

Prenatal Use of Medication for Opioid Use Disorder and Other Prescription Opioids in Cases of Neonatal Opioid Withdrawal Syndrome: North Carolina Medicaid, 2016–2018

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Objectives. To estimate use of medication for opioid use disorder (MOUD) and prescription opioids in pregnancy among mothers of infants with neonatal opioid withdrawal syndrome (NOWS).

Methods. We used linked 2016–2018 North Carolina birth certificate and newborn and maternal Medicaid claims data to identify infants with an NOWS diagnosis and maternal claims for MOUD and prescription opioids in pregnancy (n = 3395).

Results. Among mothers of infants with NOWS, 38.6% had a claim for MOUD only, 14.3% had a claim for prescription opioids only, 8.1% had a claim for both MOUD and prescription opioids, and 39.1% did not have a claim for MOUD or prescription opioids in pregnancy. Non-Hispanic Black women were less likely to have a claim for MOUD than non-Hispanic White women. The percentage of infants born full term and normal birth weight was highest among women with MOUD or both MOUD and prescription opioid claims.

Conclusions. In the 2016–2018 NC Medicaid population, 60% of mothers of infants with NOWS had MOUD or prescription opioid claims in pregnancy, underscoring the extent to which cases of NOWS may be a result of medically appropriate opioid use in pregnancy. (*Am J Public Health.* 2021;111(9):1682–1685. <https://doi.org/10.2105/AJPH.2021.306374>)

Over the past 2 decades in the United States, the prevalence of opioid use and opioid use disorder (OUD) in pregnancy has substantially increased.¹ Medication for opioid use disorder (MOUD) is the recommended, evidence-based treatment of OUD in pregnancy.² Prior research shows that MOUD, compared with detoxification or continued opioid use, is associated with improved outcomes, including reduced risk of return to drug use, improved engagement in treatment

and prenatal care, and higher birth weights.³

Neonatal opioid withdrawal syndrome (NOWS) is an expected and treatable condition following prenatal exposure to opioids, including MOUD.⁴ NOWS is a drug withdrawal syndrome with symptoms including minor behavioral problems such as feeding difficulties and high-pitched crying and, less frequently, major problems such as failure to thrive and seizures.⁴ Nationally, the incidence of NOWS has increased alongside

increases in opioid use and OUD in pregnancy.⁵

Understanding the extent to which NOWS cases are related to prenatal use of MOUD or prescription opioids as directed by a health care provider can inform appropriate pre- and postnatal intervention and reduce stigma associated with NOWS diagnoses. In 2 Florida counties from 2010 to 2012, among mothers of infants with NOWS, 41% used MOUD and 22% used prescription opioids in pregnancy.⁶ Across neonatal

intensive care units in 33 states from 2012 to 2013, among infants with NOWS, 41% of mothers used MOUD and 24% used prescription opioids in pregnancy.⁷ In Tennessee from 2013 to 2016, 59% of mothers of infants with NOWS used MOUD in pregnancy.⁸

Although results from existing studies are informative, changes in opioid and other substance use patterns in pregnancy and enhanced efforts to engage pregnant populations in treatment signal a need for more recent estimates to inform current practice. Moreover, given that 80% of NOWS-related deliveries are funded by Medicaid,⁵ a focus on this population, which has not been explicitly examined in prior studies, is warranted. We used 2016–2018 North Carolina Medicaid and birth certificate data to conduct a descriptive study, estimating MOUD and prescription opioid use in pregnancy among mothers of infants diagnosed with NOWS.

METHODS

We used the 2016–2018 North Carolina Composite Linked Birth (Babylove) files, which include linked birth certificate and newborn and maternal Medicaid claims data. Data management and linkage are conducted by the North Carolina State Center for Health Statistics.

We used newborn Medicaid claims and birth certificate data to identify singleton infants born in 2016 to 2018. We defined NOWS as a diagnosis code of neonatal withdrawal symptoms (*International Classification of Diseases, 10th Revision, Clinical Modification [ICD-10-CM] code P96.1*)⁹ within 30 days of delivery.¹⁰

We estimated each woman's pregnancy period using gestational age at delivery on the birth certificate and date of delivery in Medicaid claims. We defined MOUD use as at least 1 claim in

pregnancy with a National Drug Code for buprenorphine or naltrexone or a Healthcare Common Procedure Coding System code for buprenorphine, methadone, or naltrexone. We defined prescription opioid use as at least 1 claim in pregnancy with an opioid National Drug Code, excluding MOUD.

We restricted the sample to mothers of infants diagnosed with NOWS who had continuous enrollment (≤ 30 total gap days) in Medicaid during pregnancy ($n = 3395$). We calculated the number and proportion who had a claim for MOUD, prescription opioids, both MOUD and prescription opioids, and neither in pregnancy. We compared available maternal and infant characteristics from the birth certificate across groups.

RESULTS

From 2016 to 2018, among mothers of infants diagnosed with NOWS, 38.6% had a claim for MOUD only, 14.3% had a claim for prescription opioids only, 8.1% had a claim for both MOUD and prescription opioids, and 39.1% did not have a claim for MOUD or prescription opioids in pregnancy (Table 1).

Relative to other groups, there was a higher percentage of younger women among those with neither MOUD nor prescription opioid claims (37.1% < 25 years). Nearly all women with MOUD (91.1%) and both MOUD and prescription opioid claims (87.7%) were non-Hispanic White. There was a higher percentage of non-Hispanic Black women among those with prescription opioid claims only (20.5%) and with neither MOUD nor prescription opioid claims (29.5%). The percentage of women who used tobacco in pregnancy was highest among those with MOUD claims only (71.5%) and with both MOUD

and prescription opioid claims (68.5%). The percentage of infants born full term and normal birth weight was highest among women with MOUD claims (85.9% and 85.9%) or with both MOUD and prescription opioid claims (82.4% and 80.1%).

DISCUSSION

In the 2016–2018 North Carolina Medicaid population, 60% of mothers of infants with NOWS had MOUD or prescription opioid claims in pregnancy. Specifically, nearly half had a claim for MOUD and more than 1 in 5 had a claim for prescription opioids. This is consistent with previous research^{6,7} and documents the extent to which cases of NOWS may be due to medically appropriate opioid use in pregnancy.

Younger women and non-Hispanic Black women were underrepresented among mothers with MOUD or with both MOUD and prescription opioids in pregnancy. Previous studies have documented racial inequities in the treatment of OUD among pregnant populations.¹¹ In addition, more than two thirds of women with MOUD or with both MOUD and prescription opioids used tobacco in pregnancy. This is notable, as tobacco use is associated with a greater severity of NOWS.¹² Last, infants of mothers who had MOUD or both MOUD and prescription opioids in pregnancy were more likely to be full term and normal birth weight. This aligns with prior research³ and reinforces the potential benefits of MOUD in pregnancy for infant outcomes.

Interventions including prescription drug monitoring programs and prescribing guidelines have been implemented to reduce opioid use in pregnancy and resulting NOWS among infants. However, we found that 60% of

TABLE 1— Maternal and Infant Characteristics Among Mothers of Infants With Diagnosed Neonatal Opioid Withdrawal Syndrome: North Carolina, 2016–2018

	All, No. (%) (n = 3395)	Only Medication for OUD Claims in Pregnancy, No. (%) (n = 1309)	Only Prescription Opioid Claims in Pregnancy, No. (%) (n = 484)	Medication for OUD and Prescription Opioid Claims in Pregnancy, No. (%) (n = 276)	Neither Type of Claim in Pregnancy, No. (%) (n = 1326)
Maternal age, y					
< 25	972 (28.6)	288 (22.0)	127 (26.2)	65 (23.6)	492 (37.1)
25–29	1287 (37.9)	555 (42.4)	181 (37.4)	100 (36.2)	451 (34.0)
30–34	822 (24.2)	359 (27.4)	110 (22.7)	84 (30.4)	269 (20.3)
≥ 35	314 (9.2)	107 (8.2)	66 (13.6)	27 (9.8)	114 (8.6)
Maternal race/ethnicity					
Non-Hispanic White	2577 (75.9)	1193 (91.1)	328 (67.8)	242 (87.7)	814 (61.4)
Non-Hispanic Black	542 (16.0)	41 (3.1)	99 (20.5)	11 (4.0)	391 (29.5)
Other non-Hispanic	185 (5.4)	49 (3.7)	45 (9.3)	16 (5.8)	75 (5.7)
Hispanic	91 (2.7)	26 (2.0)	12 (2.5)	7 (2.5)	46 (3.5)
Maternal education					
< high school	1008 (29.8)	370 (28.4)	158 (32.6)	73 (26.4)	407 (30.8)
High school or GED	1161 (34.3)	442 (33.9)	153 (31.6)	95 (34.4)	471 (35.6)
Some college	1155 (34.1)	471 (36.1)	161 (33.3)	105 (38.0)	418 (31.6)
College, graduate, or professional school	62 (1.8)	21 (1.6)	12 (2.5)	3 (1.1)	26 (2.0)
Maternal marital status					
Not married	2587 (76.2)	980 (74.9)	352 (72.7)	201 (73.1)	1054 (79.5)
Married	806 (23.8)	328 (25.1)	132 (27.3)	74 (26.9)	272 (20.5)
Tobacco use in pregnancy					
No	1271 (37.5)	373 (28.5)	201 (41.8)	87 (31.5)	610 (46.1)
Yes	2117 (62.5)	936 (71.5)	280 (58.2)	189 (68.5)	712 (53.9)
Infant gestational age					
< 37 completed weeks (preterm)	593 (17.5)	184 (14.1)	103 (21.3)	39 (14.1)	267 (20.2)
≥ 37 completed weeks (full term)	2801 (82.5)	1125 (85.9)	381 (78.7)	237 (85.9)	1058 (79.8)
Infant birth weight					
Low (< 2500 g)	680 (20.0)	231 (17.6)	107 (22.2)	55 (19.9)	287 (21.6)
Normal (≥ 2500 g)	2714 (80.0)	1078 (82.4)	376 (77.8)	221 (80.1)	1039 (78.4)

Note. OUD = opioid use disorder.

mothers of infants with NOWS were either receiving the standard of care for treatment of OUD or a prescription opioid from a health care provider in pregnancy, suggesting alternative directions for intervention. First, efforts to ensure equitable access to MOUD should be prioritized. An understanding of the lived experiences and treatment

barriers among non-White pregnant populations with OUD can inform efforts to address racial inequities in MOUD receipt. Second, because NOWS is an expected outcome of medically appropriate opioid use in pregnancy, efforts to promote the uptake of interventions that are effective in reducing the severity of NOWS (including tobacco cessation

programs for pregnant persons receiving MOUD or prescription opioids¹²) or in treating NOWS (such as the “Eat, Sleep, Console” method¹³) should be prioritized.

These results should be interpreted in the context of some limitations. Prior research suggests that NOWS is under-identified in administrative data.¹⁰ Thus,

some infants with NOWS may have been misclassified as not having NOWS, and our results may underestimate NOWS. In addition, some opioid treatment programs dispensing methadone do not accept Medicaid and only accept cash or check payment. If women paid for MOUD with cash or a check, this would not have been captured in the Medicaid claims data. Thus, our results may underestimate MOUD. Last, our results are specific to the North Carolina Medicaid population and may not generalize to other populations.

CONCLUSIONS

In the 2016–2018 North Carolina Medicaid population, 60% of mothers of infants diagnosed with NOWS had a claim for MOUD or a prescription opioid in pregnancy. By highlighting the use of treatment and opioids as prescribed by a health care provider among mothers of infants with NOWS, these results provide insights for intervention and can be used to reduce stigma associated with NOWS. *AJPH*

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CONTRIBUTORS

A. E. Austin conceptualized and designed the study, interpreted the data, and drafted the article. V. Di Bona conceptualized and designed the study, analyzed and interpreted the data, and revised the article for important intellectual content. M. E. Cox, S. Proescholdbell, M. D. Fliss, and R. B. Naumann conceptualized the study, interpreted the data, and revised the article for important intellectual content. All authors approve of the final article as submitted.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

This study was reviewed and approved by the institutional review board at the University of North Carolina at Chapel Hill.

REFERENCES

- Haight SC, Ko JY, Tong VT, Bohm MK, Callaghan WM. Opioid use disorder documented at delivery hospitalization: United States, 1999–2014. *MMWR Morb Mortal Wkly Rep*. 2018;67(31):845–849. <https://doi.org/10.15585/mmwr.mm6731a1>
- ACOG Committee on Health Care for Underserved Women. ACOG Committee Opinion No. 524: opioid abuse, dependence, and addiction in pregnancy. *Obstet Gynecol*. 2012;119(5):1070–1076. <https://doi.org/10.1097/AOG.0b013e318256496e>
- Hulse GK, Milne E, English DR, Holman CDJ. The relationship between maternal use of heroin and methadone and infant birth weight. *Addiction*.

1997;92(11):1571–1579. <https://doi.org/10.1111/j.1360-0443.1997.tb02877.x>

- Kocherlakota P. Neonatal abstinence syndrome. *Pediatrics*. 2014;134(2):e547–e561. <https://doi.org/10.1542/peds.2013-3524>
- Patrick SW, Davis MM, Lehmann CU, Cooper WO. Increasing incidence and geographic distribution of neonatal abstinence syndrome: United States 2009 to 2012. *J Perinatol*. 2015;35(8):650–655. <https://doi.org/10.1038/jp.2015.36>
- Tolia VN, Patrick SW, Bennett MM, et al. Increasing incidence of the neonatal abstinence syndrome in US neonatal ICUs. *N Engl J Med*. 2015;372(22):2118–2126. <https://doi.org/10.1056/NEJMsa1500439>
- Lind JN, Petersen EE, Lederer PA, et al. Infant and maternal characteristics in neonatal abstinence syndrome—selected hospitals in Florida, 2010–2011. *MMWR Morb Mortal Wkly Rep*. 2015;64(8):213–216.
- Brennan J, Wiedeman C, Dunn JR, Schaffner W, Jones TF. Surveillance, epidemiology, and estimated burden of neonatal abstinence syndrome, Tennessee, 2013–2016. *Public Health Rep*. 2019;134(5):537–541. <https://doi.org/10.1177/0033354919867718>
- International Classification of Diseases, 10th Revision, Clinical Modification*. Geneva, Switzerland: World Health Organization; 2015.
- Chiang KV, Okoroh EM, Kasehagen LJ, Garcia-Saavedra LF, Ko JY. Standardization of state definitions for neonatal abstinence syndrome surveillance and the opioid crisis. *Am J Public Health*. 2019;109(9):1193–1197. <https://doi.org/10.2105/AJPH.2019.305170>
- Peeler M, Gupta M, Melvin P, et al. Racial and ethnic disparities in maternal and infant outcomes among opioid-exposed mother–infant dyads in Massachusetts (2017–2019). *Am J Public Health*. 2020;110(12):1828–1836. <https://doi.org/10.2105/AJPH.2020.305888>
- Akerman SC, Brunette MF, Green AI, Goodman DJ, Blunt HB, Heil SH. Treating tobacco use disorder in pregnant women in medication-assisted treatment for an opioid use disorder: a systematic review. *J Subst Abuse Treat*. 2015;52:40–47. <https://doi.org/10.1016/j.jsat.2014.12.002>
- Grisham LM, Stephen MM, Coykendall MR, Kane MF, Maurer JA, Bader MY. Eat, Sleep, Console approach: a family-centered model for the treatment of neonatal abstinence syndrome. *Adv Neonatal Care*. 2019;19(2):138–144. <https://doi.org/10.1097/ANC.0000000000000581>