Neonatal Abstinence Syndrome: 2022 Report

Bureau of Family Health and Bureau of Epidemiology

September 2024

pennsylvania
DEPARTMENT OF HEALTH

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Abbreviations

ACOG	American College of Obstetricians and Gynecologists
ASQ	Ages and Stages Questionnaire
CAPTA	Child Abuse Prevention and Treatment Act
CARA	Comprehensive Addiction and Recovery Act
COVID-19	Coronavirus Disease, 2019
CSTE	Council of State and Territorial Epidemiologists
DHS	(Pennsylvania) Department of Human Services
DHHS	(United States) Department of Health and Human Services
ESC	Eat, Sleep, Console
HCUP-SID	Healthcare Cost and Utilization Project-State Inpatient Database
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
iCMS	Internet Case Management System
MOUD	Medication for Opioid Use Disorder
NAS	Neonatal Abstinence Syndrome
NICU	Neonatal Intensive Care Unit
NOWS	Neonatal Opioid Withdrawal Syndrome
OCDEL	Office of Child Development and Early Learning
OR	Odds Ratio
PA	Pennsylvania
PA DOH	Pennsylvania Department of Health
SAMHSA	Substance Abuse and Mental Health Services Administration
WIC	(Pennsylvania Special Supplemental Nutrition Program for) Women, Infants, and Children
95% CI	95% Confidence Interval

Executive Summary

This is the Pennsylvania Department of Health's (Department) fifth neonatal abstinence syndrome (NAS) surveillance annual report. The NAS surveillance initiative allows for rapid case ascertainment and improved count of the number of infants with NAS across the state. Data in this report are intended for use by the Department or stakeholders to develop public health strategies that support families before, during, and after pregnancy. Key findings from this report may also inform clinical care and referral practices for infants with NAS and their families across the state.

The Department received 1,254 case reports of infants born in 2022 that met the NAS surveillance case definition. The incidence of NAS per 1,000 live births in 2022 was 9.6, a significant decrease from the 2021 rate of 12.1. Of 86 active hospitals with reporting capability, 78 (91%) reported NAS cases in 2022. Among infants with NAS, opioid exposure remained the most common; 95.3% of people who gave birth to an infant with NAS had used opioids during pregnancy and 91.8% of infants with NAS who were tested had a positive result for an opioid. Infants with NAS were predominantly born to people who identified as non-Hispanic white and had Medicaid insurance at delivery, consistent with previously reported state and national data. Although most infants with NAS were of normal birthweight and born at or after 37 weeks of gestation, nearly half (47.4%) were admitted to the neonatal intensive care unit (NICU) during their hospital stay.

The likelihood of an infant being admitted to the NICU, the duration of their hospital stay, and whether they receive medication are related and may depend on the scoring method the hospital uses to assess infant withdrawal symptoms. Most infants with NAS in Pennsylvania were assessed using solely the Finnegan/Modified Finnegan NAS scoring system (54.0%), and a smaller subset was assessed using the more recently developed Eat, Sleep, Console (ESC) scoring method (37.5%), which promotes rooming-in and non-pharmacologic therapies. Infants with NAS assessed using ESC were less likely to receive pharmacologic treatment and had a shorter hospital stay than those infants assessed using the Finnegan/Modified Finnegan NAS scoring system. Notably, the percentage of infants with NAS assessed using ESC has consistently increased since 2020.

Among people who gave birth to an infant with NAS in 2022, most had received some prenatal care (82.6%), and over half (61.4%) received medication for opioid use disorder (MOUD) during pregnancy. Data stratified by maternal race and ethnicity highlight disparities in receipt of prenatal care and MOUD. Non-Hispanic Black people who gave birth to an infant with NAS were less likely than non-Hispanic white people to receive prenatal care during pregnancy (75.9% vs 83.8%) and to receive MOUD during pregnancy (41.7% vs 64.0%). Linked surveillance data from 2018 to 2022 also demonstrate that 19.0% of people who gave birth to an infant with NAS in 2022 had a prior birth with an infant with NAS in the preceding four years.

Data on referral and discharge of the maternal-infant dyad in this report are not comprehensive and may not reflect all referrals made. The available data suggest that maternal-infant dyads are not universally referred to social support and health care services at discharge. This highlights an opportunity to improve healthcare providers and families'

awareness and education on available services and the importance of referral and coordinated follow-up.

This report includes NAS case counts and incidence rates for the 67 counties in Pennsylvania and its six regions. The incidence of NAS is higher in rural counties than in urban counties and remains the highest in the state's northwestern region.

To support the Department's commitment to advancing health equity and promoting the health and well-being of all Pennsylvanians, the Department developed a Neonatal Abstinence Syndrome Family Guide Tool Kit, a resource for caregivers. The Tool Kit is available as a resource on the Department's website for Neonatal Abstinence Syndrome (https://www.health.pa.gov/topics/programs/Newborn-Screening/Pages/NAS.aspx), and printed copies are available by contacting the Bureau of Family Health's Division of Newborn Screening and Genetics at 717-783-8143.

Addressing the opioid epidemic, substance use, and promoting the health of families is a collaborative effort with fellow state agencies, local and county health departments, health care organizations and many other community partners. While NAS surveillance is ongoing, this report is intended to provide data to stakeholders and members of the public to allow for data-informed decision-making and public health practice.

Introduction

Defining Neonatal Abstinence Syndrome (NAS)

Neonatal abstinence syndrome (NAS) is a constellation of signs of withdrawal in a newborn following in utero exposure to prescribed medications (including medications used to treat substance use disorder) or illicit drugs including opioids, benzodiazepines, and barbiturates (CSTE 2019; CSTE 2023). NAS may occur at or shortly following birth due to the discontinuation of exposure to such substances and manifests as symptoms including body tremors, excessive crying or inability to console, feeding difficulty, and increased muscle tone, among others. Withdrawal resulting from opioid exposure is sometimes referred to as Neonatal Opioid Withdrawal Syndrome or NOWS. Throughout this report, NAS will be used as an umbrella-term and includes cases of NOWS.

NAS Surveillance in Pennsylvania

Initiation of Rapid Case Ascertainment and Reporting Authority: 2018-2019

Surveillance for NAS was initiated in Pennsylvania following the issuance of an opioid emergency disaster declaration by former Governor Tom Wolf on January 10, 2018. While the disaster declaration ended, the Department has the authority to require and receive reports of NAS cases from hospitals across the state under Title 28 PA codes 27.3 and 27.4, which are based on the statutory provisions act 35 PS 521.2 (k) and 521.4.

Case Definition:

2018-2019

In 2018 and 2019, NAS cases were defined as Pennsylvania resident infants with clinical diagnoses of NAS who had symptoms of withdrawal due to prenatal exposure to opioids. Annual NAS data from 2018 and 2019 surveillance were published in two reports, which can be found on the Department of Health's website (https://www.pa.gov/en/agencies/health/programs/maternal-health-and-infant-care/newborn-screening/nas.html).

2020-2022

Effective January 1, 2020, all hospitals in Pennsylvania are required to report NAS cases in Pennsylvania residents' newborns (neonates that are less than 28 days old) showing withdrawal symptoms due to in utero exposure to opioids, benzodiazepines, or barbiturates via prescription, treatment with medication for opioid use disorder (MOUD), or illicit use. NAS cases are defined as follows:

> ***Confirmed NAS Case***
> Positive infant drug screen for opioids, benzodiazepines, or barbiturates from a neonate less than 28 days of age;
>
> **OR**
>
> Positive maternal drug screen and/or maternal medical record containing information about the use of prescribed or nonprescribed opioids, benzodiazepines, or barbiturates in the current pregnancy;

AND the newborn meets at least one of the following criteria:

- A newborn diagnosis of NAS/NOWS (including, but not limited to ICD-10 codes P96.1, P04.49, P04.14, P04.17); OR
- A chief complaint that mentions NAS/NOWS; OR
- Two or more clinically compatible symptoms of NAS/NOWS, where the signs have not been explicitly attributed by a provider to an alternative diagnosis or condition

Since the NAS case definition was expanded to include cases of NAS resulting from exposure to benzodiazepines or barbiturates in 2020, subsequent data are not directly comparable to preceding years when solely cases resulting from in utero exposure to opioids were reported to the Department. Additionally, cases that met the case definition on the basis of maternal self-report, labs, or medical history were previously categorized as probable, whereas cases that met the case definition based on infant lab test results were categorized as confirmed. This categorization has been discontinued as the distinction has no bearing on case reporting or follow-up care/management. Case reporting was not impacted by this change and data from 2020 and 2021 are still comparable to data from 2022. Prior NAS annual reports can be found on the Department of Health's website (https://www.pa.gov/en/agencies/health/programs/maternal-health-and-infant-care/newborn-screening/nas.html)

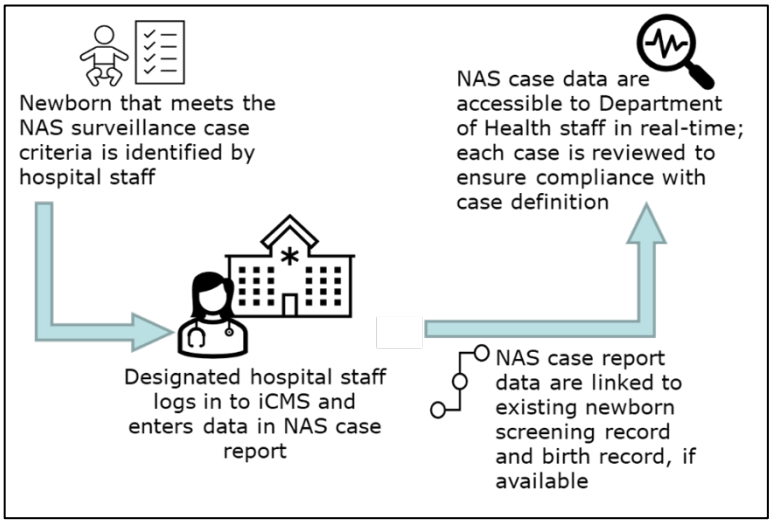
Case Reporting and Statistical Methods

NAS Case Reporting

Data Flow and Confidentiality

All hospitals are required to configure their systems and complete training prior to electronic submission of NAS case data via the internet case management system (iCMS). Upon identification of an infant that meets the NAS reporting criteria, hospital staff responsible for reporting log in to the iCMS secure server and enter the data in the case report form. Hospitals are instructed to report cases of NAS to the Department of Health within four days after discharge or by 28 days of life, whichever comes sooner. Neometrics, a division of Natus, owns the application, hosts, and maintains iCMS, and houses the data on an offsite server. Data entered by the reporting hospital are available to the Department of Health staff in real time. Each infant's case report is then linked to their existing birth record and newborn screening record in iCMS, if available. Cases reported to the Department of Health are confidential. Neither the reports nor any information contained in them which identifies or is perceived by the Department as capable of being used to identify a person named in a case report will be disclosed to any person who is not an authorized employee or

Figure 1. NAS Case Report Data Flow Diagram



Source: Bureau of Family Health, Department of Health, 2022

agent of the Department or an entity identified in a Memorandum of Understanding, unless otherwise required by law.

Quality Assurance and Data Cleaning

Upon receiving NAS case reports, designated staff in the Department of Health's Bureau of Family Health conduct a detailed review of each case to ensure compliance with the NAS surveillance case definition and confirm Pennsylvania residency. Infants with no reported symptoms on their NAS case report form are confirmed to either have a diagnosis of NAS or a chief complaint of NAS prior to being included in the surveillance dataset, in accordance with the case definition. Multiple case report forms submitted for the same infant are merged to retain all information. Another component of the case review is verifying referral to Early Intervention through data sharing with the Office of Child Development and Early Learning (OCDEL), a collaborative between the Pennsylvania Departments of Education and Human Services. OCDEL provides the Bureau of Family Health with verified Early Intervention referral data on NAS cases which are incorporated into the iCMS database.

Limitations of Reporting

NAS surveillance has inherent limitations that influence the interpretation of the data herein. Pennsylvania's NAS surveillance relies on timely and accurate reporting by hospitals and their staff. Not all fields of the case report form are currently mandatory or are further verified by the Department of Health. In particular, the data reported by hospitals on ChildLine notifications and initiation of plans of safe care have not been validated by the Department of Human Services, the agency responsible for receiving ChildLine referrals and plan of safe care initiation.

Prior to discharge, hospitals are also required to notify the Department of Human Services that they are caring for a substance affected infant (defined as a child less than one year of age, who the provider has determined to be born affected by substance use or withdrawal symptoms resulting from prenatal substance exposure or Fetal Alcohol Spectrum Disorder) in accordance with Pennsylvania Act 54 of 2018 and federal Comprehensive Addiction and Recovery Act of 2016 (P.L. 114-198, 7/22/2016) (CARA), title V, section 503 amended sections 106 (b)(2)(B)(ii) and (iii) of the Child Abuse Prevention and Treatment Act (CAPTA). Medical providers must submit this notification to the Department of Human Services' ChildLine, a hotline and online platform which receives these notifications. Reporting of an infant that meets the criteria of NAS per the surveillance case definition to the Department of Health is different from reporting of substance-affected infants to the Department of Human Services, and the requirements of reporting to the two Departments also differ. Accordingly, NAS surveillance data and data on substance-affected infants published by the Department of Human Services are not directly comparable.

Additionally, there is no mandate in Pennsylvania for universal drug testing for people giving birth or their infants at birth. Testing is not always performed. While data on laboratory testing collected on the case report form are included in this report, results were not available for all cases. When data for a given field of the NAS case report form were not provided or were unknown by the hospital, this is noted in the tables and figures throughout the report.

The Department of Health provides ongoing technical assistance to case reporters at hospitals across the state to promote comprehensive reporting of NAS cases to iCMS.

However, differences in reporting by county may be influenced by the capacity of hospitals to report NAS cases.

Finally, Pennsylvania resident births that meet the NAS case reporting criteria but occur at hospitals outside the state are not reported to iCMS. As a result, there may be underreporting of NAS among Pennsylvania resident births, especially in counties adjacent to state boundaries.

Analysis

Statistical Methods

All infants with NAS that met the surveillance case definition and were born in 2022 are included in the report. NAS case data were linked to birth certificate based on maternal information. This linkage allowed for the inclusion and evaluation of data on birth parameters and select maternal characteristics not captured on the NAS case report form. Birth parameters, infant testing, assessment, treatment, discharge, and referrals are characterized with descriptive statistics. Preliminary 2022 birth certificate data were summarized in descriptive tables and compared to NAS surveillance data. Incidence rates were calculated using preliminary 2022 birth data and compared to prior rates to assess change in the rate of NAS over time.

Maternal characteristics including demographics, maternal medical history, and maternal discharge and referrals were also characterized. Case reports for plural births (twins, triplets, etc.) were identified and a single record was retained for each person who gave birth to an infant with NAS so that they are represented only once in the data. For maternal race/ethnicity, counts for people identifying as Non-Hispanic American Indian/Alaska Native and Asian/Pacific Islander were merged into a non-Hispanic other category due to small numbers. The 2022 NAS surveillance dataset was then linked to 2018, 2019, 2020, and 2021 NAS surveillance datasets to characterize the number of people who gave birth to an infant with NAS in 2022 who also had a prior birth with an infant with NAS that was reported to the surveillance database in the preceding four years. However, this analysis may underestimate recurrent NAS births due to the changing case definition across surveillance years. While data from 2020 through 2022 are directly comparable and were collected using the same case definition, data from 2018 and 2019 are limited to opioid-exposed infants with NAS – those infants that had NAS resulting from exposure to benzodiazepines or barbiturates did not meet the case definition. Accordingly, if someone who gave birth to an infant with NAS resulting from exposure to benzodiazepines or barbiturates in 2022 also had a prior NAS birth in 2018 or 2019 that resulted from exposure to one of those substances, the prior birth would not be captured in this analysis.

For analysis by county and region, the residential address provided on the infant's linked birth record was used to determine the maternal county of residence. If a full address could not be verified or was not provided, the county was determined based on the centroid of the residential zip code. For a small proportion of cases, no address was available. Those cases were excluded from analyses by county of maternal residence but are included when assessing cases by county of the hospital. Incidence rates were calculated by county and region of maternal residence to assess the burden and facilitate comparison. Maps were generated to visually present varying counts and incidences of NAS across the state. SAS 9.4 was used for data processing and ArcGIS 10.4.1 for Desktop was used for geocoding and map generation.

Findings

Case Count and Incidence Rate of NAS

The Department of Health received 1,254 case reports of infants that met the NAS surveillance case definition in the calendar year 2022, representing 1.0% of all births in the state. There was a 21% decrease in the NAS incidence rate from 12.1 per 1,000 live births in 2021 to 9.6 in 2022. (**Table 1**; **Figure 1**).

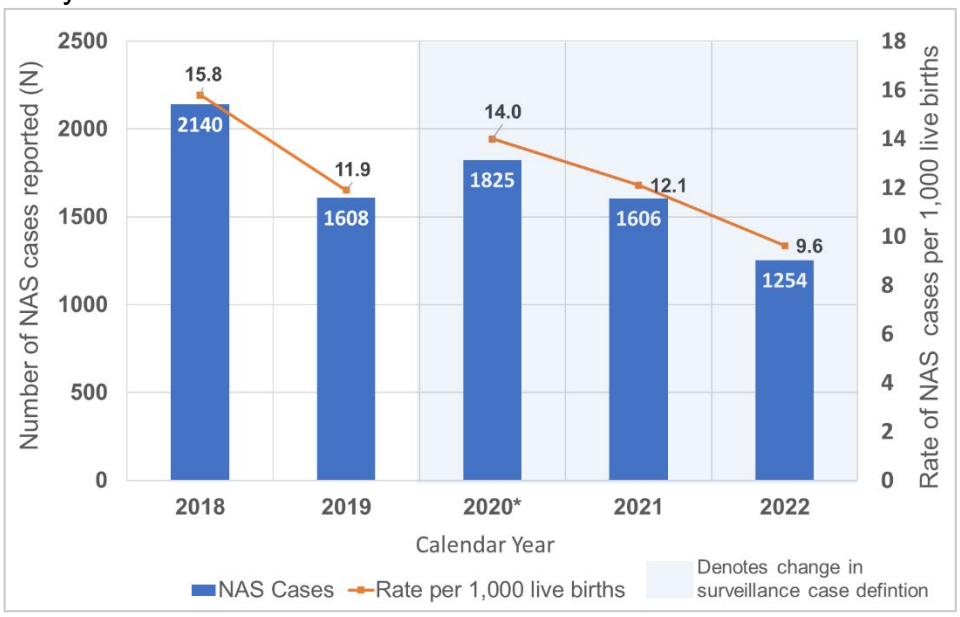
Table 1. NAS incidence rate per 1,000 live births by calendar year

	Year	NAS Cases	Total live births	NAS rate per 1,000 live births (95% Confidence Interval) *
Pennsylvania	2018	2140	135677	15.8 (15.1, 16.4)
	2019	1608	134247	11.9 (11.3, 12.4)
	2020	1825	130187	14.0 (13.3, 14.6)
	2021	1606	133036	12.1 (11.5, 12.7)
	2022	1254	130304	9.6 (9.1, 10.2)

*2018 incidence rate was calculated using 2017 occurrent resident live birth data; 2019 incidence rate was calculated using 2018 resident live birth data; 2018 and 2019 incidence rates were previously published in 2018 and 2019 NAS Annual Reports; 2020 and 2021 incidence rates were calculated using preliminary resident live birth data; 2022 incidence rate was calculated using preliminary 2022 resident live birth data. Resident live birth data for 2022 are preliminary and are subject to change. Please note that the NAS case definition expanded to include exposure to barbiturates or benzodiazepines in addition to opioids in 2020 whereas the case definition in 2018-2019 included solely those infants with exposure to opioids.

Data Source: 2018 and 2019 NAS Reports (Bureau of Epidemiology, PA DOH), 2020 and 2021 NAS Reports (Bureau of Family Health and Bureau of Epidemiology, PA DOH), NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Figure 1. Number of infants with NAS and incidence rate per 1,000 live births by calendar year



*The NAS Case definition expanded to include cases of NAS exposed to barbiturates, benzodiazepines, or opioids. In 2018 and 2019 solely cases resulting from in utero exposure to opioids were reported to the Department of Health.
Data Sources: 2018 and 2019 NAS Reports (Bureau of Epidemiology, PA DOH), 2020 and 2021 NAS Report (Bureau of Family Health and Bureau of Epidemiology, PA DOH), NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Birth Parameters of NAS Cases

Infants with NAS were predominantly male (53.8%), of normal birthweight (78.1%), born at or after 37 weeks of gestation (79.5%), and had a length of hospital stay of 4 to 7 days (50.9%). Nearly half of all infants with NAS were admitted to the NICU for care (47.4%). When compared to all 2022 resident live births, a higher percentage of infants with NAS had a low birth weight (20.2% versus 7.1%) and were born preterm (19.1% versus 9.6%). Most notably, only 9.5% of resident live births were admitted to the NICU according to vital records data compared to 47.4% of infants with NAS [**Table 2**].

Table 2. Birth parameters of infants with NAS compared to select parameters of the resident live birth population

	NAS Cases		Pennsylvania Resident Live Births (2022)*	
	N	% of total NAS cases	N	% of total births
Total	1254	100.0%	130304	100%
Sex				
Male	675	53.8%	66614	51.1%
Female	579	46.2%	63690	48.9%
Birthweight (grams)				
Very low birthweight (<1500g)	19	1.5%	1828	1.4%
Low birthweight (1500-2500g)	253	20.2%	9243	7.1%
Normal birthweight (>2500g)	980	78.1%	118976	91.3%
Unknown	2	0.2%	257	0.2%
Gestational age at birth				
Preterm (<37 weeks)	239	19.1%	12490	9.6%
Full-term (>37 weeks)	997	79.5%	117208	89.9%
Unknown	18	1.4%	606	0.5%
Plurality				
Singleton	1208	96.3%	126151	96.8%
Multiple	46	3.7%	4147	3.2%
Unknown	-	-	6	0.0%
1-minute Apgar Score				
< 7 (Abnormal	98	7.8%	-	-
≥7 (Normal)	707	56.4%	-	-
Unknown/Not Reported	449	35.8%	-	-
5-minute Apgar Score				
< 7 (Abnormal	22	1.8%	2575	2.0%
≥7 (Normal)	782	62.4%	126764	97.3%
Unknown/Not Reported	450	35.9%	965	0.7%
Location of Infant Care†				
NICU	594	47.4%	12352	9.5%
Nursery only	659	52.6%	-	-
Other	1	0.1%	-	-
Infant Length of Stay‡				
0-3 days	65	5.2%	-	-
4-7 days	638	50.9%	-	-
8-14 days	161	12.8%	-	-
15-21 days	147	11.7%	-	-
22-28 days	96	7.7%	-	-
>28 days	147	11.7%	-	-

*Resident live birth data for 2022 are preliminary and are subject to change

†Presented categories are mutually exclusive but 228 infants that received care in the neonatal intensive care unit (NICU) also received some care in a nursery/postpartum unit. The other category includes case reports where the submitter indicated that the infant was transferred and the care location was not reported, had been reported upon readmission, or it was indicated that the infant received outpatient care.

‡ The infant's length of stay was calculated using the date of birth and date of discharge from the reporting facility. If the infant was transferred and the transfer facility did not submit a case report form, the discharge date may represent the transfer date and the length of stay may be an underestimate. If the infant was identified as an NAS case solely upon readmission to the hospital, the length of stay may be an overestimate.

Data Source: NAS Surveillance Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics, PA DOH)

Maternal Characteristics

Of the 1,239 people who gave birth to an infant with NAS in 2022, they were predominantly between the ages of 20 and 34 (73.0%), identified as non-Hispanic white (78.9%), and their delivery was insured by Medicaid (41.2%). Most had initiated prenatal care (82.6%) and received medication for opioid use disorder (MOUD) during pregnancy (61.4%) [**Table 3**]. There may be an association between prenatal care and MOUD as 67.6% of those who initiated prenatal care received MOUD during pregnancy, whereas only 27.5% of people who did not initiate prenatal care received MOUD (**Table 4**). There were disparities in the receipt of supportive healthcare during pregnancy. Non-Hispanic Black people initiated prenatal care (75.9%) at lower rates than non-Hispanic white people (83.8%). Additionally, only 41.7% of non-Hispanic Black people who gave birth to an infant with NAS had received MOUD during pregnancy compared to 64.0% of non-Hispanic white people (**Table 5**).

There was evidence of maternal substance use or infant exposure for all cases of NAS, consistent with the case definition. For 97.8% of people who had an infant with NAS, substance use in the four weeks prior to delivery was confirmed on the case report form based on the maternal health record. Of those, 95.3% reported opioid use (including opioid agonists and partial agonists such as methadone and buprenorphine), 6.6% reported use of benzodiazepines, and 0.4% reported use of barbiturates. In addition to the substances included and assessed in the NAS case definition, the case report form also collects data on other substances used in the four weeks prior to delivery. Use of marijuana (19.1%), tobacco/e-cigarettes (16.3%), and alcohol (1.5%) were also reported. Approximately 27.4% of people used some other substance in the four weeks prior to delivery. Other substances reported on the case report form are listed in the notes of **Table 3**. Polysubstance use was common among people who gave birth to an infant with NAS; 53.0% reported using more than one of the substances listed on the case report form in the four weeks prior to delivery.

Linked surveillance data from 2018 to 2022 suggest that approximately 19.0% of people who gave birth to an infant with NAS in 2022 had a prior birth to an infant with NAS in the preceding three years (**Table 6**). This may be underestimated given the change in case definition between 2018-2019 and 2020-2022. Of the 236 people who had a prior birth to an infant with NAS, 159 (67.4%) were receiving MOUD during their 2022 pregnancy; people with a prior NAS birth were 2.5 times more likely to have received MOUD during their 2022 pregnancy than people who had not given birth to another infant in the prior four years (OR 2.5, 95% CI: 1.5, 4.2).

Data on interpregnancy interval (the number of months between the end of one pregnancy and the start of another) for people who gave birth to more than one infant with NAS between 2018 and 2022 are presented in Table 6. The interpregnancy interval among people who gave birth to more than one infant with NAS between 2018 and 2022 was shorter than the interval observed statewide; approximately 55% of people who had a prior infant with NAS had an interpregnancy interval <18 months compared to 33% of people who gave birth in Pennsylvania. Given that statewide data on MOUD are not available for all births in Pennsylvania, state data are not included in Table 6.

Table 3. Select maternal characteristics of people who gave birth to an infant with NAS as compared to Pennsylvania resident live births

	People who gave birth to an infant with NAS*		Pennsylvania Resident Live Births (2022)†	
Characteristic	**N**	**% of total₸**	**N**	**% of total births**
Total	1239	100.00%	130304	100%
Maternal age (years)				
≤19	5	0.4%	4382	3.4%
20-34	904	73.0%	98747	75.8%
35+	330	26.6%	27161	20.8%
Unknown	-	-	14	0.0%
Maternal race/ethnicity				
Non-Hispanic Black	108	8.7%	16222	12.4%
Non-Hispanic White	978	78.9%	82411	63.2%
Non-Hispanic Multiracial	31	2.5%	-	-
Non-Hispanic Other^	7	0.6%	7976	6.1%
Hispanic	67	5.4%	18070	13.9%
Unknown/Not Reported	48	3.9%	5625	4.3%
Prenatal care initiation				
Initiated prenatal care	1024	82.6%	123926	95.1%
No prenatal care	69	5.6%	2815	2.2%
Unknown	146	11.8%	3563	2.7%
Principal source of payment at delivery				
Medicaid	511	41.2%	44308	34.0%
Private Insurance	35	2.8%	72763	55.8%
Uninsured	4	0.3%	7072	5.4%
Other	6	0.5%	1873	1.4%
Unknown/Not Reported	683	55.1%	4288	3.3%
Received medication for opioid use disorder during pregnancy				
Yes	761	61.4%	-	-
No	176	14.2%	-	-
Unknown/Not Reported	302	24.4%	-	-
Maternal substances used in the 4 weeks prior to delivery				
Yes	1212	97.8%	-	-
No	27	2.2%	-	-
Specific substances used/reported¥				
Alcohol	18	1.5%	-	-
Tobacco/E-cigarettes	202	16.3%	-	-
Marijuana/Hash	237	19.1%	-	-
Opioids/Opiates†	1181	95.3%	-	-
Benzodiazepines	82	6.6%	-	-
Barbiturates	5	0.4%	-	-
Other Substances₸	340	27.4%	-	-

* This table presents demographic information on people who had a live birth; a person who had a plural birth is represented only once

† Resident live birth data for 2022 are preliminary and are subject to change

₸ Percentages may not add to 100% due to rounding. Frequencies by specific substances do not sum to 100% as categories are not mutually exclusive and one person may have used multiple substances in the four weeks prior to pregnancy. Polysubstance use was common with 53% of people using more than one of the substances listed in the four weeks prior to pregnancy (660 of 1239).

^ Births among people identifying as Non-Hispanic American Indian/Alaska Native and Asian/Pacific Islander were merged due to small numbers

¥Opioids/opiates include Buprenorphine (Subutex or suboxone), Methadone, Codeine, Fentanyl, Heroin, Hydrocodone, Hydromorphone, Morphine, Opiates, Oxycodone or Tramadol; Other substances include Amphetamines, Antidepressants, Antipsychotics, Bupropion (e.g., Wellbutrin), Cocaine, Gabapentin, Hallucinogens/inhalants, Methamphetamine, or Phencyclidine

Data Sources: NAS Surveillance Program - Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Table 4. Initiation of prenatal care and receipt of medication for opioid use disorder during pregnancy among people who gave birth to an infant with NAS

	People who gave birth to an infant with NAS			
		Medication for Opioid Use Disorder during pregnancy		
Prenatal Care	**n**	**Yes**	**No**	**Unknown/Not Reported**
Initiated prenatal care	1024	692 (67.6%)	107 (10.4%)	225 (22.0%)
No prenatal care	69	19 (27.5%)	22 (31.9%)	28 (40.6%)
Unknown	146	50 (34.2%)	47 (32.2%)	49 (33.6%)
Total	1239	761 (61.4%)	176 (14.2%)	302 (24.4%)

Data Sources: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Table 5. Initiation of prenatal care and receipt of medication for opioid use disorder during pregnancy among people who gave birth to an infant with NAS stratified by maternal race/ethnicity

	People who gave birth to an infant with NAS											
	Maternal race/ethnicity											
Characteristic	**Non-Hispanic White**		**Non-Hispanic Black**		**Non-Hispanic Multiracial**		**Non-Hispanic Other***		**Hispanic**		**Unknown**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Total (N=1239)	978	78.9%	108	8.7%	31	2.5%	7	0.6%	67	5.4%	48	3.9%
Prenatal Care												
Initiated prenatal care	820	83.8%	82	75.9%	25	80.6%	-	-	58	86.6%	33	68.8%
No prenatal care	52	5.3%	8	7.4%	2	6.5%	-	-	1	1.5%	6	12.5%
Unknown	106	10.8%	18	16.7%	4	12.9%	-	-	8	11.9%	9	18.8%
Received medication for opioid use disorder during pregnancy												
Yes	626	64.0%	45	41.7%	17	54.8%	-	-	42	62.7%	26	54.2%
No	102	10.4%	41	38.0%	5	16.1%	-	-	15	22.4%	11	22.9%
Unknown	250	25.6%	22	20.4%	9	29.0%	-	-	10	14.9%	11	22.9%

* Births among people identifying as Non-Hispanic American Indian/Alaska Native and Asian/Pacific Islander were merged due to small numbers

Data Sources: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Table 6. Select characteristics of people who gave birth to an infant reported to the NAS surveillance system in 2022 and a prior birth to an infant with NAS between 2018-2021 as compared to characteristics of people with no prior birth to an infant with NAS during that period

	People who gave birth to an infant with NAS		
	Prior birth to infant with NAS during 2018-2021 n (%)	**No prior birth to infant with NAS during 2018-2021 n (%)**	**p-value**
Total (N=1239)	236 (19.0%)	1003 (81.0%)	
Received medication for opioid use disorder during pregnancy			
Yes	159 (67.4%)	602 (60.0%)	<0.001
No	17 (7.2%)	159 (15.9%)	
Unknown	60 (25.4%)	242 (24.1%)	
Referred for medication for opioid use disorder at discharge			
Yes	143 (60.6%)	564 (56.2%)	<0.001
No	93 (39.4%)	439 (43.8%)	
Interpregnancy Interval*			
<6 months	31 (13.1%)	N/A	
6-17 months	98 (41.5%)	N/A	
≥18 months	107 (45.3%)	N/A	

*Interpregnancy interval is the number of months between the end of one pregnancy and the start of another. This is limited to known live births to infants with NAS to each person; other pregnancies that may not have resulted in a live birth or an infant with NAS during the 2018-2022 period were not reported or known and, therefore, were not considered. Additionally, prior births to infants with NAS resulting from exposure to barbiturates or benzodiazepines that occurred in 2018 or 2019 would not have been captured by the NAS surveillance system as they would not have met the case definition. Estimated the date of conception by subtracting infant gestational age at birth in weeks from the date of birth. Then subtracted date of conception from date of last NAS birth reported to the surveillance system in 2018, 2019, 2020, or 2021 to estimate interpregnancy interval in months. Interpregnancy interval for people with no known prior birth to an infant with NAS were not assessed as birth history was not reported on the NAS case report form.

P-values below 0.05 are indicative of a significant association between the maternal characteristic and prior birth to an infant with NAS; there is a significant association between receipt of or referral for medication for opioid use disorder and prior birth to an infant with NAS

Data sources: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Infant Testing, Assessment, and Treatment

Testing

Of the 1,254 infants with NAS, 85.7% (n=1075) were tested for substance exposure at birth (**Table 7A**). Of those tested, 86.6% (n=931) had a positive test result for a substance. Substances identified through testing of infant biological samples (such as urine or umbilical cord blood) included opioids (91.8%), benzodiazepines (4.1%), or barbiturates (0.9%). Other substances were also identified for 33.4% of infants. Of those infants with a positive test result for a substance (n=931), over half (61.4%) had a parent who was receiving MOUD during pregnancy (**Table 7B**).

Table 7A. Laboratory testing for in utero exposure to substances and results among infants with NAS*

	NAS Cases	
	N	**% of total NAS cases**
Total NAS Cases	1254	100%
Testing for substance exposure		
Not Tested	179	14.3%
Tested	1075	85.7%
Testing results (n=1075)		
Tested - Negative Result	112	10.4%
Tested - Results Unknown or Pending	32	3.0%
Tested - Positive for Any Substance	931	86.6%

*There is no mandate in Pennsylvania for universal drug testing for infants at birth and any testing that is performed must be done solely with the consent of the patient or caregiver. If laboratory testing results are available hospital staff may report them on the NAS case report form for infants as these results may be used to ascertain whether the infant meets the NAS surveillance case definition. However, resulting data are not comprehensive as testing is not always performed, especially if a history of substance use or in utero exposure to substances is already documented in the medical record. Data on laboratory testing collected on the case report form included in this table should be interpreted with consideration of these qualifying factors
Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Table 7B. Substance-specific results of laboratory testing of biological samples among infants with NAS tested for in utero exposure

	NAS Cases	
	n	**% of tested NAS cases with positive test result**
Total NAS cases with positive test result	931	100.0%
Positive result by substance*		
Positive test results for any opioid	855	91.8%
Positive test results for benzodiazepines	38	4.1%
Positive test results for barbiturates	8	0.9%
Positive test results for other substance	311	33.4%
Received medication for opioid use disorder (MOUD) during pregnancy		
Parent received MOUD	572	61.4%
Parent did not receive MOUD	138	14.8%
Unknown	221	23.7%

*Positive results by substance frequencies are not mutually exclusive and percentages do not sum to 100% as an infant may have tested positive for more than one substance

Assessment and Scoring

Nearly all infants reported to the NAS surveillance system were assessed using a scoring and assessment tool or method (97.9%). Over half (54.0%) were assessed with Finnegan/Modified Finnegan scoring, and 37.5% were assessed using the Eat, Sleep, Console (ESC) method (**Table 8A**).

Symptoms were documented for 97.4% of infants reported to the NAS surveillance system. Of those infants (n=1222), most experienced 3 or more symptoms that were clinically compatible with NAS (81.3%). The most frequently reported symptoms among symptomatic infants were elevated muscle tone (67.5%), poor feeding (64.8%), and body shakes/tremors (48.0%) [**Table 8B**].

Table 8A. Scoring method for identification of NAS and reporting of clinically compatible symptoms among infants with NAS

	NAS Cases	
	N	**% of total NAS cases**
Total NAS Cases	1254	100.0%
Scoring method		
Finnegan/Modified Finnegan Only	677	54.0%
Eat, Sleep, Console Only	470	37.5%
Finnegan/ Modified Finnegan and Eat, Sleep, Console	81	6.5%
None	26	2.1%
Clinically compatible symptoms of NAS		
Symptoms Not Documented/Unable to Assess Symptoms	32	2.6%
Symptoms Documented	1222	97.4%

Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Table 8B. Clinically compatible symptoms of NAS among infants with documented symptoms

	NAS Cases	
	n	% of symptomatic NAS cases
Total symptomatic NAS cases	1222	100.0%
Number of symptoms reported		
1-2 symptoms	229	18.7%
3 or more symptoms	993	81.3%
Frequency of reported symptoms*		
Body shakes (tremors)	843	48.0%
Seizures (convulsions)	3	0.2%
Hyperactive moro reflex	245	20.0%
Myoclonus (including hiccups)	34	2.8%
Hypertonia (Elevated muscle tone)	825	67.5%
Continuous, excessive, or high-pitched cry/inability to console	590	48.3%
Poor feeding (including poor or excessive suck)	792	64.8%
Tachypnea/Respiratory distress	459	37.6%
Fever	468	38.3%
Blotchy skin/mottling	224	18.3%
Poor sleep	665	54.4%
Lots of yawning	116	9.5%
Loose stools	455	37.2%
Vomiting/Regurgitation	276	22.6%
Nasal congestion	244	20.0%
Sneezing	491	40.2%
Skin abrasions or excoriation	301	24.6%

*Symptoms are not mutually exclusive as most infants experienced three or more symptoms. Submitters also had the opportunity to document other symptoms experienced by the infant. However, not all symptoms reported can be solely attributed to NAS and therefore were not included in the table or considered when assessing the number of clinically compatible symptoms of NAS experienced by each infant. Other symptoms were reported for 50 cases (4.0%) and included: sweating, nasal flaring, weight loss, and hypothermia.
Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Treatment and Therapy

Treatment of infants with NAS may include supportive non-pharmacologic strategies and medications (pharmacologic). Among infants with NAS 25.5% were administered medication during their hospital stay (n=320). Approximately 9.0% of NAS infants received both pharmacologic treatment and non-pharmacologic therapy. Non-pharmacologic therapy may include activities such as rooming-in with the parent, swaddling, skin-to-skin contact, breastfeeding, and maintaining a quiet care environment. Non-pharmacologic therapy alone was provided to 34.8% of infants with NAS during their hospital stay. No treatment was reported for 27.2% and treatment status was unknown for 3.5% of infants with NAS (**Table 9A**).

Scores from the Modified Finnegan/Finnegan tool are often used to guide the administration of medications to infants to treat withdrawal symptoms. Since repeated scores between 8 and 12 and above are indicative of greater severity of withdrawal symptoms, non-pharmacologic treatment and supportive care were most common among infants with NAS scores of 7 and below and pharmacologic treatment was more common among infants with a score

exceeding 8 (see **Table 9B**). Infants assessed using the ESC method were less likely to receive pharmacologic treatment (20.6%) during their hospital stay compared to infants assessed using the Finnegan/Modified Finnegan scoring method (43.8%).

Table 9A. Type of treatment received among infants with NAS

	NAS Cases	
	N	**% of total NAS cases reported**
Total NAS Cases	1254	100%
Infant treatment		
Pharmacologic treatment	320	25.5%
Pharmacologic and non-pharmacologic treatment	113	9.0%
Non-pharmacologic treatment	436	34.8%
No treatment	341	27.2%
Unknown/Not Reported	44	3.5%

Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Table 9B. Scoring method and score by treatment type among infants with NAS

		Received Pharmacologic Treatment		No Pharmacologic Treatment		Unknown/Not Reported	
Scoring Method	**N**	**n**	**%**	**n**	**%**	**n**	**%**
Finnegan/Modified Finnegan	758	332	43.8%	395	52.1%	31	4.1%
Highest Score							
0-7	282	21	7.4%	249	88.3%	12	4.3%
8-12	270	124	45.9%	131	48.5%	15	5.6%
13-16	162	144	88.9%	15	9.3%	3	1.9%
17-20	39	38	97.4%	0	0.0%	1	2.6%
>20	5	5	100.0%	0	0.0%	0	0.0%
Eat, Sleep, Console Only	470	97	20.6%	360	76.6%	13	2.8%
Not reported/other scoring system used	26	4	15.4%	8	30.8%	14	53.8%

Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Length of Hospital Stay

Scoring method, treatment, and other parameters of the infant's birth influence the length of stay in the hospital (**Table 10)**. Infants who were very low or low birthweight or born preterm remained in the hospital for more than seven days. An extended hospital stay was also observed among infants with NAS who received pharmacologic treatment or were cared for in the NICU (92.6% and 74.1%, respectively) as compared to their counterparts who received nonpharmacologic therapies or were not transferred to the NICU. Only 29.9% of infants with NAS who were assessed with ESC remained in the hospital for more than seven days compared to 54.5% of infants with NAS assessed using the Modified Finnegan/Finnegan scoring method.

Table 10. Birth parameters and other characteristics of infants with NAS stratified by hospital length of stay

	NAS Cases				
		Infant Length of Stay*			
	N	0-7 days		>7 days	
Total NAS cases	1254	703	56.1%	551	43.9%
Birthweight (grams)					
Very low birthweight (<1500g)	19	0	0.0%	19	100.0%
Low birthweight (1500-2500g)	253	83	32.8%	170	67.2%
Normal birthweight (>2500g)	980	620	63.3%	360	36.7%
Unknown	2	-	-	2	-
Gestational age at birth					
Preterm (<37 weeks)	239	57	23.8%	182	76.2%
Full-term (≥37 weeks)	997	641	64.3%	356	35.7%
Unknown	18	5	27.8%	13	72.2%
Scoring method					
Eat, Sleep, Console	551	386	70.1%	165	29.9%
Finnegan or Modified Finnegan only	677	308	45.5%	369	54.5%
None	26	9	34.6%	17	65.4%
Infant treatment					
Received pharmacologic treatment	433	32	7.4%	401	92.6%
No pharmacologic treatment	777	639	82.2%	138	17.8%
Unknown/Not Reported	44	32	72.7%	12	27.3%
Infant care location					
NICU care	594	154	25.9%	440	74.1%
No NICU care (Nursery or Other)	660	549	83.2%	111	16.8%

Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)
*The infant's length of stay was calculated using the reported date of birth and reported date of discharge from the reporting hospital. If the infant was transferred and the transfer facility did not submit a case report form, the discharge date may represent the transfer date and the length of stay may be an underestimate. If the infant was identified as an NAS case solely upon readmission to the hospital, the length of stay may be an overestimate.

Infant and Maternal Discharge and Referrals

In 2022, hospital staff indicated on the NAS case report forms that a ChildLine notification was made for 89.0% and a plan of safe care was initiated for 63.9% of infants with NAS. Case report data on discharge suggest that most infants with NAS were discharged to a parent (80.4%). For approximately 10.2% of infants with NAS, a children and youth services agency was engaged at discharge to facilitate placement in a foster home. For 7.9% of infants with NAS, a discharge person was listed but the relationship between the discharge person and the infant was unknown or not specified. The remaining 1.5% of infants with NAS had not been discharged at the time that the case report was made, or the discharge status was unknown or not specified (**Table 11**). It is important to note that these data were not verified or confirmed by the Office of Children, Youth, and Families and are the result of hospital-reported data.

Best practices indicate that infants and their parents should be referred for follow-up services at the time of discharge from the hospital; 43.7% of infants with NAS were referred to a pediatrician experienced with NAS and 18.6% to home visiting services. Early Intervention received referrals for 28.1% of the infants with NAS reported to the surveillance system in 2022, a slight increase from 27.7% in 2021. As noted elsewhere in this report, the Office of Child Development and Early Learning reviewed and verified data on referrals to Early Intervention (**Table 11**).

The most frequent referral made for people who gave birth to an infant with NAS at the time of hospital discharge was to receive MOUD; 57.1% of people received a referral for either initiation or continuation of MOUD. Referrals were also made to services such as parenting support, other forms of care for substance use, community support programs, and home visiting services, but these were less common. For nearly half of all people (45.0%), referrals were made to other services (detailed in **Table 12**), were not reported, or were unknown at the time that the case report form was submitted.

Table 11. Characteristics of discharge plan and referrals among infants with NAS

	NAS Cases	
	N	**% of total NAS cases**
Total NAS cases	1254	100.0%
ChildLine notification		
Yes	1116	89.0%
No	138	11.0%
Plan of Safe Care initiated		
Yes	801	63.9%
No	453	36.1%
Discharged to*		
Parent	1008	80.4%
Children and Youth Services/Foster System	128	10.2%
Other	99	7.9%
Unknown	19	1.5%
Referrals†		
Early Intervention	353	28.1%
Home visiting services	233	18.6%
Medical home	42	3.3%
Pediatrician experienced with NAS	548	43.7%
High-risk infant follow-up clinic	62	4.9%
Developmental assessment Clinic	150	12.0%
Other/Unknown‡	319	25.4%

* The other category includes infants for whom the discharge person's relationship to the infant was unknown or not specified in the case report form. The unknown categories include infants that had not been discharged at the time that the case report was made or for whom the discharge person was unknown or not reported.
† The frequencies by type of referral are not mutually exclusive and do not sum to 100% as infants were referred to multiple services
‡ The other category includes infants with referrals made to other services such as a pediatrician or primary care provider, children and youth services, a specialist, WIC, or a community organization. Infants who were not discharged at the time of the report or for whom referrals were unknown or not reported are also included
Data source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH)

Table 12. Characteristics of maternal discharge plan and referrals among people who gave birth to an infant with NAS

	People who gave birth to an infant with NAS	
	N	% of total
Total	1239	100%
Referrals†		
Medication for Opioid Use Disorder	707	57.1%
Parenting support	108	8.7%
Care for substance use	132	10.7%
Community support program	125	10.1%
Home visiting services	78	6.3%
Other behavioral health services	109	8.8%
Other/Unknown*	557	45.0%

*The other category includes referral to other services such as WIC, a primary care provider, Children and Youth, and substance use treatment services. Those who were not discharged at the time of the report or for whom referrals were unknown or not reported are also included.
† The frequencies by type of referral are not mutually exclusive and do not sum to 100% as people who gave birth to an infant with NAS were referred to multiple services

Active Hospitals: Changes since 2021

In 2021, there were 88 hospitals capable of reporting NAS cases. Three hospitals have since closed or no longer have active labor and delivery units. Closures occurred in Clarion, Mercer, and Cumberland counties. In 2022 one hospital opened in Lancaster County, resulting in a total of 86 hospitals with iCMS reporting capabilities in 2022.

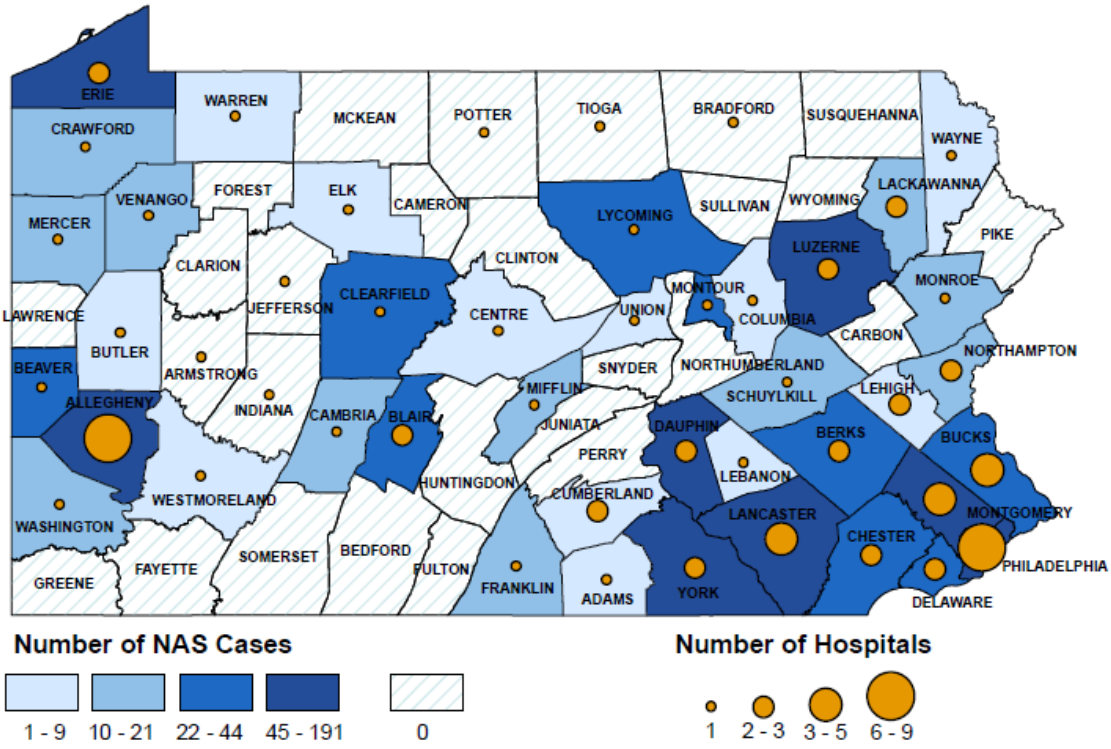
Case Reporting by Hospital

Of the 86 active hospitals with iCMS reporting capabilities in 2022, 78 (91%) reported cases that met the NAS surveillance case definition. Of the remaining 8 active hospitals four hospitals reported cases that did not meet the case definition and four hospitals indicated that they did not have any cases to report for the 2022 calendar year. One of the non-reporting hospitals opened at the end of the calendar year.

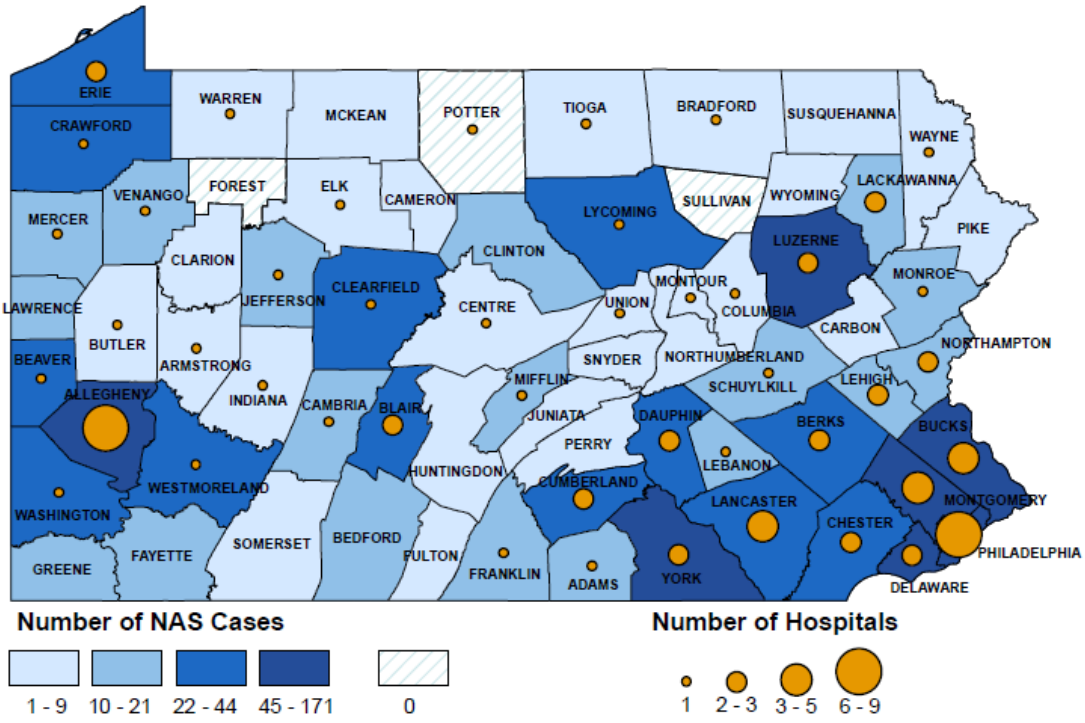
Cases by County of Facility and County of Maternal Residence

Map 1 depicts the number of active hospitals and the number of NAS cases reported by county. Counts on the map include all hospitals, regardless of whether they reported a NAS case in 2022. The map demonstrates that counties with a higher number of hospitals, such as Philadelphia and Allegheny counties, reported more cases of NAS during 2022. This is consistent with prior years. NAS cases were not reported in 27 counties (40%), but 21 of those counties did not have an active birth or pediatric hospital in 2022. Armstrong, Bradford, Indiana, Jefferson, Potter, and Tioga counties are the only counties for which there was an active hospital, and no cases were reported. Case counts by county of facility ranged from 0 to 191 in Allegheny County. **Map 2** depicts case counts by county of maternal residence. Case counts by county of residence ranged from 0 in Potter, Sullivan, and Forest counties to 171 in Philadelphia County. Map 2 demonstrates that people who reside in counties that lack a hospital migrate to surrounding counties to give birth. Case counts by county of hospital and county of maternal residence are included in **Table 13**.

Map 1. Number of hospitals and reported NAS cases by county of hospital



Map 2. Number of hospitals and NAS cases by county of maternal residence



Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Table 13. NAS cases reported by county of hospital and by maternal residence

	Hospitals	NAS Cases Reported by County of Hospital		NAS Cases Reported by County of Maternal Residence	
County	N	N	% of total NAS cases	N	% of total NAS cases
Total	86	1254	100.0%	1254	100.0%
ADAMS	1	3	0.2%	14	1.1%
ALLEGHENY	9	191	15.2%	92	7.3%
ARMSTRONG	1	0	0.0%	8	0.6%
BEAVER	1	24	1.9%	28	2.2%
BEDFORD	0	0	0.0%	10	0.8%
BERKS	2	27	2.2%	24	1.9%
BLAIR	2	29	2.3%	24	1.9%
BRADFORD	1	0	0.0%	3	0.2%
BUCKS	4	33	2.6%	46	3.7%
BUTLER	1	2	0.2%	8	0.6%
CAMBRIA	1	14	1.1%	19	1.5%
CAMERON	0	0	0.0%	2	0.2%
CARBON	0	0	0.0%	5	0.4%
CENTRE	1	9	0.7%	5	0.4%
CHESTER	3	34	2.7%	26	2.1%
CLARION	0	0	0.0%	5	0.4%
CLEARFIELD	1	40	3.2%	24	1.9%
CLINTON	0	0	0.0%	18	1.4%
COLUMBIA	1	8	0.6%	8	0.6%
CRAWFORD	1	12	1.0%	26	2.1%
CUMBERLAND	2	9	0.7%	22	1.8%
DAUPHIN	2	55	4.4%	28	2.2%
DELAWARE	3	38	3.0%	65	5.2%
ELK	1	4	0.3%	9	0.7%
ERIE	2	55	4.4%	39	3.1%
FAYETTE	0	0	0.0%	12	1.0%
FOREST	0	0	0.0%	0	0.0%
FRANKLIN	1	17	1.4%	15	1.2%
FULTON	0	0	0.0%	1	0.1%
GREENE	0	0	0.0%	11	0.9%
HUNTINGDON	0	0	0.0%	2	0.2%
INDIANA	1	0	0.0%	5	0.4%
JEFFERSON	1	0	0.0%	10	0.8%
JUNIATA	0	0	0.0%	6	0.5%
LACKAWANNA	2	17	1.4%	19	1.5%
LANCASTER	4	45	3.6%	38	3.0%
LAWRENCE	0	0	0.0%	17	1.4%
LEBANON	1	6	0.5%	10	0.8%
LEHIGH	2	9	0.7%	12	1.0%
LUZERNE	3	61	4.9%	51	4.1%
LYCOMING	1	27	2.2%	27	2.2%
MCKEAN	0	0	0.0%	1	0.1%
MERCER	1	21	1.7%	13	1.0%
MIFFLIN	1	11	0.9%	11	0.9%
MONROE	1	12	1.0%	17	1.4%
MONTGOMERY	5	77	6.1%	48	3.8%
MONTOUR	1	44	3.5%	3	0.2%
NORTHAMPTON	2	20	1.6%	15	1.2%
NORTHUMBERLAND	0	0	0.0%	9	0.7%
PERRY	0	0	0.0%	9	0.7%
PHILADELPHIA	7	179	14.3%	171	13.6%
PIKE	0	0	0.0%	5	0.4%
POTTER	1	0	0.0%	0	0.0%
SCHUYLKILL	1	13	1.0%	13	1.0%
SNYDER	0	0	0.0%	1	0.1%
SOMERSET	0	0	0.0%	2	0.2%
SULLIVAN	0	0	0.0%	0	0.0%
SUSQUEHANNA	0	0	0.0%	6	0.5%
TIOGA	1	0	0.0%	4	0.3%
UNION	1	1	0.1%	2	0.2%
VENANGO	1	18	1.4%	17	1.4%
WARREN	1	2	0.2%	2	0.2%
WASHINGTON	1	21	1.7%	31	2.5%
WAYNE	1	4	0.3%	2	0.2%
WESTMORELAND	1	2	0.2%	24	1.9%
WYOMING	0	0	0.0%	1	0.1%
YORK	3	60	4.8%	52	4.1%
UNKNOWN*	-	-	-	1	0.1%

* Residence or discharge to a person/entity in Pennsylvania was confirmed for all cases. If a residential address was not provided those cases are included in "Unknown."

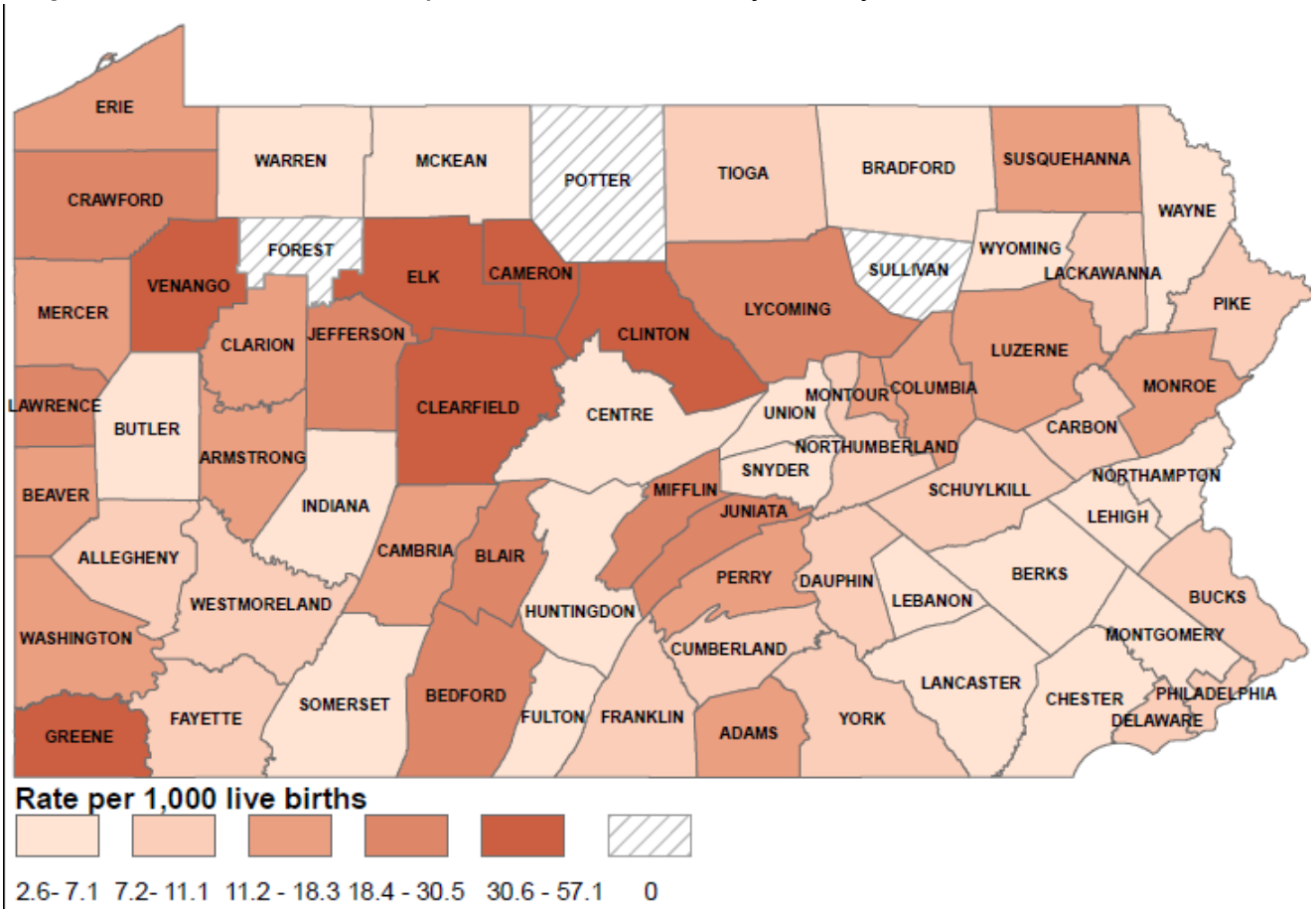
Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Incidence Rates by County and Region of Maternal Residence

Map 3 depicts incidence rates of NAS cases per 1,000 live births by county of maternal residence. Incidence rates of NAS were highest in Cameron (57.1), Clinton (42.0), Greene (42.0), Venango (40.3), and Clearfield (35.6) counties. Incidence rates by county of maternal residence are included in **Table 14**; incidence rates based on fewer than 10 events are unstable and should be interpreted with caution. Unstable rates are italicized and highlighted in grey in Table 14.

Map 4 depicts case counts and incidence rates of NAS per 1,000 live births by region of maternal residence. The northwestern region of the state had the highest incidence rate of 20.3 NAS cases per 1,000 live births – a rate that is 2.7 times higher than the lowest incidence rate in the Southeast (7.4). Incidence rates by region of maternal residence are included in **Table 15**. While the Northwestern region still has the highest incidence rate of NAS in the state, there was a slight decrease from 26.4 cases per 1,000 live births in 2021 to 20.3 cases per 1,000 in 2022. No significant increases were observed by region in 2022 but a significant decrease was observed in the Southeast (9.6. cases of NAS in 2021 to 7.4 cases of NAS in 2022).

Map 3. NAS incidence rate per 1,000 live births by county of maternal residence



Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Table 14. NAS cases and incidence rate per 1,000 live births by county of maternal residence

NAS Cases Reported by County of Maternal Residence				
County	NAS Cases (N)*	Resident Live Births (2022)†	1,000 live births	(95% CI)
Total	1254	130304	9.6	(9.1, 10.2)
ADAMS	14	941	14.9	(8.8, 25.0)
ALLEGHENY	92	11688	7.9	(6.4, 9.6)
ARMSTRONG	*8*	*540*	*14.8*	*(7.4, 29.3)*
BEAVER	28	1528	18.3	(12.7, 26.4)
BEDFORD	10	482	20.7	(11.2, 38.1)
BERKS	24	4573	5.2	(3.5, 7.8)
BLAIR	24	1182	20.3	(13.6, 30.1)
BRADFORD	*3*	*610*	*4.9*	*(1.6, 15.1)*
BUCKS	46	5605	8.2	(6.2, 10.9)
BUTLER	*8*	*1722*	*4.6*	*(2.3, 9.3)*
CAMBRIA	19	1185	16.0	(10.2, 25.0)
CAMERON	*2*	*35*	*57.1*	*(14.3, 201.6)*
CARBON	*5*	*522*	*9.6*	*(4.0, 22.8)*
CENTRE	*5*	*1118*	*4.5*	*(1.9, 10.7)*
CHESTER	26	5542	4.7	(3.2, 6.9)
CLARION	*5*	*365*	*13.7*	*(5.7, 32.5)*
CLEARFIELD	24	674	35.6	(24.0, 52.6)
CLINTON	18	429	42.0	(26.6, 65.6)
COLUMBIA	*8*	*576*	*13.9*	*(7.0, 27.5)*
CRAWFORD	26	852	30.5	(20.9, 44.4)
CUMBERLAND	22	2704	8.1	(5.4, 12.3)
DAUPHIN	28	3286	8.5	(5.9, 12.3)
DELAWARE	65	6487	10.0	(7.9, 12.8)
ELK	*9*	*245*	*36.7*	*(19.2, 69.1)*
ERIE	39	2650	14.7	(10.8, 20.1)
FAYETTE	12	1142	10.5	(6.0, 18.4)
FOREST	0	19	0.0	-
FRANKLIN	15	1704	8.8	(5.3, 14.6)
FULTON	*1*	*140*	*7.1*	*(1.0, 48.9)*
GREENE	11	262	42.0	(23.4, 74.2)
HUNTINGDON	*2*	*381*	*5.2*	*(1.3, 20.7)*
INDIANA	*5*	*738*	*6.8*	*(2.8, 16.2)*
JEFFERSON	10	450	22.2	(12.0, 40.8)
JUNIATA	*6*	*296*	*20.3*	*(9.1, 44.4)*

NAS Cases Reported by County of Maternal Residence				
County	NAS Cases (N)*	Resident Live Births (2022)†	1,000 live births	(95% CI)
LACKAWANNA	19	1964	9.7	(6.2, 15.1)
LANCASTER	38	7137	5.3	(3.9, 7.3)
LAWRENCE	17	763	22.3	(13.9, 35.5)
LEBANON	10	1557	6.4	(3.5, 11.9)
LEHIGH	12	3823	3.1	(1.8, 5.5)
LUZERNE	51	3091	16.5	(12.6, 21.6)
LYCOMING	27	1085	24.9	(17.1, 36.0)
MCKEAN	*1*	*332*	*3.0*	*(0.4, 21.1)*
MERCER	13	962	13.5	(7.9, 23.1)
MIFFLIN	11	572	19.2	(10.7, 34.4)
MONROE	17	1362	12.5	(7.8, 20.0)
MONTGOMERY	48	8505	5.6	(4.3, 7.5)
MONTOUR	*3*	*226*	*13.3*	*(4.3, 40.3)*
NORTHAMPTON	15	2707	5.5	(3.3, 9.2)
NORTHUMBERLAND	*9*	*809*	*11.1*	*(5.8, 21.2)*
PERRY	*9*	*504*	*17.9*	*(9.3, 34.0)*
PHILADELPHIA	171	19120	8.9	(7.7, 10.4)
PIKE	*5*	*462*	*10.8*	*(4.5, 25.7)*
POTTER	0	145	0.0	-
SCHUYLKILL	13	1223	10.6	(6.2, 18.2)
SNYDER	*1*	*378*	*2.6*	*(0.4, 18.5)*
SOMERSET	*2*	*615*	*3.3*	*(0.8, 12.9)*
SULLIVAN	0	31	0.0	-
SUSQUEHANNA	*6*	*382*	*15.7*	*(7.1, 34.5)*
TIOGA	*4*	*376*	*10.6*	*(4.0, 28.0)*
UNION	*2*	*375*	*5.3*	*(1.3, 21.1)*
VENANGO	17	422	40.3	*(25.2, 63.8)*
WARREN	*2*	*353*	*5.7*	*(1.4, 22.4)*
WASHINGTON	31	1988	15.6	(11.0, 22.1)
WAYNE	*2*	*406*	*4.9*	*(1.2, 19.5)*
WESTMORELAND	24	2901	8.3	(5.6, 12.3)
WYOMING	*1*	*209*	*4.8*	*(0.7, 33.2)*
YORK	52	4844	10.7	(8.2, 14.1)

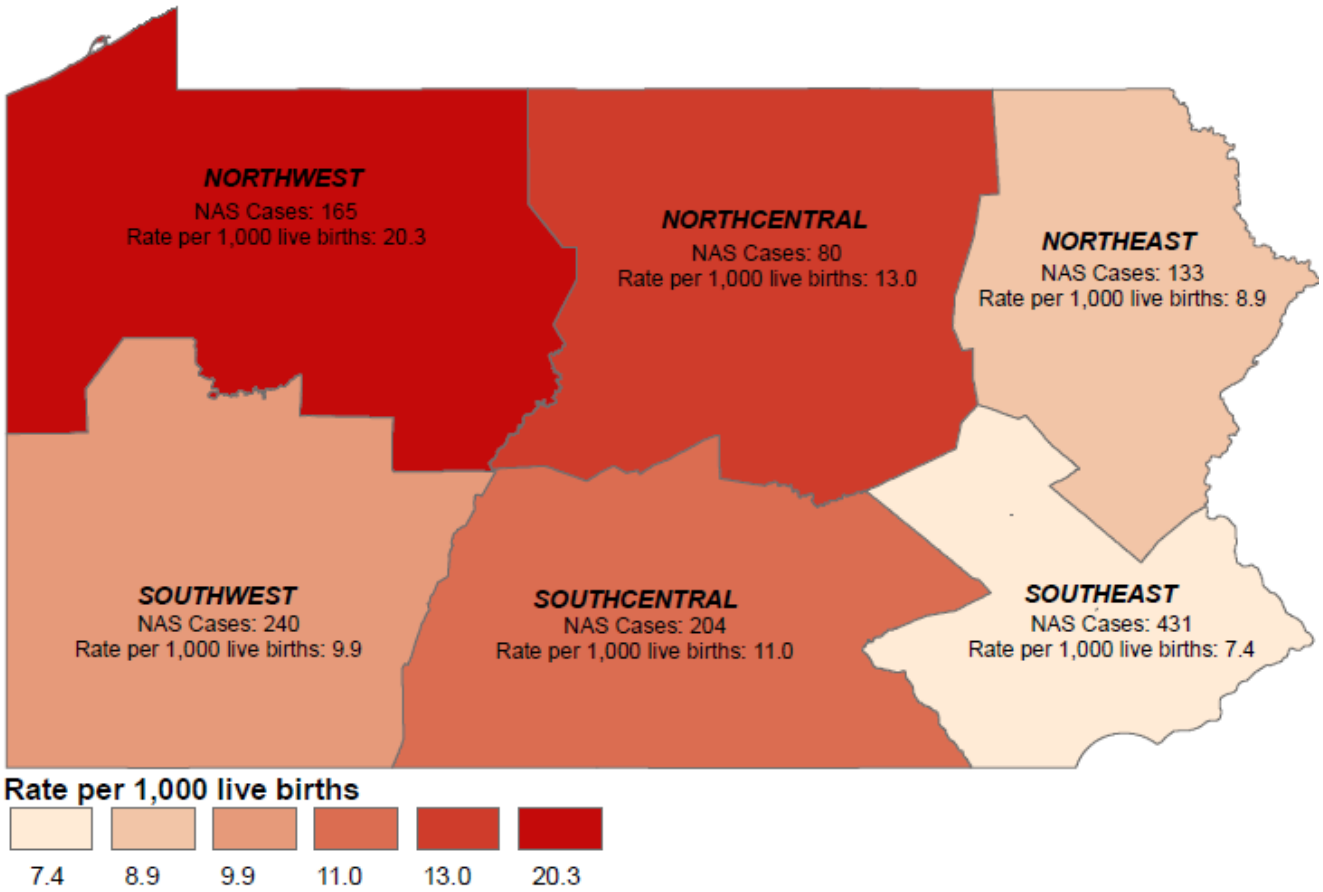
*Residence or discharge to a person/entity in Pennsylvania was confirmed for all cases. For 1 case, a residential address was not provided; this case is excluded from the table as county of residence was undetermined.

†Preliminary 2022 resident live birth data are subject to change

Rates calculated based on 10 or fewer events are unstable. Please note the wide confidence intervals and interpret these estimates with caution; these rates are italicized and highlighted in grey.

Data Sources: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Map 4. NAS incidence rate per 1,000 live births by region of maternal residence



Data Source: NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Table 15. NAS case counts and incidence rates per 1,000 live births by calendar year and region of maternal residence

NAS Cases Reported by Region of Maternal Residence										
	2018*		2019*		2020†		2021†		2022†	
Region	NAS Cases (n)	Rate per 1,000 live births (95% CI)	NAS Cases (n)	Rate per 1,000 live births (95% CI)	NAS Cases (n)	Rate per 1,000 live births (95% CI)	NAS Cases (n)	Rate per 1,000 live births (95% CI)	NAS Cases (n)	Rate per 1,000 live births (95% CI)
Northwest	251	28.0 (24.8, 31.7)	207	**23.7 (20.5, 26.9)**	254	**30.8 (27.3, 34.8)**	223	26.4 (23.2, 30.1)	165	20.3 (17.5, 23.6)
Southwest	670	26.0 (24.1, 28.0)	438	16.8 (15.2, 18.4)	414	16.7 (15.2, 18.4)	314	**12.1 (10.8, 13.5)**	240	9.9 (8.7, 11.2)
Northcentral	90	14.3 (11.7, 17.6)	85	15.0 (11.8, 18.2)	95	15.1 (12.3, 18.4)	105	16.6 (13.8, 20.1)	80	13.0 (10.4, 16.1)
Southcentral	280	15.4 (13.7, 17.3)	244	13.1 (11.5, 14.7)	232	12.8 (11.3, 14.6)	209	11.2 (9.8, 12.8)	204	11.0 (9.6, 12.6)
Northeast	198	12.7 (11.0, 14.6)	132	**8.2 (6.8, 9.6)**	200	**13 (11.3, 14.9)**	180	11.6 (10.0, 13.4)	133	8.9 (7.5, 10.6)
Southeast	618	10.4 (9.6, 11.3)	500	**8.4 (7.7, 9.1)**	625	**10.9 (10.1, 11.8)**	570	9.6 (8.9, 10.5)	431	**7.4 (6.7, 8.1)**

*2018 incidence rates were calculated using 2017 occurrent resident live birth data; 2019 incidence rates were calculated using 2018 resident live birth data; 2018 and 2019 incidence rates were previously published in 2018 and 2019 NAS Annual Reports; 2020, 2021 and 2022 incidence rates were calculated using preliminary resident live birth data. Preliminary 2022 resident live birth data are subject to change. Please note that the NAS case definition expanded to include exposure to barbiturates or benzodiazepines in addition to opioids in 2020 whereas the case definition in 2018-2019 included solely those infants with exposure to opioids.

†Residence or discharge to a person/entity in Pennsylvania was confirmed for all cases. For 1 case in 2022, a residential address was not provided; this case is excluded from the table as region of residence was undetermined

Rates in **bold** are those that changed significantly from the prior surveillance year. A statistically significant decrease in the incidence rate of NAS was observed in the Southeast region of the state between 2021 and 2022

Data Sources: 2019 NAS Report (Bureau of Epidemiology, PA DOH), NAS Surveillance Program Database (Bureau of Family Health, PA DOH), Vital Statistics (Bureau of Health Statistics and Registries, PA DOH)

Discussion

This report presents findings from the fifth year of Pennsylvania's NAS surveillance initiative. This surveillance initiative enables the Department of Health to quantify the number of infants with NAS in the state, making it possible to better understand the burden of NAS and inform the development of public health strategies that aim to support families before, during, and after pregnancy.

The burden of NAS in Pennsylvania remains high with 1,254 cases reported to the Department of Health in 2022. However, the incidence of 9.6 infants with NAS per 1,000 live births is a significant decrease from the 2021 rate of 12.1 infants with NAS per 1,000 live births (Department of Health, 2021). As in 2021, NAS resulting from opioid exposure remained most common in 2022; NAS surveillance data indicate that 95.3% of people who gave birth to an infant with NAS reported using opioids in the four weeks prior to delivery and 91.8% of infants with NAS who were tested had a positive result for an opioid.

The lack of a standardized national surveillance system for NAS makes interstate and national comparisons difficult. National NAS data for 2022 are not yet available but, as of 2021, the Pennsylvania rate of NAS per 1,000 birth hospitalizations was 1.5 times higher than the observed national rate of 6.3 (HCUP-SID 2021).

Overall, many trends observed in 2022 data are similar to those in 2021 and, accordingly, many recommendations in the discussion section of this report are similar to those presented in the 2021 report. However, differences or changes since 2021 are noted and discussed. As in 2021, infants with NAS in 2022 were predominantly born to people who identified as non-Hispanic white, were between the ages of 20 and 34, and were covered by Medicaid at delivery. Case report data suggest that 97.8% of people who gave birth to an infant with NAS used a substance in the four weeks prior to delivery. Given that this field is not mandatory on the case report form, this may be underestimated. Polysubstance use also remained common with 53% of people who gave birth to an infant with NAS using more than one substance during pregnancy – consistent with the proportions reported in 2020 (54%) and 2021 (59%). These data are consistent with previously published Pennsylvania NAS data and national data which suggest that polysubstance use during pregnancy is common, particularly among people with opioid use disorder (Department of Health 2018-2020; Hirai et al. 2021; Jarlenski et al. 2020).

Over half of all people who gave birth to an infant with NAS in Pennsylvania in 2022 had received MOUD during their pregnancy (61.4%), consistent with previous reports. While receipt of MOUD during pregnancy to treat a substance use disorder may increase the risk of infants with NAS, MOUD during pregnancy should be supported and encouraged. MOUD during pregnancy is the recommended standard of care for people in recovery from opioid use disorder (Commonwealth of Pennsylvania, 2016; ACOG 2017; Dowell et al. 2022; SAMHSA 2023). Unfortunately, as observed in previous years, MOUD during pregnancy among people with an infant with NAS differs by maternal race/ethnicity; only 41.7% of non-Hispanic Black people who gave birth to an infant with NAS had received MOUD during pregnancy compared to 64.0% of non-Hispanic white people who received MOUD.

Similarly, while most people who gave birth to an infant with NAS had received prenatal care, a lower proportion of non-Hispanic Black people had initiated prenatal care (75.9%) compared to people who identified as non-Hispanic white (83.8%) in 2022. These data continue to highlight the need for more equitable access to and receipt of treatment for substance use disorder (Peeler et al. 2020) as well as preconception and prenatal care for all. Screening for substance use disorder and other co-morbidities often occurs during prenatal care, making it a key opportunity for providers to connect people using substances with MOUD and counseling. Identifying and addressing system-level issues such as access, stigma, provider biases, patient mistrust of the medical system, and other barriers to care is essential to promote optimal care before and during pregnancy (Frazer et al. 2019; Renbarger et al. 2020).

Postpartum and interpregnancy care are also integral to better maternal health outcomes and should be coordinated prior to discharge. Given that it was not possible to characterize referrals for people who gave birth to an infant with NAS who were not discharged at the time the NAS case report was submitted, related findings presented in this report may not provide a comprehensive characterization of all referrals. Yet, 2022 data suggest that connection to social support and health care services, such as referral for initiation or continuation of MOUD at discharge, is not universal highlighting an opportunity to improve awareness and education of hospital providers on available services and the importance of coordinated follow-up and referral.

Findings in this report also demonstrate that people in recovery from a substance use disorder or who are using substances during pregnancy may have more than one birth to an infant with NAS; this is consistent with findings from prior annual reports. Nearly 19% of people who gave birth to an infant with NAS in 2022 had a prior birth to an infant with NAS between 2018 and 2021. As previously discussed, this may be an underestimate as infants with NAS resulting from exposure to benzodiazepines or barbiturates that were born in 2018 or 2019 would not have met the case definition at that time. Most people with a prior birth to an infant with NAS received MOUD during their 2022 pregnancy (60.6%). This analysis is limited to NAS surveillance data from 2018 to 2022 and does not assess complete pregnancy or birth history. It was not possible to consider births to infants who did not have NAS or births that occurred prior to 2018 or after 2022. Additionally, this analysis is limited to live births – pregnancy loss, fetal death, or termination were also not considered.

When assessing linked births reported to the NAS surveillance system between 2018 and 2022, the interpregnancy interval was less than 18 months for 54.6% of people who had a prior birth to an infant with NAS. Notably, 13.1% of people who gave birth to an infant with NAS had a short interpregnancy interval of less than six months. Interpregnancy intervals that are less than 18 months are associated with increased risk of adverse infant and maternal health outcomes such as preterm birth and maternal morbidity (Garg et al. 2021; Hanley et al. 2017; ACOG 2019). Given that interpregnancy interval is modifiable, the continued provision of patient-centered postpartum and interpregnancy care that includes discussion of pregnancy intention, family planning counseling, and birth spacing may optimize maternal and infant health across the life course (Morse et al. 2018; Charron et al. 2020; Terplan et al. 2016).

Characteristics and birth parameters of infants with NAS presented in this report are also consistent with previously published reports and literature. A higher proportion of infants with NAS in 2022 were male (Department of Health 2018-2021; Charles et al. 2017), were of normal birthweight, and were born at or after 37 weeks gestation. However, infants with NAS were two times as likely to be low birthweight than infants without NAS.

Findings from this report may also inform clinical care of infants with NAS. As in 2021, findings suggest that hospital length of stay is impacted by prematurity and low birthweight, receipt of pharmacological treatment, withdrawal scoring method (ESC versus Finnegan/Modified Finnegan), and level of care (NICU versus nursery). In 2022, most infants with NAS remained in the hospital for 4 to 7 days or longer (94.8%). While hospital protocols differ, standard clinical practice is to observe an infant within utero exposure to substances who may develop NAS in the hospital for at least 3 to 5 days to assess symptoms and provide treatment and care as needed.

In 2022 NICU admission remained markedly higher among infants with NAS as compared to the overall resident live birth population. Infants with NAS should be admitted to the NICU when clinically indicated. However, recent studies and practice have demonstrated the importance of promoting the maternal-infant dyad by allowing the infant to room in with their parent when feasible to facilitate breastfeeding, non-pharmacologic interventions (skin-to-skin, swaddling, reduced stimulation), and encourage the person who gave birth and other caregivers to participate in symptom assessment and care for the duration of their hospital stay (Wachman et al. 2018).

Admission to the NICU may be influenced by whether the infant receives pharmacologic treatment. Pharmacologic treatment was administered to over a third of all infants with NAS in 2022. The Finnegan/Modified Finnegan scoring system is often used to direct the administration of pharmacologic treatment despite limited validation (Schiff et al. 2019). The Finnegan/Modified Finnegan scoring system remains the most common system used to assess withdrawal symptoms nationally and was used to assess 54.0% of infants with NAS in Pennsylvania in 2022. The relationship between the Finnegan/Modified Finnegan scoring method and administration of pharmacologic treatment is evident in the findings of this report as the proportion of infants that received pharmacologic treatment gradually increases as the highest Finnegan/Modified Finnegan score observed increases.

Approximately 37.5% of infants with NAS were assessed using the ESC method in 2022, an increase from previous years (14.1% in 2020, 27.1% in 2021). The ESC method focuses on the infant's ability to eat, sleep, and be consoled and their level of function informs care management. Research indicates that the ESC method, which maintains the emphasis on the maternal-infant dyad, can decrease the average length of stay and reduce the likelihood of admission to the NICU, and the need for pharmacologic intervention of the infant (Grossman et al. 2018; Blount et al., 2019; Holmes et al. 2016). Findings from this report further support an apparent reduction in pharmacologic intervention among infants with NAS assessed using ESC compared to those assessed using the Finnegan/Modified Finnegan method. In 2022, as in 2020 and 2021, a higher proportion of infants assessed using ESC remained in the hospital for <7 days compared to infants assessed using the Finnegan/Modified Finnegan method. Given that the ESC promotes the maternal-infant dyad

and has demonstrable benefits, this method should be considered by more hospitals as an alternative to the Finnegan/Modified Finnegan scoring method.

Discharge planning and coordinated referral by hospitals ensure that infants with NAS receive needed follow-up care. This is the third year that it was possible to characterize infant discharge and referral. As in 2021, most infants with NAS were discharged with their parents in 2022 (80.4%), highlighting the importance of continued support of birth parents after discharge. As with data on maternal referrals, it was not possible to characterize referrals for infants with NAS who were not discharged at the time the NAS case report was submitted. While related findings presented in this report may not provide a comprehensive characterization of all referrals made at discharge, the available data suggest that infants with NAS are not being universally connected to services at discharge, highlighting an opportunity to improve awareness and education of hospital providers on available services and the importance of coordinated follow-up and referral.

Prior to discharge, hospitals are also required to notify the Department of Human Services that they are caring for a substance affected infant (defined as a child less than one year of age, who the provider has determined to be born affected by substance use or withdrawal symptoms resulting from prenatal substance exposure or Fetal Alcohol Spectrum Disorder) in accordance with Pennsylvania Act 54 of 2018 and federal Comprehensive Addiction and Recovery Act of 2016 (P.L. 114-198, 7/22/2016) (CARA), title V, section 503 amended sections 106 (b)(2)(B)(ii) and (iii) of the Child Abuse Prevention and Treatment Act (CAPTA). Medical providers must submit this notification to the Department of Human Services' ChildLine and a plan of safe care including multidisciplinary team input, to address the needs of both the infant and family, must be offered to the family member or caregiver. Per findings presented in this report, a notification to ChildLine was made for 89.0% of infants with NAS and 63.9% had a plan of safe care initiated. Given that all infants with NAS who meet the Department of Health's NAS case definition may also be considered substance affected infants per the Department of Human Services definition, these percentages should be higher and, as in 2020 and 2021, may indicate a need for improved provider education on reporting requirements. However, as noted elsewhere in this report, data on ChildLine notifications and plans of safe care are self-reported by the hospital and are not validated by the Department of Human Services or the Office of Children, Youth, and Families. Accordingly, reported data may not accurately reflect notifications received by DHS or involvement of the Office of Children, Youth, and Families. Additionally, it should be noted that DHS' substance affected infant definition is more expansive than the NAS surveillance case definition; while reports included in NAS surveillance must have evidence of in-utero exposure to specific substances (benzodiazepine, barbiturate, or opioid), reporting and plan of safe care requirements for substance affected infants are not defined by the type or legality of substances. Accordingly, not all substance affected infants meet the NAS surveillance case definition, and data collected by DHS on substance affected infants are not directly comparable to NAS surveillance data.

A referral to Early Intervention should be considered for infants with NAS. Pennsylvania's Early Intervention program provides developmental screening, evaluation, and services to families with children, birth to age five, with developmental concerns and disabilities. Infants diagnosed with NAS are eligible for, at minimum, Early Intervention tracking services which provide routine screening using the Ages and Stages Questionnaire (ASQ). The ASQ is an

effective screening tool used for infants and toddlers to identify possible developmental delays. Referrals to Early Intervention can be made by telephone, email or online form, and parental permission must be received prior to a referral submission by a provider. The Bureau of Early Intervention Services and Family Supports has a statewide data system that includes all infants, toddlers, and preschool-aged children that are referred to Early Intervention, evaluated, or entered services or tracking. This data system is used to determine the Early Intervention status for infants with NAS. Early Intervention status is then entered into iCMS. Approximately 28.1% of infants with NAS were located in the Early Intervention database in 2022, and therefore, confirmed as having received a referral. While it is possible that an infant received a referral to Early Intervention but was not located in the database, findings indicate an opportunity for targeted education to hospitals, agencies, and other providers involved in Early Intervention referrals.

County and regional NAS data demonstrate varying burden of NAS across Pennsylvania. Data by county of reporting hospital demonstrate that counties with a higher number of hospitals are reporting and caring for infants with NAS who reside across county lines. People travel to hospitals in surrounding counties to give birth, particularly when there is no hospital in their county of residence. This highlights the importance of location-appropriate referrals and system-level health care coordination both prior to and after delivery. NAS data by county of maternal residence indicate that the incidence of NAS was highest in the rural counties of Cameron, Clinton, Greene, Venango, and Clearfield counties. The incidence of NAS in the northwestern region of the state remained high in 2022 and still suggests that this is an area where resources, community-based support services, and treatment options should be optimized. In 2022 the incidence of NAS decreased significantly from 9.6 in 2021 to 7.4 in the southeastern region of the state. It is also important to note that people in the southwestern region of the state may cross state lines into neighboring Ohio and West Virginia to give birth. While cross-state travel likely also occurs in other regions of the state, the impact may be more significant in the southwestern region of the state where there are fewer Pennsylvania hospitals. Hospitals in other states do not report NAS cases to the Department and such case reports would only be captured if the infant was transferred to a Pennsylvania hospital after delivery. Accordingly, the incidence rate in the southwestern counties and region of the state may be underestimates and may account, in part, for the continued decrease in incidence observed in that region in 2022.

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