



MISSISSIPPI STATE DEPARTMENT OF HEALTH

**COVID-19 and Neonatal
Hospitalizations
Related to Maternal Substance Use in
Mississippi: An Escalating Crisis**

10/12/2022

DATA FOR ACTION



In addition to providing accurate and timely data, the Mississippi State Department of Health (MSDH) is dedicated to generating innovative public health policies, preventing detrimental health outcomes, and improving the well-being of our most vulnerable populations. For several years, MSDH has produced annual reports discussing the harmful impact of maternal substance use on newborns. Yet, levels of such use remain stubbornly high. The lack of preventive measures and policy action has resulted in a continuous increase in neonatal hospitalizations related to maternal substance use. In particular, the COVID-19 pandemic fueled a surge in such admissions. This report is a call for urgent action to reverse this alarming trend. Mississippi's medical community, public health structures, policy makers, NGOs, and faith communities need to create an action plan to address maternal drug use, reduce prenatal substance exposure, and improve health outcomes for infants. A statewide collaborative initiative is needed to establish the framework for future action and incorporate examples of successful national and state-level policies.

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 use or medication-assisted treatment during pregnancy, other prescription or illicit substances may cause symptoms of withdrawal in exposed infants. The 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. In addition to ongoing surveillance, this report examines the impact of COVID-19 on neonatal hospitalizations with prenatal exposure.

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.

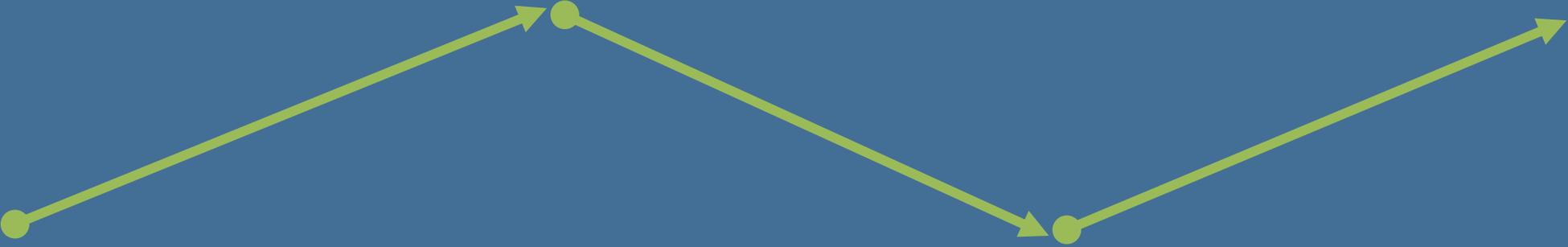
Methods: This is a retrospective analysis of inpatient hospital stays for state resident and non-resident newborns. Presented in the report are the numbers and evolving trends in neonatal (0-28 days) hospitalizations associated with maternal substance use from 2010 through 2021. In addition, we evaluated the demographic and comorbid characteristics, hospital charges, and length of stay for substance-related neonatal stays that occurred during the 2016-2021 period. 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 1,222 in 2021.
- ❑ Between 2020 and 2021, the number of such hospitalizations increased by 25%, jumping from 982 in 2020 to 1,222 in 2021. This is a little studied and underappreciated consequence of the increase in substance abuse by alienated and anxious pregnant women during the height of the COVID pandemic.
- ❑ Between 2016 and 2021, comorbidities were highly prevalent among infant stays related to maternal substance exposure: 26% were born prematurely, 26% had a coexisting low birth weight, 25% had coexisting respiratory conditions, and 14% had a coexisting congenital disease.
- ❑ In 2021, the overwhelming majority of infants impacted by maternal substance use were more likely to be poor. Among the 1,222 such hospitalizations, 89% (1,085) were covered by Medicaid and 7% (80) were uninsured.
- ❑ Total charges for these hospital stays more than doubled over this six-year period, increasing from \$19,936,930 in 2016 to \$42,592,517 in 2021, totaling over \$176 million between 2016 and 2021.

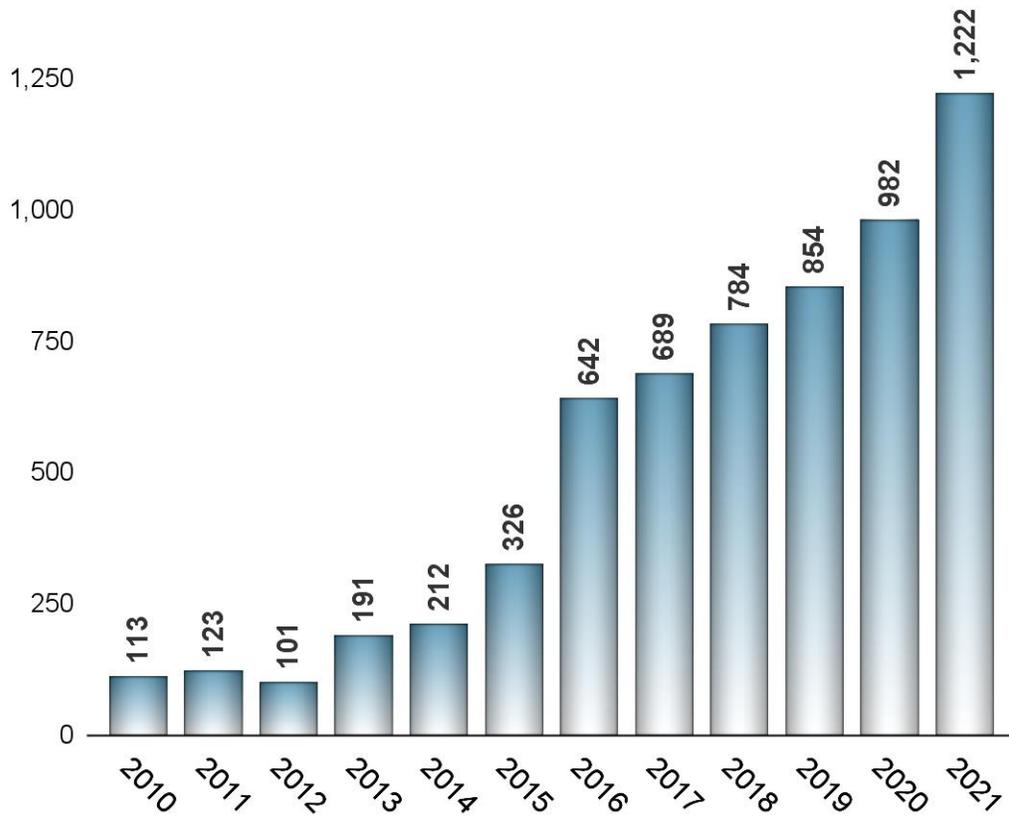
TREND ANALYSIS



OVERALL



Figure 1. Neonatal Hospitalizations Related to Maternal Substance Use, MS, 2010-2021



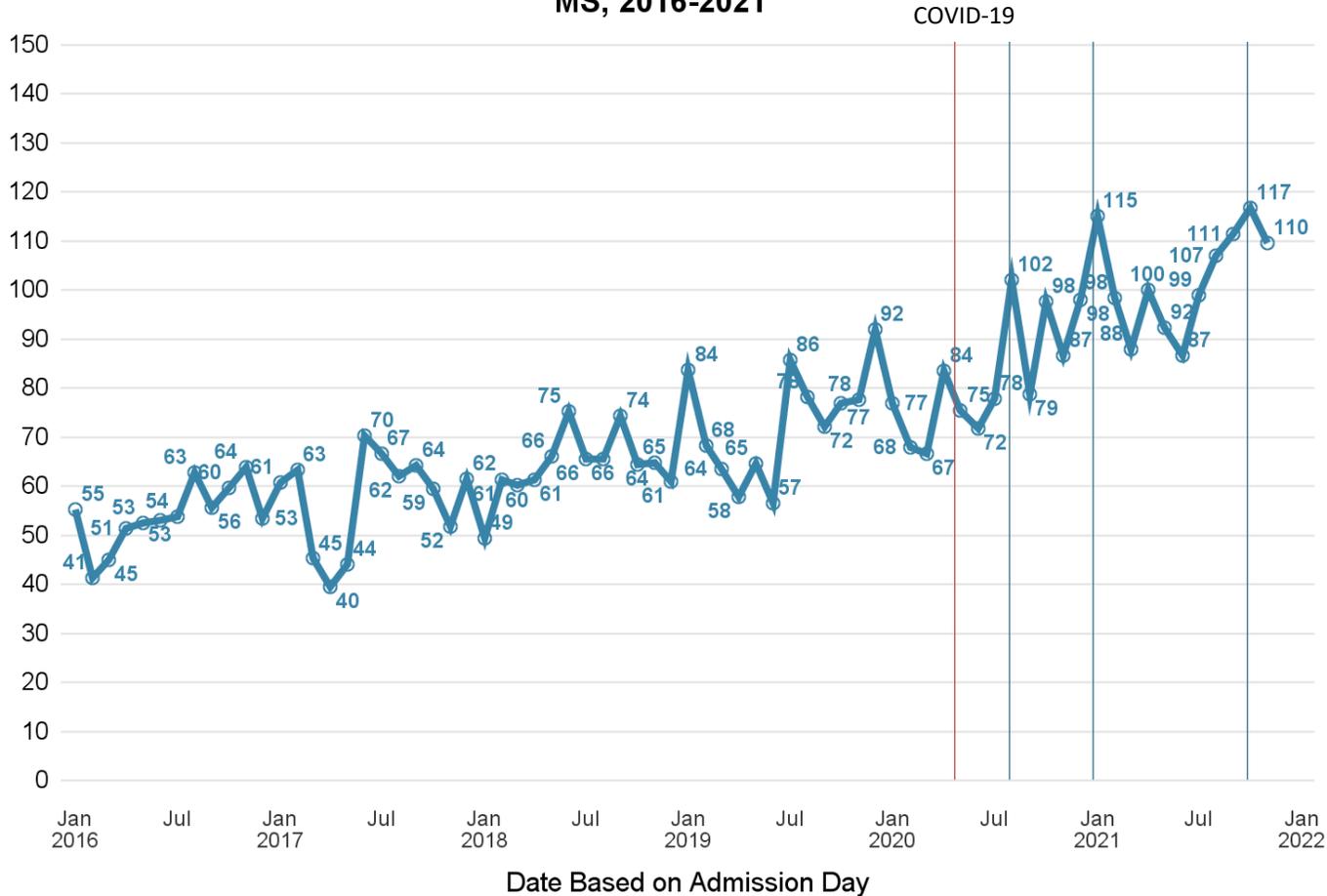
The number of newborn hospitalizations due to intrauterine substance exposure increased sharply, from 113 infants in 2010 to 1,222 infants in 2021 (Figure 1). As shown in Figure 1, there were two noticeable spikes between 2010 and 2021. There was a substantial increase in such hospitalizations between 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 the COVID-19 pandemic years, there was a second spike. Neonatal hospitalizations related to prenatal substance exposure jumped from 982 in 2020 to 1,222 in 2021 – this represented a 24.5% increase.

How can we stop this crisis from escalating?

TREND DURING COVID-19

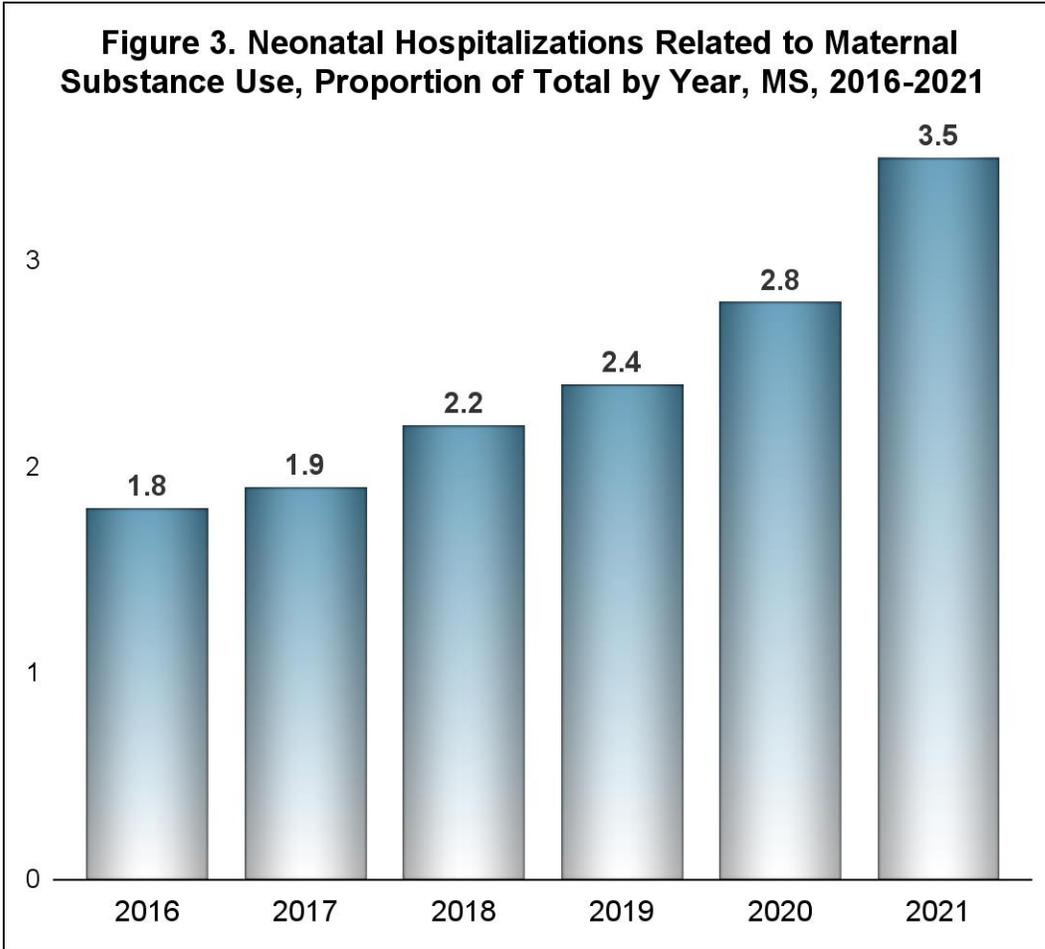


Figure 2. Neonatal Hospitalizations Related to Maternal Substance Use, Monthly Total, MS, 2016-2021



Even before the COVID-19 pandemic, neonatal hospitalizations related to maternal substance use were trending upward in our state. During the pandemic’s first months, such admissions remained relatively stable. Following this initial period of stability, however, there were three spikes in neonatal admissions related to maternal substance use. The state’s first spike was noted in August 2020 and coincided with the end of the second wave of COVID-19. The second spike occurred during the last phase of the third COVID-19 wave in the winter of 2020-2021. Mississippi’s last spike was in October 2021, shortly after the Delta wave subsided. The strong temporal relationship between these COVID-19 surges and increases in neonatal admissions with prenatal substance exposure provides evidence of the pandemic’s detrimental impact on maternal substance use.

PROPORTION OF TOTAL



Proportional Analysis: Between 2016 and 2021, neonatal hospitalizations related to maternal substance use in Mississippi accounted for 2.4% of all neonatal hospital stays. During the first four years of this period, the proportion of neonatal hospitalizations with prenatal substance use increased gradually, from 1.8% in 2016 to 2.4% in 2019. During the COVID-19 pandemic, however, the proportion of such admissions jumped from 2.4 in 2019 to 2.8% in 2020 and 3.5% in 2021. This analysis offers more evidence of COVID-19's negative impact on maternal substance use.

TYPES OF DRUGS



During 2021, nearly half (46%) of the drugs involved in newborn hospitalizations affected by maternal substance abuse were unspecified (Table 1). This high percentage of unknown drugs is concerning because the short and long treatment approaches could be most effective if the used substance is known. The proportion of hospitalizations with maternal cannabis use was also alarming – 42% of all neonatal hospitalizations with prenatal substance exposure had such a diagnosis in 2021. By comparison, this percentage was 37% in 2020 and 30% in 2019. Neonatal abstinence syndrome, caused by severe intrauterine drug exposure, was documented in 12% or 152 hospitalizations. Among admissions with specified drugs, only the proportion of opioid-related hospitalizations declined between 2019 and 2021. The greatest increase in such admissions was noted for maternal use of cannabis (a 101% increase) and amphetamines (a 95% increase).

Type of Drug	Year (Number and Percentage of Total)			Absolute Change, 2019-2021	Percent Change, 2019-2021
	2019 N = 854	2020 N = 982	2021 N = 1,222		
Unknown	403 (47%)	490 (50%)	563 (46%)	160	+40%
Cannabis	255 (30%)	360 (37%)	513 (42%)	258	+101%
Cocaine	58 (7%)	58 (6%)	72 (6%)	14	+24%
Opiates	54 (6%)	32 (3%)	40 (3%)	-14	-26%
Amphetamines (stimulants)	41 (5%)	53 (5%)	80 (7%)	39	+95%
Neonatal withdrawal syndrome	139 (16%)	133 (14%)	152 (12%)	13	+9%

Note: Some hospitalizations have more than one substance-related diagnostic code. Therefore, the sum of hospitalizations by drug categories exceeds the total number for each year.

THE IMPACT OF COVID-19



Aside from exacerbating some of the existing problems, the COVID-19 pandemic created new challenges for pregnant women suffering from substance use disorder. Medication-assisted treatment, behavioral therapies, and social support for pregnant patients with substance use disorder were already limited before the pandemic.¹ Nationwide, for example, only 23 percent of all substance-use treatment facilities in 2018 had programs for pregnant and postpartum women.² Access to such services, however, only worsened during the pandemic as telemedicine replaced in-person visits for substance use disorder treatment.³ While beneficial for patients suffering from opioid use disorder, telemedicine was difficult to implement in remote rural areas.⁴ Besides creating further barriers to treatment, the COVID-19 pandemic also disrupted prenatal care for many pregnant patients. Due to social distancing, direct interaction between providers and patients declined, reducing the opportunities for screening, diagnosis, and treatment of substance use disorder among pregnant patients. In addition to sudden changes in medical care, pregnant women faced a plethora of unprecedented social and family hurdles, especially at the beginning of the pandemic. Social isolation, fear of infection, loss of employment, economic uncertainty, and day care/school closures increased the level of stress and anxiety among pregnant women.⁵ Troublingly, domestic abuse spiked worldwide, a phenomenon labeled as “a pandemic within a pandemic.”⁶ Unsurprisingly, such stressors enhanced the risk for substance use among pregnant women as a coping mechanism during this unprecedented time.

PUBLIC HEALTH RESPONSE



During the COVID-19 pandemic, Mississippi's limited public health resources were channeled towards containing the spread of this deadly virus. Nonetheless, maternal and child health remained a top public health priority for the Mississippi State Department of Health. Throughout the pandemic, the agency continued its ongoing surveillance of neonatal hospitalizations related to substance use and warned the public about a sudden increase in such admissions during 2020.⁷ Identifying the problem and monitoring trends is not enough, however. Public health structures also have the difficult task of designing and implementing data-driven interventions. During the last several years, our state has created robust drug misuse prevention programs. This report highlights the need for tailored public health interventions that target substance abuse among pregnant women specifically.

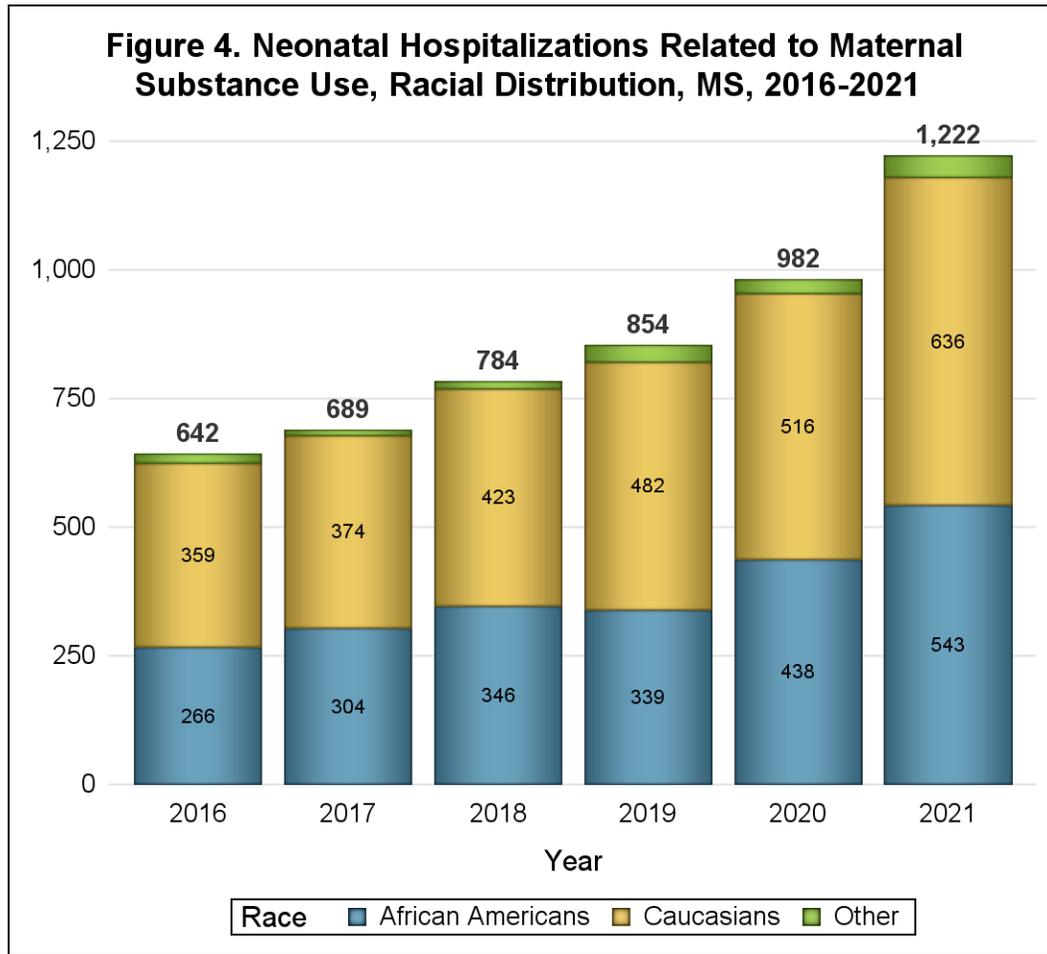


DEMOGRAPHICS,
RESOURCE UTILIZATION,
AND
COMORBIDITIES

DEMOGRAPHICS



Figure 4. Neonatal Hospitalizations Related to Maternal Substance Use, Racial Distribution, MS, 2016-2021



During the 2016-2021 period, of the 5,173 neonatal hospitalizations with prenatal exposure, 5,035 (97.3%) were among Mississippi residents. Compared to African American newborns (2,236 or 43.2%) and newborns from other racial groups (147 or 2.8%), white newborns accounted for more infant hospitalizations related to maternal substance use (2,790 or 54.0%). 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: 2.7% of all white newborns and 2.5% of all African Americans newborns had complications related to maternal substance use during the 2016-2021 period. Females (2,522 or 48.8%) and males (2,648 or 51.2%) were similarly affected (the sex of three infant was unknown). In terms of age, most of the infants (4,965 96.0%) were diagnosed during the day of their birth.

SOCIOECONOMIC STATUS



During 2021 the vast majority (88.8%) of neonatal hospitalizations related to maternal substance use were covered by Medicaid and 6.5% were self-pay (Figure 5 and Table 2). These findings indicate that nearly all infants impacted by maternal substance use were born in low-income households. By comparison, Medicaid hospitalizations accounted for 65.1% of all other neonatal hospitalizations and self-pay hospitalizations for 5.0% of all other neonatal hospitalizations in 2021.

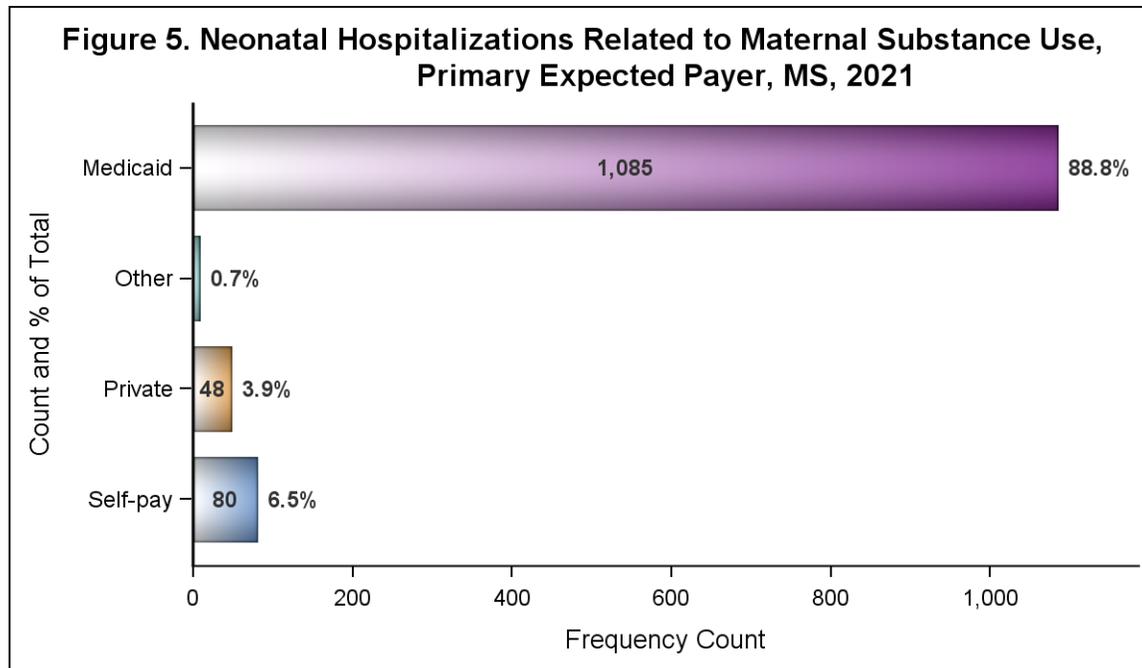


Table 2. Neonatal Hospitalizations Related to Maternal Drug Use: Total Charges per Primary Expected Payer, Mississippi, 2019

Payer	All	Mean	Sum
Medicaid	1,085	\$35,973.80	\$39,031,551
Self-pay	80	\$30,874.00	\$2,469,922
Private	48	\$19,744.70	\$947,748
Other	9	\$15,921.70	\$143,295
All	1,222	\$34,854.80	\$42,592,517

LENGTH OF STAY AND CHARGES



Between 2016 and 2021, 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: 8.4 days compared to 3.8 (Figure 6). During the same time, the mean charges of \$34,034 for neonatal stays related to maternal substance use were more than two times higher than the mean charges of \$14,024 for all other neonatal stays (Figure 7). In addition, the total charges more than doubled from \$19,936,930 in 2016 to \$42,593,517 in 2021, totaling over \$176 million for the six-year period (Table 3). Of the 176 million, 156 million were (88.6%) Medicaid charges.

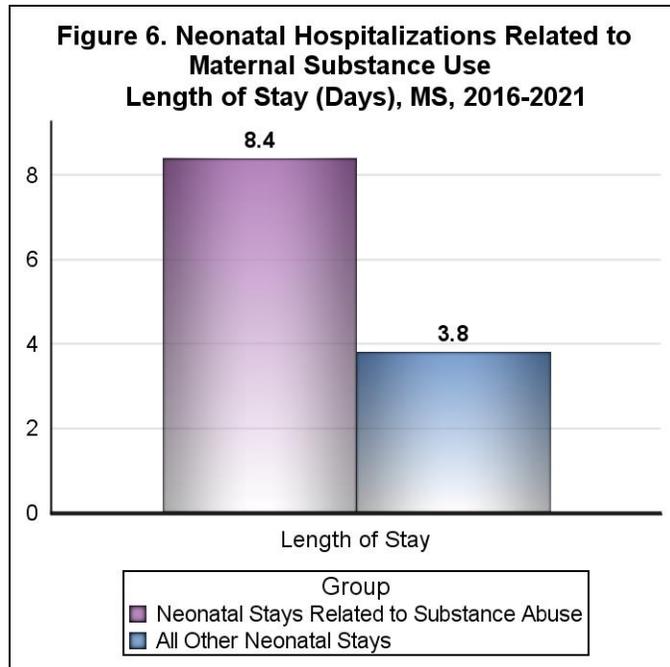
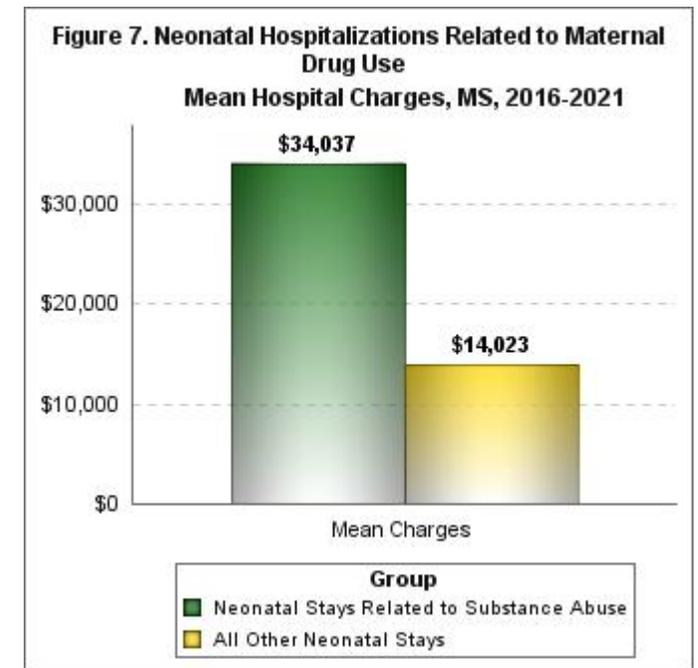


Table 3. Neonatal Hospitalizations Related to Maternal Drug Use: Total Charges per Year, Mississippi 2016-2021

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
2021	1,222	\$34,855	\$42,593,517



COMORBIDITIES



Neonatal hospitalizations related to maternal substance use were assessed for comorbidities for the 2016-2021 period. Newborns affected by maternal substance use were more likely to be born prematurely (25.7% vs. 12.5%) compared to all other newborns. Such infants were also more likely to have low birth weight (25.7% versus 10.6%), respiratory complications (25.3% versus 11.2%), congenital diseases (14.0% versus 9.6%), feeding difficulties (9.4% versus 3.2%), and congenital bacterial sepsis (4.0% vs. 1.5%). These differences were statistically significant at $p < .001$. Seizures, a hallmark sign of neonatal withdrawal, were recorded in 41 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, 2016-2021

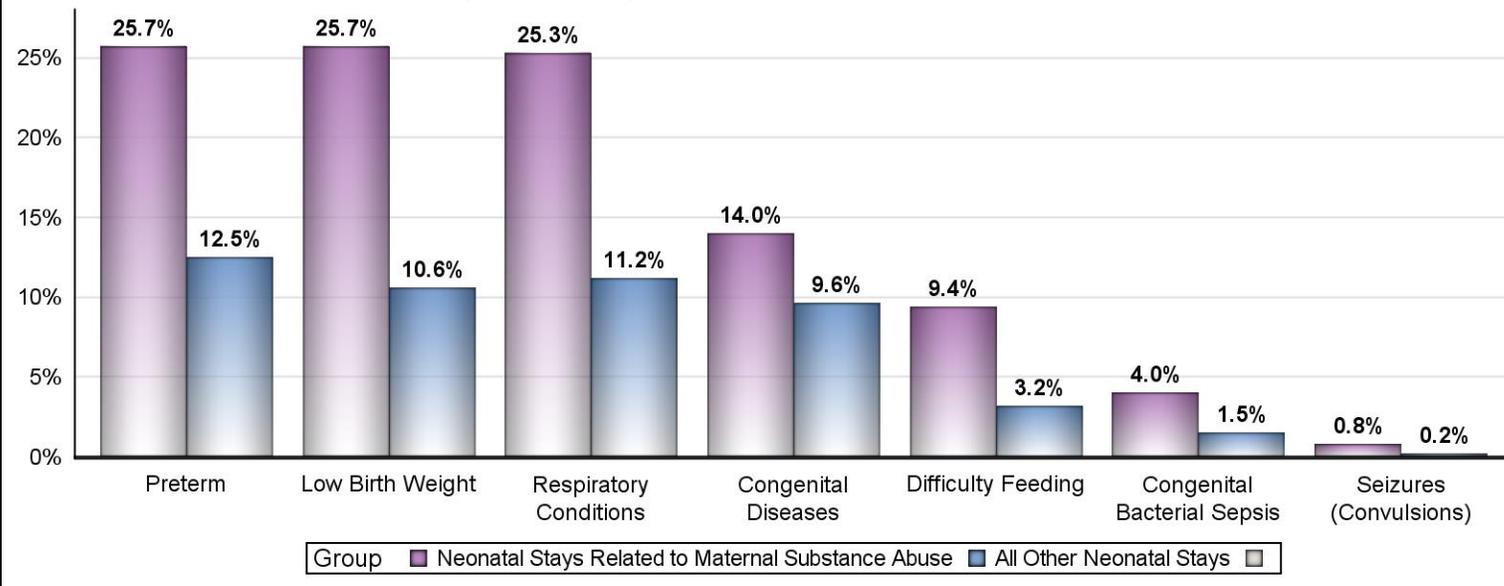


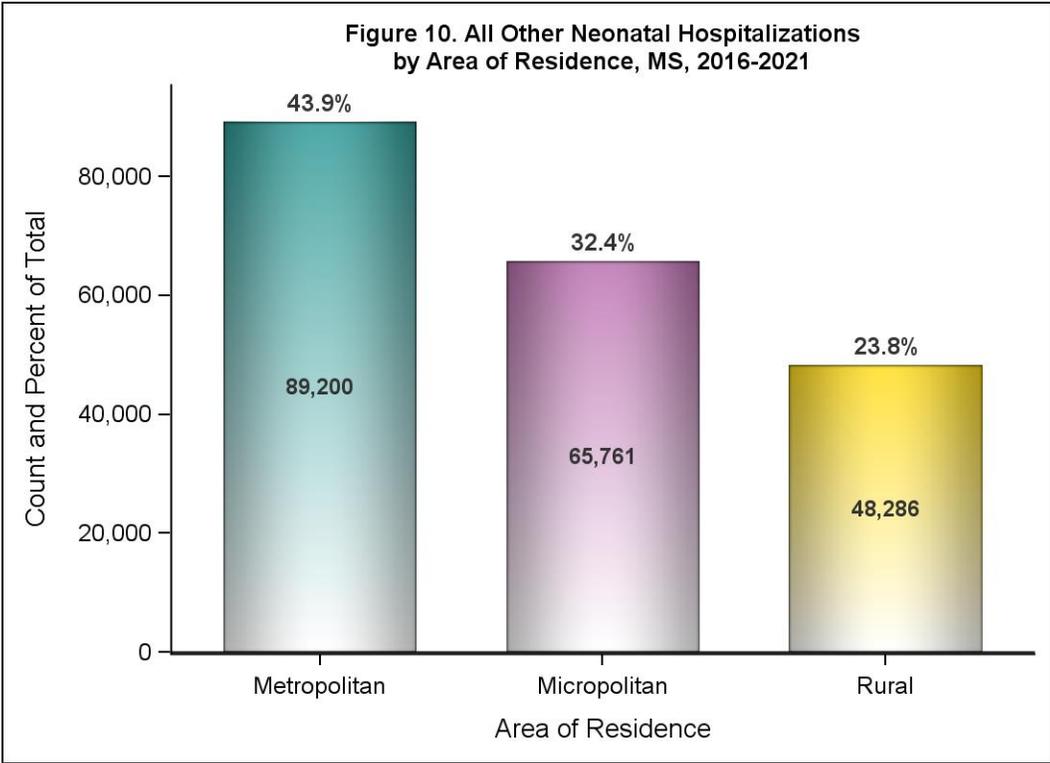
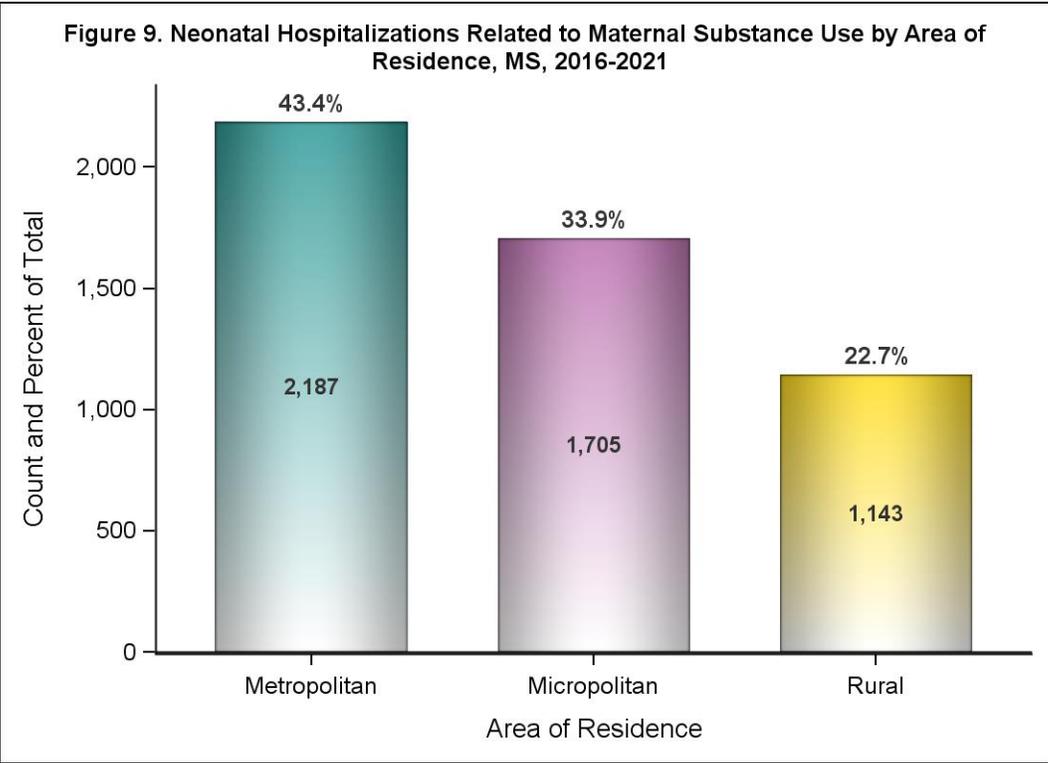
Table 4. Neonatal Hospitalizations and Associated Comorbidities in MS: Combined Data for 2016-2021

Conditions	Number	Percent
Preterm	1,331	25.7%
Low Birth Weight	1,329	25.3%
Respiratory Conditions	1,306	25.2%
Congenital Diseases	723	14.0%
Difficulty Feeding	487	9.4%
Congenital Bacterial Sepsis	209	4.0%
Seizures (convulsions)	41	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.

GEOGRAPHIC DISTRIBUTION

During the 2016-2021 period, the overall number of hospitalizations related to maternal drug use was highest in metropolitan areas (Figure 9). The distribution of neonatal hospitalizations with and without substance exposure was similar, however (Figure 10). When analyzed by county of residence, the following counties had the highest proportion of neonatal hospitalizations related to maternal substance use: Harrison (11.0%), Hinds (9.6%), Lee (4.2%), Jackson (3.8%), Jones (3.5%), and Forrest (3.5%).

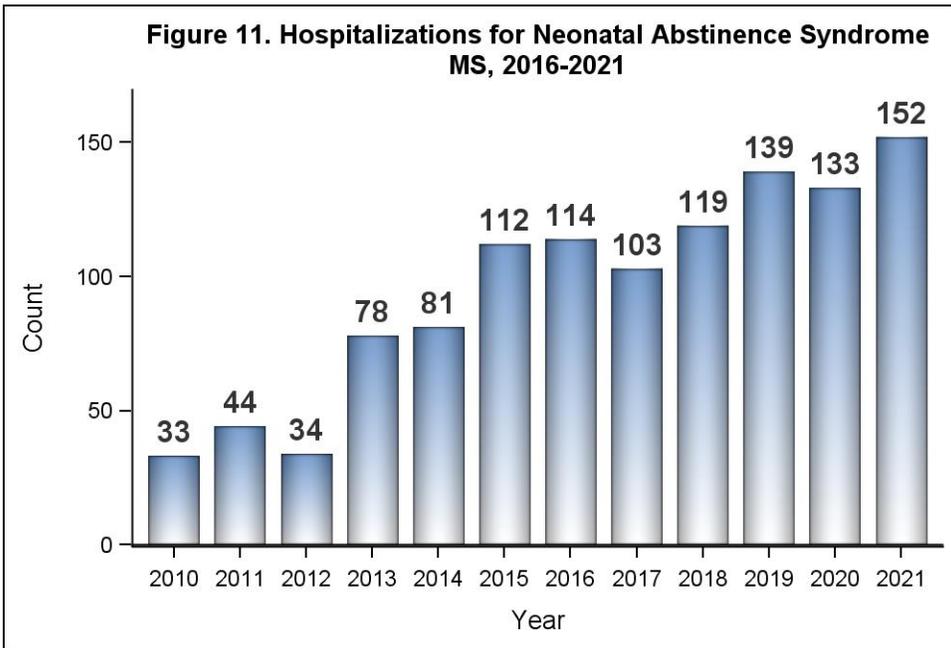


NEONATAL ABSTINENCE SYNDROME



What is Neonatal Abstinence Syndrome? The neonatal abstinence syndrome (NAS) 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.⁸

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 2021 (Figure 11). During 2021, on average, a baby suffering from drug withdrawal was born every two and a half days in Mississippi – a total of 152 newborns. Compared to 2020, there were 19 more newborns with NAS in 2021.



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.⁹ 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.

Healthy Moms/Healthy Babies (HM/HB) 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.¹⁰
- ❑ 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.¹¹

NOTES AND ACKNOWLEDGMENTS

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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 most of the analyses, we used only the data for 2016-2021 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 the analysis of residence status only discharges among Mississippi residents were used; otherwise, analyses included residents and non-residents.

REFERENCES



1. Atkins D N. and Durrance CP. "COVID-19 Converges With The Opioid Epidemic: Challenges For Pregnant And Postpartum Women With Opioid Use Disorder", Health Affairs Blog, February 19, 2021. DOI: 10.1377/hblog20210218.847791.
2. Angélica Meinhofer, Jesse M. Hinde, Mir M. Ali, Substance use disorder treatment services for pregnant and postpartum women in residential and outpatient settings, *Journal of Substance Abuse Treatment*, Volume 110, 2020, Pages 9-17, ISSN 0740-5472, <https://doi.org/10.1016/j.jsat.2019.12.005>.
3. Drug Enforcement Agency (DEA): DEA/SAMHSA buprenorphine telemedicine. March 31, 2020. [https:// www.deadiversion.usdoj.gov/GDP/\(DEA-DC-022\)](https://www.deadiversion.usdoj.gov/GDP/(DEA-DC-022)).
4. Chen J, Amaize A, Barath D. Evaluating Telehealth Adoption and Related Barriers Among Hospitals Located in Rural and Urban Areas. *J Rural Health*. 2021 Sep;37(4):801-811. doi: 10.1111/jrh.12534. Epub 2020 Nov 12. PMID: 33180363; PMCID: PMC8202816.
5. Smith, C. L., Waters, S. F., Spellacy, D., Burduli, E., Brooks, O., Carty, C. L., Ranjo, S., Mcpherson, S., & Barbosa-Leiker, C. (2021). Substance use and mental health in pregnant women during the COVID-19 pandemic. *Journal of Reproductive and Infant Psychology*, 1–14. <https://doi.org/10.1080/02646838.2021.1916815>
6. Evans ML, Lindauer M, Farrell ME. A Pandemic within a Pandemic - Intimate Partner Violence during Covid-19. *N Engl J Med*. 2020 Dec 10;383(24):2302-2304. doi: 10.1056/NEJMp2024046. Epub 2020 Sep 16. PMID: 32937063.
7. Mississippi State Department of Health. Neonatal Hospitalizations Related to Maternal Substance Use in Mississippi. Surveillance Report. 06/15/2021. Accessed on 09/15/2022 at https://msdh.ms.gov/msdhsite/_static/resources/15101.pdf.
8. Hudak ML, Tan RC. Neonatal Drug Withdrawal. *Pediatrics*. 2012;129 (2): e540-60. doi: 10.1542/peds.2011-3212.
9. Prabhakar Kocherlakota. Neonatal Abstinence Syndrome. *Pediatrics* Aug 2014, 134 (2) e547-e561; DOI: 10.1542/peds.2013-3524
10. Jumah NA, Graves L, Kahan M. The management of opioid dependence during pregnancy in rural and remote settings. *CMAJ*. 2015;187(1):E41–E46. doi:10.1503/cmaj.131723.
11. Stone R. Pregnant women and substance use: fear, stigma, and barriers to care. *Health Justice*. 2015;3:2. Published 2015 Feb 12. doi:10.1186/s40352-015-0015-5.
12. NCHS Urban-Rural Classification Scheme for Counties. National Center for Health Statistics. *Vital Health Stat* 2(166). 2014.