

## COVID-19-Related Hospitalizations in 13 States, by Community-Level Income, 2020

### STATISTICAL BRIEF #273

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#### Introduction

This Healthcare Cost and Utilization Project (HCUP) Statistical Brief presents statistics on COVID-19-related hospitalizations using 2019 State Inpatient Databases (SID) and 2020 quarterly inpatient data from 13 States. Differences in monthly hospitalizations by community-level income from April to September 2020 are compared with the same months in the prior year. Community-level income is based on the median household income of the patient's ZIP Code of residence and is categorized by quartiles. Variation in utilization, average length of stay, and in-hospital mortality is illustrated. Because of the large sample size of the HCUP data, small differences can be statistically significant but not meaningful. Thus, only differences greater than or equal to 10 percent are discussed in the text.

This analysis is limited to discharges for patients treated in community, nonrehabilitation hospitals in 13 States (Colorado, Georgia, Iowa, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, New Jersey, Ohio, South Carolina, and Vermont) for which HCUP data were available for April–September 2019 and April–September 2020. These States account for 24.7 percent of the resident U.S. population in 2019.<sup>1,2</sup> All information contained in this Statistical Brief (except age-adjusted rates) can be found in the [HCUP Summary Trend Tables](#).<sup>3</sup> The Summary Trend Tables, accessed as downloadable tables, provide State-specific monthly trends in hospital utilization for the most recent HCUP data available. These tables will be updated as more quarterly data become available. The analysis in this Statistical Brief is based on data available as of March 2021.

#### Findings

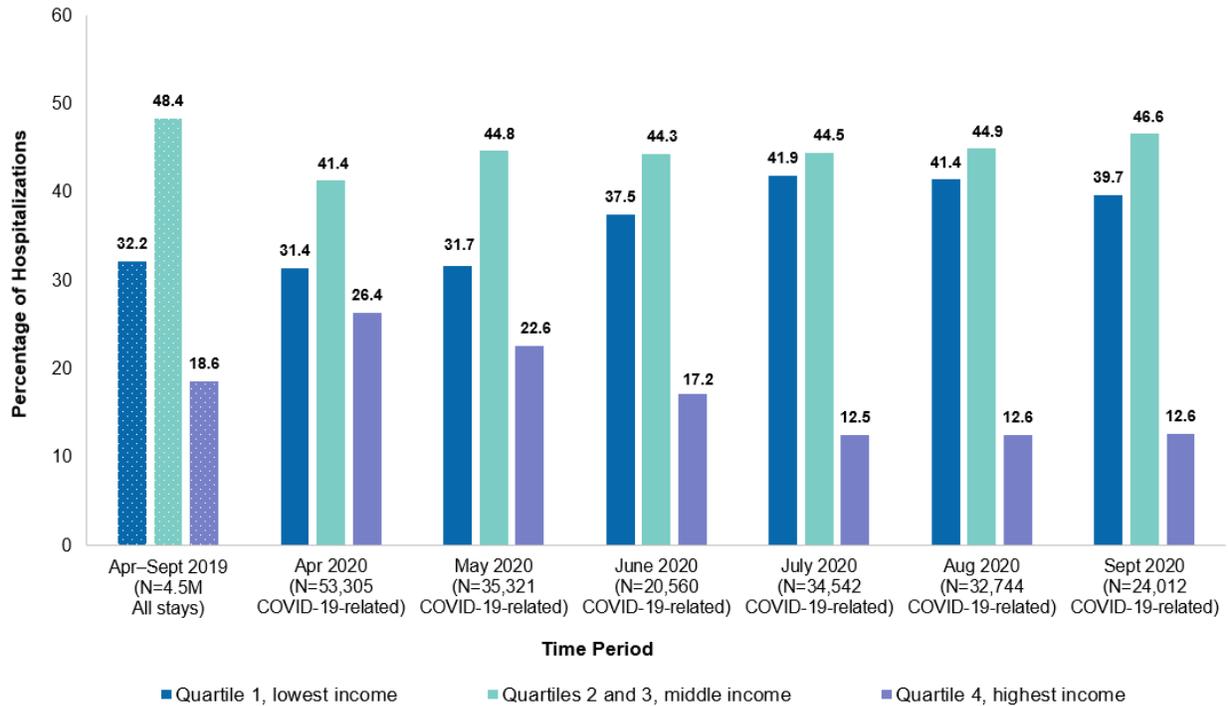
##### *Differences in COVID-19-related hospitalizations, by community-level income, April–September 2020*

Figure 1 displays the distribution of COVID-19-related hospitalizations in 13 States in each of 6 months, April, May, June, July, August, and September 2020, by community-level income of the patient (lowest income quartile, middle income, and highest income quartile). As a reference, the distribution of all hospitalizations in the same States during April–September 2019 is also shown.

#### Highlights

- Compared with the distribution of all hospitalizations in April–September 2019, patients from the highest income communities in the 13 States accounted for a larger share of COVID-19-related hospitalizations in April and May 2020, whereas patients from the lowest income communities accounted for a larger share each month from June to September 2020.
- Between April 2020 and July 2020, the observed (unadjusted) COVID-19-related in-hospital mortality rate declined 55 percent for patients from the lowest income communities and 64 percent for patients from the highest income communities.
- In each month from July to September 2020, the COVID-19-related age-adjusted in-hospital mortality rate for patients from the lowest income communities was more than 10 percent higher than the rate for patients from the highest income communities.
- Age-adjusted in-hospital mortality rates varied by month, community-level income, and State in which the patient was hospitalized.

**Figure 1. Distribution of COVID-19-related hospitalizations in April–September 2020 compared with all hospitalizations in April–September 2019, by community-level income, 13 States**



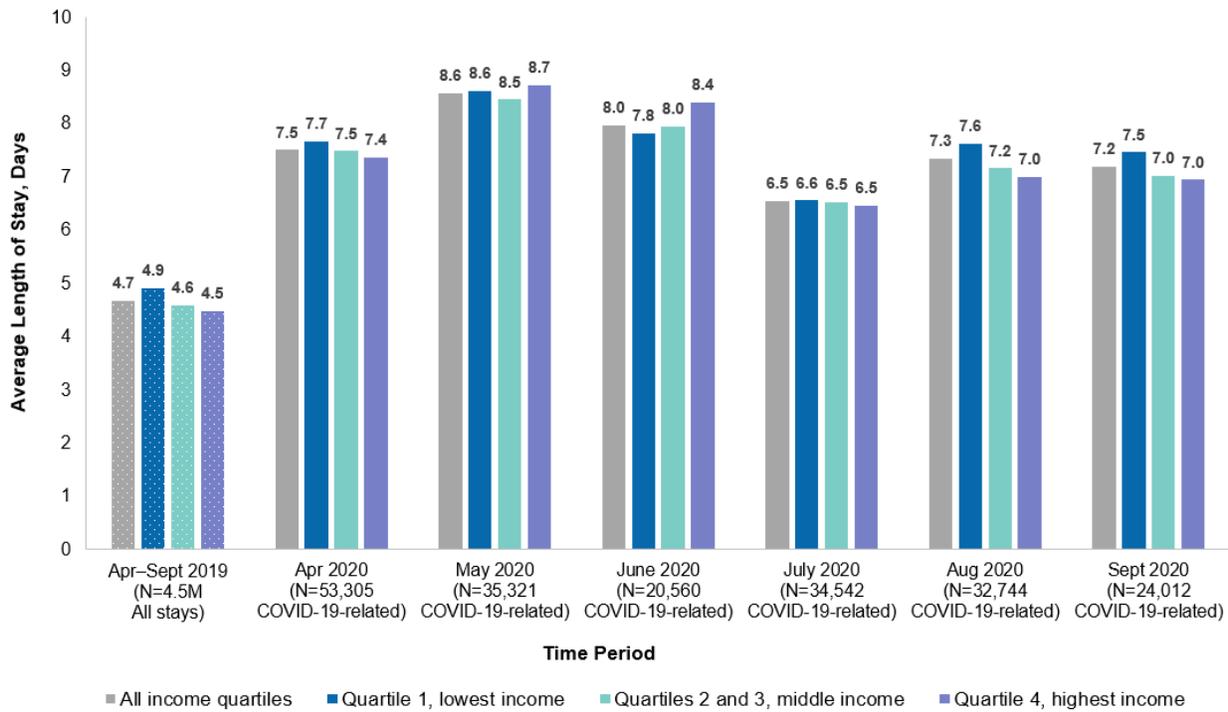
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- Compared with the distribution of all hospitalizations in April–September 2019, patients from the highest income communities in these 13 States accounted for a larger share of COVID-19-related hospitalizations in April and May 2020, whereas patients from the lowest income communities accounted for a larger share each month from June to September 2020.
- In April 2020, more than one in four COVID-19-related hospitalizations were for patients from the highest income communities (26.4 percent). By September 2020, only one in eight COVID-19-related hospitalizations were for patients from these communities (12.6 percent).
- In April 2020, patients from the lowest income communities accounted for 31.4 percent of all COVID-19-related hospitalizations. The share of COVID-19-related hospitalizations for patients from the lowest income communities increased from 31.4 percent in April 2020 to 39.7–41.9 percent in July–September 2020.
- In April 2020, COVID-19-related hospitalizations were 1.2 times more likely to be for patients from the lowest income communities than the highest income communities (31.4 vs. 26.4 percent, respectively). In September 2020, COVID-19-related hospitalizations were more than three times more likely to be for patients from the lowest income communities than the highest income communities (39.7 vs. 12.6 percent, respectively).

*Differences in average length of COVID-19-related hospitalizations, by community-level income, April–September 2020*

Figure 2 presents the average length of COVID-19-related hospitalizations in April–September 2020 across 13 States, by community-level income of the patient (lowest income quartile, middle income, and highest income quartile). As a reference, the average length of all hospitalizations during April–September 2019 across the 13 States is also shown.

**Figure 2. Average length of stay for COVID-19-related hospitalizations in April–September 2020 compared with all hospitalizations in April–September 2019, by community-level income, 13 States**



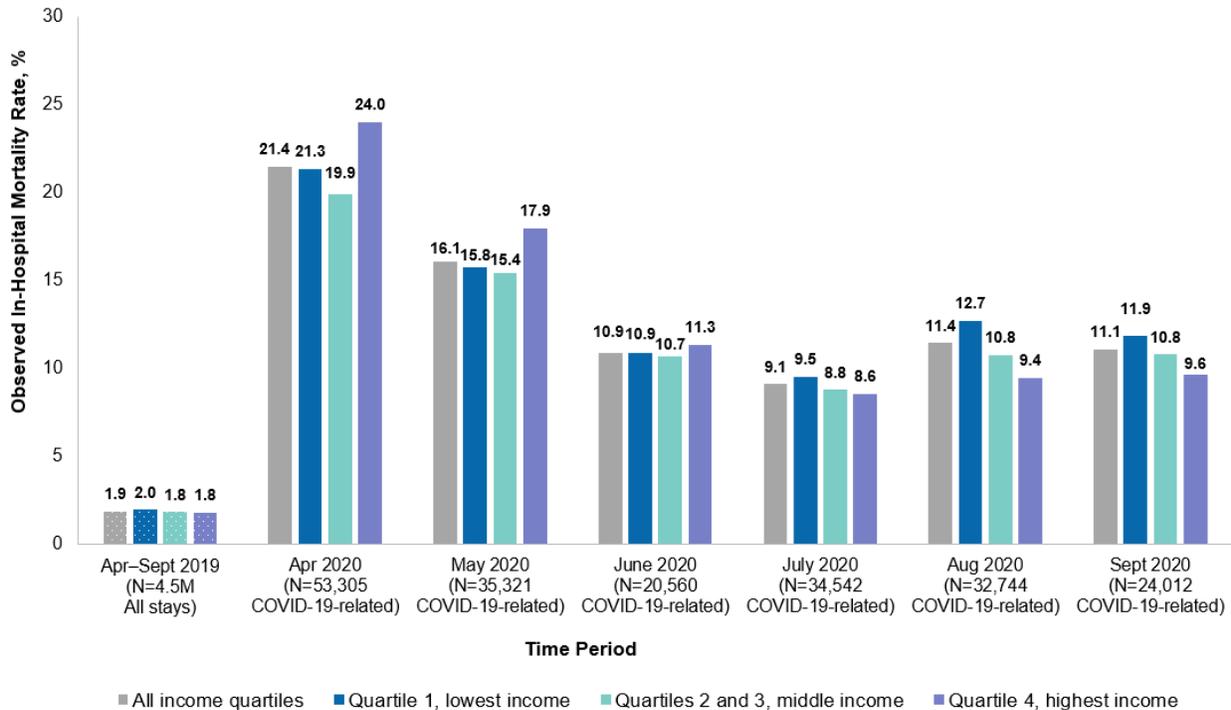
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- The longest average length of COVID-19-related hospitalizations across these 13 States occurred in May 2020, regardless of community-level income. The shortest average length of COVID-19-related hospitalizations occurred in July 2020, regardless of community-level income. There was less than a 5 percent difference in average length of hospitalizations across the community-level income groups.

*Differences in in-hospital mortality for COVID-19-related hospitalizations, by community-level income, April–September 2020*

Figure 3 displays the observed (unadjusted) in-hospital mortality rate for COVID-19-related hospitalizations for each month during April–September 2020 across 13 States, by community-level income of the patient (lowest income quartile, middle income, and highest income quartile). As a reference, the all-cause observed (unadjusted) in-hospital mortality rates across the 13 States during April–September 2019 are also shown. The observed in-hospital mortality rates do not account for differences in the distribution of the population by age.

**Figure 3. Observed COVID-19-related in-hospital mortality rate in April–September 2020 compared with the observed all-cause in-hospital mortality rate in April–September 2019, by community-level income, 13 States**

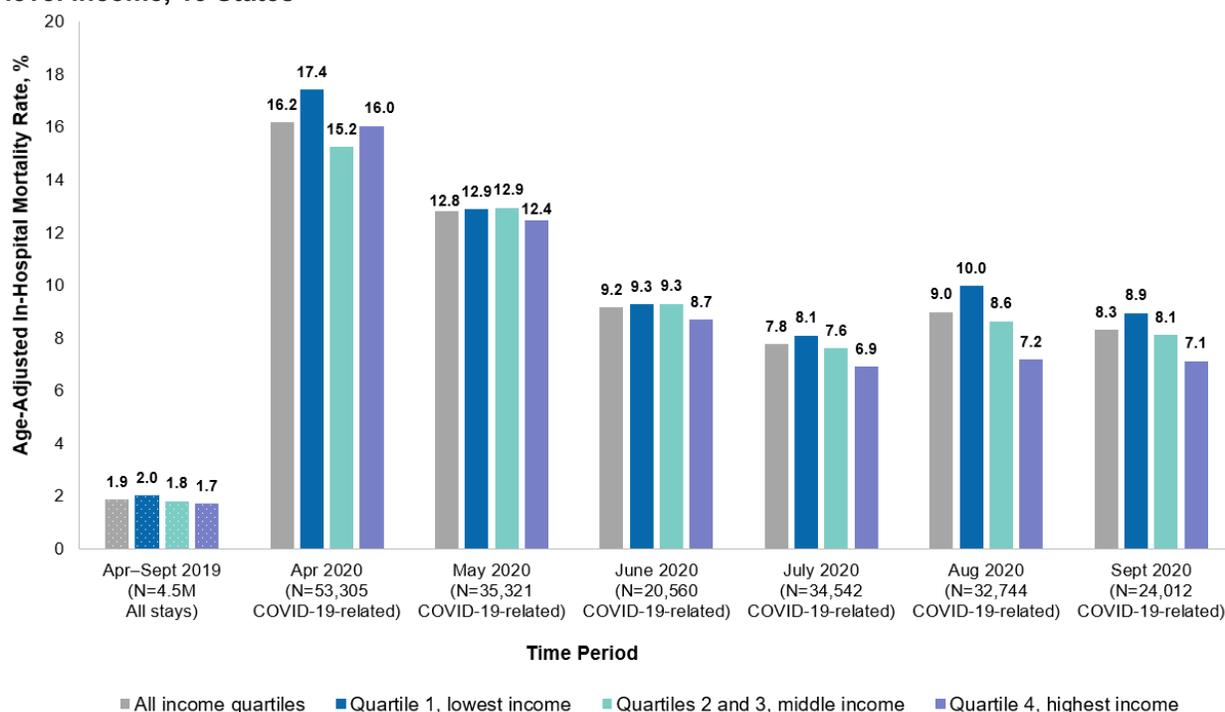


Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- The observed (unadjusted) COVID-19-related in-hospital mortality rate for patients from the lowest income communities dropped from 21.3 percent in April 2020 to 9.5 percent in July 2020, a 55 percent decline in the observed in-hospital mortality rate.
- Similarly, the observed (unadjusted) COVID-19-related in-hospital mortality rate for patients from the highest income communities dropped from 24.0 percent in April 2020 to 8.6 percent in July 2020, a 64 percent decline in the in-hospital mortality rate.

To account for the differences in in-hospital mortality due to differences in the age distribution among the income groups, Figure 4 displays the age-adjusted in-hospital mortality rate for COVID-19-related hospitalizations in April–September 2020 across the 13 States, by community-level income of the patient (lowest income quartile, middle income, and highest income quartile). The magnitude of the rates presented in this figure is dependent on the standard population used to adjust for age. In this case, the standard population is the nationwide hospitalized population in 2018. These age-adjusted in-hospital mortality rates are useful for comparisons across groups or time after accounting for the age distribution of the population. As a reference, the all-cause age-adjusted in-hospital mortality rates across the 13 States during April–September 2019 are also shown.

**Figure 4. COVID-19-related age-adjusted in-hospital mortality rate in April–September 2020 compared with the all-cause in-hospital mortality rate in April–September 2019, by community-level income, 13 States**



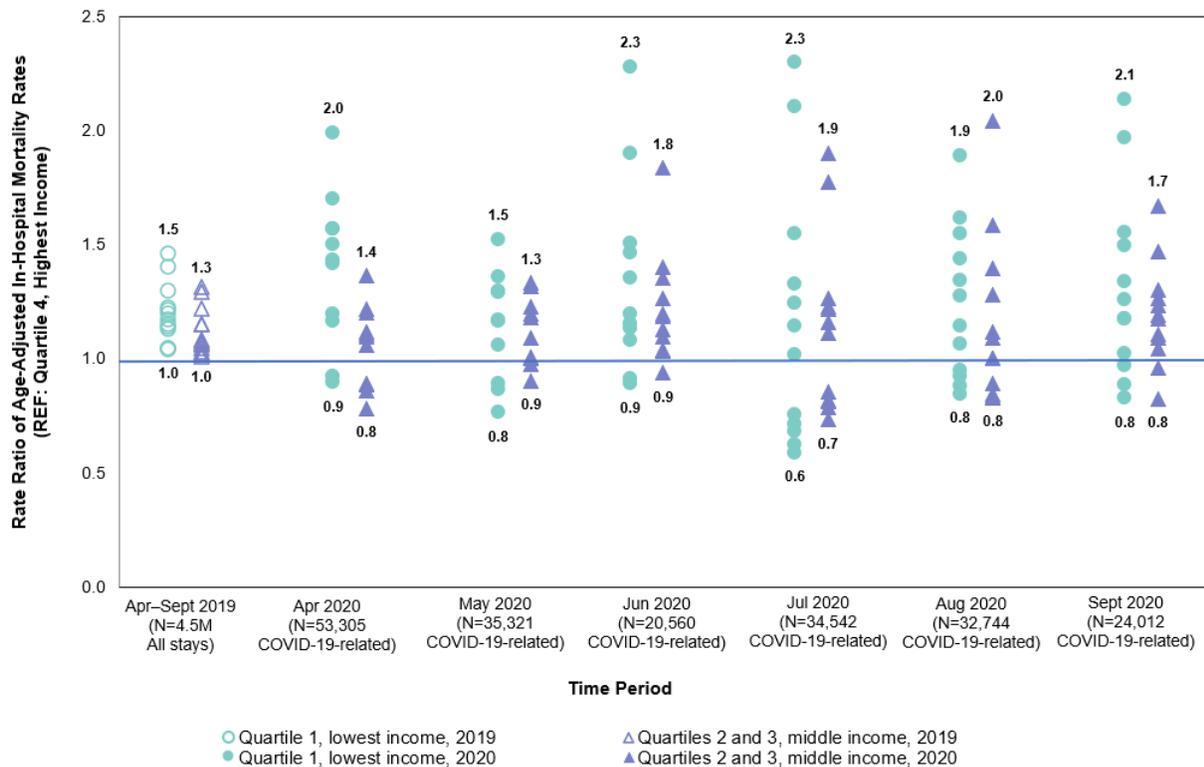
Note: In-hospital mortality rates were adjusted for age based on the national age distribution of hospitalizations for patients in the 2018 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS).

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 13 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, SC, and VT) (available as of March 2021)

- In April 2020, the COVID-19-related age-adjusted in-hospital mortality rate for patients from the lowest income communities was 13 percent higher than the rate for patients from the middle-income communities and 8 percent higher than the rate for patients from the highest income communities (17.4 vs. 15.2 for the middle-income group and 16.0 for the highest income group per 100 standard hospitalized population).
- In each month from July to September 2020, the COVID-19-related age-adjusted in-hospital mortality rate for patients from the lowest income communities was more than 10 percent higher than the rate for patients from the highest income communities.

Figure 5 displays the State variation in the rate ratio (RR) of COVID-19-related age-adjusted in-hospital mortality rates in April–September 2020, by community-level income of the patient. As a reference, age-adjusted in-hospital mortality RRs for all hospitalizations during April–September 2019 in each State are shown. Each dot in the figure represents one State’s age-adjusted in-hospital mortality RR for a specific community-level income group (i.e., age-adjusted in-hospital mortality rate for a specific community-level income group in a State divided by the age-adjusted in-hospital mortality rate for patients from the highest income communities). If there were fewer than 30 discharges in a State-specific community-level income category, the corresponding age-adjusted State-specific in-hospital mortality RR is suppressed.

**Figure 5. State-specific COVID-19-related age-adjusted in-hospital mortality rate ratios in April–September 2020 compared with the State-specific all-cause in-hospital mortality rate ratios in April–September 2019, by community-level income, 13 States**



Abbreviation: REF, reference group

Note: If there were fewer than 30 discharges in a State-specific community-level income category, the corresponding age-adjusted State-specific in-hospital mortality rate ratio is suppressed. In-hospital mortality rates were adjusted for age based on the national age distribution of hospitalizations for patients in the 2018 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS).

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), 2019 State Inpatient Databases (SID) and 2020 quarterly data from 12 States (CO, GA, IA, KY, MD, MI, MN, MO, MS, NJ, OH, and SC) (available as of March 2021)

- State-specific COVID-19-related age-adjusted in-hospital mortality RRs varied by community-level income of the patient and across time, indicating that age-adjusted in-hospital mortality rates also varied by month, community-level income, and the State in which the patient was hospitalized.
- More variation was noted in the COVID-19-related age-adjusted in-hospital mortality RR for patients from the lowest income communities (relative to those from the highest income communities) than for patients from the middle-income communities in each month from May to September 2020, except August 2020.
- Between April and September 2020, most States had higher monthly age-adjusted in-hospital mortality rates for patients from the lowest income and middle-income communities than for patients from the highest income communities (RR > 1.0).

## References

<sup>1</sup> Annual Estimates of the Resident Population by Sex, Race, and Hispanic Origin for the United States: April 1, 2010 to July 1, 2019 (NC-EST2019-SR11H). U.S. Census Bureau, Population Division. Release Date: June 2020. [www.census.gov/newsroom/press-kits/2020/population-estimates-detailed.html](http://www.census.gov/newsroom/press-kits/2020/population-estimates-detailed.html). Accessed March 1, 2021.

<sup>2</sup> Annual Estimates of the Resident Population by Sex, Race, and Hispanic Origin for Colorado, Georgia, Iowa, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, New Jersey, Ohio, South Carolina, and Vermont: April 1, 2010 to July 1, 2019 (NC-EST2019-SR11H-nn). U.S. Census Bureau, Population Division. Release Date: June 2020. [www.census.gov/data/tables/time-series/demo/popest/2010s-state-detail.html](http://www.census.gov/data/tables/time-series/demo/popest/2010s-state-detail.html). Accessed March 1, 2021.

<sup>3</sup> Agency for Healthcare Research and Quality. HCUP Summary Trend Tables. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality. Updated December 2020. [www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp](http://www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp). Accessed February 10, 2021.

## About Statistical Briefs

Healthcare Cost and Utilization Project (HCUP) Statistical Briefs provide basic descriptive statistics on a variety of topics using HCUP administrative healthcare data. Topics include hospital inpatient, ambulatory surgery, and emergency department use and costs, quality of care, access to care, medical conditions, procedures, and patient populations, among other topics. The reports are intended to generate hypotheses that can be further explored in other research; the reports are not designed to answer in-depth research questions using multivariate methods.

## Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2019 State Inpatient Databases (SID) and 2020 quarterly inpatient data. Information based on quarterly data should be considered preliminary, as additional quarterly data may become available over time. This analysis is limited to patients treated in community, nonrehabilitation hospitals in 13 States (Colorado, Georgia, Iowa, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, New Jersey, Ohio, South Carolina, and Vermont) for which HCUP data were available for April–September 2019 and April–September 2020. These States account for 24.7 percent of the total U.S. population.<sup>1,2</sup> All of the information contained in this Statistical Brief (except age-adjusted rates) can be found in the HCUP Summary Trend Tables at [www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp](http://www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp).

The HCUP inpatient data contain the universe of the inpatient discharge abstracts in the participating HCUP States, translated into a uniform format to facilitate multistate comparisons and analyses. In the aggregate, the inpatient data encompass more than 95 percent of all U.S. community hospital discharges. The inpatient data can be used to investigate questions unique to one State, to compare data from two or more States, to conduct market-area variation analyses, and to identify State-specific trends in inpatient care utilization, access, charges, and outcomes.

### *Types of hospitals included in HCUP State Inpatient Databases (and quarterly inpatient data)*

This analysis used SID and quarterly inpatient data limited to information from community hospitals, which are defined as short-term, non-Federal, general, and other hospitals, excluding hospital units of other institutions (e.g., prisons). Community hospitals include obstetrics and gynecology, otolaryngology, orthopedic, cancer, pediatric, public, and academic medical center hospitals. Excluded for this analysis are long-term care facilities such as rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. However, if a patient received long-term care, rehabilitation, or treatment for a psychiatric or chemical dependency condition in a community hospital, the discharge record for that stay was included in the analysis.

## Definitions

### *Diagnoses and ICD-10-CM*

The *principal diagnosis* is that condition established after study to be chiefly responsible for the patient's admission to the hospital. *Secondary diagnoses* are conditions that coexist at the time of admission that require or affect patient care treatment received or management, or that develop during the inpatient stay. *All-listed diagnoses* include the principal diagnosis plus the secondary conditions.

ICD-10-CM is the International Classification of Diseases, Tenth Revision, Clinical Modification. There are over 70,000 ICD-10-CM diagnosis codes.

### *Case definition*

COVID-19-related hospitalizations are identified by any-listed ICD-10-CM code of U07.1 (2019 novel coronavirus disease) on the discharge record. Per coding guidelines,<sup>a</sup> the use of U07.1 is based on documentation by the provider or documentation of a positive COVID-19 test result. The ICD-10-CM code for COVID-19 was implemented beginning April 1, 2020. As such, there may be some measurement error in the identification of cases.

### *Unit of analysis*

The unit of analysis is the hospital discharge (i.e., the hospital stay), not a person or patient. This means that a person who is admitted to the hospital multiple times in 1 year will be counted each time as a separate discharge from the hospital.

### *Community-level income*

Community-level income is based on the median household income of the patient's ZIP Code of residence. Quartiles are defined so that the total U.S. population is evenly distributed. Cut-offs for the quartiles are determined annually using ZIP Code demographic data obtained from Claritas, a vendor that produces population estimates and projections based on data from the U.S. Census Bureau.<sup>b</sup> The value ranges for the income quartiles vary by year. Patients in the first quartile are designated as having the *lowest* income, patients in the middle two quartiles are designated as having *middle* income, and patients in the highest quartile are designated as having the *highest* income. The income quartile is missing for patients who are homeless or foreign.

### *In-hospital mortality rate, age-adjusted in-hospital mortality rate, and in-hospital mortality rate ratio*

The simplest in-hospital mortality rate is the observed in-hospital mortality rate, defined as the total number of COVID-19-related deaths in the hospital divided by the number of patients hospitalized with COVID-19. However, the observed in-hospital mortality rate does not account for the age distribution of the population.

Because in-hospital mortality rates generally increase with age, another important measure is the age-adjusted mortality rate. The age-adjusted in-hospital mortality rate (in-hospital mortality per 100 standard population) is the proportion of patients with COVID-19 who died while in the hospital, standardized using the direct method and the age distribution of a standard population. The standard population is the nationwide hospitalized population in 2018, using data from the 2018 HCUP National Inpatient Sample (NIS). The rates represent the expected in-hospital mortality rates if the observed age-specific rates were applied to the same standard population.

The age-adjusted in-hospital mortality rate ratio is defined as the age-adjusted in-hospital mortality rate of one group divided by the age-adjusted in-hospital mortality rate of the comparison, or reference, group. State-specific age-adjusted in-hospital mortality rates are suppressed for groups with fewer than 30 discharges.

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<sup>a</sup> Centers for Disease Control and Prevention, National Center for Health Statistics. ICD-10-CM Official Guidelines for Coding and Reporting FY 2021 (October 1, 2020 - September 30, 2021). [www.cdc.gov/nchs/data/icd/10cmguidelines-FY2021.pdf](http://www.cdc.gov/nchs/data/icd/10cmguidelines-FY2021.pdf). Accessed February 10, 2021.

<sup>b</sup> Claritas. Claritas Demographic Profile by ZIP Code. [claritas360.claritas.com/mybestsegments/](http://claritas360.claritas.com/mybestsegments/). Accessed February 3, 2020.

## About HCUP

The Healthcare Cost and Utilization Project (HCUP, pronounced "H-Cup") is a family of healthcare databases and related software tools and products developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP databases bring together the data collection efforts of State data organizations, hospital associations, and private data organizations (HCUP Partners) and the Federal government to create a national information resource of encounter-level healthcare data. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. These databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to healthcare programs, and outcomes of treatments at the national, State, and local market levels.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

<b>Alaska</b> Department of Health and Social Services	<b>Nevada</b> Department of Health and Human Services
<b>Alaska</b> State Hospital and Nursing Home Association	<b>New Hampshire</b> Department of Health & Human Services
<b>Arizona</b> Department of Health Services	<b>New Jersey</b> Department of Health
<b>Arkansas</b> Department of Health	<b>New Mexico</b> Department of Health
<b>California</b> Office of Statewide Health Planning and Development	<b>New York</b> State Department of Health
<b>Colorado</b> Hospital Association	<b>North Carolina</b> Department of Health and Human Services
<b>Connecticut</b> Hospital Association	<b>North Dakota</b> (data provided by the Minnesota Hospital Association)
<b>Delaware</b> Division of Public Health	<b>Ohio</b> Hospital Association
<b>District of Columbia</b> Hospital Association	<b>Oklahoma</b> State Department of Health
<b>Florida</b> Agency for Health Care Administration	<b>Oregon</b> Association of Hospitals and Health Systems
<b>Georgia</b> Hospital Association	<b>Oregon</b> Office of Health Analytics
<b>Hawaii</b> Laulima Data Alliance	<b>Pennsylvania</b> Health Care Cost Containment Council
<b>Hawaii</b> University of Hawai'i at Hilo	<b>Rhode Island</b> Department of Health
<b>Illinois</b> Department of Public Health	<b>South Carolina</b> Revenue and Fiscal Affairs Office
<b>Indiana</b> Hospital Association	<b>South Dakota</b> Association of Healthcare Organizations
<b>Iowa</b> Hospital Association	<b>Tennessee</b> Hospital Association
<b>Kansas</b> Hospital Association	<b>Texas</b> Department of State Health Services
<b>Kentucky</b> Cabinet for Health and Family Services	<b>Utah</b> Department of Health
<b>Louisiana</b> Department of Health	<b>Vermont</b> Association of Hospitals and Health Systems
<b>Maine</b> Health Data Organization	<b>Virginia</b> Health Information
<b>Maryland</b> Health Services Cost Review Commission	<b>Washington</b> State Department of Health
<b>Massachusetts</b> Center for Health Information and Analysis	<b>West Virginia</b> Department of Health and Human Resources, West Virginia Health Care Authority
<b>Michigan</b> Health & Hospital Association	<b>Wisconsin</b> Department of Health Services
<b>Minnesota</b> Hospital Association	<b>Wyoming</b> Hospital Association
<b>Mississippi</b> State Department of Health	
<b>Missouri</b> Hospital Industry Data Institute	
<b>Montana</b> Hospital Association	
<b>Nebraska</b> Hospital Association	

## For More Information

For information on COVID-19 resources at AHRQ, refer to the AHRQ COVID-19 Resources page at [www.ahrq.gov/coronavirus/index.html](http://www.ahrq.gov/coronavirus/index.html). For other information on COVID-19 healthcare utilization, refer to the HCUP Statistical Briefs located at [www.hcup-us.ahrq.gov/reports/statbriefs/sb\\_covid.jsp](http://www.hcup-us.ahrq.gov/reports/statbriefs/sb_covid.jsp).

For additional HCUP statistics, visit:

- HCUP Fast Stats at [www.hcup-us.ahrq.gov/faststats/landing.jsp](http://www.hcup-us.ahrq.gov/faststats/landing.jsp) for easy access to the latest HCUP-based statistics for healthcare information topics
- HCUPnet, HCUP's interactive query system, at [www.hcupnet.ahrq.gov/](http://www.hcupnet.ahrq.gov/)
- HCUP Summary Trend Tables at [www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp](http://www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp) for monthly information on hospital utilization

For more information about HCUP, visit [www.hcup-us.ahrq.gov/](http://www.hcup-us.ahrq.gov/).

For a detailed description of HCUP and more information on the design of the State Inpatient Databases (SID), please refer to the following database documentation:

Agency for Healthcare Research and Quality. Overview of the State Inpatient Databases (SID). Healthcare Cost and Utilization Project (HCUP). Rockville, MD: Agency for Healthcare Research and Quality. Updated October 2020. [www.hcup-us.ahrq.gov/sidoverview.jsp](http://www.hcup-us.ahrq.gov/sidoverview.jsp). Accessed January 22, 2021.

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of healthcare in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please email us at [hcup@ahrq.gov](mailto:hcup@ahrq.gov) or send a letter to the address below:

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