Doi: 10.32481/djph.2023.06.025

Postpartum Contraceptive Use, Pregnancy Intentions in Women With and Without a Delivery of a NAS-Affected Infant in Delaware, 2012-2018

Khaleel Hussaini, PhD[1] and George Yocher, MS, MS[2]

1. Division of Public Health, Delaware Department of Health and Social Services; Division of Reproductive Health, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services

2. Division of Public Health, Delaware Department of Health and Social Services

Abstract

Objective: Assess differences in postpartum contraceptive use and pregnancy intentions in women with a recent live birth who delivered a neonatal abstinence syndrome (NAS) affected infant. **Study Design:** Using linked Delaware Birth Certificate Data, Hospital Discharge Data and PRAMS data for 2012–2018 (n = 6,358 singleton births), we assessed differences among women with and without a delivery of an NAS-affected infant by effective postpartum contraceptive use and pregnancy intentions. We calculated prevalence estimates, crude (cPOR), and prevalence odds ratios adjusted (aPOR) for NAS by maternal characteristics. We used alpha ≤ 0.05 to determine statistical significance. **Results:** Prevalence of NAS was 2.2% (95% CI: 1.8 – 2.6). Effective postpartum contraceptive use was 60.4% (95% CI: 51.9-69.0) among women with delivery of an NAS-affected infant compared with a non-NAS delivery 56.4% (95% CI: 55.1-57.8%) and cPOR was 1.2 (95% CI: 0.8-1.7). Prevalence of intended pregnancy was 26.5% (95% CI: 18.9-34.0) among women with delivery of an NAS-affected infant compared with a non-NAS delivery 53.0% (95% CI: 51.7-54.4) and cPOR was 0.3 (95% CI: 0.2-0.5). After adjustment, women who delivered an NAS-affected infant had lower odds (aPOR = 0.5; 95% CI: 0.3-0.8) of indicating that their pregnancy was intended as compared to those who did not deliver an NAS-affected infant. **Conclusions:** Our study found no association between delivery of an NAS-affected infant and use of an effective postpartum contraceptive method. However, we found that pregnancy intendedness was lower among women delivering an NAS-affected infant compared with women without an NAS delivery even after accounting for maternal characteristics.

Introduction

Neonatal abstinence syndrome (NAS) is a withdrawal syndrome and a complex multisystem disorder that varies in signs, symptoms, and severity among infants. NAS occurs shortly after birth in infants born to women with chronic opioid use (heroin, prescription pain medicines), or with maternal medications for opioid use disorder such as methadone or buprenorphine, as well as exposures to cocaine, selective serotonin reuptake inhibitors (SSRIs) and nicotine.[1–10] The rates of NAS and maternal opioid use disorder have also shown to vary across states in the U.S. and Delaware's NAS rate is among top five in the U.S.[9]

Reddy et al. discuss the importance of providing postpartum care support such as contraceptive counseling to women affected by opioid use disorder (OUD), because accessing reproductive life planning services may be particularly challenging for women with OUD due to stigma and discrimination.[11]

There are limited studies on contraceptive choices, use, and pregnancy intentions of women who deliver an NAS-affected infant. In a retrospective U.K. cohort study of 376 women aged 20-61 years in active treatment for opioid addiction, Cornford et al.,[12] noted lower use of planned contraception. In another

retrospective cohort study, Krans et al.[13] used data for Medicaid enrolled women in Pennsylvania and found that women with OUD were less likely to use highly effective postpartum contraception. In an experimental study of 31 women in Vermont at an opioid maintenance treatment program, Heil et al.[14] found that all women in the experimental condition, initiated prescription contraceptive use. In another study of 946 pregnant women who misused opioids, Heil et al.[15] found that 86% of the pregnancies were unintended.

Apart from Krans et al.'s study that was specific to Medicaid enrolled women, other studies have focused on participants in opioid use treatment, or a sub-population of opioid users limited by generalizability, and small sample size. Given the limited number of studies on contraceptive choice, use, and pregnancy intentions in this population, and high maternal OUD and NAS rates in Delaware, our primary aim was to assess differences in postpartum contraceptive use, and our secondary aim was to assess pregnancy intentions in women with a recent live birth who delivered an NAS-affected infant[16–18] versus those who did not.

Methods

Data and Sample

We utilized linked Pregnancy Risk Assessment Monitoring System (PRAMS) data, Hospital Discharge data (HDD) and Birth Certificates data (BCD) for 2012-2018 for Delaware. PRAMS is administered by the Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health and operates through cooperative agreements between CDC and the states. It is a dual-mode survey that uses U.S. mail as the primary method for data collection with telephone follow-up for respondents and comprises a stratified random sample of women from the birth certificate records who had a recent live birth[19,20] and complete the questionnaire between two to six months postpartum. Delaware PRAMS was established in 2006 and has continually collected data on a variety of topics of women's experiences before, during, and after pregnancy. The HDD for inpatient admissions from all Delaware licensed hospitals are collected under Delaware law (16 Del.C. Ch. 20, § 2001-2009) and include all non-federal facilities. Records are collected quarterly based on the uniform claims and billing dataset (UB-82 or successor form) for all hospital inpatient discharges.

Unique identifiers (e.g., hospital identifiers, medical record numbers, first name, last name, date of birth, etc.) were used to identify all hospital births to Delaware residents between 2012 and 2018. We used these identifiers to first link HDD data containing information on all newborns (e.g., diagnoses including NAS, procedures, discharge summary, length of stay, etc.) with hospital births in BCD that contain information on demographics, insurance status, information on prenatal care. The HDD-BCD linkage yielded about a 99 percent match using a deterministic linkage method. Since PRAMS respondents are a subset of BCD (i.e., sampled from birth certificate data), we re-linked PRAMS data that contains information on postpartum contraceptive use, health and health-related behaviors before, during, and after pregnancy, pregnancy intentions, healthcare quality, etcetera to the linked HDD-BCD dataset for 2012-2018.

Our analytic sample comprised of 6,358 singleton deliveries during 2012-2018 with linked HDD-BCD-PRAMS data. PRAMS data contain weights to account for the survey and sampling design and produce estimates generalizable to the population of women who deliver a live birth. Because we use multiple years of survey data, we recreated a weight for combined years of PRAMS based on Korn et al.[21] methodology. As we used secondary analysis of data that involved no human participants, our study was reviewed by the Delaware Division of Public Health review board and exempt under applicable federal law and the activity was determined to meet the requirements of public health surveillance as defined in

45 CFR 46.102(l)(2). The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Measures

Use of postpartum contraception was ascertained from PRAMS. The PRAMS question asks women, "*Are you or your husband or partner doing anything now to keep from getting pregnant*?" with response choices: (yes/no). Respondents who indicate "no" to this core question are classified as using no method. Respondents who answer "yes" are further asked, "*What kind of birth control are you or your husband or partner using now to keep from getting pregnant?*" with response choices: 1) tubes tied or blocked (female sterilization, Essure®, Adiana®); 2) vasectomy (male sterilization); 3) birth control pill; 4) condoms; 5) injection (Depo-Provera®); 6) contraceptive implant (Implanon®); 7) contraceptive patch (OrthoEvra®) or vaginal ring (NuvaRing®); 8) intrauterine devices (IUD including Mirena® or ParaGard®); 9) natural family planning (including rhythm method); 10) withdrawal (pulling out); 11) not having sex/abstinence; and 12) other methods. Respondents who answer "yes" and indicate specific contraceptive methods were categorized into: a) most effective (items 1, 2, 6, and 8); b) moderately effective methods (items 3, 5, and 7); and least effective methods (items 4, 9, 10, 12) based on CDC and previous studies.[20,22,23] Respondents who answered "yes" but indicated not having sex/abstinence (item 11) were also classified as no method because, while abstinence may theoretically be 100% effective if used perfectly, the effectiveness of abstinence may approach zero, in typical use.[24] We dichotomized this further into effective (i.e., most, and moderately effective) and other methods (i.e., least or no method).

We also ascertained pregnancy intentions from PRAMS which asks women, "*Thinking back to just before you got pregnant with your new baby, how did you feel about becoming pregnant?*" Response choices are: 1) I wanted to be pregnant later; 2) I wanted to be pregnant sooner; 3) I wanted to be pregnant then; 4) I didn't want to be pregnant then or at any time in the future; 5) I wasn't sure what I wanted. The pregnancy intention measure described here is consistent with use of PRAMS data in other studies[20,21,25,26] as "wanted then or sooner" (i.e., items 2 and 3); "unsure" (i.e., item 5); and "wanted later or unwanted" (i.e., items 1 and 4). For purposes of simplicity, we further dichotomized this as "intended" and "other."

For our primary exposure, we ascertained delivery of an infant with NAS from the HDD using International Classification of Diseases – Ninth Revision Clinical Modification (ICD-9-CM) diagnosis of 779.5 and ICD-10-CM diagnosis of P96.1 excluding iatrogenic cases of NAS, very low birth weight, intraventricular hemorrhage, periventricular leukomalacia, necrotizing enterocolitis, spontaneous intestinal perforation, or bronchopulmonary dysplasia similar to Patrick et al.,[6,8] and similar to the current tier 2 definitions from the Council of State and Territorial Epidemiologists.[27]

Covariates

We include maternal characteristics from BCD that were shown in previous studies[22,23,25,26] to be associated with contraceptive use and pregnancy intentions: maternal age (<25 and 25 years or more), maternal education (<12 years of school; high school graduate; more than 12 years of school), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic other races i.e., includes Asian, American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and two or more races), marital status (married vs. other), parity (0, 1, 2, or 3 or more) and insurance status (i.e., Medicaid vs. non-Medicaid).

Doi: 10.32481/djph.2023.06.025

Statistical Analysis

We estimated the overall prevalence estimates with 95% confidence intervals (CIs) for each outcome stratified by delivery of an NAS-affected infant and each maternal characteristic. We calculated the crude prevalence odds ratio (cPOR) for the association between each of the maternal characteristic. Finally, we calculated the adjusted prevalence odds ratio (aPOR) for the association between delivery of a NAS-affected infant and each outcome, adjusted for all maternal characteristics. As we had less than 2.0% missing data, we used listwise deletion. All tests were two-sided with alpha at 0.05 level of significance. All analyses were weighted and carried out using SAS v9.4 (SAS Institute, Inc., Cary, NC) with complex survey module.

Results

For the 6,358 deliveries in Delaware during 2012-2018, Table 1 shows the prevalence of delivery of an NAS-affected infant, postpartum contraceptive methods and pregnancy intentions. NAS was identified in 169 infants (Table 1) for an estimated prevalence of 2.2% (95% CI:1.8-2.6) of deliveries, consistent with statewide population estimates.[29] Prevalence of most effective postpartum contraceptive methods in Delaware women with a recent live birth was 26.3% (95% CI: 25.1-27.5); moderately effective methods was 30.2% (95% CI: 29.0-31.5); least effective methods was 23.2% (95% CI: 22.0-24.3); and no method was 20.6% (95% CI: 19.3-21.4). Overall, 56.5% (95% CI: 55.2-57.8) of Delaware women with a recent live birth indicated effective use of contraceptive methods. Regarding pregnancy intentions, 52.4% (95% CI: 51.1-53.8) indicated that their pregnancy was intended (i.e., wanted then or sooner), 16.1% (95% CI: 15.1-17.1) were “not sure”, and 31.5% (95% CI: 30.2-32.7) indicated that their pregnancy was unintended (i.e., wanted later or unwanted).

Table 1. Prevalence Estimates with 95% Confidence Intervals for Delivering an Infant with Neonatal Abstinence Syndrome, Contraceptive Methods, and Pregnancy Intentions in Delaware Women with a Live Birth, 2012-2018[28]

Exposure/Outcome	N	Prevalence (95% CI)
NAS Delivery		
Yes	169	2.2 (1.8-2.6)
No	6,189	97.8 (97.4-98.2)
Postpartum Contraceptive Methods		
Most effective	1,620	26.3 (25.1-27.5)
Moderately effective	1,889	30.2 (29.0-31.5)
Least effective	1,465	23.2 (22.0-24.3)
No method	1,273	20.6 (19.3-21.4)
Unknown/missing	111	N/A
Effective Postpartum Contraceptive Method		
Effective	3,509	56.5 (55.2-57.8)
Other	2,738	43.5 (42.2-44.8)
Unknown/missing	111	N/A
Pregnancy Intentions		
Intended (wanted then or sooner)	3,286	52.4 (51.1-53.8)
Not sure	1,029	16.1 (15.1-17.1)
Unintended (wanted later or unwanted)	1,961	31.5 (30.2-32.7)

Doi: 10.32481/djph.2023.06.025

Unknown/missing	82	N/A
Intended Pregnancy		
Intended	3,286	52.4 (51.1-53.8)
Other (i.e., unsure/unintended)	2,990	47.6 (46.2-48.9)
Unknown/missing	82	N/A

Notes: N is unweighted count of pregnant women with weighted percent and 95% confidence intervals (CI). NAS = neonatal abstinence syndrome; International Classification of Diseases – Ninth Revision Clinical Modification (ICD-9-CM) diagnosis of 779.5 and ICD-10-CM diagnosis of P96.1

All maternal characteristics were associated with effective postpartum contraceptive method and pregnancy intentions (Table 2). Although, the prevalence of postpartum effective contraceptive method was slightly higher in women who delivered an NAS-affected infant as compared with a non-NAS delivery (60.4%; 95% CI: 51.9-69.0 vs. 56.4%; 95% CI: 55.1-57.8), the difference was not statistically significant and the estimated cPOR was 1.2 (95% CI: 0.8-1.7) and after adjusting for maternal characteristics the aPOR (Table 3) was 0.8 (95% CI: 0.6-1.2).

Doi: 10.32481/djph.2023.06.025

Table 2. Prevalence Estimates and Crude Prevalence Odds Ratios of Postpartum Contraceptive Methods and Pregnancy Intendedness by Maternal Characteristics in Delaware, 2012-2018[28]

Maternal Characteristics	Postpartum Contraceptive Methods			Pregnancy Intended		
	Effective % (95% CI)	Other % (95% CI)	cPOR (95% CI)	Intended % (95% CI)	Other % (95% CI)	cPOR (95% CI)
NAS Delivery						
Yes	60.4 (51.9-69.0)	39.6 (31.0-48.1)	1.2 (0.8-1.7)	26.5 (18.9-34.0)	73.5 (66.0-81.1)	0.3 (0.2-0.5)***
No	56.4 (55.1-57.8)	43.6 (42.2-44.9)	Ref	53.0 (51.7-54.4)	47.0 (45.6-48.3)	Ref
Age (in years)						
Less than 25	61.7 (59.1-64.4)	38.3 (35.6-40.9)	1.3 (1.2-1.5)***	31.3 (28.7-33.8)	68.7 (66.2-71.3)	0.3 (0.3-0.3)***
25 and older	54.7 (53.2-56.2)	45.3 (43.8-46.8)	Ref	59.8 (58.3-61.3)	40.2 (38.7-41.7)	Ref
Education						
< 12 years of schooling	57.8 (54.5-61.2)	42.2 (38.8-45.5)	1.2 (1.0-1.4)*	40.9 (37.6-44.2)	59.1 (55.8-62.4)	0.4 (0.3-0.4)***
High school graduate	61.8 (59.2-64.4)	38.2 (35.6-40.8)	1.4 (1.2-1.6)***	37.9 (35.3-40.5)	62.1 (59.5-64.7)	0.4 (0.4-0.5)***
> 12 years of schooling	53.8 (52.0-55.5)	46.2 (44.5-48.0)	Ref	62.3 (60.6-64.0)	37.7 (36.0-39.4)	Ref
Marital Status						
Married	49.5 (47.7-51.3)	50.5 (48.7-52.3)	0.5 (0.5-0.6)***	70.1 (68.5-71.8)	29.9 (28.2-31.5)	4.8 (4.3-5.4)***
Other	64.3 (62.4-66.2)	35.7 (33.8-37.6)	Ref	32.9 (31.0-34.8)	67.1 (65.2-69.0)	Ref
Parity						
0	53.7 (51.5-55.8)	46.3 (44.2-48.5)	0.6 (0.5-0.8)***	54.6 (52.5-56.8)	45.4 (43.2-47.5)	2.4 (2.0-2.9)***
1	57.5 (55.1-59.9)	42.5 (40.1-44.9)	0.7 (0.6-0.9)***	60.4 (58-62.7)	39.6 (37.3-42)	3.1 (2.5-3.7)***
2	59.6 (56.3-62.9)	40.4 (37.1-43.7)	0.8 (0.6-1.0)***	45.5 (42.1-48.9)	54.5 (51.1-57.9)	1.7 (1.3-2.1)***
3 or more	64.8 (61.0-68.6)	35.2 (31.4-39.0)	Ref	33.3 (29.6-37)	66.7 (63-70.4)	Ref
Race and Ethnicity						
White (non-Hispanic)	55.3 (53.5-57.1)	44.7 (42.9-46.5)	2.3 (1.9-2.9)***	60.4 (58.7-62.2)	39.6 (37.8-41.3)	1.1 (0.9-1.4)
Black (non-Hispanic)	63.3 (60.6-66.0)	36.7 (34.0-39.4)	3.2 (2.6-4.1)***	34.5 (31.9-37.2)	65.5 (62.8-68.1)	0.4 (0.3-0.5)***
Hispanic	60.3 (56.9-63.7)	39.7 (36.3-43.1)	2.9 (2.2-3.7)***	51.4 (47.9-54.8)	48.6 (45.2-52.1)	0.8 (0.6-1.0)*
Other races	34.7 (30.1-39.4)	65.3 (60.6-69.9)	Ref	58.0 (53.2-62.8)	42.0 (37.2-46.8)	Ref
Medicaid						
Yes	63.8 (61.9-65.7)	36.2 (34.3-38.1)	1.7 (1.6-2.0)***	35.4 (33.5-37.3)	64.6 (62.7-66.5)	0.3 (0.2-0.3)***
No	50.2 (48.4-52.0)	49.8 (48.0-51.6)	Ref	68.0 (66.3-69.7)	32.0 (30.3-33.7)	Ref

****p < .0001 **p < .01 *p < .05

Doi: 10.32481/djph.2023.06.025

Notes: Weighted percent and crude prevalence odds ratio (cPOR) with 95% confidence intervals (CI). NAS = neonatal abstinence syndrome; International Classification of Diseases – Ninth Revision Clinical Modification (ICD-9-CM) diagnosis of 779.5 and ICD-10-CM diagnosis of P96.1

Table 3. Adjusted Prevalence Odds Ratios of NAS Delivery, Postpartum Contraceptive Methods, and Pregnancy Intendedness in Delaware, 2012-2018[28]

Maternal Characteristics	**Adjusted Prevalence Odds Ratio**	
	Effective Postpartum Contraceptive Method (95% CI)	**Pregnancy Intended (95% CI)**
NAS delivery		
Yes	0.8 (0.6-1.2)	0.5 (0.3-0.8)**
No	Ref	Ref

***p < .0001 ** < .01 *p < .05

Notes: Adjusted prevalence odds ratios (aPOR) with 95% confidence intervals (CI). Models adjusted for maternal age, education, marital status, parity, race and ethnicity, and Medicaid status.

NAS = neonatal abstinence syndrome; International Classification of Diseases – Ninth Revision Clinical Modification (ICD-9-CM) diagnosis of 779.5 and ICD-10-CM diagnosis of P96.1

In contrast, the prevalence of intended pregnancy was lower in women who delivered an NAS-affected infant as compared with a non-NAS delivery (26.5%; 95% CI: 18.9-34.0 vs. 53.0%; 95% CI: 51.7-54.4). The difference was statistically significant and the estimated cPOR was 0.3 (95% CI: 0.2-0.5). After adjusting for maternal characteristics, women who delivered an NAS-affected infant had 50 percent lower odds (aPOR = 0.5; 95% CI: 0.3-0.8) of indicating that their pregnancy was intended as compared with women without an NAS-affected delivery (Table 3).

Discussion

Using statewide linked PRAMS, birth certificate, and hospital discharge data, our study aimed to assess differences between women who delivered an NAS-affected infant (i.e., a proxy for opioid use) versus those who did not for postpartum contraceptive use and pregnancy intentions in Delaware. Our study found no association between delivery of an NAS-affected infant and use of an effective postpartum contraceptive method. Cornford et al., found lower use of planned contraception in a U.K. cohort of women with OUD.[12] Similarly, Krans et al., study of Pennsylvania's Medicaid enrolled women found that women with OUD were less likely to use highly effective postpartum contraception.[13] Heil et al. found that in the experimental group, all women in the OUD treatment program who received free prescription contraceptives, and "financial incentives" initiated prescription contraceptive use following delivery, when compared to the control group who received usual care (i.e., free condoms, received emergency contraception, referral to providers) although such strategies may be coercive.[14,30,31]

During our 2012-2018 study period, Delaware saw a significant increase in use of long-acting reversible contraceptives in Title X and Medicaid populations.[32,33] A statewide data brief indicated that there was 107% increase in reversible contraceptive methods during 2012-2018, and a 17% percent increase in the percent of Delaware women indicating their pregnancy was intended.[34] Although our study did not find statistically significant differences in effective postpartum contraceptive use among women with an NAS-affected and non-NAS delivery, the low prevalence of effective postpartum contraceptive methods for both groups suggest that sustained and continued statewide efforts that are non-coercive and culturally appropriate may be needed to increase access to effective methods of contraceptives.

With regard to pregnancy intention, our study found that Delaware women with delivery of an NAS-affected infant had lower odds of indicating that their pregnancy was "intended" as compared to women without an NAS-affected delivery even after we account for maternal characteristics. Our study findings are consistent with Heil et al.'s study who also found that unintended pregnancy was highly prevalent (nine of every 10 women screened) and intended pregnancies were low among women with OUD.[15] Unintended pregnancy is associated with increased risk for postpartum depression and lower levels of perceived support,[35] and OUD treatment is lower among women who reported unintended pregnancies.[36] Women with OUD who already contend with several life stressors, may benefit from treatment for opioid use disorder, increased access to preconception and interconception resources including reproductive health planning.

Limitations

Despite the strength of linked administrative data and PRAMS survey data, the cross-sectional nature of our study limits our ability to draw causal inferences. PRAMS data are based on self-report and may be subject to recall bias, although this may have been minimized for contraceptive use in our analysis because we focused on contraceptive use at the time the PRAMS survey was completed in the postpartum period (typically 2-6 months after delivery). Our contraceptive estimates did not account for women who were trying to get pregnant and were not sexually active. Identification of NAS was based on administrative data such as HDD and may be prone to coding errors.[6] In addition, not all neonates

chronically exposed to opioids develop NAS postdelivery.[5] Even though PRAMS is a probability-based representative sample from birth certificates generalizable to all Delaware women with a recent live birth, low numbers of total NAS cases during 2012-2018 (n = 169), limited our ability to conduct sub-group analyses to examine effect modification. Linked datasets such as ours from other states may provide a sufficient sample size to allow discernment of how a delivery of an NAS-affected infant (i.e., proxy for opioid use disorder) may be associated with contraceptive use and choices, and pregnancy intentions. Lastly, our dataset was limited as we did not have information on NAS due to appropriate use of prescription opioids, misuse of opioids, or maternal opioid use disorder.

Conclusion

Using representative statewide data, we assessed whether an NAS delivery was associated with effective postpartum contraceptive methods, and pregnancy intendedness. Although we did not find an association among women who delivered an NAS-affected infant and effective postpartum contraceptive method, our data suggests that intended pregnancies were lower in women who delivered an NAS-affected infant as compared with those without a delivery of an NAS-affected infant even after accounting for maternal characteristics. The importance of reproductive counseling to women affected by opioid use disorder has been well-established. However, there is limited research on postpartum contraceptive use and pregnancy intentions in women with and without a NAS delivery. Our findings suggest an opportunity to improve outreach efforts in this population during preconception and interconception periods to develop a reproductive life-plan, counsel women on effective postpartum contraceptive use methods, and increase their access to effective contraceptive methods. Strategies to prevent the incidence of NAS deliveries through CDC's opioid prescribing guidelines[37] and access to preconception and family planning services, pregnancy intention screening, improving access to reproductive counseling and a full-range of contraceptive methods that include long-acting reversible contraception (e.g., intrauterine devices, and implants) may help reduce this disparity in unintended pregnancy.

Dr. Hussaini may be contacted at Khaleel.hussaini@delaware.gov.

References

1. Jansson, L. M., & Patrick, S. W. (2019, April). Neonatal abstinence syndrome. *Pediatric Clinics of North America*, *66*(2), 353–367. https://doi.org/10.1016/j.pcl.2018.12.006 PubMed

2. Jansson, L. M., & Velez, M. L. (2019, August). Optimal care for NAS: Are we moving in the wrong Direction? *Hospital Pediatrics*, *9*(8), 655–658. https://doi.org/10.1542/hpeds.2019-0119 PubMed

3. Jansson, L. M., & Velez, M. (2012, April). Neonatal abstinence syndrome. *Current Opinion in Pediatrics*, *24*(2), 252–258. https://doi.org/10.1097/MOP.0b013e32834fdc3a PubMed

4. Kocherlakota, P. (2014, August). Neonatal abstinence syndrome. *Pediatrics*, *134*(2), e547–e561. https://doi.org/10.1542/peds.2013-3524 PubMed

5. McQueen, K., & Murphy-Oikonen, J. (2016, December 22). Neonatal abstinence syndrome. *The New England Journal of Medicine*, *375*(25), 2468–2479. https://doi.org/10.1056/NEJMra1600879 PubMed

6. Patrick, S. W., Schumacher, R. E., Benneyworth, B. D., Krans, E. E., McAllister, J. M., & Davis, M. M. (2012, May 9). Neonatal abstinence syndrome and associated health care expenditures: United States, 2000-2009. *JAMA*, *307*(18), 1934–1940. https://doi.org/10.1001/jama.2012.3951 PubMed

7. Patrick, S. W., Burke, J. F., Biel, T. J., Auger, K. A., Goyal, N. K., & Cooper, W. O. (2015, October). Risk of hospital readmission among infants with neonatal abstinence syndrome. *Hospital Pediatrics*, *5*(10), 513–519. https://doi.org/10.1542/hpeds.2015-0024 PubMed

8. Patrick, S. W., Dudley, J., Martin, P. R., Harrell, F. E., Warren, M. D., Hartmann, K. E., . . . Cooper, W. O. (2015, May). Prescription opioid epidemic and infant outcomes. *Pediatrics*, *135*(5), 842–850. https://doi.org/10.1542/peds.2014-3299 PubMed

9. Hirai, A. H., Ko, J. Y., Owens, P. L., Stocks, C., & Patrick, S. W. (2021, January 12). Neonatal abstinence syndrome and maternal opioid-related diagnoses in the US, 2010-2017. *JAMA*, *325*(2), 146–155. https://doi.org/10.1001/jama.2020.24991 PubMed

10. Winkelman, T. N. A., Villapiano, N., Kozhimannil, K. B., Davis, M. M., & Patrick, S. W. (2018, April). Incidence and costs of neonatal abstinence syndrome among infants with Medicaid: 2004-2014. *Pediatrics*, *141*(4), e20173520. https://doi.org/10.1542/peds.2017-3520 PubMed

11. Reddy, U. M., Davis, J. M., Ren, Z., & Greene, M. F., & the Opioid Use in Pregnancy, Neonatal Abstinence Syndrome, and Childhood Outcomes Workshop Invited Speakers. (2017, July). Opioid Use in Pregnancy, Neonatal Abstinence Syndrome, and Childhood Outcomes: Executive Summary of a Joint Workshop by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, American College of Obstetricians and Gynecologists, American Academy of Pediatrics, Society for Maternal-Fetal Medicine, Centers for Disease Control and Prevention, and the March of Dimes Foundation. *Obstetrics and Gynecology*, *130*(1), 10–28. https://doi.org/10.1097/AOG.0000000000002054 PubMed

12. Cornford, C. S., Close, H. J., Bray, R., Beere, D., & Mason, J. M. (2015, March 4). Contraceptive use and pregnancy outcomes among opioid drug-using women: A retrospective cohort study. *PLoS One*, *10*(3), e0116231. https://doi.org/10.1371/journal.pone.0116231 PubMed

13. Krans, E. E., Kim, J. Y., James, A. E., III, Kelley, D. K., & Jarlenski, M. (2018, April 1). Postpartum contraceptive use and interpregnancy interval among women with opioid use disorder. *Drug and Alcohol Dependence*, *185*, 207–213. https://doi.org/10.1016/j.drugalcdep.2017.12.023 PubMed

14. Heil, S. H., Hand, D. J., Sigmon, S. C., Badger, G. J., Meyer, M. C., & Higgins, S. T. (2016, November). Using behavioral economic theory to increase use of effective contraceptives among opioid-maintained women at risk of unintended pregnancy. *Preventive Medicine*, *92*, 62–67. https://doi.org/10.1016/j.ypmed.2016.06.023 PubMed

15. Heil, S. H., Jones, H. E., Arria, A., Kaltenbach, K., Coyle, M., Fischer, G., . . . Martin, P. R. (2011, March). Unintended pregnancy in opioid-abusing women. *Journal of Substance Abuse Treatment*, *40*(2), 199–202. https://doi.org/10.1016/j.jsat.2010.08.011 PubMed

16. Faherty, L. J., Kranz, A. M., Russell-Fritch, J., Patrick, S. W., Cantor, J., & Stein, B. D. (2019, November 1). Association of punitive and reporting state policies related to substance use in pregnancy with rates of neonatal abstinence syndrome. *JAMA Network Open*, *2*(11), e1914078. https://doi.org/10.1001/jamanetworkopen.2019.14078 PubMed

17. Faherty, L. J., Matone, M., Passarella, M., & Lorch, S. (2018, June). Mental health of mothers of infants with neonatal abstinence syndrome and prenatal opioid exposure. *Maternal and Child Health Journal*, *22*(6), 841–848. https://doi.org/10.1007/s10995-018-2457-6 PubMed

18. Kozhimannil, K. B., Graves, A. J., Jarlenski, M., Kennedy-Hendricks, A., Gollust, S., & Barry, C. L. (2017, May 1). Non-medical opioid use and sources of opioids among pregnant and non-pregnant

reproductive-aged women. *Drug and Alcohol Dependence*, *174*, 201–208. https://doi.org/10.1016/j.drugalcdep.2017.01.003 PubMed

19. Centers for Disease Control and Prevention. (2021). PRAMS model surveillance protocol, 2015 version. http://www.cdc.gov/prams/methodology.htm
20. Shulman, H. B., D'Angelo, D. V., Harrison, L., Smith, R. A., & Warner, L. (2018, October). The Pregnancy Risk Assessment Monitoring System (PRAMS): Overview of Design and Methodology. *American Journal of Public Health*, *108*(10), 1305–1313. https://doi.org/10.2105/AJPH.2018.304563 PubMed
21. Korn, E., & Graubard, B. (1999). *Analysis of health surveys*. New York: Wiley.
22. Kortsmit, K., Williams, L., Pazol, K., Smith, R. A., Whiteman, M., Barfield, W., . . . Warner, L. (2019, July 1). Condom use with long-acting reversible contraception vs non-long-acting reversible contraception hormonal methods among postpartum adolescents. *JAMA Pediatrics*, *173*(7), 663–670. https://doi.org/10.1001/jamapediatrics.2019.1136 PubMed
23. Zapata, L. B., Murtaza, S., Whiteman, M. K., Jamieson, D. J., Robbins, C. L., Marchbanks, P. A., . . . Curtis, K. M. (2015, February). Contraceptive counseling and postpartum contraceptive use. *American Journal of Obstetrics and Gynecology*, *212*(2), 171.e1–171.e8. https://doi.org/10.1016/j.ajog.2014.07.059 PubMed
24. Dailard, C. (2022). Understanding 'abstinence': Implications for individuals, programs and policies. https://www.guttmacher.org/gpr/2003/12/understanding-abstinence-implications-individuals-programs-and-policies
25. Kost, K., & Lindberg, L. (2015, February). Pregnancy intentions, maternal behaviors, and infant health: Investigating relationships with new measures and propensity score analysis. *Demography*, *52*(1), 83–111. https://doi.org/10.1007/s13524-014-0359-9 PubMed
26. Lindberg, L., Maddow-Zimet, I., Kost, K., & Lincoln, A. (2015, May). Pregnancy intentions and maternal and child health: An analysis of longitudinal data in Oklahoma. *Maternal and Child Health Journal*, *19*(5), 1087–1096. https://doi.org/10.1007/s10995-014-1609-6 PubMed
27. Council for State and Territorial Epidemiologists. (2019). Standardized surveillance for diseases or conditions, revised 2019. https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/2019ps/19-MCH-01_NAS_updated_5.7.19.pdf
28. Delaware Department of Health and Social Services, Division of Public Health. (2018). Pregnancy Risk Assessment and Monitoring Survey, Delaware, 2012-2018
29. Hussaini, K. S., Drummond, D. E., Bartoshesky, L., Acheson, A., Stomieroski, K. A., Paul, D., & Kirby, R. S. (2021, January 15). Assessing the relationship between neonatal abstinence syndrome and birth defects in Delaware. *Birth Defects Research*, *113*(2), 144–151. https://doi.org/10.1002/bdr2.1811 PubMed
30. Brandi, K., Woodhams, E., White, K. O., & Mehta, P. K. (2018, April). An exploration of perceived contraceptive coercion at the time of abortion. *Contraception*, *97*(4), 329–334. https://doi.org/10.1016/j.contraception.2017.12.009 PubMed
31. Grace, K. T., & Anderson, J. C. (2018, October). Reproductive coercion: A systematic review. *Trauma, Violence & Abuse*, *19*(4), 371–390. https://doi.org/10.1177/1524838016663935 PubMed

32. Boudreaux, M., Choi, Y. S., Xie, L., & Marthey, D. (2019, June). Medicaid expansion at Title X clinics: Client volume, payer mix, and contraceptive method type. *Medical Care*, *57*(6), 437–443. https://doi.org/10.1097/MLR.0000000000001120 PubMed

33. Weiti, K., & Manlove, J. (2021). Estimated reductions in unintended pregnancy among Delaware Title X family planning clients after a contraceptive access intervention. Child Trends. https://www.childtrends.org/blog/estimated-reductions-in-unintended-pregnancy-among-delaware-title-x-family-planning-clients-after-a-contraceptive-access-intervention

34. Delaware Department of Health and Social Services, Division of Public Health. (2018). Reproductive health, Delaware Profile, 2012-2018, data Brief No.4. https://dethrives.com/wp-content/uploads/2020/08/Data_Brief_Reproductive_Health_PB_reviewed_team1.pdf

35. Barton, K., Redshaw, M., Quigley, M. A., & Carson, C. (2017, January 26). Unplanned pregnancy and subsequent psychological distress in partnered women: A cross-sectional study of the role of relationship quality and wider social support. *BMC Pregnancy and Childbirth*, *17*(1), 44. https://doi.org/10.1186/s12884-017-1223-x PubMed

36. Martin, C. E., Terplan, M., O'Grady, K. E., & Jones, H. E. (2018, July 11). Pregnancy intention and opioid use disorder treatment retention in the MOTHER study. *The American Journal on Addictions*. https://doi.org/10.1111/ajad.12735 PubMed

37. Frieden, T. R., & Houry, D. (2016, April 21). Reducing the Risks of Relief—The CDC Opioid-Prescribing Guideline. *The New England Journal of Medicine*, *374*(16), 1501–1504. https://doi.org/10.1056/NEJMp1515917 PubMed