of childbirth-period prescription fills on persistent use, including a stronger association of opioid fills in the late childbirth period of 7–42 days postdelivery with persistent use in the postpartum year.¹¹ Consistent with this research, the present study defines an *extended childbirth period* to include pain management happening as part of postpartum obstetric care through 8 weeks postdelivery.¹¹ At more than 5%, the prevalence of persistent use in this study was higher than that observed in the prior study; trends in the rise of the opioid crisis may explain some of this observed difference. Similarly, national Medicaid data from vaginal deliveries that occurred between 2009 and 2014 found an association between childbirth prescriptions within 7 days of delivery and persistent use and new OUD.¹² Previous

research in the Pennsylvania Medicaid program found that 12% of patients with vaginal deliveries filled an outpatient prescription for opioids within 5 days of delivery; of those, 14% filled a second opioid prescription within 2 months.⁹ Most recently, research has demonstrated an increase in postpartum opioid prescription fills after the COVID-19 pandemic,³⁰ underscoring the continued salience of work to understand and mitigate opioid risk after childbirth.

Importantly, we found identification as non-Hispanic White to be associated with notably increased incidence of postpartum persistent use, although the strength of relationship between childbirth opioid exposure and transition to postpartum persistent use was highest among non-Hispanic Black and Hispanic individuals. Research shows that pain in individuals who are Black or Hispanic is documented less frequently after delivery. Black and Hispanic birthing people receive significantly smaller opioid doses in the hospital, despite higher documented pain scores, and are less likely to be discharged with appropriate analgesia.^{17,31} Inadequate pain management may present risk for increased opioid utilization.¹⁰ The findings of the present study, therefore, underscore the need for implementation research to support adoption of clinical practice guidelines for pain management after childbirth that center equity and balance access to supportive pain management with avoidance of opioid risks.³²

Patients who were prescribed tramadol experienced significantly heightened risk. This is consistent with existing literature³³ that shows that patients who receive low-potency opioids are at greater risk of persistent opioid use. Although they are safer from a dose-dependent overdose risk perspective, low potency opioids may undertreat patients' pain, depending on the severity, and undertreatment of acute pain is a risk factor for transitioning to chronic pain. Clinicians' and patients' perception of their relative safety also may contribute to a more relaxed approach to prolonged prescription courses. A few studies show, however, that, aside from long-acting opioids, low-potency opioids as the first opioid prescription confer the highest risk of transitioning to long-term opioid use. Still, little is known about whether, for some patients, this increases their long-term overdose risk.^{33,34}

This study has several limitations. This study observed filled prescriptions for opioids, and associations are limited to those for filled prescriptions (and not consumption). Misclassification bias of opioid-exposed status and opioid naïve status is possible. Filled prescriptions may not have been consumed

and conversely, opioids may have been consumed outside of observed prescriptions. Opioid naïve status was determined with a 1-year prepregnancy period, and it is possible that individuals may have had opioid use before this observation period. This study observed filled opioid prescriptions in the childbirth period using health insurance claims data. It is possible due to the bundled nature of maternity care that some opioids administered during labor were not observed. The study inclusion criteria introduce limits to the generalizability of findings. Specifically, results may not be generalized to individuals with cancer and sickle cell. However, risk of undermanagement of pain among these populations has importantly led to differential opioid prescribing guidelines. Additionally, this study used a publicly insured claims database and required near continuous coverage for 1 year postpartum. Therefore, findings may not be generalizable to patients with insurance churn, lack of insurance, or private insurance.

In conclusion, this statewide population-based study of publicly insured birthing patients found opioid use for childbirth pain management to be associated with persistent postpartum use, including among opioid-naïve patients. Data reflecting the time period inclusive of demographic shifts of the opioid crisis affecting women of childbearing age and those in historically marginalized communities are an important contribution of this study. Additionally, this work adds confidence and improved precision to the body of scholarship related to childbirth opioid exposure with inclusion of pre-existing pain conditions and prepregnancy opioid status to minimize confounding. The findings urge attention to clinical practice guidelines grounded in equity that balance effective postpartum pain management while minimizing opioid-related risks and underscore the importance of postpartum care coordination models.

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