Improving Public Health Surveillance for Neonatal Abstinence Syndrome in Rhode Island

KRISTEN ST. JOHN, MPH; WILLIAM ARIAS, MPH

Neonatal abstinence syndrome (NAS) is the diagnosis given to a newborn who displays signs and symptoms related to withdrawal from prenatal substance use, primarily from opioids. Although a recent trend suggests a decline (114.0 cases per 10,000 newborn hospitalizations in 2017 to 84.8 per 10,000 in 2021), NAS incidence in Rhode Island remains high after steadily increasing from 2010 (58.0 per 10,000 newborn hospitalizations)[1] and continues to be a public health concern affecting newborns and impacting their families. NAS may lead to long-term issues affecting the child's vision and hearing, as well as developmental problems.[2] However, there exists varying consensus in interpreting and reporting NAS among U.S jurisdictions, hospitals, and healthcare providers.[3] To address this variation, there has been a recent push to standardize the definition of NAS to better understand its incidence.

The Council of State and Territorial Epidemiologists (CSTE) convened a workgroup to gather input from U.S. jurisdictions, state agencies, and subject matter experts, and summarized their findings to create recommendations for public health surveillance for NAS. The workgroup drafted a position statement that recommends a tiered approach to reporting NAS using standardized surveillance case definitions based on clinical case reporting and administrative data.

Until 2020, the Rhode Island Department of Health's (RIDOH) sole source for NAS data was hospital discharge data. NAS reporting was incorporated into the Rhode Island Birth Defects Program's (RIBDP) reporting regulations in 2020, which allowed RIDOH to explore using an additional data source for obtaining cases. The purpose of this study is to examine the implications of using the HDD and the CSTE NAS case definitions in Rhode Island to understand NAS in the state.

METHODS

Hospital discharge data (HDD) for 2020 and 2021 were obtained for all newborn inpatient hospital admissions (n=20,597) in Rhode Island. A NAS confirmed case was defined as the P96.1 (10th Clinical Modification of the International Classification of Diseases) ICD-10 discharge code in a newborn hospitalization. There is no definition for a probable case using HDD.

As of 2020, all providers and healthcare facilities, including RI birthing hospitals, are required to report newborns diagnosed with an ICD-10 code of P96.1, P04.4, or P04.41 upon discharge from the birth hospital to the RIDBP on a regular basis (§ 216-RICR-10-10-3). The ICD-10 codes in RIBDP regulations were decided on by the NAS/Substance Exposed Newborn (SEN) Data Group, which includes a physician, epidemiologists, and subject matter experts, prior to the release of the CSTE NAS guidance. Per regulations, RIBDP staff can confirm the accuracy of reported diagnoses by conducting subsequent chart review.

CSTE recommends jurisdictions who rely on administrative reporting, which is the classification RIDOH falls under based on its reporting method, use its Tier 2 case definition.[4] The CSTE Tier 2 case definition relies solely on ICD-10 codes, with a confirmed case being a P96.1 ICD-10 code and a probable is a P04.14, P04.17, or P04.1A diagnosis. The Tier 2 probable case ICD-10 codes were not included in the RIBDP reporting regulations, so staff cannot report Tier 2 probable cases counts.

Since the RIBDP has the authority to review medical records of reported cases to confirm accuracy of the diagnosis, it also considered using a hybrid approach: using administrative reporting to identify cases with confirmation via medical record review (aspects of Tier 1). Using the cases reported through the RIBDP, staff classified newborns reported with the three ICD-10 codes in RIBDP regulations (P96.1, P04.4, P04.41) according to CSTE Tier 1 case definitions[4] (Refer to **Table 1** for CSTE Case Definitions).

A CSTE Tier 1 confirmed case had a positive toxicology test for opioids, benzodiazepines, or barbiturates plus any of the following: a diagnosis of NAS, a chief complaint of NAS, or three or more signs of neonatal withdrawal.[4] A Tier 1 probable case had no or unknown newborn laboratory results, maternal history of opioid, benzodiazepine, or barbiturate use or confirmatory maternal laboratory evidence in the four weeks prior to delivery, and any of the following: NAS diagnosis, chief complaint mentioning NAS, or three or more signs of neonatal withdrawal.[4] During medical record review for cases reported from hospitals in 2020 and 2021, information on toxicology testing (infant and maternal), maternal history of drug use, NAS symptoms and scoring, and discharge diagnoses was gathered to classify cases according to the CSTE Tier 1 case definition. Additionally, RIBDP staff verified all cases met the criteria of a diagnosis

Table 1. Council of State and Territorial Epidemiologists (CSTE) Neonatal Abstinence Syndrome (NAS) Case Definition

CSTE Tier 1 Classification: A hospitalized newborn less than 28 days of age with symptoms not explained by another diagnosis meeting the following criteria:			
	Neonatal Exposure Evidence	**Maternal substance use (4 weeks prior to delivery)**	**Neonatal Symptoms/ Clinical Diagnosis**
Confirmed	Positive lab for opioid, benzodiazepine, or barbiturate	n/a	3 or more withdrawal symptoms or a diagnosis/ chief complaint mentioning NAS
Probable	No or unknown lab results (negative results are 'not a case')	Positive maternal lab for or chronic maternal history of opioid, benzodiazepine, or barbiturate use	3 or more withdrawal symptoms or a diagnosis/ chief complaint mentioning NAS
CSTE Tier 2 Classification			
	ICD-10 Diagnosis Code		
Confirmed	P96.1		
Probable	P04.14, P04.17, or P04.1A*		

* These codes were not added to RIBDP regulations and cannot be used to report NAS probable cases.

Table 2. Rhode Island Department of Health (RIDOH)'s Neonatal Abstinence Syndrome (NAS) Case Definition

RIDOH NAS Case Definition: A hospitalized newborn less than 28 days of age with symptoms not explained by another diagnosis meeting the following criteria:			
	Neonatal Exposure Evidence	**Maternal substance use (4 weeks prior to delivery)**	**Neonatal Symptoms/ Clinical Diagnosis**
Confirmed	Positive lab result for opioid, benzodiazepine, or barbiturate	n/a	3 or more withdrawal symptoms or a diagnosis/ chief complaint mentioning NAS
Probable	Negative, no, or unknown lab results	Positive maternal lab for or chronic maternal history of opioid, benzodiazepine, or barbiturate use	3 or more withdrawal symptoms or a diagnosis/ chief complaint mentioning NAS

in a newborn under the age of 28 days where the etiology was not explained by another condition.[4] Although Tier 1 classifies cases into confirmed, probable, and suspect, the RIBDP considered only Tier 1 confirmed and probable cases, as CSTE recommends using confirmed and probable cases for NAS reporting.[4] All case information was collected and classified in Microsoft Excel.

After cases were classified using the HDD and CSTE case definitions, the NAS/ SEN Data Group reviewed the results of HDD and CSTE Tiers to determine the implications of using each case definition and the need for a Rhode Island-specific NAS case definition. Any cases classified by the CSTE Tier 1 case definitions as 'not a case' were discussed by the NAS/SEN Data Group to determine if the case definition should be modified based on findings. Based on these findings, a RIDOH-specific NAS case definition was created (**Table 2**), which includes newborns with a negative toxicology in its 'probable' case category. These newborns had been excluded from the CSTE Tier 1 case definition.

RESULTS

When examining cases identified as 'not a case' for CSTE Tier 1, there were 18 cases from 2020 and 2021 classified as 'not a case' due to a negative newborn toxicology test, despite these infants meeting the remainder of the CSTE criteria for a probable case. These infants were all included in the probable case counts for the RIDOH-specific NAS case definition.

The findings comparing various case definitions used are shown in **Table 3**. For HDD, there were 82 cases reported in 2020 and 88 in 2021. For the CSTE and RIDOH-specific case definitions, 83 possible NAS cases were reported to and reviewed by the RIBDP epidemiologist in 2020 and 87 in 2021. Case counts were highest when using HDD and lowest when using the CSTE Tier 1 approach. Comparing the CSTE case definitions, Tier 1 counts were lower than Tier 2. HDD counts were higher than those of the CSTE Tier 2 despite using similar sources (hospital administrative reporting).

Table 3. Neonatal Abstinence Syndrome Case Counts by Case Type and Definition, Rhode Island, 2020 and 2021

	2020			**2021**		
Case Definition	**Confirmed**	**Probable**	**Total Case Count**	**Confirmed**	**Probable**	**Total Case Count**
Hospital Discharge Data	82	n/a	**82**	88	n/a	**88**
CSTE Tier 1 Hybrid Approach	52	10	**62**	56	10	**66**
CSTE Tier 2	73	n/a	**73**	74	n/a	**74**
RIDOH Case Definition	52	18	**70**	56	20	**76**

DISCUSSION

Before 2020, the only data source available to RIDOH for reporting NAS cases was HDD. This is the first time Rhode Island has compared HDD to other case definitions. Although both case definitions use hospital administrative reporting to define cases, HDD counts were higher than CSTE Tier 2 counts. This may be because RIDOH cannot deduplicate HDD cases due to the lack of identifying information other than medical record number and date of birth. Newborns experiencing NAS are often moved from one hospital to another to receive higher level care, which may result in a newborn counted twice if both hospitals report the case through HDD. These issues do not appear to exist in the RIBDP's NAS reporting.

Similar to findings in other states, using ICD-10 diagnosis codes alone, as is done in HDD and the CSTE Tier 2 case definitions, may overestimate the true burden of NAS[5] in Rhode Island. After reviewing medical records, some 'confirmed' cases per CSTE Tier 2 administrative reporting were classified as 'not a case' in Tier 1 when considering the additional information gathered from toxicology testing, history of maternal drug use, and symptomology. Given the caveats of the CSTE Tier 1 case definition, using only administrative reporting (Tier 2 definition and HDD) appears to be overestimating the burden of NAS in Rhode Island. Reliance on hospital ICD-10 coding for identification of cases also may under- or over-ascertain cases due to errors in coding procedures.

Moving forward, RIDOH will use the CSTE recommended approach of reporting confirmed and probable cases, along with its modified case definition. The only difference between these two case definitions involved RIDOH counting newborns with negative toxicology results (CSTE Tier 1 only includes those with no or unknown results[4]). An additional 18 cases were included as 'probable' using the RIDOH case definition. Excluding newborns with a negative toxicology test, as recommended by CSTE, would likely underestimate NAS incidence in the state. Newborn toxicology testing did not always confirm exposure to drugs in these infants, which is dependent on factors including the type of sample collected (urine or meconium), as urine samples have a higher rate of false-negative results[6] due to a short timeframe for drug detection (few days before delivery) and issues collecting enough sample for testing.[6,7]

Using the RIDOH-specific approach to case classification will allow staff to gather additional information on cases not obtained from strictly using HDD or the CSTE Tier 2 case definitions (ICD-10 codes alone), such as substances found in both toxicology screening and maternal history, while acknowledging the limitations of using the CSTE Tier 1 case definition in relying on newborn toxicology testing. Despite being more time intensive, this additional information will further define the NAS problem in the state, including type of drug exposure (illicit or medication-assisted treatment (MAT)). As more pregnant women with substance use disorder receive MAT, NAS rates may appear to remain stable or increase, but the percentage of infants exposed to illicit drugs would be expected to decrease over time. This information would not be obtained if RIDOH used only an administrative reporting approach. To better understand NAS in Rhode Island, future analyses will focus on substances of exposure in newborn and maternal toxicology results, along with maternal history, all of which is gathered through medical record reviews. As more CSTE guidance becomes available, RIDOH will consider updating its NAS case definition.

RIDOH will also explore linking NAS cases to other data sources that may help increase the understanding of NAS in the state. Annually, NAS cases will be linked to RIDOH's Center for Vital Records' birth file to provide insight into newborn and maternal demographics in the NAS-affected population. Additionally, as a quality check to verify the accuracy and completeness of medical records, RIDOH will also link NAS data to the Prescription Drug Monitoring Program (PDMP) database to verify accuracy of reported prescription drugs and determine any unreported drug exposures. Moving forward, RIDOH will use its case definition to better define the NAS problem in Rhode Island to assist in targeting prevention and outreach efforts.

References

1. Hospital discharge data, Rhode Island Department of Health.
2. March of Dimes: Neonatal abstinence syndrome. Retrieved June 6, 2022. https://www.marchofdimes.org/complications/neonatal-abstinence-syndrome-(nas).aspx
3. Ko JY, Patrick SW, Tong VT, et al. Incidence of Neonatal Abstinence Syndrome - 28 States, 1999-2013. MMWR Morb Mortal Wkly Rep. 2016;65(31):799-802.
4. Council of State and Territorial Epidemiologists. Position statement: 19-MCH-01, Neonatal Abstinence Syndrome Standardized Case Definition https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/2019ps/19-MCH-01_NAS_updated_5.7.19.pdf
5. Lind JN, Ailes EC, Alter CC, et al. Leveraging Existing Birth Defects Surveillance Infrastructure to Build Neonatal Abstinence Syndrome Surveillance Systems — Illinois, New Mexico, and Vermont, 2015–2016. MMWR Morb Mortal Wkly Rep. 2019;68:177–180.
6. North Carolina Pregnancy and Opioid Exposure Project: Neonatal abstinence syndrome (NAS). Retrieved June 10, 2022. https://ncpoep.org/guidance-document/neonatal-abstinence-syndrome-overview/neonatal-abstinence-syndrome-nas/
7. Colby JM, Cotton SW. Facing Challenges in Neonatal Drug Testing: How Laboratory Stewardship Enhances Care for a Vulnerable Population. Clinical Laboratory News. March 1, 2018. Retrieved June 10, 2022. https://www.aacc.org/cln/articles/2018/march/facing-challenges-in-neonatal-drug-testing

Authors

Kristen St. John, MPH, is a Senior Public Health Epidemiologist in the Center for Health Data and Analysis (CHDA), Rhode Island Department of Health (RIDOH).

William Arias, MPH, is the Maternal and Child Health Epidemiologist in CHDA, RIDOH.