



9/14/2021

Epidemiological Brief

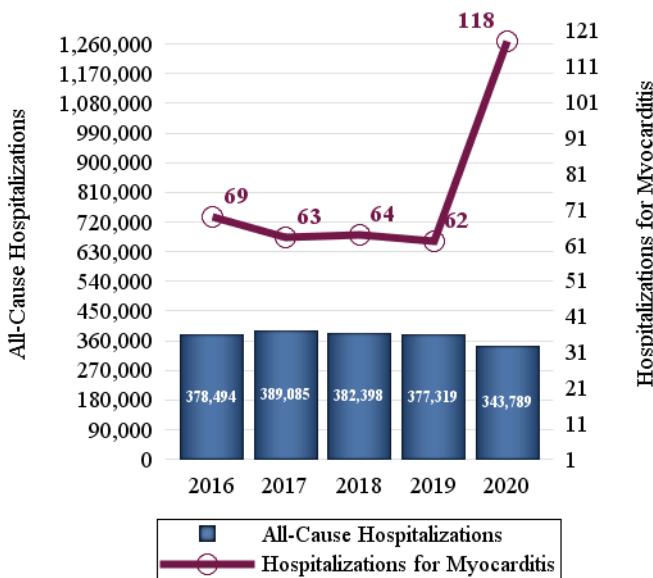
**Background:** Myocarditis is inflammation of the heart muscle that is usually triggered by viral infections.<sup>1</sup> Although relatively uncommon, myocarditis is a potentially fatal disease that has been occurring more frequently since the beginning of the COVID-19 pandemic. A growing body of evidence suggests a causal link between COVID-19 and increasing rates of myocarditis. For example, a recent CDC study estimated that patients with COVID-19 have 16 times the risk for developing myocarditis.<sup>2</sup>

**Objectives:** Our first objective was to look for trends in Mississippi's hospitalizations for myocarditis from 2016 through 2020. Next, we examined hospitalizations with coexisting diagnoses for COVID-19 and myocarditis during the first twelve months (04/01/2020-03/31/2021) of the pandemic in Mississippi. Data for this report were obtained from the statewide hospital discharge data system, which contains information on diagnoses, procedures, demographics, and hospital resource utilization from all non-federal hospitals. The report included data on hospitalizations from the inpatient hospital discharge data file.

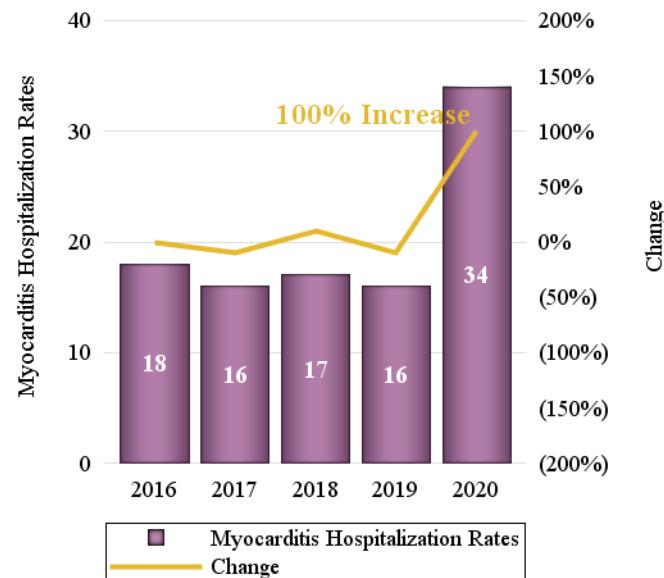
**Hospitalizations by Numbers and Rates:** Between 2016 and 2020, the total number of hospitalizations for myocarditis was 376. Before the COVID-19 pandemic, there were—on average—65 hospitalizations for myocarditis per year (Figure 1). As COVID-19 spread rapidly through the state, however, hospitalizations for myocarditis spiked. In 2020, for instance, there were 118 hospitalizations for myocarditis, which was a 82% increase compared to the average of 65 for the previous four years.

To account for variations in the annual number of hospital admissions, we calculated the proportion of myocarditis hospitalizations among all-cause hospitalizations (i.e., hospitalization rates). For the pre-COVID period (2016-2019), the average hospitalization rate was 17 myocarditis hospitalizations per 100,000 all-cause hospitalizations (Figure 2). In 2020, this hospitalization rate increased by 100%, doubling to 34 myocarditis hospital discharges per 100,000 all-cause hospitalizations. It is important to note that the mass COVID-19 vaccination campaign started in January 2021. Hence, the spike in acute myocarditis that occurred in 2020 was not related to COVID-19 vaccinations.

**FIGURE 1. HOSPITALIZATIONS FOR MYOCARDITIS PER ANNUM, MS, 2016-2020**



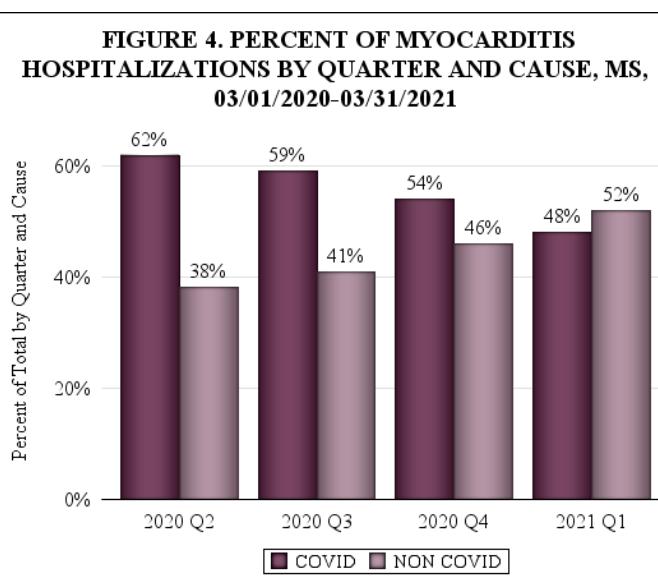
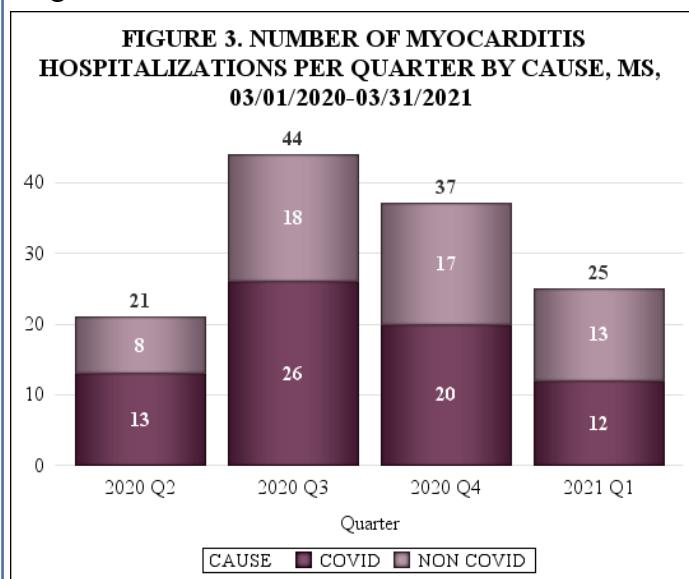
**FIGURE 2. MYOCARDITIS: RATES PER 100K HOSPITALIZATIONS, MS, 2016-2020**



**Myocarditis Hospitalizations in the COVID Era:** During the first twelve months of the pandemic (April 2020—March 2021), there were 127 hospitalizations for myocarditis in Mississippi; of these, 71 (56%) had a coexisting COVID-19 diagnosis. None of these 127 hospitalizations for myocarditis had a coexisting code for postvaccination adverse effect. During the same period, there were 23 in-hospital deaths among patients with myocarditis, with nearly all (22 out 23) of these deaths among patients with a COVID-19 diagnosis. This value reveals a high in-hospital mortality rate among patients hospitalized for COVID-19 and myocarditis. Almost one out of every three such hospitalizations (31%) had a fatal outcome.

On average, patients who had COVID-19-related myocarditis were older than those with myocarditis without a COVID-19 diagnosis (59 years vs. 39 years). In fact, patients older than 65 years accounted for 51% of all hospitalizations with myocarditis and COVID-19, but only for 11% of the hospitalizations for myocarditis without a coexisting COVID-19 diagnosis. Hospitalizations for COVID-19 and myocarditis were also more frequent among males (55%) and Caucasians (51%) than women (45%) and African Americans (41%) or other races (8%).

The highest number of COVID-19 related hospitalizations for myocarditis (26) were reported during the third quarter of 2020 (Figure 3). The proportion of COVID-19-related myocarditis, however, was greatest at the beginning of the pandemic. During the second quarter of 2020, 62% of all hospitalizations for myocarditis had a coexisting COVID-19 diagnosis (Figure 4). During the second half of 2020, the proportion of patients with COVID-19-related myocarditis started to decline. This trend reversed during the first quarter of 2021, when less than half (48%) of all hospitalizations for myocarditis had a COVID-19 diagnosis.



**Discussion:** Consistent with national research, our study demonstrated an increased prevalence of hospitalizations for myocarditis since the beginning of the COVID-19 pandemic in Mississippi. Such a temporal relationship is indicative of a causal relation between COVID-19 and increased hospitalizations for myocarditis in Mississippi. More importantly, the proportion of hospitalizations for COVID-19-related myocarditis started to decline during the first quarter of 2021. This finding suggests that Mississippi's COVID-19 vaccination campaign may have reduced the incidence of COVID-19-related myocarditis.

**Data and Methods:** All Mississippi hospitals, except for federal facilities, are required to report their hospital discharge data to the Inpatient Outpatient Data System. In addition to clinical diagnoses and procedures performed, these data contain information on patient demographics, expected payers, hospital charges, and length of stay. To select COVID-19 cases, we used the following International Classification of Diseases (ICD-10-CM) diagnosis codes: B97.29 and B34.2 before 1 April 2020 and U07.1 from 1 April 2020 onward. Myocarditis was identified by the ICD-10-CM codes: B33.20, B33.22, B33.24, I40.0, I40.1, I40.8, I40.9, or I51.4. Diagnostic codes for vaccine-related adverse effects: T50.B and T50.Z. We included in this study patients with primary and secondary diagnoses for COVID-19, myocarditis, and vaccine-related adverse effects.

#### References

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- Boehmer TK, Kompaniyets L, Laverty AM, et al. Association Between COVID-19 and Myocarditis Using Hospital-Based Administrative Data — United States, March 2020–January 2021. *MMWR Morb Mortal Wkly Rep* 2021;70:1228–1232.

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