



MISSISSIPPI STATE DEPARTMENT OF HEALTH

**Neonatal Hospitalizations  
Related to Maternal Substance  
Use in Mississippi  
2010-2020**

**Surveillance Report**

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# 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:** This is a retrospective analysis of inpatient hospital stays for state resident and non-resident newborns. Presented in the report are the numbers and evolving trends in neonatal (0-28 days) hospitalizations associated with maternal substance use from 2010 through 2020. In addition, we evaluated the demographic and comorbid characteristics, hospital charges, and length of stay for substance-related neonatal stays that occurred during 2020. 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

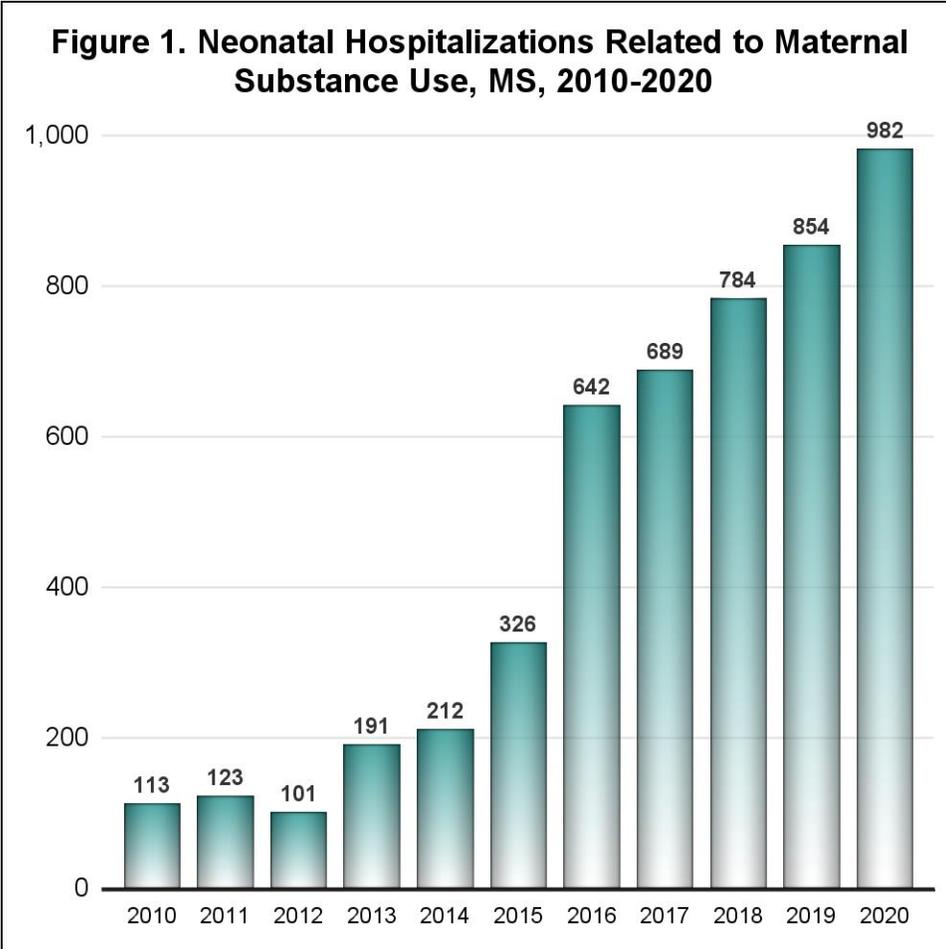


- ❑ In Mississippi, neonatal hospital stays related to maternal substance use spiked from 113 in 2010 to 982 in 2020
- ❑ During 2020, the number of such hospitalizations increased by 35.6%, jumping from 208 during the first quarter to 282 during the last quarter of the same year. This could be an underappreciated and little studied consequence of the increase in substance abuse by alienated and anxious pregnant women during the height of the COVID pandemic.
- ❑ Between 2016 and 2020, comorbidities were highly prevalent among infant stays related to maternal substance exposure: 25.6% were born prematurely, 25.4% had a coexisting low birth weight, 25.2% had coexisting respiratory conditions, and 13.7% had a coexisting congenital disease.
- ❑ In 2020, the overwhelming majority of these infants were poor. Among the 892 such hospitalizations, 87.6% (860) were covered by Medicaid and 7.2% (71) were uninsured.
- ❑ Total charges for these hospital stays grew 59.9% over this four-year period, increasing from \$19,936,930 in 2016 to \$31,877,252 in 2020, totaling over \$133 million.

# OVERALL



**Figure 1. Neonatal Hospitalizations Related to Maternal Substance Use, MS, 2010-2020**



The number of newborn hospitalizations due to intrauterine substance exposure increased sharply, from 113 infants in 2010 to 982 infants in 2020 (Figure 1). There was a substantial increase in such hospitalizations between 2015 and 2016. 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 steadily. Compared to 2019, there were 128 more newborn hospitalizations in 2020 following maternal use of addictive drugs. This was a 15.0% increase.

During 2020, half (50%) of the drugs involved in newborn hospitalizations affected by maternal substance abuse were unspecified (Table 1). Cannabis was recorded in 37%, cocaine in 6%, opiates in 3%, 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 14% or 133 hospitalizations. Among admissions with specified drugs, only the proportion of cannabis-related hospitalizations increased between 2019 and 2020.

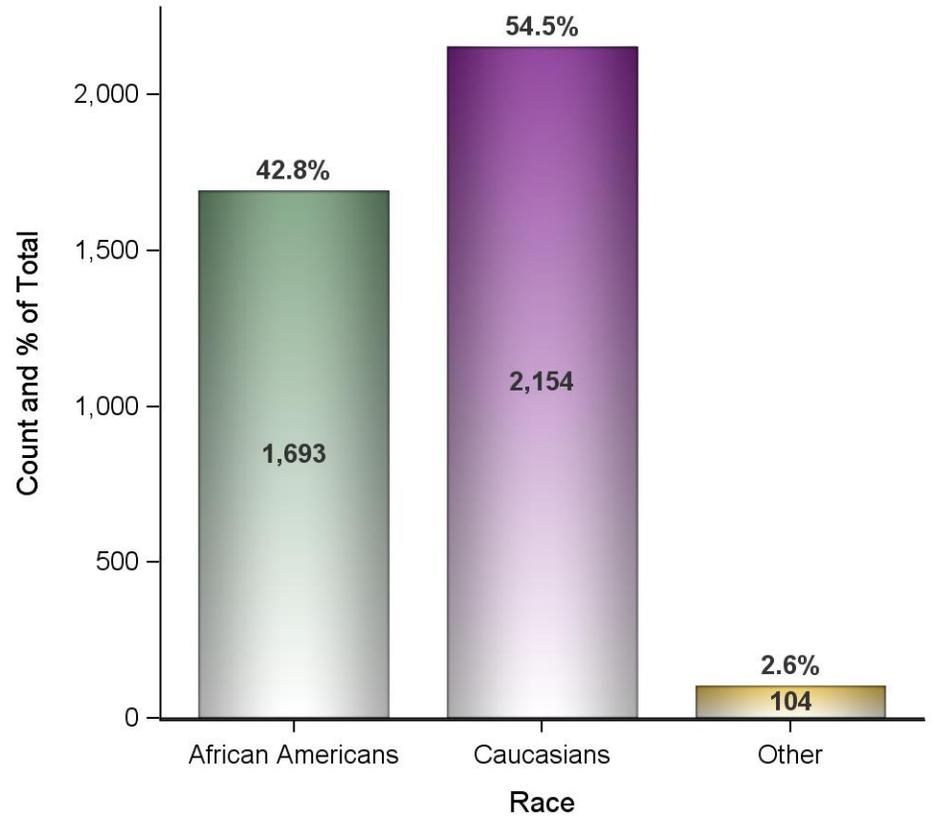
**Table 1. Neonatal Hospitalizations Related to Maternal Substance Use by Type of Drugs Involved: Mississippi, 2019 and 2020**

Type of Drug	2019		2020	
	Hospitalizations	Percent	Hospitalizations	Percent
Unknown	405	47%	490	50%
Cannabis	255	30%	360	37%
Cocaine	58	7%	58	6%
Opiates	54	6%	32	3%
Amphetamines (stimulants)	41	5%	53	5%
Neonatal withdrawal syndrome	139	16%	133	14%

# DEMOGRAPHICS



Figure 2. Neonatal Hospitalizations Related to Maternal Drug Use  
Racial Distribution, MS, 2016-2020



Between 2016 and 2020, there was a total of 3,951 neonatal hospitalizations related to maternal substance use in Mississippi. This represents 2.2% of all neonatal hospital stays. Most of the infants (95.9%) were diagnosed during the day of their birth. Of these hospitalizations, 3,854 (97.5%) were among Mississippi residents.

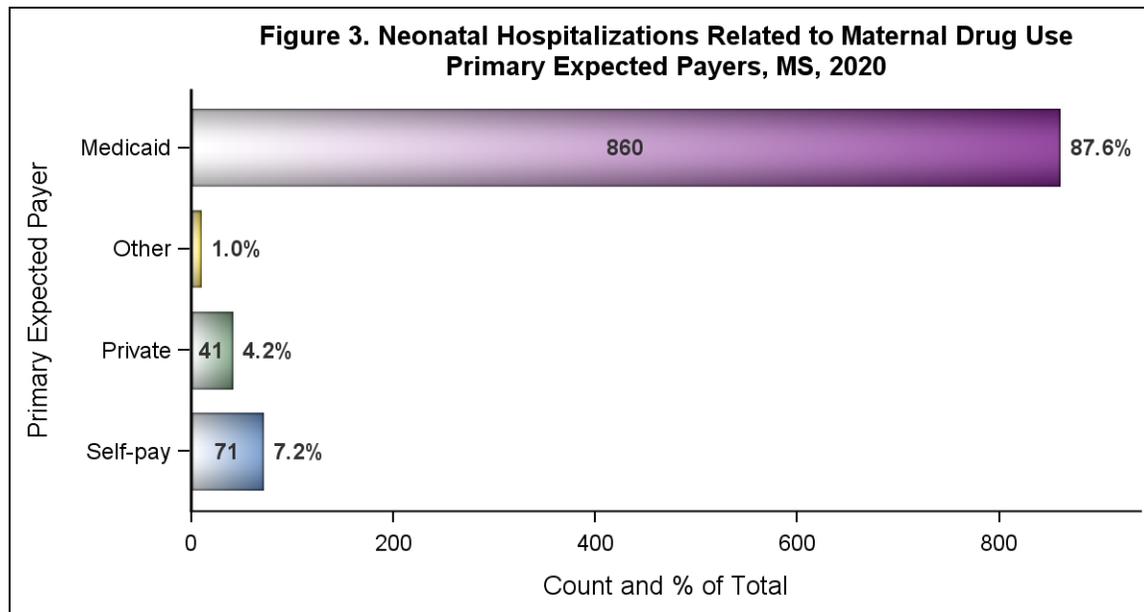
Compared to African American newborns (1,693 or 42.8%) and newborns from other racial groups (104 or 2.6%), white newborns accounted for more infant hospitalizations related to maternal substance use (2,154 or 54.5%). This is due to the fact, however, that there are more white births than African American births in Mississippi. When examined by percentage of all neonatal stays, the proportions of white and African Americans newborns affected by maternal substance use were not significantly different: 2.2% of all white newborns and 2.4% of all African Americans newborns had complications related to this diagnostic category.

Females (1,930 or 48.9%) and males (2,020 or 51.1%) were similarly affected (the sex of one infant was unknown). Between 2016 and 2020, females accounted for 48.9% of all neonatal hospitalizations.

# SOCIOECONOMIC STATUS



During 2020, the vast majority (87.6%) of neonatal hospitalizations related to maternal substance use were covered by Medicaid and 7.2% were self-pay (Figure 3 and Table 2). These findings indicate that nearly all infants impacted by maternal substance use were born in low-income households.



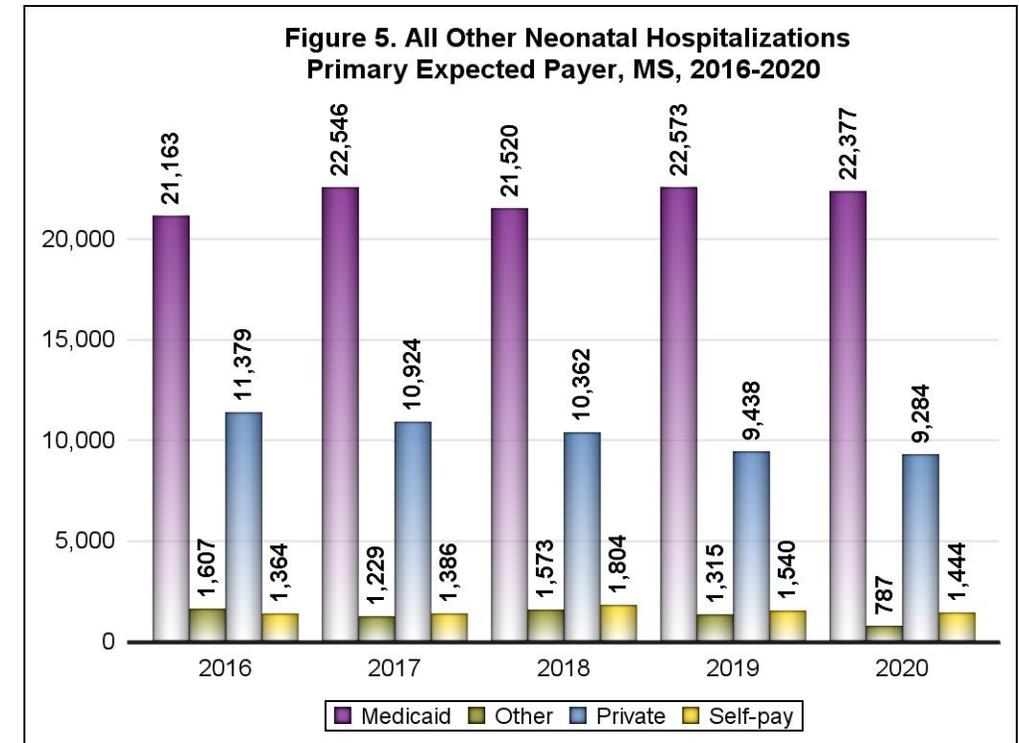
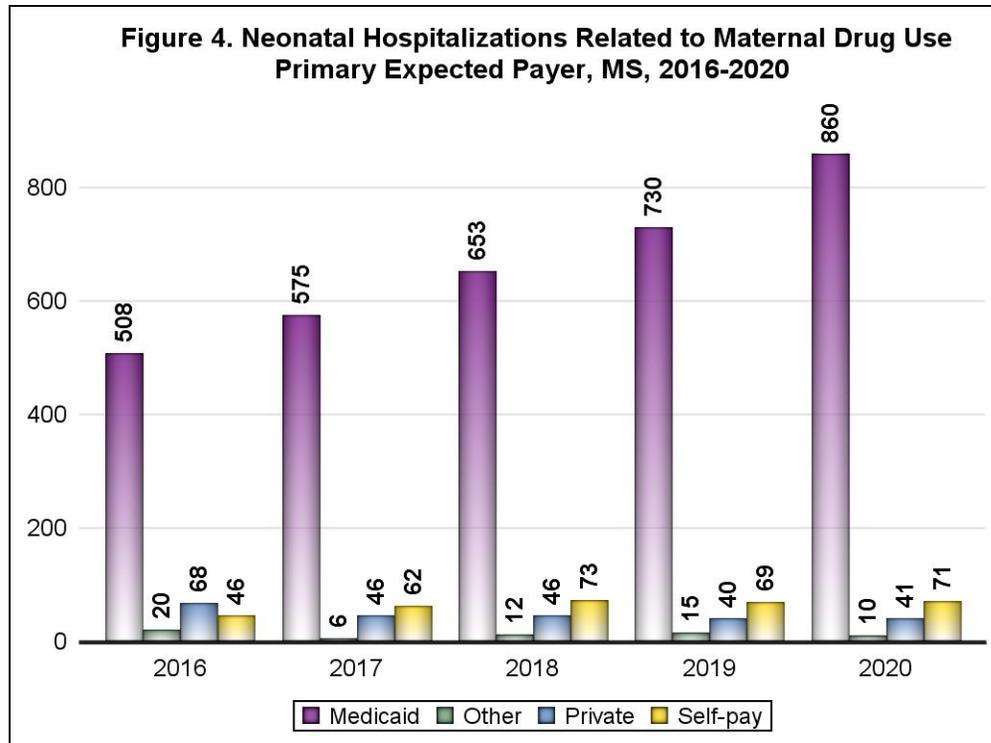
**Table 2. Neonatal Hospitalizations Related to Maternal Drug Use: Total Charges per Primary Expected Payer, Mississippi, 2019**

Payer	All	Mean	Sum
<b>Medicaid</b>	860	\$33,787	\$29,056,422
<b>Other</b>	10	\$43,644	\$436,437
<b>Private</b>	41	\$16,755	\$686,961
<b>Self-pay</b>	71	\$23,908	\$1,697,431
<b>All</b>	982	\$32,462	\$31,877,252

# PAYERS



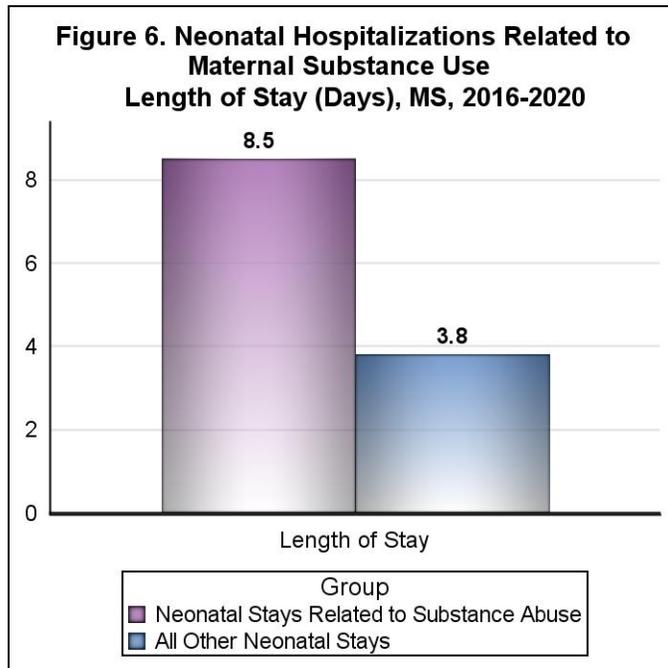
Moreover, there were differences in the health insurance coverage between newborns with and without maternal substance exposure. During 2016-2020, Medicaid was responsible for the 84.2% (3,326) of substance-related neonatal stays versus 62.7% (110,179) of all other neonatal stays. Compared with all other neonatal stays, infants affected by drugs of abuse were more likely to be uninsured (8.1% versus 4.3%) and less likely to have private insurance coverage (6.1% versus 29.3%).



# LENGTH OF STAY AND CHARGES

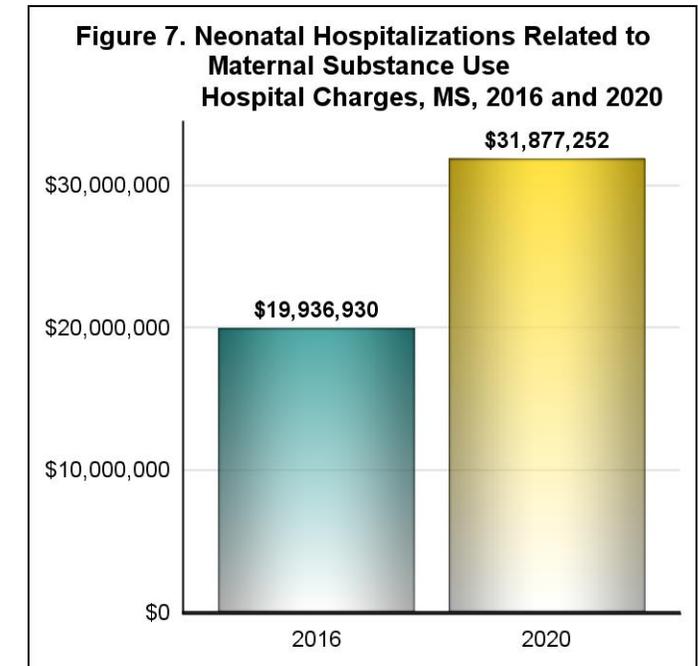


Between 2016 and 2020, the mean length of stay for neonatal stays related to maternal substance use was two times higher than the mean length of stay for all other neonatal stays: 8.5 days compared to 3.8 (Figure 6). During the same time, the mean charges of \$33,784 for neonatal stays related to maternal substance use were more than two times higher than the mean charges of \$13,698 for all other neonatal stays. In addition, the total charges increased by 59.9%, from \$19,936,930 in 2016 to \$31,877,252 in 2020, totaling over \$133 million for the five-year period (Table 3 and Figure 7).



**Table 3. Neonatal Hospitalizations Related to Maternal Drug Use: Total Charges per Year, Mississippi 2016-2020**

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	\$38,283	\$32,694,118
2020	982	\$32,462	\$31,877,252
All	3,951	\$33,784	\$133,480,559

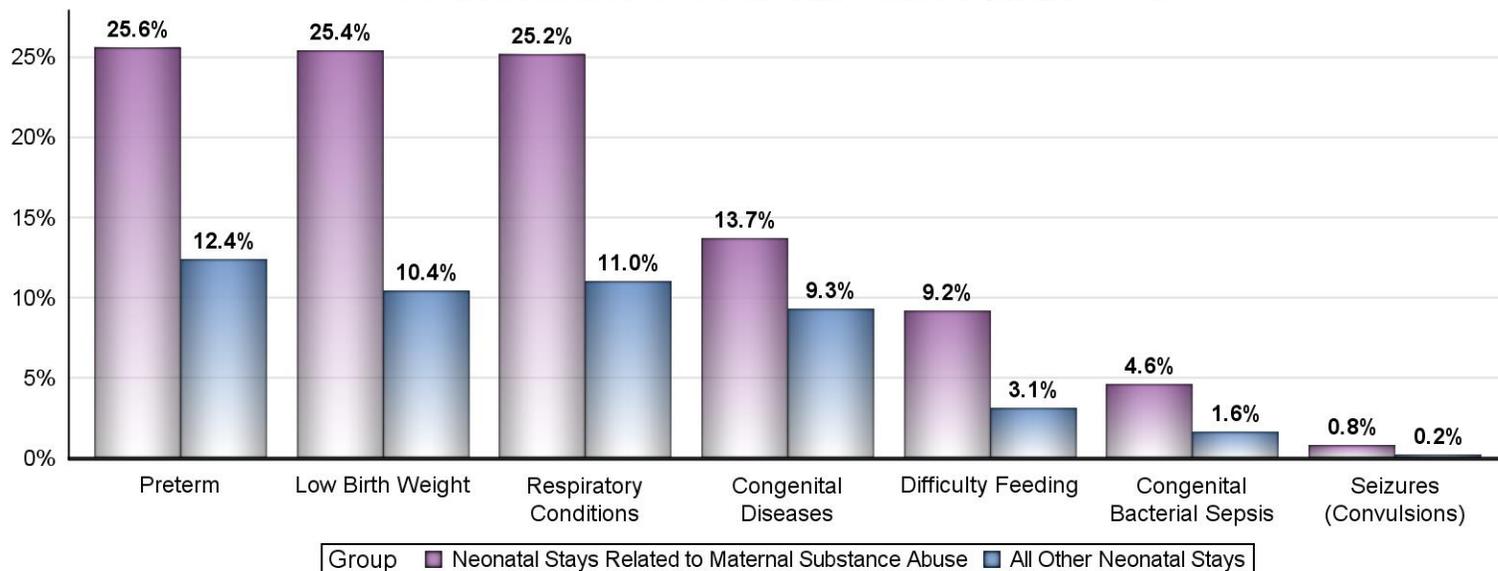


# COMORBIDITIES



Neonatal hospitalizations related to maternal substance use were assessed for comorbidities for the 2016-2020 period. Newborns affected by maternal substance use were more likely to be born prematurely (25.6% vs. 12.4%) compared to all other newborns. Such infants were also more likely to have low birth weight (25.4% versus 10.4%), respiratory complications (25.2% versus 11.0%), congenital diseases (13.7% versus 9.3%), feeding difficulties (9.2% versus 3.1%), and congenital bacterial sepsis (4.6% vs. 1.6%). These differences were statistically significant at  $p < .001$ . Seizures, a hallmark sign of neonatal withdrawal, were recorded in 32 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, 2016-2020**



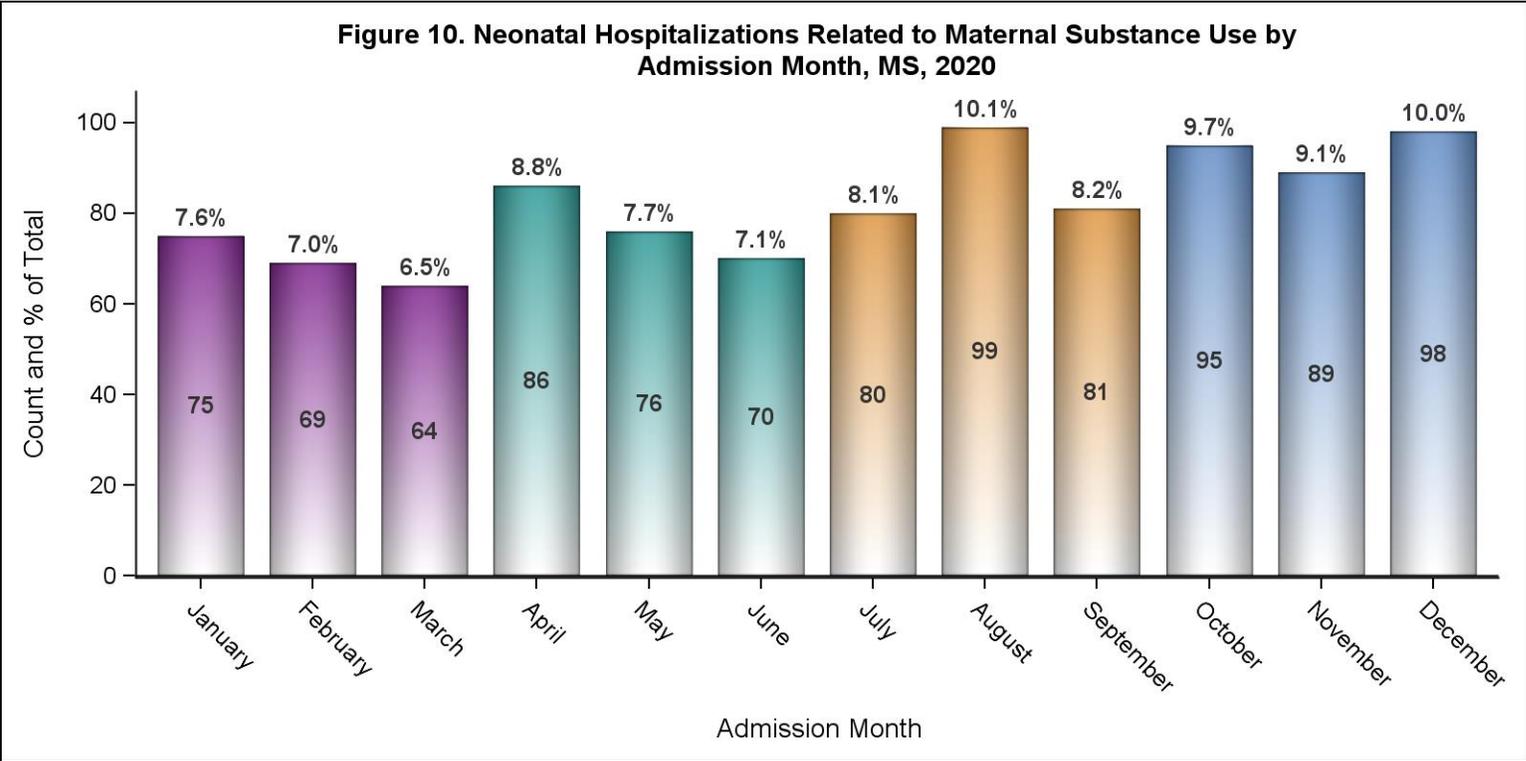
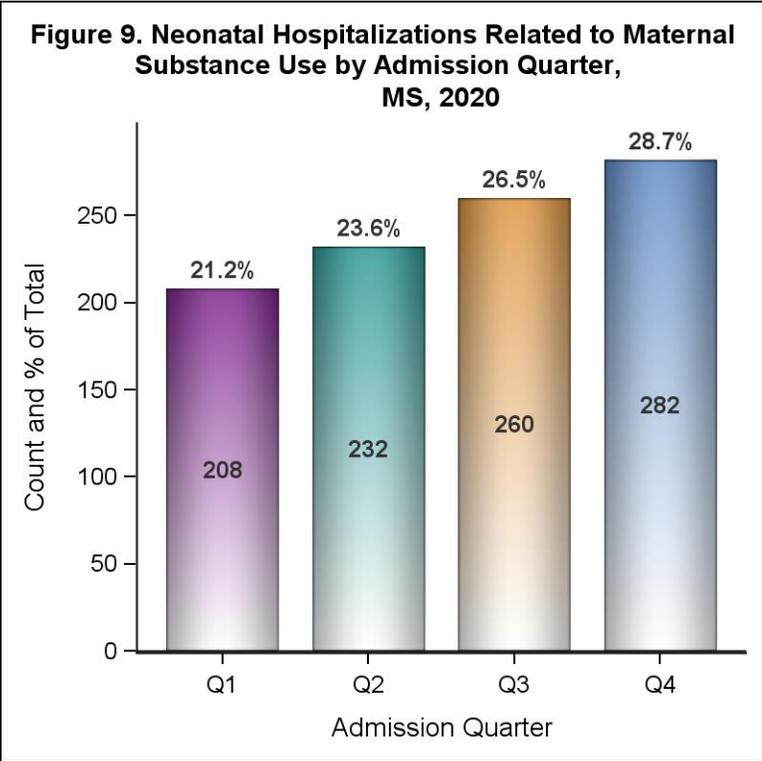
**Table 4. Neonatal Hospitalizations and Associated Comorbidities in MS: Combined Data for 2016-2020**

Conditions	Number	Percent
Preterm	1,013	25.6%
Low Birth Weight	1,004	25.4%
Respiratory Conditions	997	25.2%
Congenital Diseases	540	13.7%
Difficulty Feeding	364	9.2%
Congenital Bacterial Sepsis	180	4.6%
Seizures (convulsions)	32	0.8%

This analysis was performed using the following ICD-10-CM diagnostic codes preterm/immaturity (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.

# 2020 ADMISSION TRENDS BY MONTH AND QUARTER

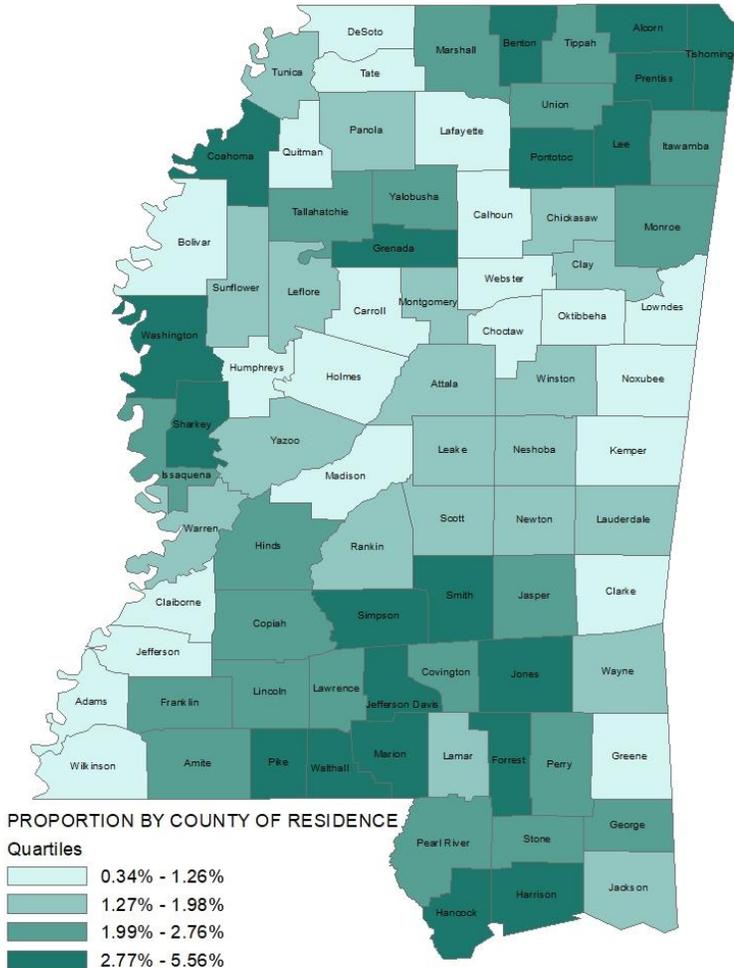
Neonatal hospitalizations related to maternal substance use increased steadily in Mississippi. During 2020, the number of such hospitalizations increased by 35.6%, jumping from 208 during the first quarter to 282 during the last quarter of the same year (Figure 9). This could be an underappreciated and little studied consequence of the increase in substance abuse by alienated and anxious pregnant women during the height of the COVID pandemic. For example, the highest numbers of recorded neonatal hospitalizations related to maternal substance use occurred during August and December, peak months for COVID cases in Mississippi (Figure 10).



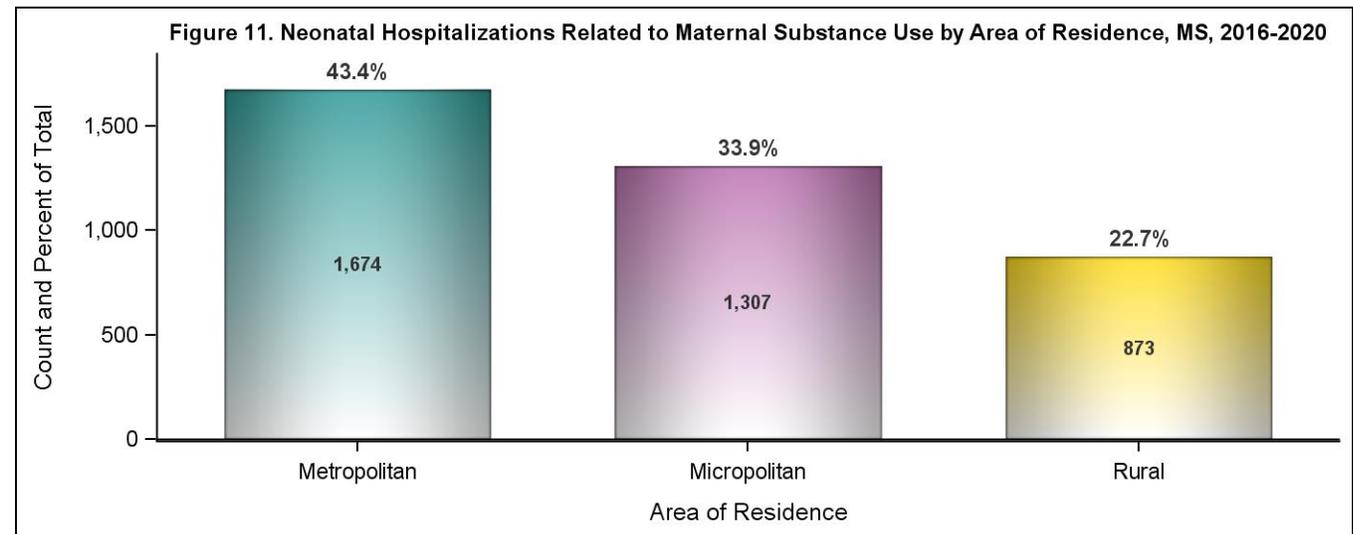
# GEOGRAPHIC DISTRIBUTION



NEONATAL HOSPITALIZATIONS RELATED TO MATERNAL SUBSTANCE USE, MS, 2016-2020  
PROPORTION OF ALL NEONATAL HOSPITALIZATIONS



During the 2016-2020 period, the overall number of hospitalizations related to maternal drug use was highest in metropolitan areas (Figure 11). When analyzed by county of residence, the following counties had the highest proportion of neonatal hospitalizations related to maternal substance use: Pike (5.6%), Jefferson Davis (5.1%), Alcorn (4.6%), Benton (4.5%), Hancock (4.1%), Grenada (4.0%), Walthall (3.9%), Prentiss (3.8%), Pontotoc, 3.7%, Marion (3.6%), Smith (3.6%), Sharkey (3.6%), Sharkey (3.6%), Tishomingo (3.5%), Harrison (3.5%), Washington (3.1%), Lee (3.1%), Jones (3.0%), Coahoma (3.0%), Forrest (2.9%), and Simpson (2.8%). Presented in the map are all counties grouped by quartiles.

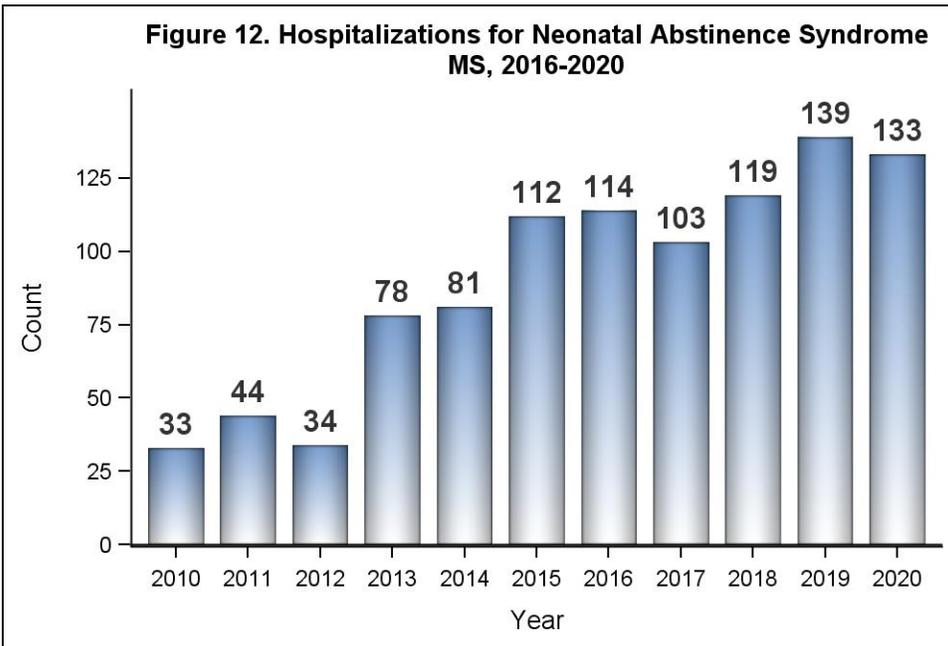


# NEONATAL ABSTINENCE SYNDROME



**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.<sup>1</sup>

**Findings:** The overall trend in neonatal abstinence syndrome was upward during the study period; however, there were several fluctuations: between 2011 and 2012; between 2016 and 2017; and between 2019 and 2020 (Figure 12). During 2020, on average, a baby suffering from drug withdrawal was born every two and a half days in Mississippi – a total of 133 newborns. This was a small decline from the previous year.



**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.<sup>2</sup> 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

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## 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](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](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.<sup>3</sup>
- ❑ 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.<sup>4</sup>

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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.<sup>5</sup> This report presents data since 2010; however, for some of the analyses, we used only the data for 2016-2020 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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