



MISSISSIPPI STATE DEPARTMENT OF HEALTH

**Neonatal Hospitalizations
Related to Maternal Substance
Use in Mississippi, 2019**

Surveillance Report
05/03/2021

INTRODUCTION



Background: In addition to increasing morbidity and mortality rates among adults, the abuse of opioids and other substances has led to increased risks to infants from *in utero* exposure to drugs of addiction. Although neonatal abstinence syndrome (NAS) is historically attributed to prenatal opioid abuse or medication-assisted treatment during pregnancy, other prescription or illicit substances may cause symptoms of withdrawal in exposed infants. The growing epidemic of prescription and illicit drug use imposes an ongoing need for monitoring the impact of maternal substance use on infants. Hospital discharge data, a population-level data source, present an opportunity for such surveillance.

Data Source: Hospital discharge data are one of the richest and most valuable sources of health-related information. In addition to clinical diagnoses and procedures performed, this data source contains information on patient demographics, expected payers, hospital charges, and length of stay. In Mississippi, all hospitals, except for federal facilities, are required to submit data on inpatient stays, emergency department encounters, and outpatient visits to the Inpatient Outpatient Data System, a collaborative effort between the Mississippi Hospital Association and Mississippi State Department of Health. Reporting hospitals are short-term general hospitals, specialty hospitals, and long-term healthcare facilities.

Methods: We performed a retrospective analysis of inpatient hospital stays for state resident and non-resident newborns. Presented in the report are the numbers, rates, and evolving trends in neonatal (0-28 days) hospitalizations associated with substance use from 2010 through 2019. In addition, we evaluated the demographic and comorbid characteristics, hospital charges, and length of stay for substance-related neonatal stays. The unit of analysis is a hospitalization, not an individual patient. Included in the report are cases with primary and secondary diagnoses of neonatal exposure to drugs of abuse, excluding tobacco and alcohol.

KEY FINDINGS

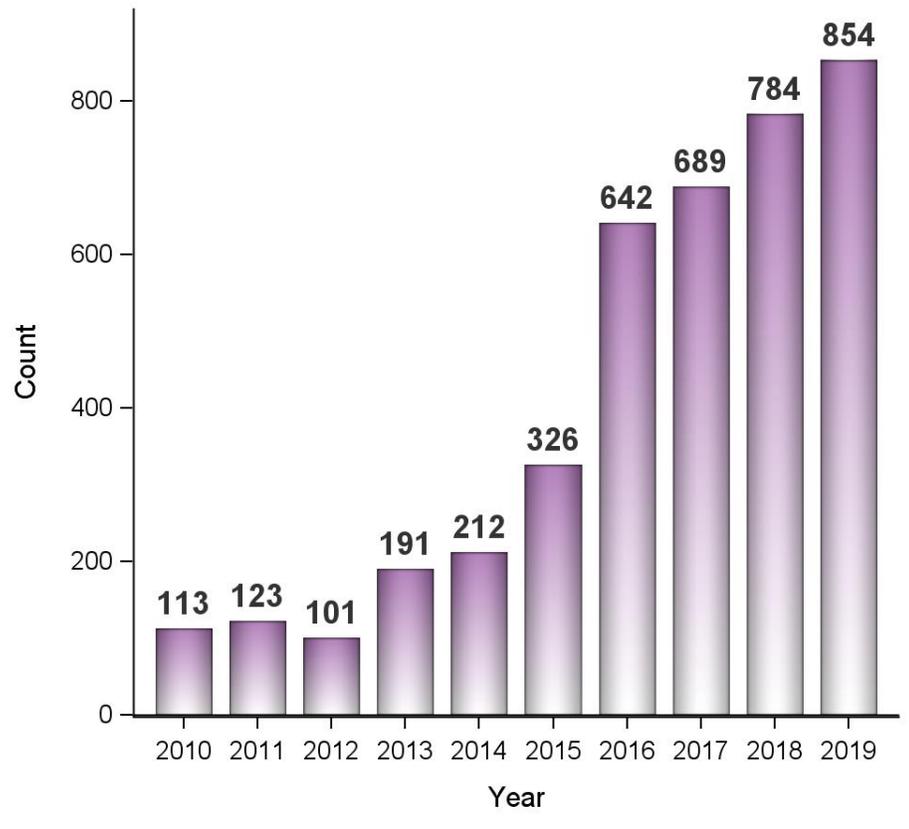


- ❑ In Mississippi, neonatal hospital stays related to maternal substance use spiked from 113 in 2010 to 854 in 2019.
- ❑ Among infant stays related to substance exposure, comorbidities were highly prevalent: 26.4% were born prematurely, 25.6% had a coexisting low birth weight, 25.7% had coexisting respiratory conditions, and 13.9% had a coexisting congenital disease.
- ❑ The overwhelming majority of these infants were poor. Among the 854 such hospitalizations, 85.5% (730) were covered by Medicaid and 8.1% (69) were uninsured.
- ❑ Total charges for these hospital stays grew 64.0% over this four-year period, increasing from \$19,936,930 in 2016 to \$32,694,118 in 2019 and totaling over \$101 million for the study period.
- ❑ Rates were nearly identical for African American and Caucasian newborns. Infants residing in rural areas, however, had slightly higher hospitalization rates than infants residing in urban areas. Rates were highest in the northeastern corner of the state and in south Mississippi.

OVERALL TREND AND TYPES OF DRUGS



Figure 1. Neonatal Hospitalizations Related to Maternal Use of All Drugs of Addiction, MS, 2010-2019



The number of newborn hospitalizations due to intrauterine substance exposure increased sharply, from 113 infants in 2010 to 854 infants in 2019 (Figure 1). This spike may be attributed to the 2015 implementation of new diagnostic codes that allowed for the coding of non-specific maternal drug abuse. Following this surge, the trend moderated but continued to increase. Compared to 2018, there were 70 more newborn hospitalizations in 2019 following maternal use of addictive drugs.

During 2019, nearly half (47%) of the drugs involved in newborn hospitalizations affected by maternal substance abuse were unspecified (Table 1). Cannabis was recorded in 30%, cocaine in 7%, opiates in 6%, and stimulants in 5% of all neonatal hospitalizations related to maternal substance use. Neonatal abstinence syndrome, caused by severe intrauterine drug exposure, was documented in 16% or 139 hospitalizations.

Table 1. Neonatal Hospitalizations Related to Maternal Drug Use: Types of Drugs Involved, Mississippi, 2019

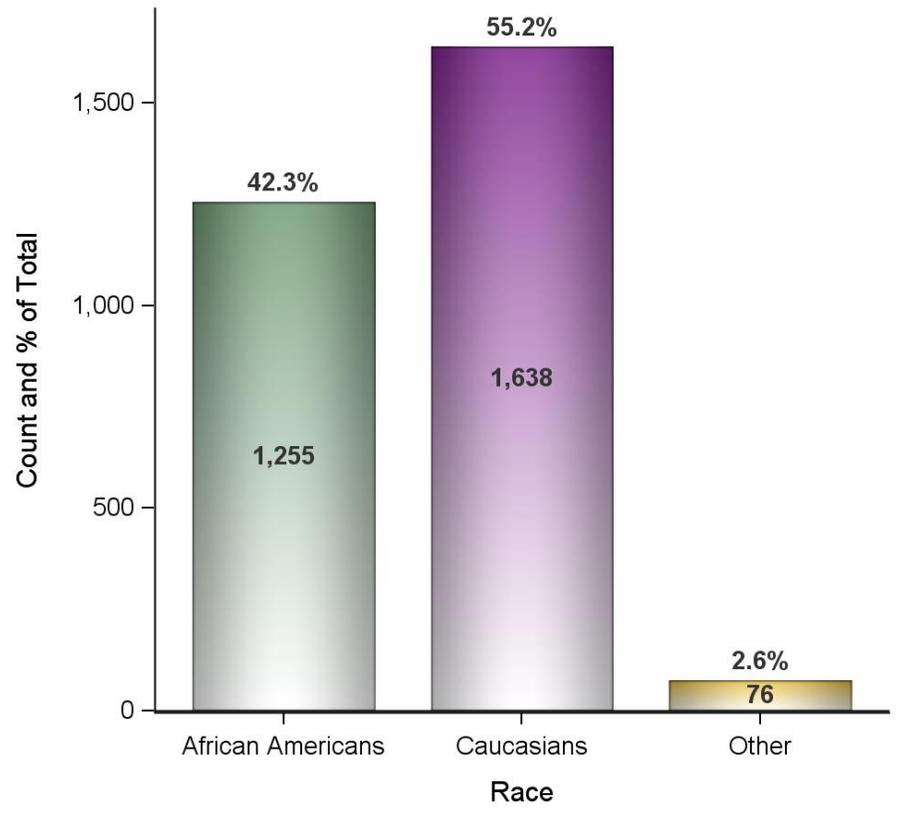
Type of Drug	Hospitalizations	Percent
Unknown/other drugs of addiction	405	47%
Cannabis	255	30%
Cocaine	58	7%
Opiates	54	6%
Amphetamines (stimulants)	41	5%
Neonatal withdrawal syndrome	139	16%

These groups are not mutually exclusive and their sum is higher than the total number of discharges.

DEMOGRAPHICS



Figure 2. Neonatal Hospitalizations Related to Maternal Drug Use
Racial Distribution, MS, 2016-2019



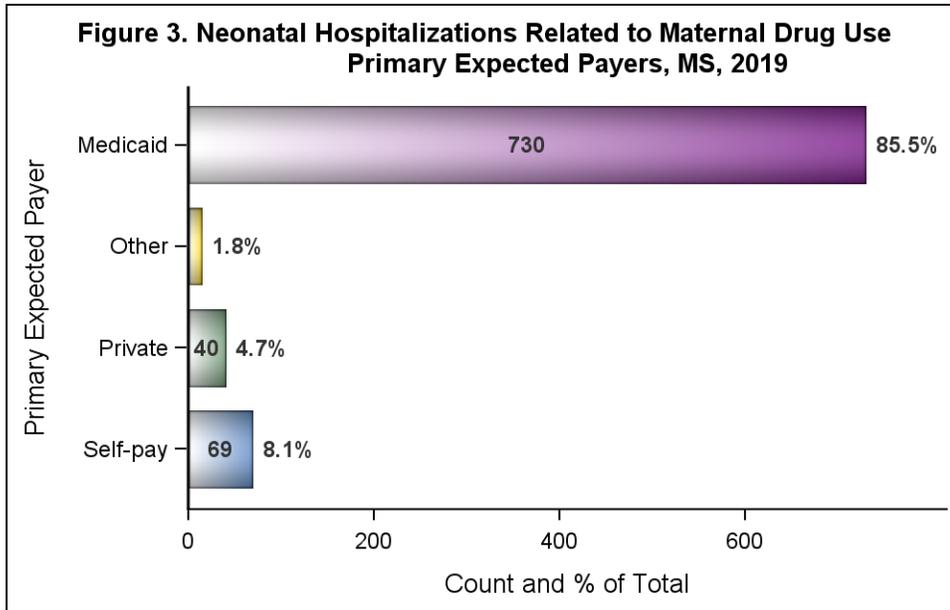
Between 2016 and 2019, there was a total of 2,969 neonatal hospitalizations related to maternal substance use in Mississippi. This represents 2.1% of all neonatal hospital stays. Of these hospitalizations, 2,888 (97.3%) were among Mississippi residents.

There were more infant hospitalizations related to substance use among Caucasian newborns (1,638 or 55.2%) compared to African American newborns (1,255 or 43.2%) and other racial groups (76 or 2.6%). Unlike the absolute numbers, the hospitalization rates were almost identical for Caucasian and African American infants, respectively 20.1 and 19.7 per 1,000 live births. The rate was 18.8 per 1,000 live births for other races.

Females (1,450 or 48.9%) and males (1,518 or 51.1%) were similarly affected (the sex of one infant was unknown). Most of the infants (95.7%) were diagnosed during the day of their birth.

SOCIOECONOMIC STATUS

During 2019, the vast majority (85.5%) of neonatal hospitalizations related to maternal substance use were covered by Medicaid and 8.1% were self-paid (Figure 3 and Table 2). These findings indicate that nearly all infants impacted by maternal substance use were born in low-income households.



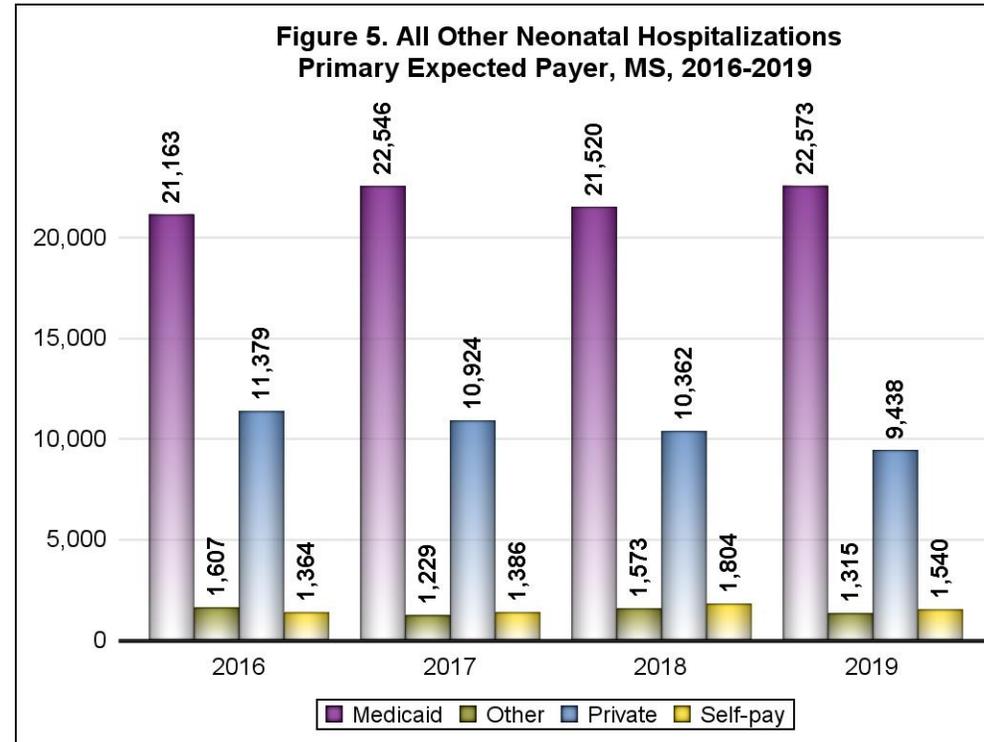
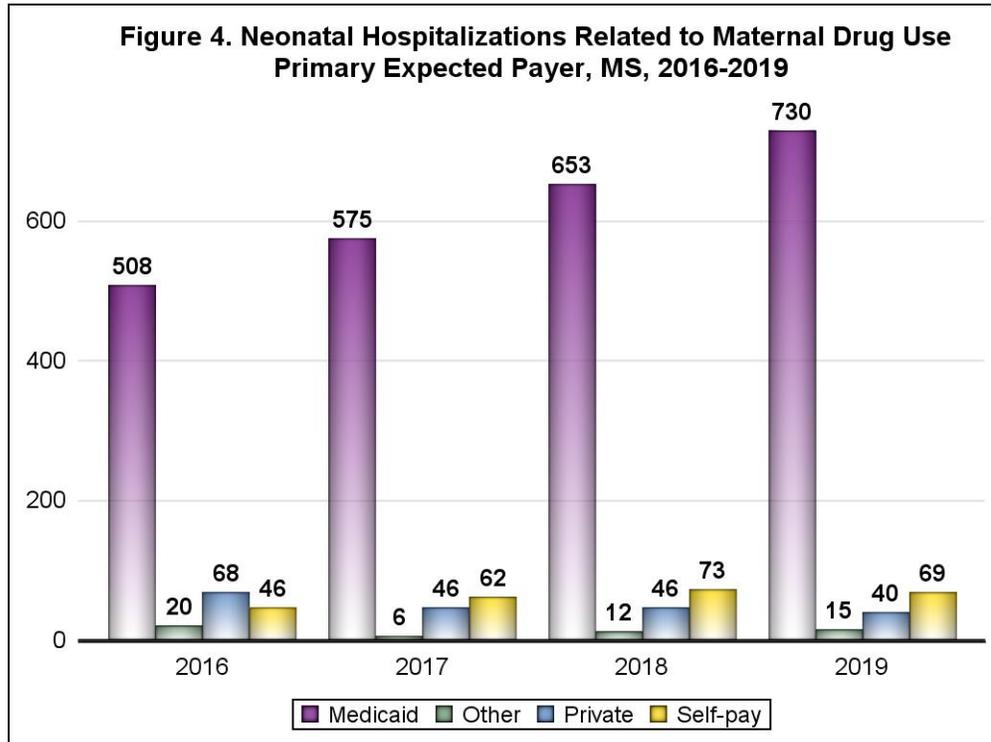
**Table 2. Neonatal Hospitalizations Related to Maternal Drug Use:
Total Charges per Primary Expected Payer,
Mississippi, 2019**

Payer	All	Mean	Sum
Medicaid	730	\$39,683	\$28,968,760
Other	15	\$67,393	\$1,010,900
Private	40	\$37,950	\$1,517,988
Self-pay	69	\$17,340	\$1,196,469
All	854	\$38,284	\$32,694,118

PAYERS



Moreover, there were differences in the health insurance coverage between newborns with and without substance exposure. During 2016-2019, Medicaid was responsible for the vast majority (2,466 or 83.1%) of substance-related neonatal stays versus (87,802 or 62.0%) of all other neonatal stays. Compared with all other neonatal stays, infants affected by drugs of abuse were more likely to be uninsured (8.4% versus 4.3%) and less likely to have private insurance coverage (6.7% versus 29.7%).



LENGTH OF STAY AND CHARGES

Between 2016 and 2019, the mean length of stay for neonatal stays related to maternal substance use was two times higher than the mean length of stay for all other neonatal stays: 8.7 days compared to 3.8 (Figure 6). During the same time, the mean charges of \$34,221 for neonatal stays related to substance use were nearly three times higher than the mean charges of \$13,282 for all other neonatal stays. In addition, the total charges increased by 64.0%, from \$19,936,930 in 2016 to \$32,694,118 in 2019, totaling over \$101 million for the four-year period (Table 3 and Figure 7).

Figure 6. Neonatal Hospitalizations Related to Maternal Drug Use Length of Stay (Days), MS, 2016-2019

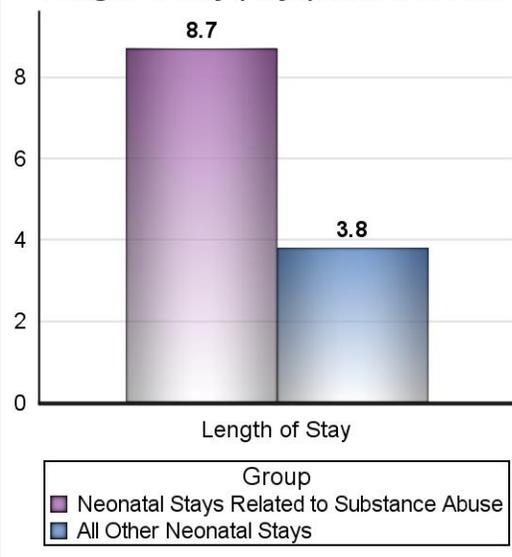
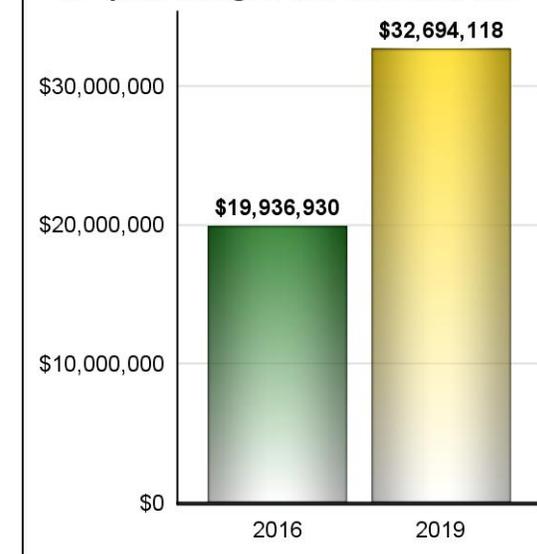


Table 3. Neonatal Hospitalizations Related to Maternal Drug Use: Total Charges per Year, Mississippi 2016-2019

Year	All	Mean	Sum
2016	642	\$31,054	\$19,936,930
2017	689	\$33,753	\$23,255,948
2018	784	\$32,801	\$25,716,312
2019	854	\$38,284	\$32,694,118
All	2,969	\$34,221	\$101,603,307

Figure 7. Neonatal Hospitalizations Related to Maternal Drug Use Hospital Charges, MS, 2016 and 2019



COMORBIDITIES



Neonatal hospitalizations related to maternal substance use were assessed for comorbidities for the 2016-2019 period. Newborns affected by maternal substance use were more likely to be born prematurely (26.4% vs. 12.3%) compared to all other newborns. Such infants were also more likely to have low birth weight (25.6% versus 10.3%), respiratory complications (25.7% versus 10.9%), congenital diseases (13.9% versus 9.2%), feeding difficulties (9.2% versus 3.1%), and congenital bacterial sepsis (5.3% vs. 1.7%). These differences were statistically significant at $p < .001$. Seizures, a hallmark sign of neonatal withdrawal, were recorded in 26 neonatal hospital stays related to maternal substance use (Figure 8 and Table 4).

Figure 8. Neonatal Hospitalizations Related to Maternal Use of Addictive Drugs Comparative Analysis of Comorbid Conditions, MS, 2016-2019

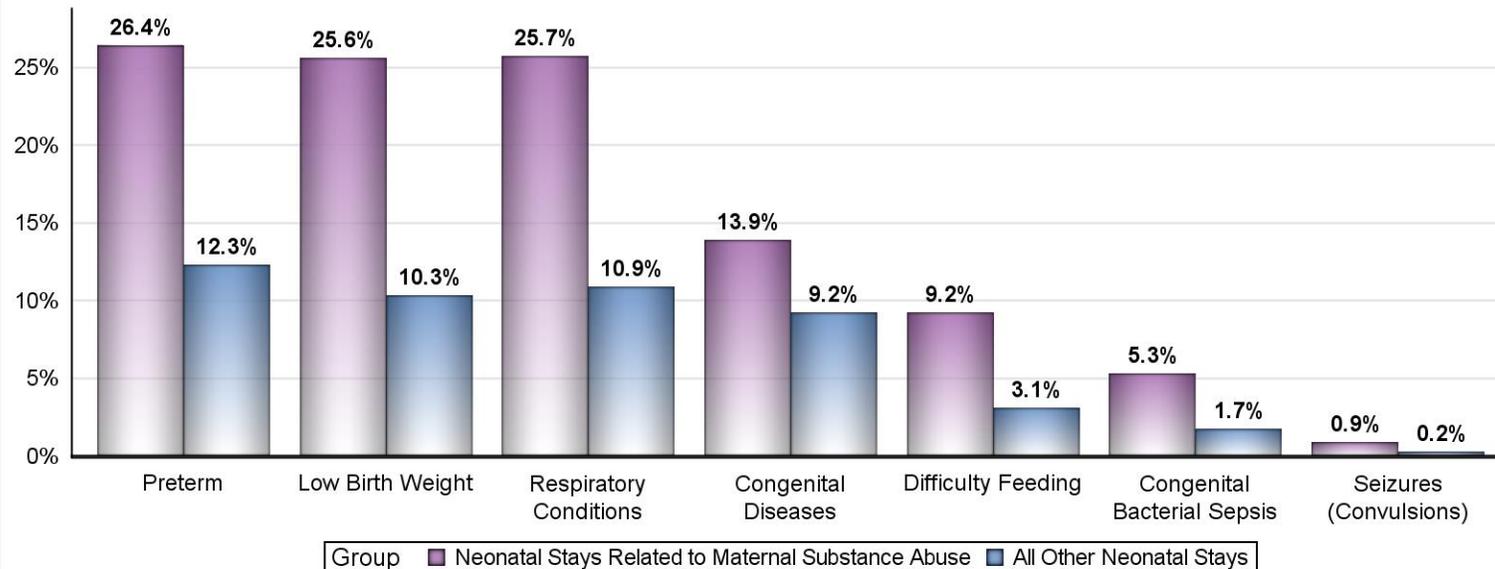


Table 4. Neonatal Hospitalizations and Associated Comorbidities in MS: Combined Data for 2016-2019

Conditions	Number	%
Preterm	783	26.4%
Low Birth Weight	761	25.6%
Respiratory Conditions	764	25.7%
Congenital Diseases	412	13.9%
Difficulty Feeding	273	9.2%
Congenital Bacterial Sepsis	157	5.3%
Seizures (convulsions)	26	0.9%

This analysis was performed using the following ICD-10-CM diagnostic codes preterm (P072, P073), low birth weight (P05, P070, P071), respiratory conditions (P22-P28), congenital diseases (Q00-Q99), feeding difficulties of newborn (P92), congenital bacterial sepsis (P36) and convulsions of newborn (P90). Comorbidities between neonatal stays with and without substance-related diagnoses were compared with chi-square tests.

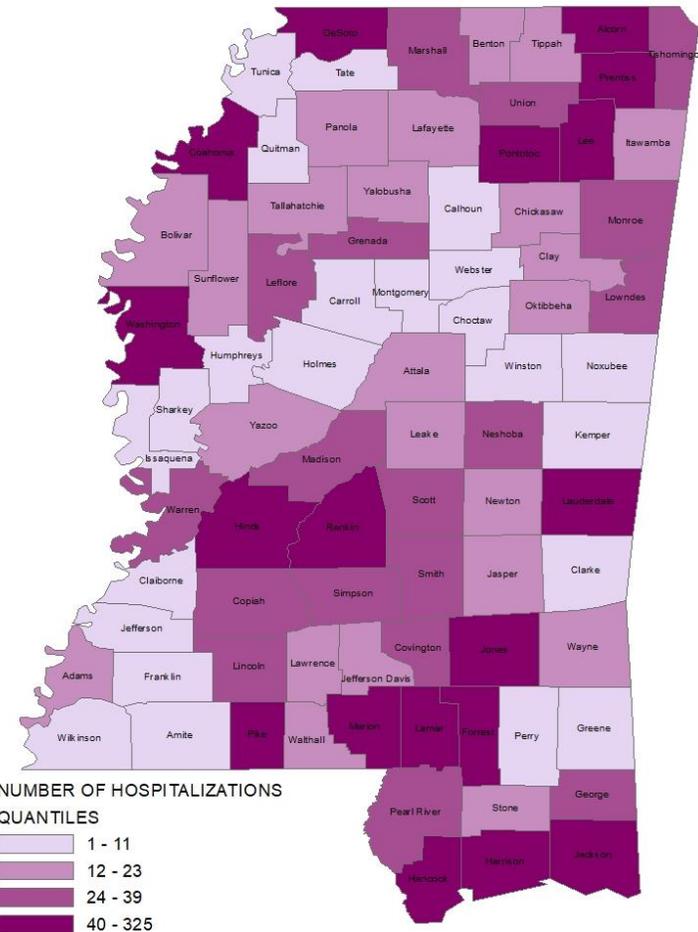
GEOGRAPHIC DISTRIBUTION

NEONATAL HOSPITALIZATIONS RELATED TO MATERNAL USE OF ADDICTIVE DRUGS, MISSISSIPPI, 2016-2019

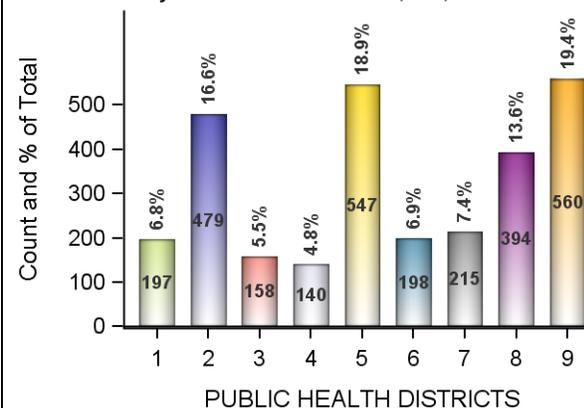
During 2016-2019, the overall number of hospitalizations related to maternal drug use was higher in rural areas (Table 1). However, such areas showed only slightly higher rates of infants affected by maternal drug use when examined as a percentage of live births. When analyzed by county of residence, for example, infants born to rural women had a hospitalization rate of 20.2 per 1,000 live births as compared to their urban peers who had a hospitalization rate of 18.5 per 1,000 live births (Table 5). In terms of regions, rates were highest in District 2 (the northeastern corner of the state), followed by districts 7, 8, and 9 in south Mississippi. The geographic analysis included only Mississippi residents.

Table 5. Neonatal Hospitalizations Related to Maternal Drug Use, Mississippi, 2016-2019

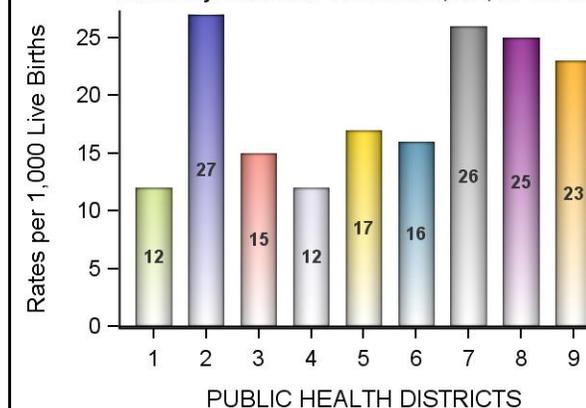
Area	Number and %	Rate per 1,000 Live Births
Rural Counties	1,626 (56.3%)	20.2
Urban Counties	1,262 (43.7%)	18.5
Statewide	2,888 (100.0%)	19.4



**Figure 9. Neonatal Hospitalizations Related to Maternal Use of Addictive Drugs
Number By District of Residence, MS, 2016-2019**



**Figure 10. Neonatal Hospitalizations Related to Maternal Use of Addictive Drugs
Rates By District of Residence, MS, 2016-2019**

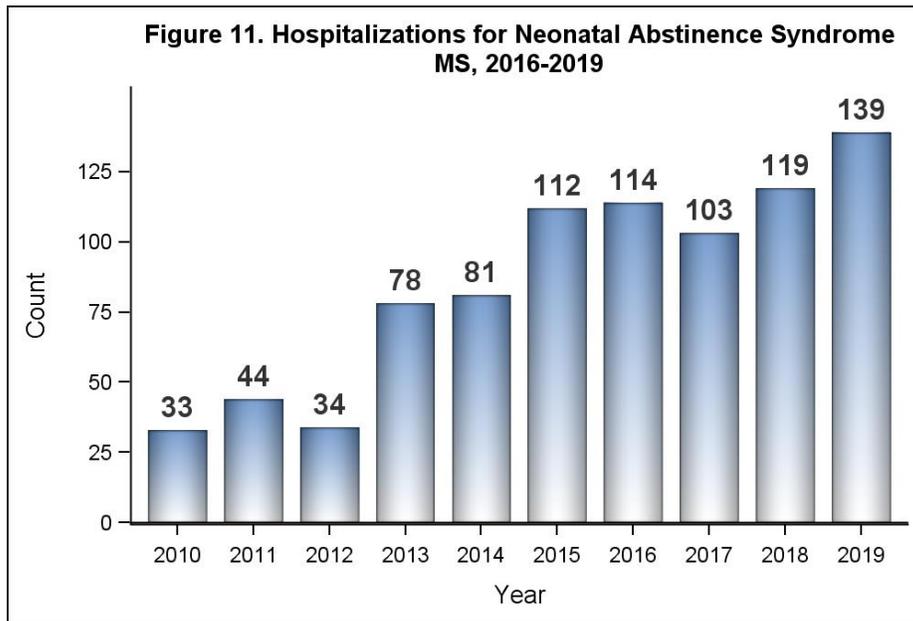


NEONATAL ABSTINENCE SYNDROME



What is Neonatal Abstinence Syndrome? The neonatal abstinence syndrome is a clinical condition in newborn caused by the prolonged exposure of the fetus to drugs of addiction used during pregnancy. The sudden discontinuation of these drugs after delivery causes an onset of withdrawal signs. According to literature reports, between 55% and 94% of exposed infants develop withdrawal.¹

Findings: The overall trend in neonatal abstinence syndrome was upward during the study period, except for two dips: between 2011 and 2012 and between 2016 and 2017 (Figure 11). During 2019, on average, a baby suffering from drug withdrawal was born every two and half days in Mississippi – a total of 139 newborns. Compared to 2018, there were 20 more hospitalizations associated with neonatal abstinence syndrome in 2019.



Clinical Signs of Neonatal Abstinence Syndrome: The intrauterine exposure to drugs of addiction could be associated with a constellation of clinical signs of the nervous and gastrointestinal systems such as restlessness, high-pitched crying, irritability, sleep disturbances, tremors, seizures, feeding difficulties, diarrhea, and failure to thrive.² Such clinical signs may have various degrees of severity depending on the level of exposure. In addition, neonatal withdrawal may be evident in the first 24-72 hours of life, but signs of the condition may also be delayed by a week or longer. The nonspecific nature of the signs associated with the intrauterine exposure to addictive drugs and short hospitalization stays make the neonatal abstinence syndrome difficult to recognize and diagnose. Because of the above-mentioned reasons, neonatal abstinence syndrome may be underdiagnosed and, consequently, underreported.

FROM DATA TO ACTION



WHAT WE AT THE MISSISSIPPI STATE DEPARTMENT OF HEALTH DO

The Early Intervention (First Steps) is a federal program at MSDH that provides services to infants and young children with developmental delays and disabilities. This support may include comprehensive development assessment, service coordination, behavioral services, speech therapy, physical therapy, language development and other services. Perinatal substance use may lead to development delays. Infants with disorders secondary to drugs or alcohol exposure qualify for such development support. For more information and to seek help for your child, please visit MSDH's website at: https://msdh.ms.gov/msdhsite/_static/41,0,74.html#services.

Perinatal High Risk Management/Infant Services System (PHRM/ISS) is a case management program established to increase access to health care and social services for Medicaid-eligible pregnant/postpartum women at-risk for health complications (e.g., substance use). Supportive services may include finding doctors for maternity/child care, offering health education as well as psycho-social and nutritional assessments/counseling, assisting with supplemental nutritional programs (WIC), and providing visits by nurses, social workers, and nutritionists. For more information, please visit MSDH's website at: https://msdh.ms.gov/msdhsite/_static/41,0,106.html.

PUBLIC HEALTH GOALS

The goal of this report is to increase awareness among the medical community, public health structures, and policy makers about the impact of maternal substance use on infant health, a condition associated with severe health outcomes and high societal costs. The specific objectives are outlined below:

- ❑ Engaging the maternity hospitals in our state to collaborate on the development and implementation of standardized protocols for the identification, management, and follow-up of infants exposed to drugs of addiction during pregnancy.
- ❑ Reaching out to prenatal care providers and underlining the necessity of screening for substance abuse disorders (SUD) during the prenatal period as well as the need for the timely treatment and follow-up of such disorders.
- ❑ Encouraging measures aimed at expanding treatment options for women with SUD and extending effective therapeutic approaches such as methadone or buprenorphine maintenance therapies.³
- ❑ Building support groups for newborns affected by substance use and their mothers — drug abuse is a disease — mothers and babies affected by substance abuse need family, community, and social support.
- ❑ Drawing attention to addiction treatment barriers — substance-using pregnant women may fear to seek medical care because of shame, stigma, possible criminal sanctions, or losing custody of children.⁴

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ANALYTICAL NOTES: To identify neonatal hospitalizations related to maternal substance use, we used the following International Classifications of Diseases-10-Clinical Modifications codes (ICD-10-CM): P961, P0414, P0416, P0417, P0440, P0441, P0442, P0449, P0481. To categorize residence status, we applied the Urban-Rural Classification Scheme for Counties developed by the National Center for Health Statistics.⁵ This report presents data since 2010; however, for some of the analyses, we used only the data for 2016-2019 since ICD-10-CM was introduced in the fourth quarter of 2015, replacing the previous classification system, ICD-9-CM. These two classification systems are not entirely comparable. For calculating rates only discharges among Mississippi residents were used; otherwise, analyses included residents and non-residents.

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