



08/25/2022

Epidemiological Brief

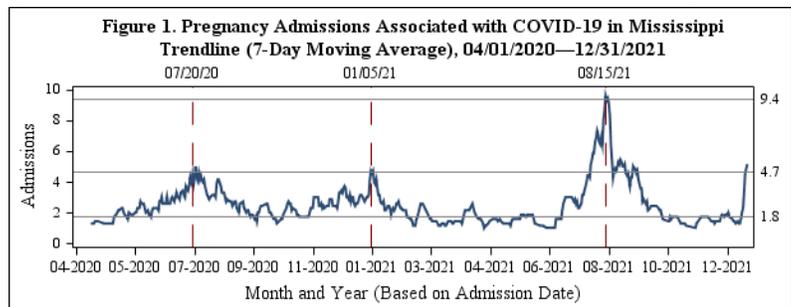
KEY FINDINGS

Between April 2020 and December 2021, there were 1,273 hospitalizations in Mississippi with coexisting diagnoses for pregnancy and COVID-19. Compared to all other pregnancy hospitalizations, those with COVID-19 had an increased comorbidity burden, longer length of stay, and higher hospital charges. In-hospital mortality among pregnant patients with COVID-19 was high. During the study period, 16 out of all 24 maternal in-hospital deaths had a COVID-19 diagnosis. The proportion of stillbirths was twice as high among the COVID-19 cohort compared to the non-COVID-19 cohort.

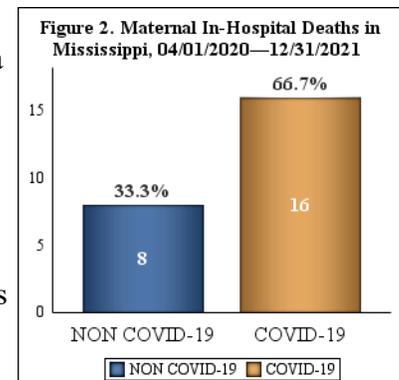
Goals and Data: We evaluated the epidemiology of in-state pregnancy-related hospitalizations with COVID-19 during the April 2020—December 2021 period. We also described the demographic and comorbidity characteristics of these admissions. The study included hospital discharge data from all non-federal hospitals in the state. These data have information on demographics, diagnoses, procedures, and resource utilization. We selected pregnancy admissions with a primary or secondary COVID-19 diagnosis.

Overview: Between April 2020 and December 2021, there were 1,273 hospitalizations in Mississippi with coexisting diagnoses for pregnancy and COVID-19. This number represented 2.1% of all pregnancy hospitalizations but such admissions reached 3.9% during the Delta wave. The vast majority (995 or 78.1%) of all admissions with coexisting pregnancy and COVID-19 were encounters for delivery.

Trendline: During the study period, there were three noticeable surges (Figure 1). The first surge occurred during the second COVID-19 wave in the summer of 2020; the second surge peaked in early January 2021; and the third surge (Delta) crested in mid-August 2021. Nearly one third (366 or 28.8%) of all pregnancy hospitalizations associated with COVID-19 occurred during the Delta wave (07/01/21-09/30/21). Compared to previous waves, the Delta wave was twice as high, reaching at its peak 9.4 pregnancy admissions per day. In the two waves before Delta, the maximum number of admissions reached only 4.7 per day. Between surges, by contrast, there were 1.8 admissions per day on average.

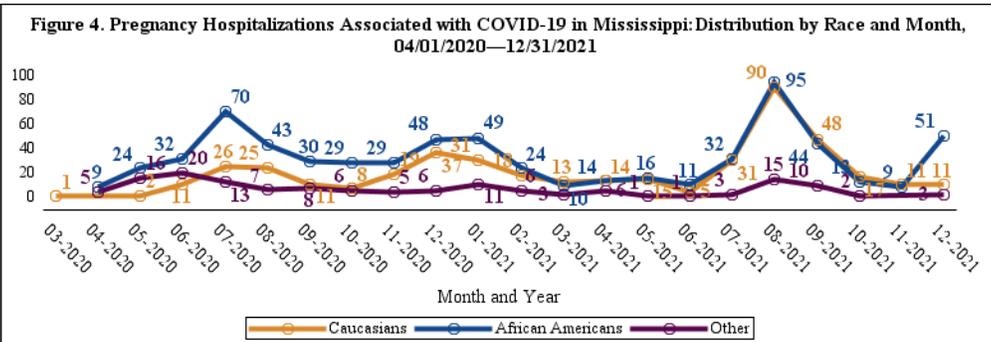
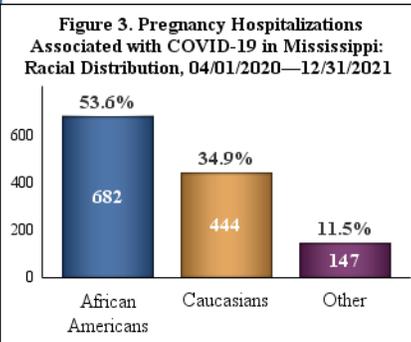


Maternal Deaths: There were 24 maternal deaths during the study period; of them 16 (66.7%) had a coexisting COVID-19 diagnosis (Figure 2). The majority of the COVID-19-associated maternal deaths (10 or 62.5%) occurred during the Delta wave. Among the 16 fatalities with a COVID-19 diagnosis, 9 (56.3%) were African Americans and 10 (62.5%) were rural residents. Ten of these patients (62.5%) were insured by Medicaid and 2 (12.5%) were self-pay. Deceased patients with COVID-19 were younger than those without such a diagnosis (31 years vs. 33 years).



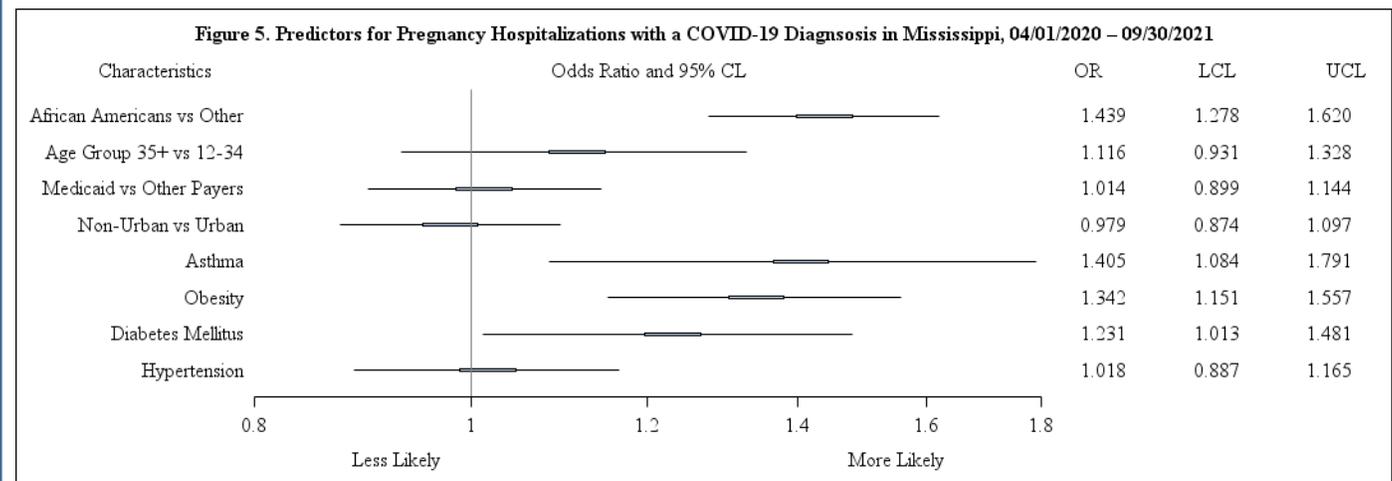
Comorbidity and COVID-19 Maternal Deaths: Pregnant COVID-19 patients who died while hospitalized had a high occurrence of obesity (11 patients or 68.8%) and hypertensive disorder (9 patients or 56.3%). Diabetes was recorded in four of the deceased patients (25.0%). All 16 deceased patients had fluid/electrolyte disorder, 13 (81.3%) had a diagnosis for pneumonia, and 9 (56.3%) had sepsis. These findings demonstrate the high prevalence of acute complications in the COVID-19 study group.

Demographics: On average, pregnant patients with a COVID-19 diagnosis were the same age (27 years) compared to patients without such a diagnosis (Table 1, Page 3). African Americans accounted for 53.6% of all pregnancy hospitalizations associated with COVID-19 (Figure 3). This racial gap started to close during the Delta wave, however (Figures 4). African Americans accounted for 64.2% of all COVID-19 ED visits during July 2020 but for only 47.5% of such encounters during August 2021. This trend started to reverse, again, in December 2021. In terms of residence, COVID-19 pregnancy hospitalizations were more prevalent among non-urban residents than urban residents (54.9% vs. 45.1%) and this proportion remained stable throughout the time frame studied (data not shown).



Pre-existing health challenges: Although this was not a primary goal of our study, we identified that Mississippi’s pregnancy hospitalizations were associated with a high rate of hypertension. For example, among the 63,296 pregnancy hospitalizations studied, 13,784 (21.8%) had a recorded hypertensive disorder (chronic hypertension, preeclampsia-eclampsia, preeclampsia superimposed on chronic hypertension, and gestational hypertension). The prevalence of hypertensive disorder was especially high among African American women: one quarter (25.3%) of all pregnancy admissions among the African American cohort had hypertension vs. 19.6% among the Caucasian cohort. Although the rates of diabetes mellitus were not as high, this chronic disease was noted in 5,092 (8.0%) of all pregnancy hospitalizations. Unlike hypertension, the prevalence of diabetes mellitus was similar for African American and Caucasian pregnancy hospitalizations (8.0% vs. 7.7%).

Comparative Analysis: The overall comorbidity burden as measured by the Charlson Comorbidity Index was higher for COVID-19 pregnancy hospitalizations. Detailed information on chronic comorbidities is presented in Table 1 (Page 3). Compared to all other pregnancy hospitalizations, those with COVID-19 had higher proportions of hypertensive disorder (24.0% vs. 21.7%, $p = 0.057$) and diabetes mellitus (10.4% vs. 8.0%, $p = 0.002$). To further identify risk factors for COVID-19-associated pregnancy hospitalizations, we constructed a multivariable regression model. Covariates included in the model were demographics and major chronic risk factors for COVID-19 complications. The findings are presented in Figure 5. The multivariable regression model suggested that the strongest risk factors for pregnancy hospitalizations associated with COVID-19 were African American race (OR, 1.44% CI, 1.28-1.62), asthma (OR, 1.41 95% CI, 1.08-1.79), obesity (OR, 1.34 95% CI, 1.15-1.56), and diabetes (OR, 1.23 95% CI, 1.01-1.48).



Acute Complications and Outcomes: Compared to all other pregnancy hospitalizations, those with a COVID-19 diagnoses were more likely to have fluid/electrolyte disorders suggestive of dehydration (20.3% vs. 0.3%, $p < .001$) and pneumonia (12.6% vs. 1.5%, $p < .001$). Admissions to intensive care units (ICU) were more common among pregnant patients with COVID-19 than for those without COVID-19 (8.4% vs. 0.6%, $p < .001$). In fact, the odds ratio for ICU admissions among pregnant COVID-19 patients was 14.33 (95% CI, 11.733-17.99) after adjusting for demographics and chronic comorbidities.

Table 1. Sociodemographic characteristics, comorbidities, acute complications, and outcomes

Variable	COVID-19		Non-COVID-19		P value
	Number	Percent	Number	Percent	
Total					
Age, years, mean	26.9		27.0		0.524
Age					
12-24 years	483	37.9	22,486	36.3	0.087
25-34 years	639	50.2	32,963	53.2	
35-55 years	151	11.9	6,574	10.6	
Race					
African Americans	682	53.6	27,321	44.1	< 0.001
Caucasians	444	34.9	30,906	49.8	
Other	147	11.6	3,796	6.1	
Ethnicity					
Hispanic	113	8.9	2321	3.7	< 0.001
Non-Hispanic	1,140	89.6	58,644	94.6	
Other	20	1.6	1058	1.7	
Primary Expected Payer					
Medicaid	734	57.7	34,158	54.0	< 0.001
Private	401	31.5	24,125	38.1	
Self-pay	98	7.7	1,826	2.9	
Other	33	2.6	1,658	2.6	
Medicare	7	0.6	256	0.4	
Residence					
Urban Counties	561	45.1	26,833	44.6	0.731
Non-Urban Counties	682	54.9	33,274	55.4	
Hospital Size					
Large (300 beds or more)	740	58.13	29,204	47.09	< 0.001
Medium/Small (less than 300 beds)	533	41.87	32,819	52.91	
Charlson Comorbidity Index, mean, CI	0.13 (0.10-0.48)		0.07 (0.05-0.33)		< 0.001
Chronic Comorbidities					
Hypertension	305	24.0	13,479	21.7	0.057
Diabetes	132	10.4	4,960	8.0	0.002
Obesity	233	18.3	8252	13.3	< 0.001
Asthma	70	5.5	2233	3.6	< 0.001
Acute Complications					
Pneumonia	160	12.6	943	1.5	< 0.001
Fluid/electrolyte disorder	258	20.3	161	0.3	< 0.001
Disseminated intravascular coagulation	20	1.6	257	0.4	< 0.001
Severe Outcomes					
ICU Care	107	8.4	360	0.6	< 0.001
Mechanical ventilation	44	3.5	72	0.1	< 0.001
In-Hospital Mortality	16	1.3	8	0.01	< 0.001
Length of stay, days, mean	3.6		2.4		< 0.001
Total hospital charges, \$, mean	43,857		23,340		< 0.001

Stillbirths: A stillbirth is a fetal death occurring after 20 completed pregnancy weeks. In our data, there was a total of 654 stillbirths reported during the study period; of those 23 (3.5%) stillbirths were among the COVID-19 cohort. The percentage of stillbirths was 2.3% for the cohort of deliveries with a COVID-19 diagnosis and 1.1% for deliveries without a COVID-19 diagnosis.

Resource Utilization: Compared to pregnancy hospitalizations without a coexisting COVID-19 diagnosis, those with a COVID-19 diagnosis had longer length of stay (3.6 days vs. 2.4 days) and were nearly twice as expensive (\$43,857 vs. \$23,340). Pregnancy hospitalizations with COVID-19 were more prevalent among economically disadvantaged groups: such admissions were more likely to be covered by Medicaid (57.7% vs. 55.1%, $p < .001$) or to be uninsured (7.7% vs. 2.9%, $p < .001$) compared to all other pregnancy hospitalizations. Two thirds (832 or 65.4%) of all COVID-19-associated pregnancy hospitalizations were among those more likely to be low-income patients: 734 (57.7%) were covered by Medicaid and 98 (7.7%) were self-pay. The proportion of Medicaid patients was even higher among African Americans with 499 (73.2%) of COVID-19-associated hospitalizations among this racial group covered by this insurer.

Discussion: National-level research has identified that pregnant women suffering from COVID-19 are at increased risk for severe maternal morbidity, delivery-related complications, and mortality.^{1,2} In Mississippi, COVID-19-associated pregnancy hospitalizations had a high prevalence of chronic comorbidities, acute complications, and severe outcomes. Such patients were at increased risk for ICU admissions and mortality. For example, 16 out of all 24 maternal in-hospital deaths that occurred during the study period had a COVID-19 diagnosis. We also identified an increased rate of severe neonatal outcomes. In line with national trends, the proportion of stillbirths was higher among the COVID-19 cohort compared to the non-COVID-19 cohort.³ Our study further uncovered a disproportionate impact of COVID-19-related complications on African Americans. Being African American was the strongest predictor for COVID-19-associated hospitalizations. In addition, nearly two thirds of all hospitalizations with coexisting COVID-19 and pregnancy diagnoses were among low-income patients. Among pregnant African American patients with a COVID-19 diagnosis, 73% were insured by Medicaid: a finding demonstrating the intertwined nature of race, income, and poor health outcomes. Structural barriers such as discrimination, income, occupation, housing, and inadequate healthcare access have been recognized as driving forces for COVID-19-related complications among minority groups in the United States.^{4,5} In this regard, our study highlights the role of poverty, social marginalization, and inequality for severe outcomes among pregnant African American persons suffering from COVID-19 in Mississippi. To improve maternal health, the state needs to address ongoing social and racial injustices and take measures to reduce the high comorbidity burden among women in reproductive age. To prevent COVID-19-related maternal morbidity and mortality, the Mississippi State Department of Health recommends ongoing COVID-19 vaccination for all pregnant women in Mississippi.

Methodology Notes: To select COVID-19 cases, we used the following International Classification of Diseases (ICD-10-CM) diagnosis codes: U071 from April 1, 2020 and J1282, and M3581 from January 1, 2021 onward. The diagnostic and procedural codes used to select pregnancy- and delivery-related discharges, as well as codes used for analyzing comorbidities are available upon request due to the limited space in this brief. This study captures maternal deaths that occurred only in the hospital during pregnancy, delivery, and the immediate (i.e., acute) postpartum period (or at the time of hospital discharge). For analysis of stillbirths, we excluded pregnancy hospitalizations with abortive outcomes, pregnancy with unknown gestation weeks, and pregnancy with less than 20 weeks of gestation. To categorize residence status, we applied the Urban-Rural Classification Scheme for Counties developed by the National Center for Health Statistics.⁶ For the analysis on residence status, we include only Mississippi residents (1,243 hospitalizations out of 1,273 hospitalizations).

References

1. Villar J, Ariff S, Gunier RB, et al. Maternal and Neonatal Morbidity and Mortality Among Pregnant Women With and Without COVID-19 Infection: The INTERCOVID Multinational Cohort Study. *JAMA Pediatr.* 2021;175(8):817–826. doi:10.1001/jamapediatrics.2021.10
2. Chmielewska B, Barratt I, Townsend R, et al. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. *Lancet Glob Health.* 2021;9(6):e759–e772. doi:10.1016/S2214-109X(21)00079-6
3. DeSisto CL, Wallace B, Simeone RM, et al. Risk for Stillbirth Among Women With and Without COVID-19 at Delivery Hospitalization — United States, March 2020–September 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70:1640–1645. DOI: <http://dx.doi.org/10.15585>.
4. Parolin Z and Lee EK. The Role of Poverty and Racial Discrimination in Exacerbating the Health Consequences of COVID-19, *The Lancet Regional Health - Americas*, Volume 7, 2022, 100178, ISSN 2667-193X, <https://doi.org/10.1016/j.lana.2021.100178>.
5. Health Equity Considerations and Racial and Ethnic Minority Groups Centers for Disease Control and Prevention. Accessed May 22, 2022. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html>.
6. NCHS Urban-Rural Classification Scheme for Counties. National Center for Health Statistics. *Vital Health Stat* 2(166). 2014.

Authors: Manuela Staneva, MPH (corresponding author); Thomas Dobbs, MD, MPH; and Paul Byers, MD